**CITY UNIVERSITY OF HONG KONG**
香港城市大學

# An Audit Model for Intellectual Property Management Excellence
# 知識產權管理卓越之評審模型

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# Abstract

The aim of this research is to study the critical success factors for implementing IP management related activities in organizations. These factors encompass the essential elements of an IP management excellence audit model that is used to assess the position of the organizations for achieving IP management improvements. The initiative under this project encourages the organizations to use the audit model for conducting assessment programmes in order to give the organizations a head start in their paths to IP management excellence. In order to accomplish the aim, four specific objectives to be achieved under the aim of this project are set: first, "Develop an IP management model"; second, "Investigate the IP management practices of HK-GD based manufacturing industry"; third, "Prioritize the relative importance of enabling categories and criteria in IP management for HK-GD based manufacturing industry", and lastly, "Develop and implement an IP management excellence audit model that is suggested for the HK-GD based manufacturing industry".

The project attempts to make contributions in both theoretical and practical areas to introduce an IP management excellence audit model which is an important part of the business process in the current environment. At the theoretical level, the scope of project focuses on theoretical justification and theory development of a set of key enabling criteria for an IP management excellence audit model. At the practical level, the scope covers implementation of the IP management excellence audit model with the HK-GD based manufacturing organizations being used to test the theory.

The research has provided a number of valuable findings and implications about IP management. First, the research identifies five core values in IP management and four enabling categories with twelve key enabling criteria and then develops a criteria-based IP management model through literature review. Based on this review of literature, a questionnaire survey is conducted in the HK-GD based manufacturing industry and the extent of implementation of the four enabling categories with twelve key enabling criteria is examined. Second, the results indicate that the general IP management practices (extent of implementation of IP management enabling categories and key enabling criteria) in the HK-GD based manufacturing industry are

lagging far behind in some key enabling criteria. This implies that there is a lot of room for the HK-GD based manufacturing industry to improve by allocating more resources to the twelve key enabling criteria. Third, the relationships of the extent of implementation of twelve key enabling criteria are examined to be positively related to the IP management excellence; moreover, four enabling categories contribute to IP management result categories, thus providing industrial practitioners with implications to improve IP management. Fourth, an Analytic Hierarchy Process (AHP) study based on expert interviews is conducted to prioritize the relative importance of the four enabling categories and twelve key enabling criteria. This provides HK-GD based manufacturing organizations with priority rankings of these enabling categories and key enabling criteria; and can be utilized by them as a step-by-step approach to improve their IP management, which is the dominant factor for achieving the full potential and the competitiveness position of their business. By employing the findings and results from the AHP study, the HK-GD based manufacturing organizations can allocate resources and efforts in enabling categories or key enabling criteria in priority for implementation so as to obtain immediate changes. Fifth, the research results indicate that the HK-GD based manufacturing industry can employ the IP management excellence audit model as a tool to assess, measure and diagnose its IP management and for management to develop an improvement action plan and strategy. By interpreting the results, HK-GD based manufacturing organizations can use the audit model as a tool and guideline to formulate appropriate strategies to improve themselves in IP management which, in turn, achieve the result categories and performance dimensions that has been employed in the “Results” section of the IP management excellence audit model. Finally, through conducting case studies, the IP management excellence audit model is validated by the audited HK-GD based manufacturing organizations that have participated in the assessment of the enabling categories and key enabling criteria.

This research presents significant contributions to the development of an audit model for IP management excellence. In the theoretical areas, the results of the research have integrated most enabling criteria from different researchers and literature review in IP management, including the support that is found in the studies of good systems and practices of organizations. The empirical research fills up the blank spot in the current literature. In practical areas, three case studies were used in this research for model

testing of a rapid audit system and one case study was used for model testing of a comprehensive audit system. From the evidential reasoning analysis and comparison with external assessors' results, it was found that the new IP management excellence audit model has the potential to improve the accuracy of the measurement system for a local Award and compensate for the lack of experience in assessment. Furthermore, different improvement scenario results can be predicted without undergoing real implementation and changes. In this way, the audit model can be used as a strategic planning tool. In addition, the model places emphasis on system works and general practices, called the enabling criteria, which provide organizations with guidelines so as to operate IP management strategy, policies, systems and practices to achieve IP management excellence. The model provides implications on how do organizations learn to adjust from product-oriented decisions and management practices to those that can accommodate the intangibles such as IP. It also provides the organizations necessary supports to upgrade their operation mode from original equipment manufacturing (OEM) to original design manufacturing (ODM) and original brand manufacturing (OBM).

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# Chapter 1 Introduction

This project aims to identify the key factors in intellectual property (IP) management for the Hong Kong-invested industrial organizations in the Guangdong Province, and to propose an audit model in IP management for the industrial organizations to improve their IP management performance. By employing the proposed audit model in IP management, industrial organizations can use it as a guiding system to improve their IP management practices and management performance and simultaneously enhance their competitiveness in the global business environment. In this chapter, background information is provided, followed by project justification. Then the aims and objectives of the project are defined, and, more specifically, the scope of the project is described. Finally, an outline of each chapter of the project report will be provided.

## 1.1 Background of Project

With the globalization of the world economy and the flourishing joint venture activities among Hong Kong, Mainland and overseas organizations, IP management becomes significantly important for business enhancement and successful collaborations. Given the importance of IP, Hong Kong and Mainland organizations need to enhance the IP management capability in order to overcome challenges arising from the rapid economic development in the Guangdong Province and upgrade themselves from original equipment manufacturing (OEM) to original design manufacturing (ODM) and original brand manufacturing (OBM).

### 1.1.1 What is Intellectual Property Management?

IP can be defined as certain intellectual creations that have commercial application such as patents, trademarks, trade names, copyrights, engineering drawings, computer software, databases and certain types of agreements. IP management refers to the holistic management of the entire life cycle of an organization’s IP that directly supports the organization’s business strategies to achieve and maintain competitive advantage. It includes the management of the creation, ownership, protection, commercial exploitation and adoption of the best practice of IP.

IP which is a vital part of organizational assets is the main driver of business. In organizing IP activities, organizations should promote the organizational culture of innovation as a crucial competitiveness. The organizations that adopt IP management can benefit from the wealth of technological and commercial information available in patent and trademark databases to learn about recent technological breakthroughs, identify future partners, and find out about the innovative activities of competitors. To avoid overlook the protection of an innovation and intangible asset, careful attention should be paid by an organization to secure the ownership of a patent, industrial design or trademark. Acquiring IP protection is a crucial initial step, but IP management means more than just protecting an organization's inventions, trademarks, designs, or copyright. It also involves an organization's ability to commercialize such inventions, market its brands, license its know-how, conclude joint ventures and other contractual agreements involving IP, and effectively monitor and enforce its IP rights. Indeed, an organization's portfolio of IP must be viewed as a collection of key assets that add significant value to the organization.

IP management is all about maximizing profitability. IP makes money for organizations in three ways. Firstly, IP can protect a unique selling proposition in the marketplace and generate marginal profit for products that competitors cannot match because of not holding the IP. Secondly, IP allows the organization to generate additional revenue streams using carrot-and-stick licensing avenues, which have direct impact on the business of competitors. Thirdly, IP preserves the organization's freedom to operate and minimize the risks of reducing or eliminating the organization's revenue streams by litigation avoidance.

The current development shows a tendency to utilize IP as the prime driver for business growth. Managing IP effectively and using it to devise business strategies is an increasingly critical task for entrepreneurs worldwide. Senior executives and managers play important roles to assist the organizations to achieve the above business objectives.

### 1.1.2 Trends and Development of Intellectual Property Management

The global development of IP laws and enforcement are strengthened in last decades (Hanel 2006). In 1980s, software becomes patentable in US (U.S. Patent and Trademark Office 2008; Hovey 2002; Stobbs 1995). In 1982, the USA established single patent appeal court (CAFC) (Jaffe 2002). Since 1985, the Patent Law of the PRC has become effective (State Intellectual Property office of PRC 2009; Sun 2004; Yang 2003). In 1994, WTO adopts TRIP agreement, creating international harmonization of patent laws (World Trade Organization 2007; Kong 2005; Correa 2000). In 1998, business methods become patentable in US (Jaffe 2002). Since 2002 the Japanese government has been launching various policies and measures aimed at

strengthening the IP system in Japan (Heath 2003; Strategic Council on Intellectual Property 2002). In 2005, the increase in Chinese patent applications has for the first time reached the top-ten list of countries for global patent applications (State Intellectual Property Office of PRC 2009). In June 2008, The State Council of China officially released the Outline of the National Intellectual Property Strategy designed for utilizing the intellectual property system to boost the comprehensive economic and developments in China. With the development of a pro-patent climate, the IP rights became a strategic weapon in competition.

Though the global economic growth is impressive in the past decades, most businesses today are operating in a very competitive environment and are desperately striving for an edge in competition.

For leading industrial organizations, the major challenges in competition are lower profit margins, shorter product life cycles, price erosion and increasing costs and risks in R&D. A typical example is the gradually shortened product life cycles and price erosion of VCD and DVD experienced by Philips in the last 20 years as shown in Figure 1.1. For many multi-national corporations, the competitive edge of organizations shifts from production-based to knowledge based, and manufacturing has now become a commodity for outsourcing to low wage regions such as China.

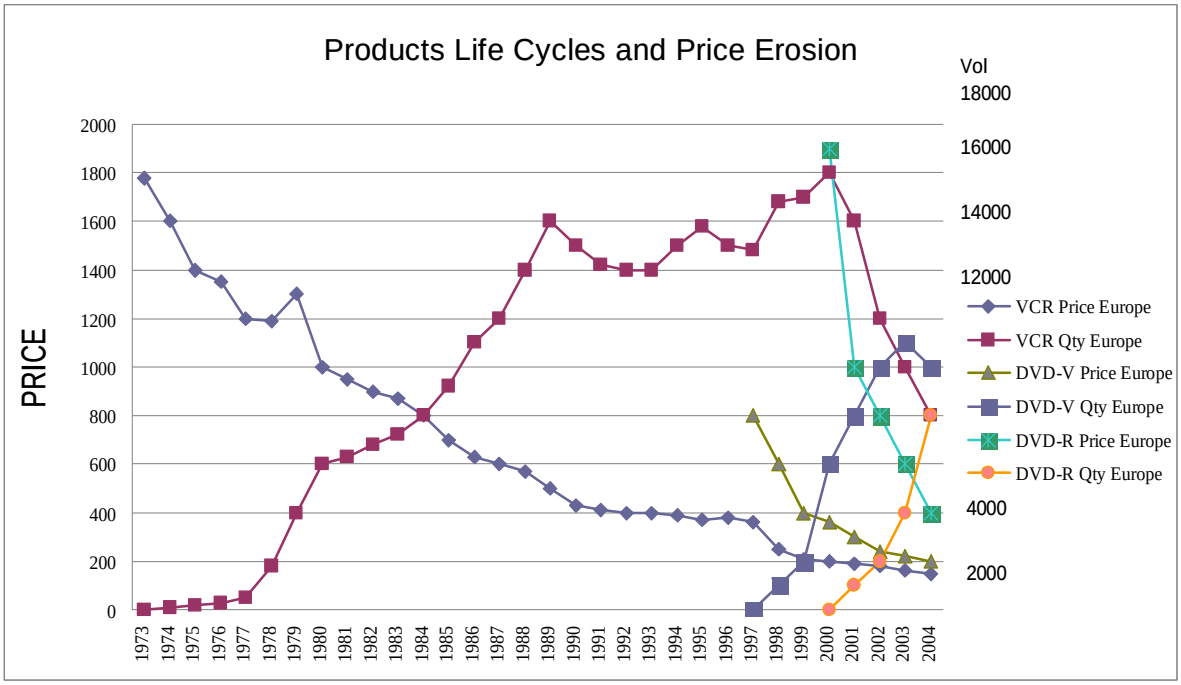



Figure 1.1 Statistic on product life cycles and price erosion of VCD and DVD from 1973 to 2004, showing the product life cycles tend to be shorter while prices tend to be lower due to keen competition. (Sources from Philips 2007)

The trends of globalization have produced significant impacts on new product development. The mass production of standardized goods cannot create high added value. High value generating products derive from more intensive use of information, technology and services. Accompanying the development of the knowledge-based economy, organizations are now embarking on a new course for the utilization of IP in their manufacturing activities (Alikhan and Mashelkar 2004). The shift from straight forward manufacturing activities to IP generation becomes the daily agenda of progressive organizations for driving their business development. As a result, increasingly more organizations recognize that IP rights are an asset that can create significant value by itself. Many organizations are building up large IP rights portfolios. There are increased efforts to generate revenues out of these IP rights

portfolios.

### 1.1.3 Current Problems in the Guangdong Province

IP management is an important part of the business processes, in particular, for generating creativity, transferring technology, gaining market shares, securing customers and raising investor's confidence. The importance of IP management has drawn the attention of the industrial organizations, foreign investors and policy makers in the Guangdong Province (Yang 2003; International Bureau of WIPO 2002; Haley 2000). The growing interest in IP revealed a lack of consensus on a set of IP management criteria that all the three parties have mutually recognized. The different perspectives among them are depicted in the following.

**IP Management for Industrial Organizations in the Guangdong Province** - The classic concept of mass production for OEM is gradually losing its competitive advantage. To sustain future competitive strength, ODM and OBM have become the preferred modes (Hong Kong Trade Development Council 2003, 2008). During the rapid migration from OEM to ODM and OBM, IP management is an important part of the changes in the business modes. The IP policy development and implementation, in particular for OEM, ODM and OBM, may have the following purposes:

- Secure protection for innovations (WIPO 1983);
- Safeguard against infringing patents owned by others;
- Conduct patent searches to gain technical information;
- Survey the product strategies of competitors and plan ways to "patent-block" them (Rivette and Kline 2000);

- Generate new revenues through licensing and acquire exclusive rights to emerging market-leading technologies;
- Boost R&D, branding and market effectiveness;
- Watch the trademark activities of competitors and detect infringements; and
- Raise business valuations and enhance equity and other financing opportunities.

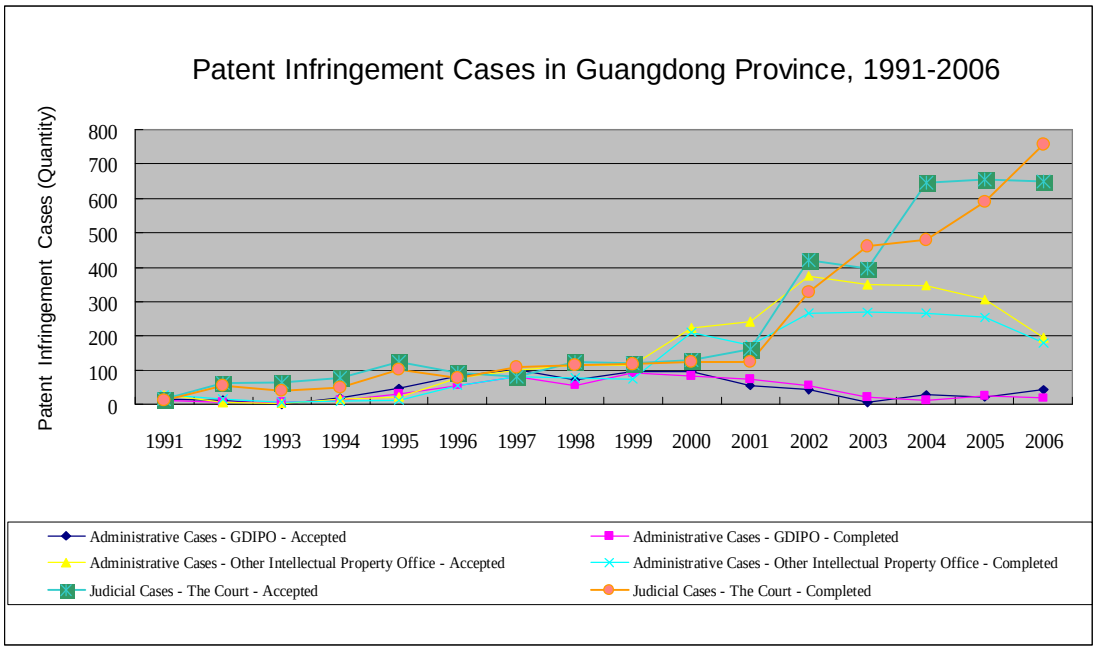



Figure 1.2 Statistic on the patent infringement cases in the Guangdong Province from 1991 to 2006, showing increasing number of judicial cases in infringement issues. (Sources from GDIPO 2009)

Figure 1.2 shows the statistical data on the numbers of patent-related infringement and disputes in the Guangdong Province. In 2006 the Intellectual Property Offices at all levels across the Guangdong Province received 236 patent-related infringement cases, and 200 of the cases, or 84.7 percent, were resolved. The Guangdong Province had accepted 648 judicial litigation involving patent disputes, and 756 cases were resolved. The number of patent-related infringement litigation will tend to be larger in the

future (GDIPO 2009). If the above IP concerns are not addressed, the industrial organizations shall have inadequate protection of IP rights leading to trademark counterfeiting, copyright piracy of pictures, music and other works of design imitation, as well as the manufacture and distribution of products that infringe on IP rights, thereby reducing the incentives and allocations of resources for new product development. The current problem is reflected from the major weakness in the IP management of organizations to safeguard against infringing the IP rights owned by others.

**IP Management for Foreign Investors Doing Business in the Guangdong Province -** With the globalization of the world economy, multi-national organizations find increasing difficulties in protecting their IP from theft and infringement (Tang and Molas-Gallart 2005; Fink and Maskus 2005). When the technology involved in the foreign investment is pirated, the economic losses are high. Nowadays, managers of foreign organizations will ensure that IP issues are considered in undertaking foreign direct investment in the Guangdong Province (Yang 2003). For this reason, IP management is an important part of their evaluation, in particular, on the relative degree of risk an organization can afford to take (Haley 2000). Managers may undertake the followings:

- Define how important technology affects the organization's competitive position;
- Take advantage of the learning curve effect on a significant technology and maintain first mover advantage;
- Determine if the crucial elements of the technology employed in overseas is really divisible from the rest and can be withhold so that the risk of IP theft is reduced;
- Identify the proportion of future revenue streams that might be lost or threatened

due to the loss of technological advantage;

- Prepare to use the more advanced or latest technologies and schedule to replace those that are plagiarized in overseas; and
- Increase significant barriers to entry other than technology into the industry such as, size of capital investment, distribution, cost of promotion, brand equity, etc.

Figure 1.3 shows the statistical data on foreign investment in the Guangdong Province. Till the end of 2007, the Foreign Direct Investment (FDI) and Other Foreign Investment absorbed by the Guangdong Province amounted to USD $196 billion, representing one-fourth of the national total and accounted for 40% of all international trade between China and other countries. In 2008, the foreign investment reached USD $212 billion, up by 8.4% over the previous year (Statistics Bureau of Guangdong Province 2009). If the above IP threats are not addressed, the foreign investors shall pursue business outside the Guangdong Province or in other countries because they risk loss of technological superiority which is important in maintaining their success and competitive position. The current problem is reflected from the critical failure in the IP management of organizations to foster an IP management culture of integrity and high standard in order to cope with the concerns about IP theft raised by the foreign investors.

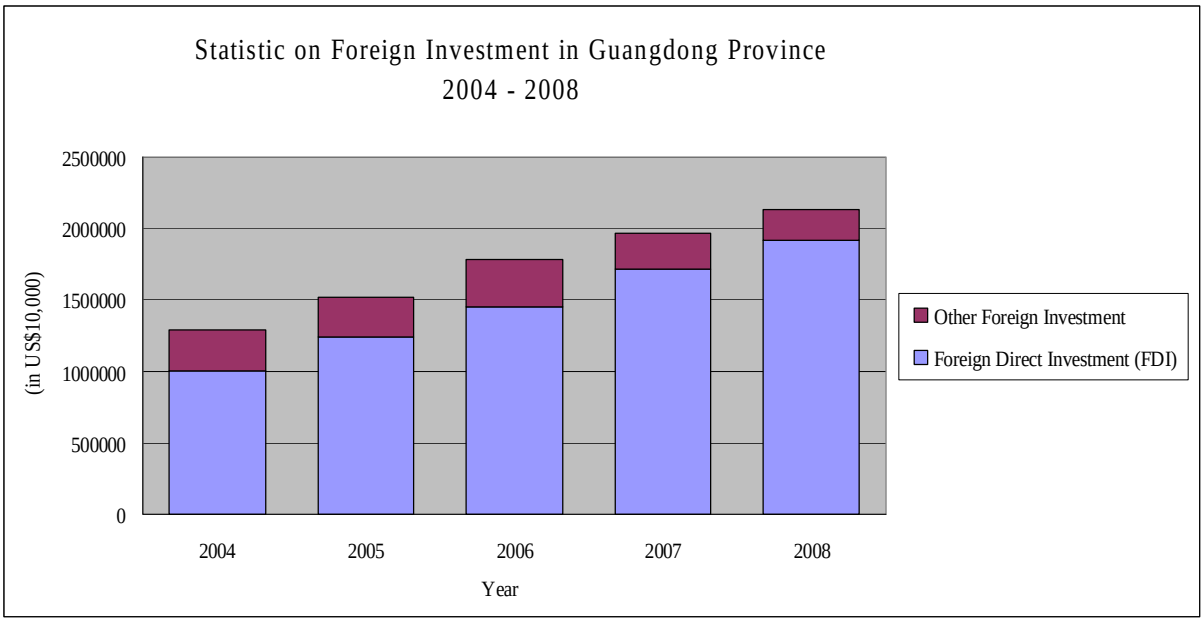



Figure 1.3 Statistic on foreign investment in the Guangdong Province from 2004 to 2008, showing successive annual increase in Foreign Direct Investment (FDI). (Sources from Statistics Bureau of Guangdong Province 2009)

**IP Management for Policy Makers in the Guangdong Province** - China is required to adopt strengthened IP protection system as a condition of entry into the World Trade Organization (WTO) (Kong 2005). It is beneficial to the nation's long-term interest to formulate a national IP policy for the local business organizations when they create IP (State Intellectual Property Office of PRC 2009). For this reason, the Guangdong Provincial Intellectual Property Office (GDIPO) initiates various IP management policies to improve the support to the local organizations. The importance of IP management is recognized by the policy makers who may enforce their policy as below:

- Provoke innovative, creative and inventive activities and induce inventors to protect and commercialize their inventions and/or grant exclusive or non-exclusive licenses to exploit the inventions for the benefit of mankind (GDIPO 2009);
- Create wealth for the individuals, organizations and the nation through the payment of royalties, patent fees and the generation of foreign exchange;
- Create an environment for transfer of technology with good system to protect the security of IP;
- Promote foreign direct investment into the nation and safeguard the resources of international investors (Heath 2003);
- Provide an environment in which innovation is rewarded and will further promote inventive, innovative and creative activities in the nation (Ogunbanjo 2006); and
- Stimulate the development of domestic industries.

Figure 1.4 shows the statistical data on patent applications in the Guangdong Province. In 2007, the number of patent applications in the Guangdong Province was 102,458, up 12.7% over the previous year. “Design” takes the most shares in patent application, while “Invention” which is fast increasing has for the first time reached the second position. “Utility Model” takes the least. In 2008, the number of patent applications in Guangdong Province was 103,883, which continued moderately rising 1.4%. For the 14$^{th}$ consecutive year, the numbers of patent applications and grants ranked first in China (GDIPO 2009). In 2007, the State IP Office of PRC received 694,153 applications for three different kinds of patents, for which home applications accounted for 84.5% and foreign ones comprised 15.5%. More than 115 countries or regions have filed patent applications in China. Japan has applied the most patents (5.5%), followed by the United States (3.7%), the Republic of Korea (1.4%) and Germany (1.4%). The Sate IP Office of PRC received 2,562 applications from Hong

Kong, which represented less than 0.4% of the total applications, implying that the position of the local patent related businesses is lagging behind the leading countries or regions. If the IP policy does not produce the public benefits, the local industrial organizations and foreign investors shall have obstacles to the proper and effective use of IP system for achieving the full potential and the competitiveness position of their businesses.

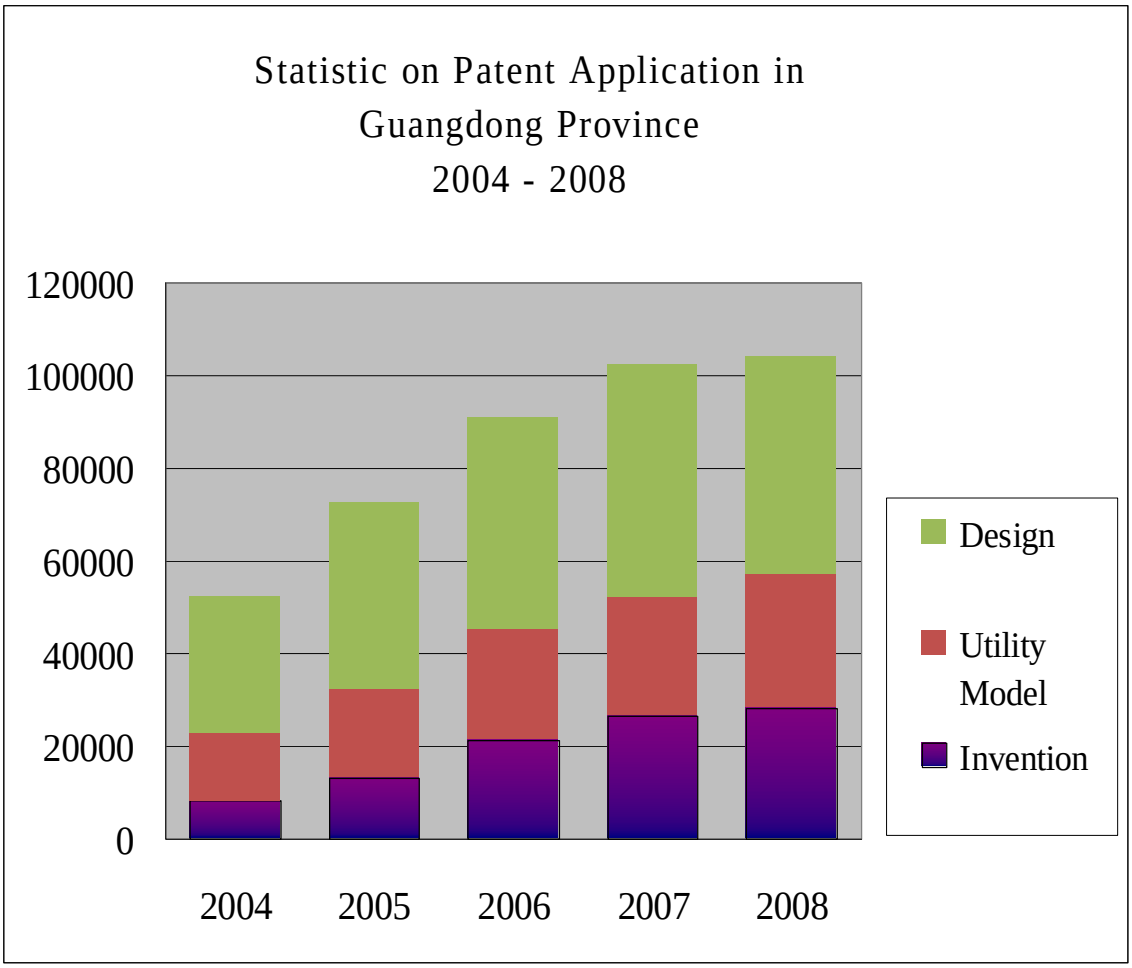



Figure 1.4 Statistic on patent applications in the Guangdong Province from 2004 to 2008, showing successive annual increase in patent application. (Sources from GDIPO 2009)

In response to the current problems in the Guangdong Province, a radical rethinking is needed on the way of doing business for any industrial organizations that wish to move away from low value added business process. Senior executives and managers should consider the factors on IP management activities in their daily works and provide the organizations necessary supports to upgrade their operation mode from OEM to ODM and OBM.

### 1.1.4 Project Justification

In recent decades, different management techniques, concepts, and principles have been developed by academics and industries. There exists a large body of literature discussing the introduction of a set of IP management practices in order to cope with the revolutionary change brought about by the development and use of IP and innovation in business activities. To understand the IP management performance of a manufacturing organization, it is necessary that organizations breakdown the complicated concept of IP management practices into success factors such that the IP management could be implemented and evaluated by focusing on measuring respective success factors.

This project endeavors to study the critical success factors of good IP management practices and apply them to investigate the current IP practices of Hong Kong-Guangdong (HK-GD) based manufacturing industry. The findings will help enhance the competitiveness of “HK-GD based manufacturing organizations” through the introduction of a set of good IP management practices. “HK-GD based manufacturing organizations” refers to Hong Kong-invested industrial organizations

in the Guangdong Province of China, with manufacturing activities based in Hong Kong and Guangdong (Hong Kong Trade Development Council 2006). The Guangdong manufacturing region, located in the Southern China, is named as the factory of the world because of its first-rank outputs in toys, electrical appliances, watches, etc. Although original equipment manufacturing (OEM) remains the major production mode of manufacturing organizations in Guangdong, an increasing number of these organizations are developing original design manufacturing (ODM) and original brand manufacturing (OBM) in recent years (Federation of Hong Kong Industry 2007). Similar to the problems in other developing countries in Asia and East Europe, manufacturing organizations in Guangdong are now receiving increasing pressure as the business environment changes. The energy, land, labour and manpower shortage in Guangdong have pushed up production costs. Meanwhile, the Guangdong Province has continued to tighten its grip on processing trade in an effort to expedite the transformation and upgrade of processing trade and promote the gradient transfer of industries (China Daily 2007a). The deepening global economic downturn has affected Guangdong, a famous home of labor-intensive and export-oriented companies, as demand of foreign buyers has continued to decline and many enterprises suffering shrinking orders or business suspension (China Daily 2008). This project considers the implementation of good IP management could help the transformation of HK-GD based manufacturing organizations from low-cost labor-intensive OEM business to high-value-added ODM/OBM business. With this investigation of the situation in Guangdong Province, the future development of China's manufacturing industry, the major momentum of global manufacturing, will be understood. This research aims to develop an IP management excellence audit model for the following justifications:

Firstly, according to the TDC survey (Hong Kong Trade Development Council 2003, 2008), over 50% of HK-GD based manufacturing organizations would opt for developing products of a better quality in their pursuit of upgrade, while 45.1% would improve their product design and make innovations. They believe that the only way to maintain their competitive edge is to make their products “unique”. Senior executives and managers now have increasing responsibilities so as to cope with the above changes. These additional responsibilities include designing innovative products as well as identifying, protecting and managing the innovation and IP generated in the product development process. It is essential that they should have solid understanding of the IP and capabilities required to fulfil their roles and assist the organizations to manage their IP effectively. In order to effectively and efficiently implement IP management, it is more practical to firstly implement the most important factors which could provide immediate beneficial results to organizations. Then, organizations could evaluate the feasibility of further implementation of other factors by allocating more resources. This project breaks down the complicated concept of IP management system and practices into a list of enabling criteria such that the IP management performance can be measured in details, in terms of enabling criteria. The enabling criteria are the critical success factors to good IP management systems and practices. It will help organizations easier to understand the IP management issues so that they could pay attention to these critical factors in order to improve their IP management performance.

Secondly, in Europe and the USA, the European Foundation for Quality Management (EFQM 2007) and Malcolm Baldrige National Quality Award (MBNQA) (United States Department of Commerce 2007) respectively provide audit framework consisting of “Enablers” and “Results”. The proposed IP management excellence

audit model is also designed with two parts; one is to audit the “Systems and Practices” and the other is to audit the “Results”. The part of “Systems and Practices”, called “Enablers”, helps to examine the IP system and deployment issues in the organization while the “results” part is directly related to the actual outcome of IP management. There is little empirical research on IP management excellence audit model relating to HK-GD based manufacturing organizations. These blank spots form the fundamental motivation for current study. The key benefits of adopting the IP management excellence audit model are to examine the organization’s internal control over IP management critically and identify strengths and opportunities for improvements. IP management evaluators perform the assessment within the organization and formulate written assessment report with best practice recommendation. Through the establishment of effective IP management system, the organization can align its IP portfolio with business objectives and eventually maximize the potential value from its IP assets.

In business world, many organizational problems are identified as a result of a simple self-assessment and/or external audit. The most common type of problem identification processes in organizations is the audit programmes as required by the ISO 9000 series quality standards. Based on the successful experiences of the ISO’s quality audit process, the problem identification is consuming remarkably small resources within organizations, but they are valuable as a tool for improvement or for changing the way of the organizations to do business. The correction of problems from the auditing effort can assist organizations to improve competitiveness and gain significant benefit for sustaining business growth. In view of the above developments, the best ways for HK-GD based manufacturing organizations to leverage IP are to emphasize on a set of IP management enabling criteria as an important part of the

business process. Thus, this project endeavors to establish a set of enabling criteria and provide a criteria-based IP management model that is necessary to enable organizations to use their IP assets to improve their competitiveness and strategic advantage. The enabling criteria in the criteria-based model are system works and general practices which provide organizations with guidelines so as to operate IP management strategy, policies, systems and practices to achieve IP management excellence. Five research questions are suggested below:

i. What are the factors (criteria) affecting the IP management performance of a manufacturing organization?
ii. What is the effect of IP management "System and Practices" in the organization on the IP management excellence?
iii. What is the situation of IP management practices in the HK-GD based manufacturing industry?
iv. What is the relative importance among the identified criteria in the IP management excellence audit model?
v. What is the way to audit the IP management excellence of manufacturing organizations for achieving improvements in IP management?

## 1.2 Aim, Objectives and Project Scope

### 1.2.1 Aim

The aim of this project is to study the critical success factors for implementing IP management related activities in organizations. These factors encompass the essential elements of an IP management excellence audit model that is used to assess the position of the organizations for achieving IP management improvements. The

initiative under this project encourages the organizations to use the audit model for conducting assessment programmes in order to give the organizations a head start in their paths to IP management excellence.

### 1.2.2 Objectives

The followings are the specific objectives to be achieved under the aim of this project:

1. Develop an IP management model;
   (a) Identify the core values in IP management;
   (b) Define the key enabling criteria in IP management;
   (c) Develop the criteria-based IP management model by grouping the key enabling criteria into enabling categories according to their nature.
2. Investigate the general IP management practices of HK-GD based manufacturing industry;
   (a) Examine the current situation of IP management enabling categories and criteria in HK-GD based manufacturing industry;
   (b) Investigate the general IP management practices of HK-GD based manufacturing industry;
   (c) Investigate the relationships between general IP management practices and IP management performance excellence of HK-GD based manufacturing industry.
3. Prioritize the relative importance of enabling categories and criteria in IP management for HK-GD based manufacturing industry.
4. Develop and implement an IP management excellence audit model that is suggested for the HK-GD based manufacturing industry.

### 1.2.3 Project Scope

The project attempts to make contributions in both theoretical and practical areas to introduce an IP management excellence audit model which is an important part of the business process in the current environment. At the theoretical level, the scope of project focuses on theoretical justification and theory development of a set of key enabling criteria for an IP management excellence audit model. At the practical level, the scope covers implementation of the IP management excellence audit model with the HK-GD based manufacturing organizations being used to test the theory.

## 1.3 Outline of the Chapters

The content of each chapter of this study is briefly described as follows and Figure 1.5 shows the flowchart of the project.

Chapter 1 describes trends and development of IP management, the current problems of Hong Kong and Guangdong manufacturing industry and provides project justification. It also introduces the aims, objectives and scope of research and ends with a description of the organization of the thesis.

Chapter 2 gives an overview of IP and introduces the various forms of IP rights that have certain features in common. In light of the literature dealing with the concept of IP management, the result categories and enabling categories are reviewed, followed by a discussion of organization structures for IP management. There is a research gap in defining a set of assessment criteria to measure performance of IP management.

The reason for setting up a model in this project is to fill up the gap identified in the literature review.

Chapter 3 introduces methodologies of the research, including development of IP management model through literature review, questionnaire survey, Analytic Hierarchy Process (AHP) approach, and Evidential Reasoning (ER) approach with support by software of Intelligent Decision System (IDS) to establish an audit system in IP management.

Chapter 4 establishes a set of enabling criteria that improve IP management practices of organizations. In light of the literature review and studies of good systems and practices in organizations, a set of enabling criteria in support of IP management excellence is proposed. A criteria-based IP management model is developed for the HK-GD based manufacturing industry based on the literature review.

Chapter 5 develops hypothesis, presents the mail survey, the results and analysis of data, and the discussion of the research findings.

Chapter 6 examines the relative importance of enabling categories and criteria for IP management that are identified in Chapter 5 through expert interviews, analysis of the data by the AHP approach, and the discussion of the research findings.

Chapter 7 establishes an IP management excellence audit model and presents the case studies in the HK-GD based manufacturing industry. Research findings are presented and discussed.

Chapter 8 presents the achievements and contributions of the research, as well as the limitations of the research, and then proposes suggestions for future research, and concludes with overall research findings.

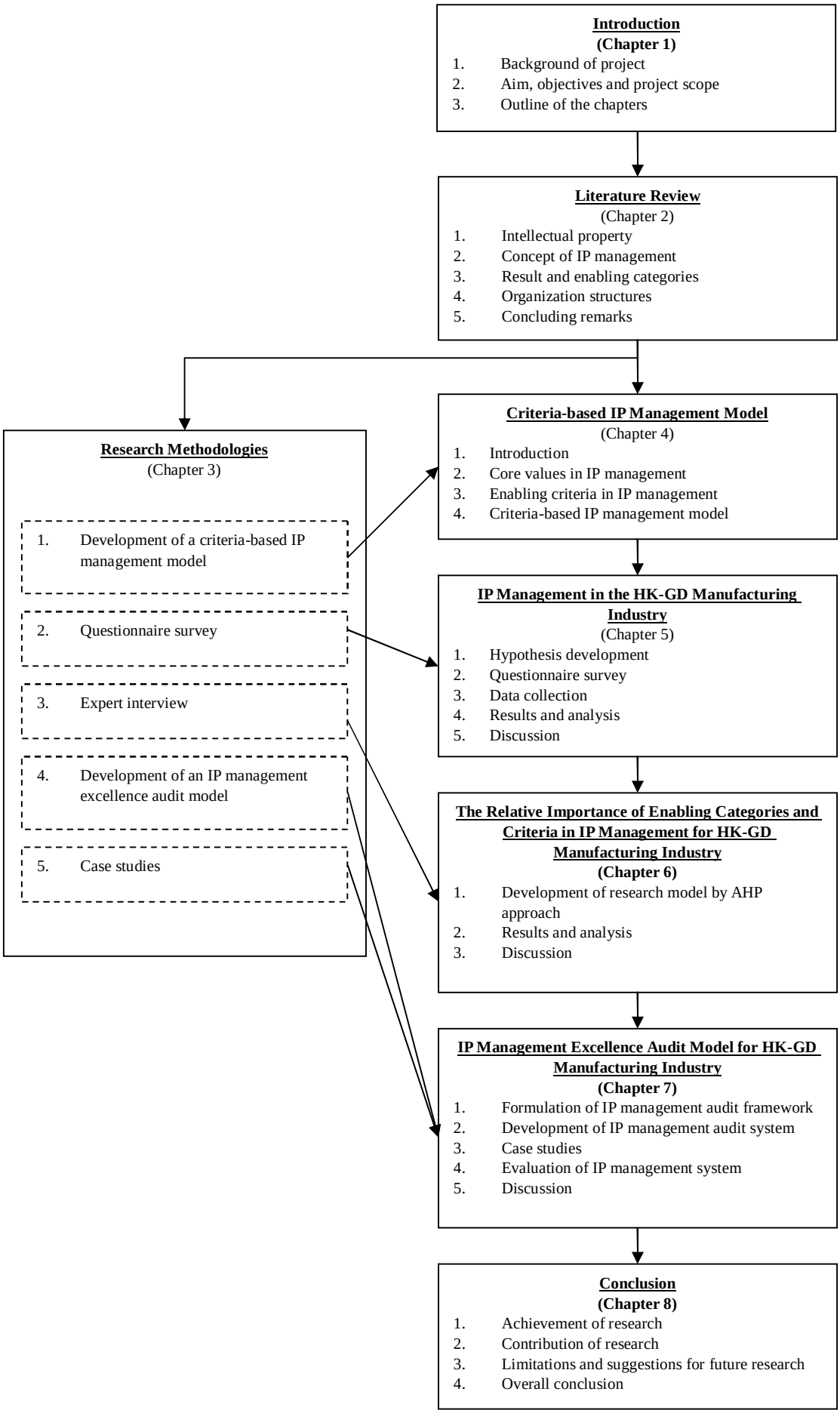



Figure 1.5 Flowchart of the Project

# Chapter 2 Literature Review

This chapter gives an overview of IP and introduces the various forms of IP rights that have certain features in common. In light of the literature dealing with the concept of IP management, the result categories and enabling categories are reviewed, followed by a discussion of organization structures for IP management.

## 2.1 Intellectual Property

IP is intangible property resulting from creations of the mind. There is a wide spectrum of intangible property which may cover inventions, literary and artistic works, symbols, names, images and designs used in commerce.

### 2.1.1 Different Forms of Intellectual Property

The World Intellectual Property Organization (WIPO 2007) has provided a very broad definition of IP which can be divided into two categories:

- Industrial property, which includes inventions (patents), trademarks, industrial designs, and geographic indications of source; and
- Copyright, which includes literary and artistic works such as novels, poems and plays, films, musical works, artistic works such as drawings, paintings, photographs and sculptures, and architectural designs. Rights related to copyright include those of performing artists in their performances, producers of phonograms in their recordings, and those of broadcasters in their radio and television programs.

Lee and Davidson (1993) state that IP rights are the rights conferred by IP laws on individuals or organizations with respect to their ideas, inventions and creations. Jacob *et al.* (2004) further describe that the object of protection is usually "a work of the mind" or human intellect, and the exclusive right guarantees the control of the exploitation of works for a limited period.

IP laws are designed to protect different forms of subject matter, although in some cases there is a degree of overlap. The following section does not intend to cover a wide and diverse range of rights, but concentrates on those that are particularly relevant to the current environment. According to the collective findings from literatures, the different forms of IP are elaborated as followings:

**Patent** - A patent is an exclusive right granted for an invention, which is a product or a process that provides, in general, a new way of doing something, or offers a new technical solution to a problem (WIPO 2007). Miele (2001) stresses that the invention must fulfill three necessary conditions for patentability, i.e. novel, inventive and industrial application in order to be patentable. Patent provides protection for owner of the invention. The protection is granted for a limited period, generally 20 years. There are similar discussions in Jacob *et al.* (2004), Philopott and Jolly (2004), IP Australia (2001) and Lee and Davidson (1993).

**Trademark** - IP Australia (2001) defines a trademark as a distinctive sign which identifies certain goods or services as those produced or provided by a specific person or organization. WIPO (2007) dates back the origin of trademarks to ancient times, when craftsmen reproduced their signatures, or "marks" on their artistic or utilitarian products. Over the years these marks evolved into today's system of trademark registration and

protection. With respect to this development, Philopott and Jolly (2004), Dorr and Munch (1995) and Murdie (2000) consider that the system helps consumers identify and purchase a product or service because its nature and quality, indicated by its unique trademark, meets their needs.

**Design** - IP Australia (2001) defines an industrial design as the ornamental or aesthetic aspect of an article. The design may consist of three-dimensional features, such as the shape or surface of an article, or of two-dimensional features, such as patterns, lines or color. WIPO (2007) shows that industrial designs are applied to a wide variety of products of industry and handicraft: from technical and medical instruments to watches, jewelry, and other luxury items; from house wares and electrical appliances to vehicles and architectural structures; from textile designs to leisure goods. To be protected under most national laws, an industrial design must appeal to the eye. This means that an industrial design is primarily of an aesthetic nature, and does not protect any technical features of the article to which it is applied (Jacob *et al.* 2004; Lee and Davidson 1993).

**Copyright** - Copyright is a legal term describing rights given to creators for their literary and artistic works (Jacob *et al.* 2004; Lee and Davidson 1993). With respect to the kinds of works covered by copyright, WIPO (2007) provides a definition which include: literary works such as novels, poems, plays, reference works, newspapers and computer programs; databases; films, musical compositions, and choreography; artistic works such as paintings, drawings, photographs and sculpture; architecture; and advertisements, maps and technical drawings. A similar description on copyright is also provided by IP Australia (2001).

**Trade Secrets** - A trade secret is information of any type that is actually or potentially

valuable to its owner, that gives its holder a competitive advantage in the marketplace, and not generally known or readily ascertainable by the public, and which the owner has made a reasonable effort to keep secret (WIPO 2007; WIPO Magazine 2002). Examples of trade secrets include formulas, patterns, processes, techniques, or procedure. Perhaps the most famous trade secret is the formula for Coca-Cola. The following authors have provided the basic concept of trade secrets: Jacob *et al.* (2004), Philopott and Jolly (2004), IP Australia (2001), Dorr and Munch (1995), Murdie (2000) and Lee and Davidson (1993).

### 2.1.2 Common Features of Intellectual Property

Jacob *et al.* (2004), Smith and Parr (2003), Yang (2003), IP Australia (2001) and Jaffe (2000) examine the main features needed to qualify for classification as IP rights. They are intangibility, exclusivity and transferability.

**Intangibility** - IP itself lacks tangible form, existing solely as abstract legal rights. Intangible property is what cannot be seen. Examples of intangible property include the ideas contained in books, journals, or music. It also includes the coding for computer software. These intangible forms of property are often called IP. Yang (2003) points out that the intangibility of IP is reflected in the different ownership rules which apply to IP. For example the 'purchaser' of a CDROM containing a software package does not get unlimited rights to the software as the owner of copyright in the software owns the copyright. The software owner can reproduce an unlimited number of copies of the software. The purchaser instead obtains a license to such software on the terms and conditions of an agreement (Smith and Parr 2003, IP Australia 2001; Melville 1986).

**Exclusivity** - Exclusivity is the main feature of IP rights. It is strictly defined to exclude others from using the IP without permission of the owner. Moreover, it is more complex than exclusivity with respect to tangible assets which commonly associate with property, real estate, cars, jewelry and clothing (Jacob *et al.* 2004). For example, two persons can own or sell the same style and design, but two inventors cannot independently own or sell the same patented invention. Only the first-to-file in most countries or the first-to-invent in U.S. can acquire the exclusive rights, the other person cannot use the invention for free; see discussions in Jaffe (2000) and National Academies Policy Advisory Group (1995).

**Transferability** - IP should be transferable. When an IP transfer happens, it can be essentially the assignment or licensing (Smith and Parr 2003; Melville 1986). The latter case is common as the right is retained by the owner. Yang (2003) points out that the license grants either exclusive or non-exclusive rights to its use, often involving the payment of royalties. Therefore, the licensing is distinguished from the assignment which is the outright transfer of IP. There is similar discussion in IP Australia (2001).

## 2.2 Concept of Intellectual Property Management

Industrial organizations today are being affected by the use of IP in business in many different ways. The different concepts of IP management are depicted as follows:

According to the Intellectual Property Office of Singapore (IPOS 2007), IP management refers to the holistic management of the entire life cycle of an organization's IP that directly supports the company's business strategies to achieve and maintain competitive advantage. It includes the management of the creation, ownership, protection, commercial exploitation and adoption of the best practice of IP.

Volker (1998) describes that IP management is all about maximizing profitability. For the high-tech venture, IP is the lifeblood of the organization. Managers should develop an organizational culture which understands the importance of this. Engineering managers should be looking at licensing out the non-core IP, which is not commercially critical to the organization, thereby generating additional profits for the organization from "old" technology. And, they should also be looking at licensing in technology which might tie in to their own. Furthermore, technical managers should make it a practice to review disclosures (patents and others) frequently in order to augment their knowledge base.

Sullivan (2000) explains that the IP management means a way of viewing the systems used by organizations to manage and extract value from their intellectual assets. The objective of the IP management includes extracting strategic value from their IP; integrating IP awareness and operations throughout all functions of the organization; becoming more sophisticated and innovative in managing and extracting value from the organization's IP.

Davis and Harrison (2001) show that IP management is integrally involved in the divestiture of organizational assets or divisions. It should be the responsibility of the IP function to be sure that all IP assets are properly linked with the appropriate business units. When there is an overlap of patent use between divisions or business units, the IP function can ensure that valuable assets are not mistakenly sold with the divestiture.

The World Intellectual Property Organization (WIPO 2007) finds that IP is a key differentiator for organizations. Efforts that organizations put into innovative product development, branding, customer relationship management and so on produce IP that can

be translated into important assets. IP can only be useful to the organization when it is able to contribute to the bottom line. To do so, organizations must manage their IP properly.

The growing interest in IP management revealed a certain level of disagreement on the definition of IP management and, more specifically, on the assessment criteria of IP management performance. In this context, some authors indicate that IP management criteria is a set of value added business processes that affects the IP management performance. The basic arguments can be found in Volpi (2006), Thomas (2003), Streater (2002), Ch'ang and Yastreboff (2002), Bratic *et al.* (2001), Haley (2000) and Klaila and Hall (2000). It is agreed that the establishment of a set of IP management criteria is in line with the objectives of organizations to promote IP awareness and management. It helps manufacturing organizations to adopt a proactive approach to IP management and a systematic model that ties IP management enablers to performance results. This is supported by a collection of historical literatures on audit concepts by the following authors: Greenwood (2006), Bollen *et al.* (2005), Delain (2003), Retsky (2002), Harrison and Sullivan (2000), Lynn (1998), Bontis (1998), Edvinsson and Malone (1997), Sveiby (1997), Roos and Roos (1997) and Brooking (1996). They are in agreement that organizations must perform an audit of IP management in order to ascertain their IP management's position in their operating environment. It is to the organization's interest and strength to develop an audit model that has considered all important criteria objectively and systematically so that nothing of importance goes unnoticed or unconsidered. However, they did not consider the questions of new IP management and regulatory requirements, which are the latest topics of discussions by Shearer (2007), Bender (2006), Banham (2005) and Barren *et al.* (2005). For example, Sarbanes-Oxley Act of 2002 (SOX) requires timely reports on "material IP events" that could impact the

finances and operations of an organization (Bender 2006). Many case studies of organizations show that it is to the long-term interest of foreign investors and policy makers to promote the audit model as a guide for developing an international business practice or national standard. It is therefore necessary to set up a model of IP management that focuses on establishing the assessment criteria to address the flow of IP in business.

In the present IP management literature, there have been few studies aimed at defining a set of assessment criteria to measure performance of IP management. The reason for setting up a model in this project is to fill up the gap identified in the literature review. The research presented here introduces an IP management excellence audit model with reference to the original concepts of business performance excellence developed by European Foundation for Quality Management (EFQM) and Malcolm Baldrige National Quality Award (MBNQA); see EFQM (2007) and United States Department of Commerce (2007). The IP management excellence audit model includes the “Enablers” and “Results” in order to investigate the input-output effects between enablers and results. The “Enablers” is “Systems and Practices” that can assist the organization in developing and maintaining its IP management process. The “Results” is used to measure the overall performance of the organization in IP management. The linkages between categories provide a framework for examining organization structures. An analysis of IP management literature that based on assessment criteria can therefore be divided into three streams:

(A) result categories;

(B) enabling categories; and

(C) organization structures.

In doing so, this study aims to enhance our understanding of the importance of IP management organization structures and enabling categories in relationship to result categories.

### 2.2.1 Result Categories

The measurement of IP management results are of critical importance to the organization so that the management has more reliable and relevant information on which to base its investment and operational decisions. Tao *et al.* (2005), Davis and Harrison (2001), Sullivan (2000) and Miele (2000) show how the accomplishments of IP management activities cut across two result categories, namely, IP outcomes and external relationship satisfaction. The collective findings reveal that the result categories and criteria are associated with the internal structure and external environment as shown in Table 2.1 (Shearer 2007; KPMG 2006; Bender 2006; Tao *et al.* 2005; Barren *et al.* 2005; Davis and Harrison 2001; Sullivan 2000; Miele 2000).

Tao *et al.* (2005) have investigated IP management results in two typical contexts, internal structure and external environment. These contexts are used to provide a way of classifying results associated with the internally-related and externally-focused activities that an organization goes through to create IP outcomes and external relationship satisfaction.

The context of internal structure focuses on the internally-related activities and the organization's internal structure. The successful implementation of IP management activities in internal structure are expected to deliver various results simultaneously. Most organizations focus on maximizing the results of IP portfolio through productization or

licensing-out to generate revenues. This leads to development of some assessment criteria that focus on the IP assets, such as patents, designs, trademarks, service marks and licenses, in the context of internal structure.

| Result Category / Kinds of Context | IP Outcomes | External Relationship Satisfaction |
|---|---|---|
| Internal Structure | The effectiveness for:<br>- Patent<br>- Design<br>- Trademark and service marks<br>- Licensing-out IP | |
| External Environment | The effectiveness for:<br>- Spinout<br>- Licensing-in IP<br>- Acquired IP<br>- Established business partnership based on IP<br>- Established customer relationship based on IP | The comfort level of external relationship for:<br>- IP compliance satisfaction<br>- IP liability reduction satisfaction<br>- IP trust satisfaction<br>- IP capitalization benefits satisfaction |

Table 2.1 The result categories in the context of internal structure and external environment

The context of external environment centres on the externally-focused activities and the organization's external environment. The focus is on spin-off, IP acquisition, strategic alliances and buyer-seller relationships to generate immediate and long-term revenue streams. The successful implementation of IP management activities are expected to have

significant impacts on many aspects of external environment. In this context, most organizations actively monitor the results in terms of IP outcomes and external relationship satisfaction.

#### 2.2.1.1 Internal Structure

The classification of research focus on IP outcomes in the context of internal structure can be found in Table 2.2. IP composed of protected assets, such as patents, designs, trademarks, service marks and licenses. The extraction of results involves a process of protecting key IP assets and finding ways to exploit these assets. Roos and Roos (1997) measures the effectiveness for the commercial application of IP and successful exploitation of the idea. Sullivan (2000) and Brooking (1996) measures the effectiveness of using IP to capture value from innovation and to maximize return on investment in research and development. During the last decades, many authors adopt the similar viewpoints regarding how to use components of IP assets, such as patents, designs, trademarks, service marks and licenses, in measuring the effectiveness of IP outcomes in the context of internal structure; see Bontis (1998) and Sveiby (1997). In fact, the successful exploitation of innovation has an important bearing on an organization's ability to improve its processes, continuously bring new and improved products and services to market, improve its efficiency and, more importantly, improve its profitability; see Shearer (2007), Tao *et al.* (2005), Bollen *et al.* (2005), Delain (2003), Retsky (2002), Bratic *et al.* (2001) and Davis and Harrison (2001).

| Research Focus | Authors |
|---|---|
| • Patent | Shearer (2007); Tao *et al.* (2005); Bollen *et al.* (2005); Delain (2003); Streater (2002); Ch'ang and Yastreboff (2002); Retsky (2002); Bratic *et al.* (2001); Davis and Harrison (2001); Sullivan (2000); Bontis (1998); Roos and Roos (1997); Sveiby (1997); Brooking (1996) |
| • Design | Streater (2002); Sullivan (2000); Roos and Roos (1997) |
| • Trademark and service marks | Shearer (2007); Tao *et al.* (2005); Delain (2003); Streater (2002); Ch'ang and Yastreboff (2002); Retsky (2002); Bratic *et al.* (2001); Sullivan (2000); Roos and Roos (1997); Sveiby (1997) |
| • Licensing-out IP | Shearer (2007); Tao *et al.* (2005); Bollen *et al.* (2005); Delain (2003); Retsky (2002); Bratic *et al.* (2001); Davis and Harrison (2001); Sullivan (2000); Bontis (1998); Roos and Roos (1997) |

Table 2.2 Literature streams for measuring the effectiveness of IP outcomes in the context of internal structure

#### 2.2.1.2 External Environment

Table 2.3 classifies the research focus on IP outcomes in the context of external environment. From a business point of view, IP assets such as spinout, licensing-in IP, acquired IP, and business partnership and customer relationship based on IP can enhance organizational performance. They cannot be ignored in the context of external environment. IP in an environment of "co-opetition" (International Bureau of WIPO 2002) strengthens technology sharing amongst organizations. Useful new or original technologies are either created by an organization itself or obtained from others by entering into various types of contractual relationships such as outsourcing,

sub-contracting, licensing, partnerships, collaborations, joint ventures and strategic alliances. In this context, Andersen and Konzelmann (2008), Amadi-Echendu and John (2008), Tao *et al.* (2005) and Bratic *et al.* (2001) measure the effectiveness of using IP as means of spinout, licensing-in and acquisition for performing technology sharing. On the other hand, Fitzpatrick and DiLullo (2005), Saunders (2003), Lynn (1998), Edvinsson and Malone (1997), Roos and Roos (1997) and Brooking (1996) measure the effectiveness of establishing business partnership and customer relationship based on IP to generate immediate and long-term revenue streams.

| **Research Focus** | **Authors** |
|---|---|
| • Spinout | Andersen and Konzelmann (2008); Amadi-Echendu and John (2008); Tao *et al.* (2005); Bratic *et al.* (2001) |
| • Licensing-in IP | Andersen and Konzelmann (2008); Amadi-Echendu and John (2008); Tao *et al.* (2005); Bratic *et al.* (2001) |
| • Acquired IP | Andersen and Konzelmann (2008); Amadi-Echendu and John (2008); Tao *et al.* (2005); Bratic *et al.* (2001) |
| • Established business partnership based on IP | Fitzpatrick and DiLullo (2005); Saunders (2003); Lynn (1998); Edvinsson and Malone (1997); Roos and Roos (1997); Brooking (1996) |
| • Established customer relationship based on IP | Fitzpatrick and DiLullo (2005); Saunders (2003); Lynn (1998); Edvinsson and Malone (1997); Roos and Roos (1997); Brooking (1996) |

Table 2.3 Literature streams for measuring the effectiveness of IP outcomes in the context of external environment

Table 2.4 classifies the research focus on external relationship satisfaction in the context of external environment. Shearer (2007), Greenwood (2006), Bender (2006), KPMG (2006), Bollen *et al.* (2005) and Barren *et al.* (2005) consider that satisfaction of external relationship such as compliance, liability reduction, trust and capitalization benefits based on IP play an important role. Shearer (2007), Berrell and Wrathall (2007), Bender (2006) and KPMG (2006) measure the comfort level of IP compliance satisfaction with reference to the new IP management and regulatory requirements. In fact, IP allows organizations to gain the "First Mover Advantage" (Lieberman and Montgomery 1988) by preventing others from entering the claimed markets, thereby reducing competition and establishing the IP owner's position in the market as a pre-eminent player. In this context, Andersen and Konzelmann (2008), Greenwood (2006), Bender (2006), KPMG (2006) and Barren *et al.* (2005) measure the comfort level of IP liability reduction satisfaction with business environment for technology development. In addition, IP can help to "break open" new market, and dramatically improve business opportunities for providers who have secured IP protection for their products and services. This leads to development of two measurements by Shearer (2007), Bender (2006), KPMG (2006), Shinozaki and Nagata (2006), Bollen *et al.* (2005), Barren *et al.* (2005) and Blomqvist *et al.* (2005): the comfort level of IP trust satisfaction which is concerned with transactions between organizations; and the comfort level of IP capitalization benefits satisfaction which is concerned with market leadership position enhanced by creative edge.

| Research Focus | Authors |
|---|---|
| • IP compliance satisfaction | Shearer (2007); Berrell and Wrathall (2007); Bender (2006); KPMG (2006) |
| • IP liability reduction satisfaction | Andersen and Konzelmann (2008); Greenwood (2006); Bender (2006); KPMG (2006); Barren *et al.* (2005) |
| • IP trust satisfaction | Shearer (2007); Bender (2006); KPMG (2006); Shinozaki and Nagata (2006); Bollen *et al.* (2005); Barren *et al.* (2005); Blomqvist *et al.* (2005) |
| • IP capitalization benefits satisfaction | Shearer (2007); Bender (2006); KPMG (2006); Shinozaki and Nagata (2006); Bollen *et al.* (2005); Barren *et al.* (2005); Blomqvist *et al.* (2005) |

Table 2.4 Literature streams for measuring the comfort level of external relationship in the context of external environment

### 2.2.2 Enabling Categories

IP management activities have significant impacts on routine business. The enabling categories provide performance measures for each function to plan actionable IP management activities that can finally address to the organization's business goal. Therefore, an effective internal IP operation structured by enabling categories creates the sustainable results in IP outcomes and external relationship satisfaction.

Tao *et al.* (2005), Gibbs and DeMatteis (2003) and Pike (2001) consider that IP management activities involve participations of some closely related functions. In many organizations, IP activities are commonly managed across eight functions of organizations: the chief executive officer, corporate/IP counsel, finance, human resources,

information technology, engineering, manufacturing and marketing. A typical configuration of the IP management activities in each function is shown in Table 2.5.

According to Tao *et al.* (2005), Gibbs and DeMatteis (2003) and Pike (2001), it is important for the senior executives to come together, coordinate and develop a plan to better manage their IP and intangible assets. An effective implementation of IP management activities will not happen unless it is understood and driven by the CEO (Rivette and Kline 2000). IP counsel plays a role in supporting the needs of different functions (Miele 2000). They have to educate the rest of the organization as to the pervasive and critical role IP plays in the creation of sustainable performance (Shearer 2007). Finance function needs to know how to budget IP, invest in protection against IP infringement and valuate IP assets (Goldheim *et al.* 2005). Human resources function needs to understand the importance of training to foster an awareness of striving for innovation and IP protection (Gibbs and DeMatteis 2003). Information technology function needs to understand the role of IP management in the information system (Berman 2001). Engineering function needs to understand the value of fostering awareness of patent generation among the engineering staff (Bader 2006). Manufacturing operations need to understand how IP can improve processes and lower costs (Gibbs and DeMatteis 2003). The marketing function needs to establish an IP plan in marketing (Rivette and Kline 2000).

| Enabling Category / Functions | Management Support | Innovation Development | Intellectual Property Capitalization | External Relationship Management |
|---|---|---|---|---|
| The CEO/ICO | Mission and vision, top management commitment in IP management; | Overall responsibility; | Overall responsibility | Overall responsibility; |
| Corporate / IP Counsel | Internal IP manager, IP defense, IP enforcement, total commitment to action in IP management; | Supporting department needs, utilizing external IP consultant; | Supporting department needs; | Supporting department needs; |
| Finance Department | Total commitment to action in IP management; | IP budget; | IP audit, IP valuation, IP cost/benefit analysis; | Startup/Spinout; |
| Human Resource Department | IP manual, employee contract, IP training, foster total commitment to action in IP management; | Foster total commitment to action in IP management; | Foster total commitment to action in IP management; | Foster total commitment to action in IP management; |
| Information Technology Department | Total commitment to action in IP management; | IP information database; | Confidential information, copyright protection, internal design documentation, software patent application; | IP right ownership; |
| Engineering Department | Total commitment to action in IP management; | Concept creation, design around, concept evaluation, concept vetting procedure, prototype testing and development, IP search, IP information database; | Confidential information, copyright protection, internal design documentation, patent application, design application, IP out-licensing, IP in-licensing, IP ownership acquisition; | IP commercialization conversion, IP right ownership, non-disclosure agreement, technology collaboration, research collaboration; |
| Manufacturing and Operations | Total commitment to action in IP management; | Concept creation, design around, concept evaluation, concept vetting procedure, prototype testing and development, IP search; | Confidential information, copyright protection, internal design documentation, patent application, design application, IP out-licensing, IP in-licensing, IP ownership acquisition; | IP commercialization conversion, IP right ownership, non-disclosure agreement, technology collaboration; |
| Marketing Department | Total commitment to action in IP management; | Concept creation, design around, concept evaluation, concept vetting procedure, IP search; | Patent application, design application, trademark and service mark registration; | Brand positioning, advertising channel, IP right ownership, non-disclosure agreement, business collaboration; |

Table 2.5 The IP management activities of functions cut across four enabling categories

Apart from the functions, collective findings from previous researchers show that the IP management activities cut across four enabling categories, namely, management support, innovation development, intellectual property capitalization, and external relationship management. The enabling categories provide the performance measures and proficiency levels for IP management activities that can be used for internal assessments, training needs analysis, or benchmarking of departmental capabilities. The key areas of IP management addressed by each of the four enabling category are listed as below:

1. Management support category focuses on organizational leadership, strategy and core competencies that provide support for a) strategic management plan for IP activities; b) internal IP management function, knowledge and skill; and c) IP defense and enforcement system.

2. Innovation development category commits and mobilizes resources for product development to execute a) creativity generation, concept selection and prototyping; and b) IP intelligence and advisory support.

3. Intellectual property capitalization category revolves around identification, protection and controlling the exploitation of IP. It is primarily concerned with a) IP security protection; b) IP application/registration; c) internal IP audit and evaluation; and d) IP licensing and acquisition.

4. External relationship management category focuses on market development, strategic alliances and buyer-seller relationship based on IP requirements. It is concerned with a) IP commercial development and marketing; b) external IP security, agreement and partners matching; and c) research venture and IP holding business

startup.

#### 2.2.2.1 Management Support Category

The classification of research focus on management support category can be found in Table 2.6. Nowadays, business leaders are increasingly aware of the importance of IP to a successful organization. Intangible value now constitutes about 74 percent of total corporate value based on the Standard & Poor's 500 Stock Index (Shearer 2007; Reitzig 2004a). According to Rivette and Kline (2000), the IP-savvy CEOs will certainly regard an organizational vision that drives for IP management excellence as one of the most important pieces of intangible assets.

IP is no longer a legal function for product protection only. It is used to develop and sustain current competitive advantage, and to build competitive advantage for the future. This is why it requires top management commitment in IP management. Philips Electronics (2007) employs 400 intellectual-asset professionals in 23 offices worldwide to maximize the value of its 100,000 patents. Shearer (2007) considers that the CEOs must take leadership, both in setting the IP policies in line with the mission and vision and in creating organization-wide commitment needed to implement the strategies throughout the organization.

| Research Focus | Authors |
|---|---|
| Strategic management plan for IP activities | Shearer (2007); Reitzig (2007); Tietze *et al.* (2006); Reitzig (2004a); Miele (2000); Rivette and Kline (2000); Sullivan (2000) |
| Internal IP management function, knowledge and skill | Wook *et al.* (2008); Shearer (2007); Yu and Chen (2006); Tao *et al.* (2005); Gibbs and DeMatteis (2003); Andersen (2003); Lynn (1998); Edvinsson and Malone (1997); Sveiby (1997); Brooking (1996) |
| IP defense and enforcement system | Zhou *et al.* (2007); Zhao and Huang (2006); Elmslie and Portman (2006); Rivette and Kline (2000); Miele (2000) |

Table 2.6 Literature streams in management support category

An organization that effectively deals with the alignment of IP strategies with the business strategies can open up new strategy options to create, protect and exploit an IP portfolio (Reitzig 2007). Miele (2000) points out that the strategy options employed by an organization to support the business development programmes will vary greatly depending on their market share, strength and strategies of their competitors, the phase of industry growth and so on. Depending on the competitive challenges, Sullivan (2000) considers that the organization may use a defensive strategy to protect the commercialization of ideas or an offensive strategy for developing new product lines or expanding into new markets.

In integrating the IP requirements into the organization's business plan, an organization needs to look at the basic tasks of prioritizing the activities in the IP action plan and allocating the appropriate resources in supporting IP portfolio (Tietze *et al.* 2006). Ford

Global Technologies and IBM are examples of organizations that take their initiatives to build successful IP businesses (Shearer 2007).

According to Lynn (1998), Edvinsson and Malone (1997), Sveiby (1997) and Brooking (1996), people are unique competitive advantage for an organization. Their knowledge, skill and leadership are the key to organizational success. To become more competitive and profitable, the organization can capitalize on people by developing and deploying the full potential of the workforce in the area of IP and assigning the right people in IP management functions (Wook ***et al.*** 2008). Japan and China have recently announced that IP rights are the cornerstones of their twenty-first-century global strategies where well-educated, resourceful and creative minds of the nations' people are the focus of organizational productivity in the competitive environment (Shearer 2007; Yu and Chen 2006). To begin with IP knowledge and skill training, the organization can educate the role and importance of IP to employees and encourage them to share and upgrade IP knowledge and skill. For many organizations, the top management deploys its people to IP management functions and assigns responsibilities to IP matters. Based on the findings by Tao ***et al.*** (2005) and Gibbs and DeMatteis (2003), IP management organizations are increasingly becoming multidisciplinary teams that include expertise in finance, marketing, business development, negotiation, licensing, enforcement, defense, portfolio management and the valuation of IP assets (Andersen 2003).

Rivette and Kline (2000) consider that a litigation process is like a daily competitive battle and a business leader should not overlook the risk of a lawsuit on business. According to Miele (2000), leading products or technologies that dominate the market can generate large profits. Infringement can occur in the marketing stage and causes the profit to erode rapidly. The IP litigation control processes play a key role in determining

the defensive and offensive actions. Zhou *et al.* (2007), Elmslie and Portman (2006) and Zhao and Huang (2006) provide some basic concept on the role of IP management function in business. In a defensive role, an organization should adopt the fact finding practices in dealing with the case of IP defense against a third party IP accuser. In an offensive role, an organization should plan IP enforcement strategy for cases of IP infringement against an alleged IP infringer.

#### 2.2.2.2 Innovation Development Category

The classification of research focus on innovation development category can be found in Table 2.7. In any organization, it is essential to have creativity generation (Graham and Bachman 2004; Ettlie 2000; Khalil 2000; Trott 1998). While a product-oriented organization will certainly look at ways to develop new products with incorporation of IP, a production-oriented organization will employ IP rights in new manufacturing process for existing products. The investment of time, money and efforts enables the organizations to achieve business growth through new technology, product and service development (Bader 2006; Siskind 2006; Teece 1998; Levin *et al.* 1987; Mansfield 1986; Scherer 1983; Mansfield *et al.* 1981). Einhorn (2006) considers that commitment to creativity is treated as a competitive necessity, rather than a competitive advantage, in management of technology/product development and commercialization.

It is essential to ensure novelty in new idea generation (Zhang *et al.* 2006; Altshuller 1996). Through competitive intelligence monitoring, the organization is not only able to keep abreast of technology development, but also to assess risk of infringement in its new idea (Berman 2001). In fact, no organization can afford the costs to ignore IP. When an alternative design is used to get around the others' products, it requires precautions to

minimize the risk of infringement.

| Research Focus | Authors |
|---|---|
| Creativity generation, concept selection and prototyping | Bader (2006); Einhorn (2006); Siskind (2006); Zhang *et al.* (2006); Graham and Bachman (2004); Berman (2001); Davis and Harrison (2001); Ettlie (2000); Sullivan (2000); Khalil (2000); Trott (1998); Teece (1998); Altshuller (1996); Levin *et al.* (1987); Mansfield (1986); Scherer (1983); Mansfield *et al.* (1981) |
| IP intelligence and advisory support | Taylor and Germeraad (2008); Haug (2007); Philpott (2004); Xu (2004); Miele (2000); Hitchcock (2000); Moore (1999); Granstrand (1999a and b); Horstmann *et al.* (1985) |

Table 2.7 Literature streams in innovation development category

Organizations that are rich in innovation receive more innovations from their employees than they can commercialize. These organizations should be interested in creating screens and filters to identify the innovations of greatest interest to the organizations (Sullivan 2000). In making concept selection decision, the management level of the relevant business unit often use a number of evaluation criteria such as profitability of the invention and the market potential of the new concept. The decision to pursue a concept or not may not based on economic considerations only. Sometimes, whether the invention is qualified for IP protection is a decisive factor in making a concept selection decision (Davis and Harrison 2001).

The opportunities to identify rivals and allies at an early stage of R&D process are just too great to be ignored. Moreover, the amount of R&D duplication is formidable

(Horstmann *et al.* 1985). It is now easy to get information about what competitors are doing. The increased availability of large, electronic databases concerning patents and the availability of computers have enabled and lowered the cost of many types of analysis (Taylor and Germeraad 2008; Xu 2004; Hitchcock 2000; Moore 1999). All of this analysis is perfectly legal and can be done with various kinds of free or fee-based databases in the websites as shown in Table 2.8.

| **Website Address** | **Organization** |
|---|---|
| http://www.uspto.gov | US Patent and Trademark Office |
| http://ep.espacenet.com | European Patent Office |
| http://www.sipo.gov.cn | State IP Office of the PRC |
| http://www.delphion.com | Delphion Database |
| http://www.dialog.com | Dialog Database |
| http://www.derwent.co.uk | Derwent Database |

Table 2.8 Databases for patent searches

According to the United Kingdom Patent Office, 50% of the patent applications published by the Patent Office are never granted. Of those that are granted, all must be renewed annually to be kept in force, and only 5% are so renewed up to the 20 year maximum lifetime. Philpott and Jolly (2004) point out that the vast majority of patents appearing in the databases are free to be read and copied if: they were never granted; or were not kept in force; or do not relate to a territory where the organization plans to make, use, import or sell its product.

According to a benchmarking study by Haug (2007), more than 50 percent of the Fortune 500 firms are now taking a more proactive approach to managing their IP assets in an effort to create greater value. A study of patenting practices in Japanese industry by Granstrand (1999a and b) shows that, without effective patent protection, large Japanese

organizations would cut R&D budget by 38%, with 59% in chemical industry, 40% in electrical and 5.5% in mechanical industry. For many organizations, the growth in IP issues and workload makes them demand more from IP attorney. Miele (2000) considers that consultation with a skilled and fully qualified patent attorney is important in the R&D process and is absolutely essential to obtain a strong and valuable patent.

#### 2.2.2.3 Intellectual Property Capitalization Category

The classification of research focus on IP capitalization category can be found in Table 2.9. According to Philpott and Jolly (2004), all organizations that produce innovative products want to control their IP better by integrating IP management into an organization's management process. To effectively manage IP, Lu (2007) and Erbisch (2005) show how an organization can focus on controlling any operational processes that may involve IP.

IP issues influence the security control process of an organization. Each piece of IP is like a portion of valuable organizational resource. The organization needs to ensure the exact organizational IP right ownership in hold (Hannah 2005). The issues behind IP rights ownership can occur internally or externally to an organization. Some organizations use standardized control process to clarify ownership of IP rights with all related parties. For example, Erbisch (2005) published a basic workbook in IP management. So it shows how to prevent potential disputes of IP right ownership in the future. A good control process is not only useful in records management for all inventive creations, it can also avoid loss of knowledge due to staff turnover (Wood and Brownlee 2005). A security control process is essential for preventing loss of confidential information such as technical know-how or business trade secrets.

Berman (2001) and Berreth (1996) find that IP is often generated from research and development activities. Without a control process, it is unable to uncover potential IP rights from technological innovations developed by employees. For example, Xerox was failed to patent many of the new computer technologies it developed in the late 1970s and lost the opportunity to create value-added from its IP (Rivette and Kline 2000).

| **Research Focus** | **Authors** |
|---|---|
| Internal IP security protection | Lu (2007); Erbisch (2005); Hannah (2005); Wood and Brownlee (2005); Philpott and Jolly (2004); Berman (2001); Rivette and Kline (2000); Berreth (1996) |
| IP application/ registration | Basnet *et al.* (2004); Litwin and Kolodka (2001); Cohen *et al.* (2000); Levin *et al.* (1987); Mansfield (1986) |
| Internal IP audit and evaluation | Rose *et al.* (2007); Tao *et al.* (2005); Sikora (2005); Decarlo (2005); Reitzig (2004b); Bhaduri and Mathew (2003); Davis and Harrison (2001); Harhoff *et al.* (1997); Scherer (1983) |
| IP licensing and acquisition | Sterling and Murray (2007); Goldscheider and Gordon (2006); Goldheim *et al.* (2005); Smith and Parr (2003); Arora and Fosfuri (2003); Fosfuri (2003); Choi *et al.* (2003); Davis and Harrison (2001); Pitkethly (2001); Anable (1996) |

Table 2.9 Literature streams in intellectual property capitalization category

An innovative organization will certainly set up a rigorous IP protection control process for various forms of IP such as patent, design, trademarks or copyrights (Basnet *et al.*

2004; Litwin and Kolodka 2001). As the occurrence of infringement is common in a competitive environment, an organization can gain competitive edge over its competitors through the proper use of protection control processes on its IP rights. Cohen *et al.* (2000) point out that in industries such as microelectronics there can be hundreds of patentable elements in one product. To protect the advantage of its core IP, an organization can enforce control processes with various forms of IP protection. Levin *et al.* (1987), Mansfield (1986) and Cohen *et al.* (2000) all find that pharmaceutical and medical equipment R&D benefits the most from patenting. Cohen et at. (2000) found that patent protection is considered effective for 50% of product and 36% process innovations in pharmaceutical industries, compared to the average of 35% of product and 23% of process innovations for all industries. In accordance to the different forms of IP, an organization can establish control processes for any application filings and examination procedures required for IP protection in local and foreign countries.

While organizations continue to engage in generation of IP, they are concerned with reducing costs, increasing efficiency, increasing effectiveness and raising productivity associated with their IP portfolios (Sikora 2005; Decarlo 2005). Davis and Harrison (2001) point out that it is not unusual to find that anywhere from 5 percent to 50 percent of an organization's portfolio is no longer useful and could be eliminated. Thus, just by reviewing their portfolios, many organizations could realize immediate savings of hundreds of thousands of dollars (Rose *et al.* 2007; Reitzig 2004b).

Scherer (1983) shows that the distribution of patent values is generally very skew. Harhoff *et al.* (1997) found a highly skewed distribution of patent values with the top 8.5% of patents comprised 80% of total value. Tao *et al.* (2005) considered that the value of patents in a portfolio can be plotted by a lognormal distribution, i.e. only a small

percentage of the population with very high value, followed by a rapid decrease through the middle range, and a long tail representing a large fraction of the population with very low value. Tao et al (2005) also find that Standford University's patent portfolio contains two Cohen-Boyer recombinant DNA patents bringing in roughly US$48 million in license fees annually, and the approximately 500 remaining patents bringing in around US$2 million. In fact, the IP management decision systems of this type of organizations try to focus and refine the IP that is allowed into their portfolios (Bhaduri and Mathew 2003).

There are distinctive economic advantages in reinforcing an organization's IP exploitation control process. Goldscheider and Gordon (2006) consider that, in transforming IP portfolio into new business, an organization opens up exploitation opportunities for its IP asset and captures additional revenue. Goldheim *et al.* (2005) find that IBM generates over US$1.5 billion annually (at a 90 percent margin) from out-licensing technology. Davis and Harrison (2001) further illustrate that the organization that wants to enhance its IP exploitation control process looks at ways to maximize the benefit of its IP to increase market shares and expand business. Smith and Parr (2003) provide many examples of IP licensing and the royalty rates that resulted from the reported transactions. Pitkethly (2001) further illustrates two proactive elements, namely, licensing to and from other companies' IP rights. The latter involves learning from external sources through licensing. Anable (1996) finds that Sony's attempt to exert total control over its Betamax video format, while competing with the freely licensed VHS format is one of the prime reasons that the industry adopted the VHS format. According to Arora and Fosfuri (2003), Fosfuri (2003) and Choi *et al.* (2003), in semiconductor industry, organizations such as Rambus and ARM rely heavily upon technology licensing. Many cases studies on licensing of chemical processes by established organizations such as Union Carbide, BP, Shell, Dow

and DuPont are documented (Sterling and Murray 2007; Smith and Parr 2003).

#### 2.2.2.4 External Relationship Management Category

The classification of research focus on external relationship management category can be found in Table 2.10. In order to make its development and commercialization efforts productive, an organization always attempts to maximize the benefit of IP rights (Teece 1998). An example of using of IP to drive competitors out of business is found in the situation of Polaroid which excluded Kodak from the instant camera industry in its 1981 suit (Rivette and Kline 2000). An innovative organization achieves business growth through added value from IP rights in products or technology. In fact, IP is highly valuable tool for:

- technological negotiations with competitors or with potential collaborators (Parr and Sullivan 1996);
- exclusion of rivals from a particular technological area (Glazier 2000);
- licensing agreements and attraction of capital (Parr and Sullivan 1996);
- avoiding to be blocked by competitors' patents (Rivette and Kline 2000); and
- building competitive advantage (Reitzig 2004a).

The concept of keeping all IP development activities within an organization is beginning to change. In developing in-house IP, relationship management has not been paid due attention since all IP management practices belongs to internal processes. As soon as the global supply chain management spreads throughout the world, organizations have no choice but to do more outsourcing and adopt an outward-oriented innovation strategy.

| Research Focus | Authors |
|---|---|
| IP commercial development and marketing | Reitzig (2004a); Glazier (2000); Rivette and Kline (2000); Teece (1998); Parr and Sullivan (1996) |
| External IP security, agreement and partners matching | Shearer (2007); Bender (2006); Goldscheider and Gordon (2006); KPMG (2006); Peeters and Potterie (2006); Slowinski and Sagal (2006); Tang and Molas-Gallart (2005); Erbisch (2005); Lyons (2004); Smith and Parr (2003) |
| Research venture and IP holding business startup | Ferington (2007); Zhang and Wang (2007); Bader (2006); Hu and Tsai (2006); Quan (2006); Smith and Parr (2003); Rivette and Kline (2000); Cohen *et al.* (1998) |

Table 2.10 Literature streams in external relationship management category

According to Peeters and Potterie (2006), undertaking R&D activities with external organizations implies, at least to some extent, a mutual access to the partners' knowledge bases. Such partnership induces a higher need for IP protection, especially in the case of collaborations with competing organizations. A 2004 survey of 203 organizations conducted by the UK National High Tech Crime Unit, reported that 12% of the organizations had experienced instances of data theft through the Internet, causing losses amounting to approximately £7 billion (Lyons 2004; Tang and Molas-Gallart 2005). The risks of information security are realized as the use of electronic data networks is growing.

The relationship management practices are no longer overlooked for participants in collaborative projects with IP rights ownership (Slowinski and Sagal 2006; Erbisch 2005). KPMG (2006) finds that 75 percent of business partners may make errors on royalty

statements. Organizations that derive revenue from IP may need to continually and pro-actively audit agreements with distributors and suppliers for compliance (Goldscheider and Gordon 2006; Smith and Parr 2003). Some organizations believe that one of the best ways to ensure accurate royalty revenues is to have strong and long-term relationships with partner organizations (Shearer 2007; Bender 2006; KPMG 2006). Relationship management between a buyer and supplier demands serious attitudes towards IP protection. Relationship is no longer boosting and satisfied in occurrence of IP disputes. An economic impact study published in 2003 by the Business Software Alliance and conducted by the independent International Data Corporation (IDC) concluded that a cut in the software piracy rate of 10 percentage points over four years would add more than a million jobs and US$200 billion of economic growth in the official economy (KPMG 2006). To enhance trust and confidence level in the buyer-supplier relationship, suppliers can take their own initiatives to improve their IP management practices and promote organizational reputation that leverages on IP. Some suppliers believe that they can do more increasingly sophisticated works as their buyers come to trust them more. Moreover, the overall trends of economy require organizations to thoroughly understand and meet IP requirements associated with relationship management of buyers, suppliers and collaborators (Shearer 2007; Bender 2006; KPMG 2006).

Instead of undertaking in-house research and development, the organization can establish a cooperative research and development relationship with research institutes such as universities in order to develop new products or processes (Ferington 2007; Bader 2006; Hu and Tsai 2006). Cohen *et al.* (1998) finds that the largest 100 universities in the US tripled their annual patent output from 1984 to 1994. Rivette and Kline (2000) find that University patents helped jump-start 333 new entrepreneurial ventures in the US in 1997. It is considered that, in some circumstances, the organization’s research output is best

maximized by exploitation through the formation of a new organization to commercialize the research (Smith and Parr 2003; Rivette and Kline 2000). Research and development collaborations can eventually fulfill the needs of lowered costs to reach customers as well as increase efficiency within the supply chain (Zhang and Wang 2007; Quan 2006).

### 2.2.3 Organization Structures

The IP management organization structures provide an excellent setting for examining the enabling and result categories. Pike (2001) describes three development stages of organization structures, in which the evolutionary pathway moves through “classic creative”, “IP company” and “virtual monopoly”. The evolutionary process of organization structures reflects the changing focuses on the enabling and result categories for each development stage as shown in Table 2.11. Davis and Harrison (2001) describe what organizations try to accomplish at different levels of IP-management sophistication corresponding to the three development stages as mentioned by Pike (2001). At the defensive level, organizations are concerned with seeking, maintaining and enforcing IP. In the cost reduction and profit generation level, organizations are concerned with the way to reduce costs and get greater return on investment for their IP. In the integration and visionary approach level, organizations are concerned with how to define their IP functions broadly and clearly for serving greater goal for their organization. Indeed, these authors are involved with similar views of the way IP management “should be”, but “valid” test data have not been created. This research uses a general classification of an organization structure that includes four enabling categories and two result categories to examine the three development stages of organization structures in the past research. The three development stages of the IP management organization structures enable the setting of an assessment framework for the enabling and result categories as follows:

| | Organization Structures | | |
|---|---|---|---|
| | **Classic Creative Organization Structure** | **IP Company Organization Structure** | **Virtual Monopoly Organization Structure** |
| **Enabling Categories:** | | | |
| **Intellectual Property Capitalization** | Creativity Generator | IP Generator | IP Generator |
| **Management Support** | IP Adviser | | |
| **Innovation Development** | Development | Development | Enlarged Development Space |
| **External Relationship Management** | Commercialization | Commercialization | Multiple Business Models |
| **Result Categories:** | | | |
| **IP Outcomes** | Creative Advantage | IP Solutions | IP Solutions and Standards |
| **External Relationship Satisfaction** | | IP Assets to Sell/Deal With | Monopoly Positions |

Table 2.11 Typical focuses of enabling and result categories in the three development stages of organization structures

**Stage One: Classic Creative Organization Structure -** The structure of the classic creative organization is shown in Fig. 2.1. According to Pike (2001) and Davis and Harrison (2001), there is a central value pathway that begins an innovative concept, develops it into a product, and then commercializes that product. A primary feedback loop is available to confirm that the innovative concept is addressed to the market needs, and secondary feedback loops ensure that any necessary product improvements or problems are provided with creative solutions. The creative and development space is narrowly defined as the objective of classic creative organization is to ensure a defensive role of IP management.

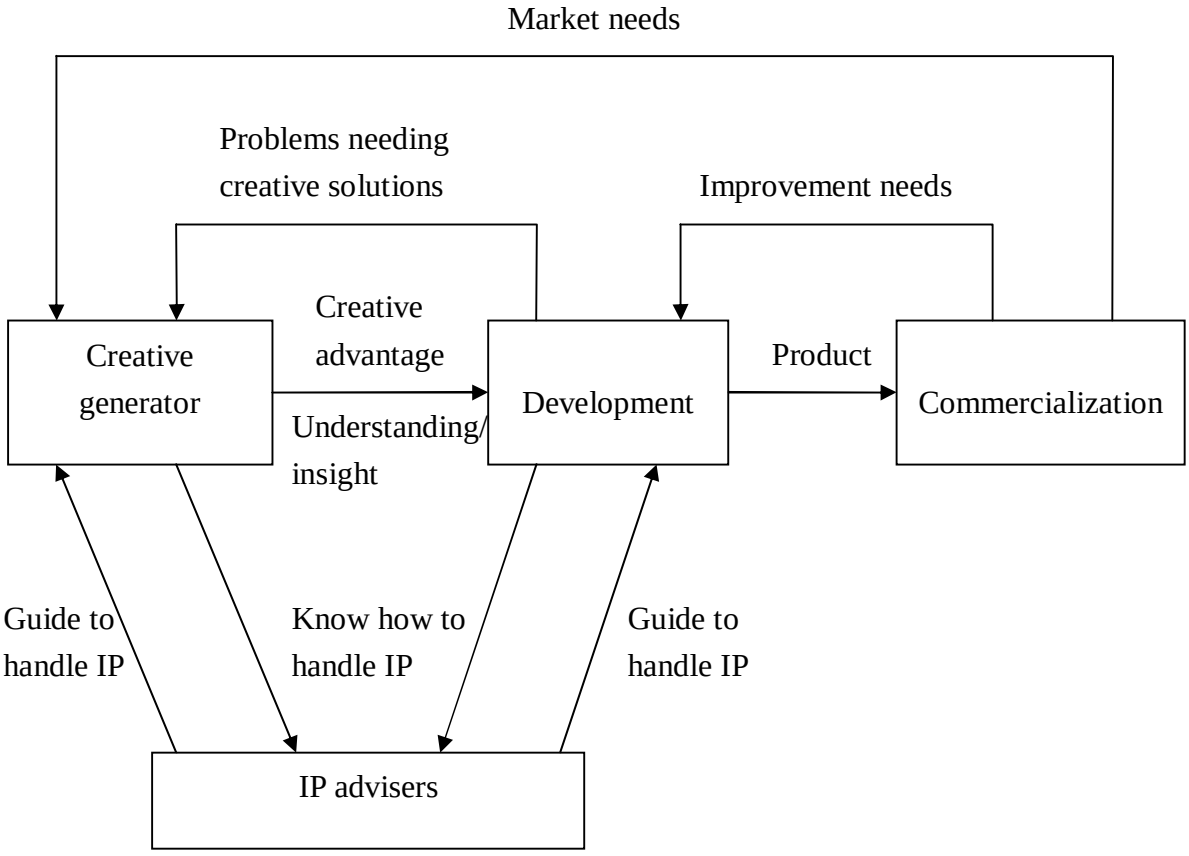



Figure 2.1 The structure of classic creative organization (Pike 2001)

IP advisers are engaged to guide the process and provide supports when requested. In general, the nature of advice is often focused on the legal aspects of IP such as IP applications, defense and enforcement (Gibbs and DeMatteis 2003; Cohen *et al.* 2000; Bontis 1998; Roos and Roos 1997). In highly structured organizations, the creative pathway will often be configured to ensure these inputs are obtained at defined decision points along that creative pathway (Sullivan 2000). In fact, the "add-on" nature of the IP adviser to the creativity pathway is only intended to support the creation of IP and the avoidance of major IP issues (Rivette and Kline 2000). Eventually, the classic creative organization achieves increasingly larger stock of IP portfolios that may start to develop independently of business (Tao *et al.* 2005; Sullivan 2000). Finally, the IP portfolios will become so large that the organization shall need to evolve into stage two where there is

scope for improvement in the areas of cost control, profit centre and integration (Davis and Harrison 2001).

**Stage Two: IP Company Organization Structure** - The structure of IP company organization is shown in Fig. 2.2. According to Pike (2001) and Davis and Harrison (2001), there is also a central value pathway which, however, has shifted the focus to extracting value from IP through development and commercialization. The creativity generator and IP advisers work so closely together that they form an integrated IP generator. All the guidance and supports offered by IP advisers in the classic creative organization structure have now extended to the other parts of the organization and serve as an integral part of the IP creation process for a greater purpose (Shearer 2007; Gibbs and DeMatteis 2003).

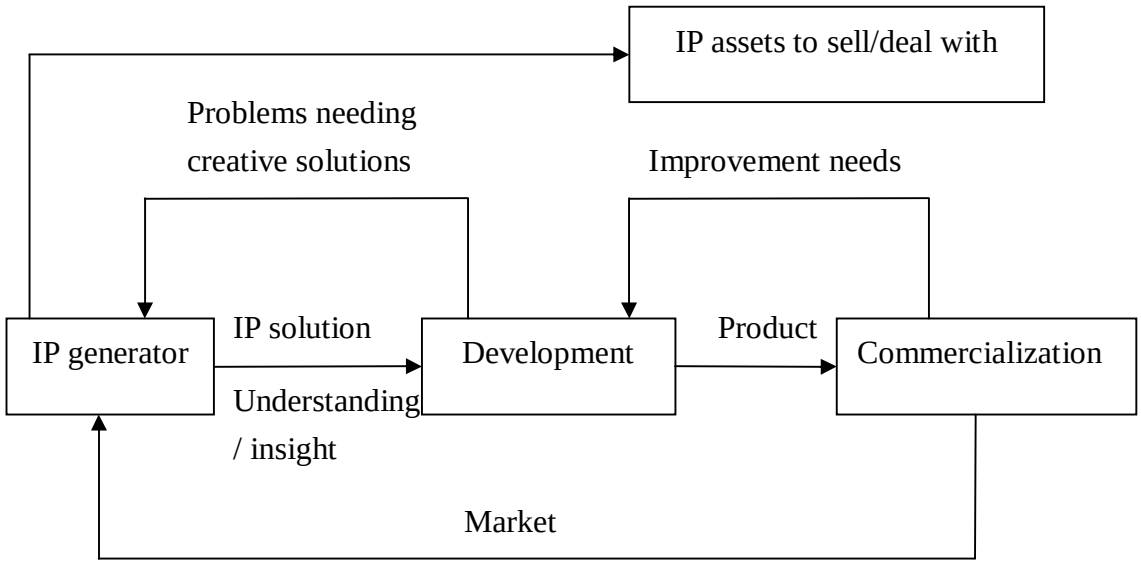



Figure 2.2 The structure of IP company organization (Pike 2001)

The proprietary new products produced from the development and commercialization functions are embedded with IP, safeguarded with strong IP protection and cleared from

potential infringement risks (Elmslie and Portman 2006; Rivette and Kline 2000; Bontis 1998; Roos and Roos 1997). Nevertheless, the creative and development space is still narrowly defined. The primary and secondary feedback loops still exist to constantly correct the directions of the IP generator.

Eventually, the IP company organization uses internal audit and evaluation to reduce costs associated with the organization's IP portfolios (Harhoff *et al.* 1997; Scherer 1983). An alternative way of commercialization is now in place to directly extract value from the "spare" or non-core IP assets (Goldheim *et al.* 2005). This comprises IP licensing, offering for a "garage sale" of unwanted assets or using IP in leveraging deals with suppliers or as bargaining chips in the event of disputes (Elmslie and Portman 2006; Smith and Parr 2003; Bratic *et al.* 2001; Edvinsson and Malone 1997; Roos and Roos 1997; Brooking 1996). Finally, the IP company organization starts to evolve to stage three where there is scope for improvement in the visionary leadership of IP management in the organization (Davis and Harrison 2001).

**Stage Three: Virtual Monopoly Organization Structure** - The structure of virtual monopoly organization is shown in Fig. 2.3. According to Pike (2001) and Davis and Harrison (2001), the central value pathway is again in place and continues to focus on extracting value from IP. The pathway begins with the IP generator, which is relatively small in scale and highly skilled, not only in creating IP, but also in identifying and building desirable virtual monopoly positions (Rivette and Kline 2000). Thus, a significantly enlarged development space is created. As the virtual monopoly organization stakes a claim on the future with so many IP portfolios, it gains the "first mover's advantages" to access the markets and in defining the industry roadmap (Shearer 2007; Barren *et al.* 2005).

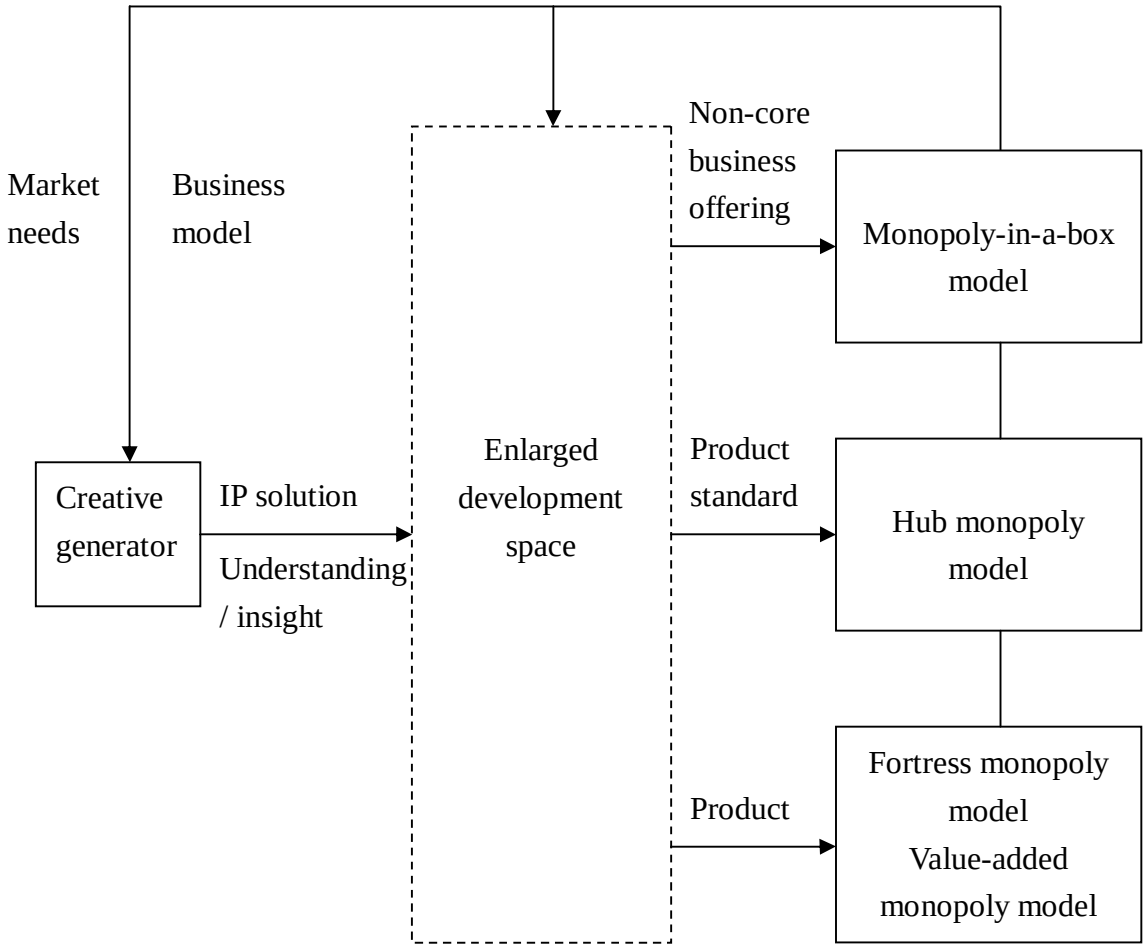



Figure 2.3 The structure of virtual monopoly organization (Pike 2001)

The resulting landscapes of a huge IP portfolios owned by the organization fend off any new entrants to the markets and provide many options for the organization to use IP as bargaining chips to resolve any disputes with competitors (Elmslie and Portman 2006; Smith and Parr 2003). Indeed, as the virtual monopoly organization grows so large in size that it encourages the IP holding business spinouts and establishes research ventures and startups independently (Bader 2006). The enlarged development space fits for multiple business models, which may be operated simultaneously if desirable (Shearer 2007; Bender 2006; KPMG 2006). Product lines embedded with IP are exploited through fortress and value-added monopoly models (Elmslie and Portman 2006). Product

standards defined by a standard-setting committee are exploited through hub monopoly models (Miele 2000). Non-core product business offerings are exploited through monopoly-in-a-box models (Smith and Parr 2003).

## 2.3 Concluding Remarks

Since industrial organizations today are being affected by the use of IP in business in many different ways, the way of doing business needs to include utilization of IP in greater detail in order to gain the competitive advantage in the business environment. Accordingly, there appears to have a need to shift the IP paradigm in organizational management from a product support role to the innovation-knowledge centered role of the organization. Figure 2.4 shows the redefined concept of IP management model resulting from the analysis of the previous literatures. This model can improve the IP management performance as follows:

1. **Management Support Category** - There are many examples of organizations ignore the importance of IP in the organization's operation. Poor IP management can suppress patent awareness and harvesting, create expensive portfolio failures to coordinate with business needs, lead to poor and inconsistent technology agreements and result in overlooked infringements by others of the organization's patents and disastrous unintentional infringements of other people's patents. Organizations today should be able to shift the focus on knowledge-driven development in continuous improvement plans in order to better coordinate among technical, legal, and financial functions and manage the present and future impacts of IP.

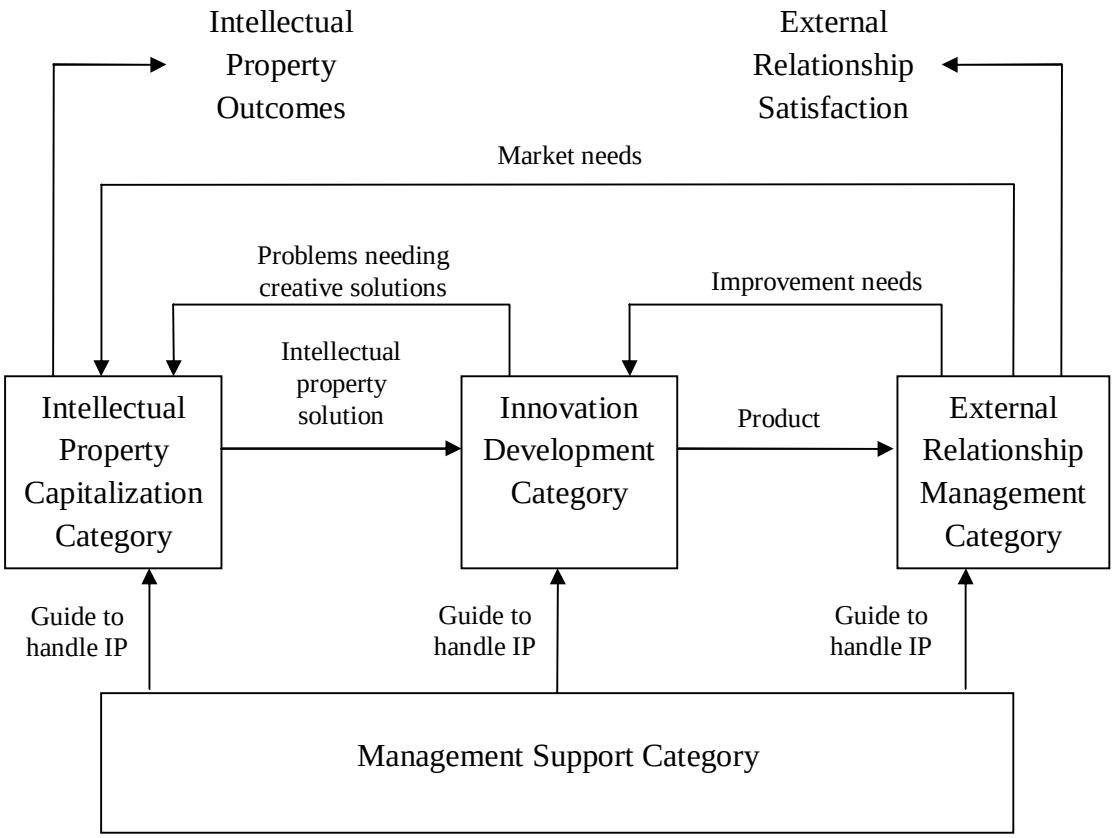



Figure 2.4 The redefined concept of IP management model

2. **Innovation Development Category** - The traditional way of doing business focuses too heavily on product refinement and improvement while ignoring new technological development, in particular, IP. A failure to create IP in new products is a loss of value to the organization. If an organization does not own any IP, the future business will be owned by its rivals. The organizations today should be able to shift the focus on technology push over the course of new technological development in order to create the next generation IP and stay ahead of the competition.

3. **Intellectual Property Capitalization Category** - There are many examples of organizations ignore the financial value of IP. An organization that considers IP to be just the legal protection shall overlook the potential opportunities to obtaining

additional revenues of the IP from licensing. But intangibles have accounting and financial attributes that influence their valuation and financial reporting of an organization. Organizations today should be able to focus on innovation-driven development in a timely fashion in order to establish IP monopoly space, identify value of IP and pursue ways to convert IP assets to cash flow.

4. **External Relationship Management Category** - The traditional way of doing business focuses too heavily on marketing strategies while ignoring the product commercialization that might create IP advantage. An organization that fails to differentiate products or services with IP shall lose its distinction over competing products or services and, therefore, can command no premium in the marketplace. The organizations today should be able to shift the focus on market pull in the long term in order to use IP to enhance the commercial value of new products, attract new capital and, more importantly, grow by way of increasing investor confidence.

It is thus necessary to replace the traditional way of doing business with a renewed IP management model for the HK-GD based industrial organizations, where the focus is on extraction of value from both products and IP. The implementation of the model can improve the IP management performance, address the flow of IP in operational level of the organization and result in an effective IP strategy for the organization.

# Chapter 3 Research Methodologies

This chapter introduces the research methodology, including development of IP management model through literature review, questionnaire survey, Analytic Hierarchy Process (AHP), and Evidential Reasoning (ER) with support by software of Intelligent Decision System (IDS) to establish an audit system in IP management.

## 3.1 Overview of the Research Methodologies

As discussed in section 1.2.2, page 18, of Chapter one, there are four objectives in this research for which Figure 3.1 provides an overview. The four stages of study focus to achieve the four objectives, namely as "Criteria-based IP management model", "IP management in the Hong Kong-Guangdong (HK-GD) based manufacturing industry", "The relative importance of IP management categories and key enabling criteria for the HK-GD based manufacturing industry" and lastly, "IP management excellence audit model for the HK-GD based manufacturing industry", they are described in detail below.

### 3.1.1 Stage 1: Criteria-based IP Management Model

The first objective is to develop a criteria-based IP management model for which there are three sub-objectives: they are, first, to identify the core values in IP management, second, to define the key enabling criteria in IP management, and lastly, to develop a criteria-based IP management model by grouping the key enabling criteria into enabling categories according to their nature.

| **Stage 1: Criteria-based IP management model** | |
|---|---|
| **Objective 1** | **Research Methodologies** |
| Develop an IP management model<br>ı Identify the core values in IP management<br>ı Define the key enabling criteria for IP management<br>ı Develop the criteria-based IP management model by grouping the key enabling criteria into enabling categories according to their nature | ı Conduct literature reviews |

↓

| **Stage 2: IP Management in the HK-GD based manufacturing industry** | |
|---|---|
| **Objective 2** | **Research Methodologies** |
| Investigate the general IP management practices of HK-GD based manufacturing industry<br>ı Examine the current situation of IP management enabling categories and key enabling criteria in the HK-GD based manufacturing industry<br>ı Investigate the general IP management practices of HK-GD based manufacturing industry<br>ı Investigate the relationships between general IP management practices and IP management | ı Hypothesis setting<br>ı Conduct questionnaire design<br>ı Conduct pre-test<br>ı Conduct mail survey<br>ı Conduct data analysis and hypothesis testing |

↓

| **Stage 3: The relative importance of IP management categories and key enabling criteria for the HK-GD based manufacturing industry** | |
|---|---|
| **Objective 3** | **Research Methodologies** |
| ı Prioritize the relative importance of enabling categories and the key enabling criteria in IP management for HK-GD based manufacturing industry | ı Structure the IP management Analytic Hierarchy Process (AHP) hierarchy<br>ı Develop measurement items<br>ı Conduct Expert interview<br>ı Conduct data analysis |

↓

| **Stage 4: IP management excellence audit model for the HK-GD based manufacturing industry** | |
|---|---|
| **Objective 4** | **Research Methodologies** |
| ı Develop and implement an IP management excellence audit model that is suggested for the HK-GD based manufacturing industry | ı Formulate the audit framework<br>ı Develop the audit system by adopting Evidential Reasoning (ER) approach supported by software of Intelligent Decision System (IDS)<br>ı Conduct case studies<br>ı Conduct data analysis<br>ı Evaluation against an award and targeted performances |

Figure 3.1 Overview of research methodologies

In order to achieve the objective, the following steps are required:

i. With an intensive literature review of IP management concepts, common factors in IP management are retrieved to identify the core values in IP management.

ii. Further defining the key enabling criteria.

iii. The criteria-based IP management model is then developed by grouping the key enabling criteria into categories according to their nature. This model is then used for further research to achieve the second objective of the research.

### 3.1.2 Stage 2: IP Management in the Hong Kong-Guangdong based Manufacturing Industry

The second objective is to investigate the IP management in the Hong Kong-Guangdong (HK-GD) based manufacturing industry. There are three sub-objectives; they are, first, to examine the current situation of IP management categories and key enabling criteria in the HK-GD based manufacturing industry, second, to investigate the general IP management practices (extent of implementation of IP management enabling categories and key enabling criteria) of HK-GD based manufacturing industry, and lastly, to investigate the relationships between general IP management practices and IP management performance excellence of HK-GD based industrial organizations.

A questionnaire survey is selected as the research method as it is more economical to obtain more data from the target group. By adopting the criteria-based IP management

model that has been developed in Stage one, the HK-GD based manufacturing industry is selected for study. In order to achieve objective two, several steps are required:

i. Set hypotheses based on the literature review and the criteria-based IP management model.

ii. Design the questionnaire for collecting data.

iii. Identify the target group for the questionnaire survey.

iv. Invite the industrial expertise to review and pre-test the questionnaire for readability, ambiguity and completeness, then modification can be made prior to the mass survey.

v. Send out the questionnaire by mail and collect the data from respondents.

vi. Finally, once all data from respondents have been collected, conduct data analysis and hypothesis testing by statistical analysis methods which are discussed in Section 3.2.

### 3.1.3 Stage 3: The Relative Importance of IP Management Categories and Key Enabling Criteria for the Hong Kong-Guangdong based Manufacturing Industry

The third objective is to prioritize the relative importance of IP management

categories and key enabling criteria that have been identified and examined in Stage one and two of the study, respectively. In order to effectively and efficiently implement IP management, it is not feasible for organizations to allocate resources in all IP management categories or key enabling criteria at once. Prioritization of the IP management categories and key enabling criteria would be more practical and economical for organizations to implement the most important criteria which, in turn, provide results to further evaluate the feasibility for implementation of other criteria by allocating more resources. In this stage of study, the Analytic Hierarchy Process (AHP) approach is adopted which involves conducting interviews with IP experts. In order to achieve objective three, several steps are required:

i. Structure the IP management AHP hierarchy by adopting the criteria-based IP management model that has been developed and examined in Stage one and two of the study.

ii. Develop the measurement items based on the literature review and the criteria-based IP management model that has been developed and examined in Stage one and two of the study.

iii. Invite IP experts for interview and conduct pairwise comparison judgment on measurement items.

iv. Lastly, once all interviews from IP experts are completed, conduct data analysis by the AHP approach which is discussed in Section 3.3.

### 3.1.4 Stage 4: IP Management Excellence Audit Model for the Hong Kong-Guangdong based Manufacturing Industry

The fourth objective is to develop and implement the IP management excellence audit model for the HK-GD based manufacturing industry. In order to achieve objective four, several steps are required:

i. Formulate the audit framework in IP management for the HK-GD based manufacturing industry: After achieving objective one, two and three, the importance and relative importance of the IP management categories and key enabling criteria for the HK-GD based manufacturing industry are examined. The criteria-based IP management model that is developed and validated in Stage one and two of the study, respectively, represents the "Systems and Practices" in IP management. An audit framework in IP management for the HK-GD based manufacturing industry is formulated.

ii. Develop an audit system: In order to implement the framework, the audit system in IP management for the HK-GD based manufacturing industry is developed by adopting the Evidential Reasoning (ER) approach with support from the Intelligent Decision System (IDS) to audit HK-GD based manufacturing organizations on how well their performance on "Systems and Practices" in IP management. The details of ER approach and IDS are described in section 3.4 and 3.5, respectively.

iii. Invite industrial practitioners from the HK-GD based manufacturing industry to conduct case studies by using the audit system developed.

iv. Review the results and conduct the data analysis.

v. Compare the assessment results against a local Award and targeted performances of improvement action plans to validate the effectiveness of the audit system in IP management for the HK-GD based manufacturing industry.

### 3.1.5 Summary

The research study of the thesis requires a series of stages, starting from the development of the criteria-based IP management model through the literature review; this is followed by the validation of the model through the questionnaire survey by the HK-GD based manufacturing industry which examines the current situation of IP management categories and key enabling criteria, the general IP management practices (extent of implementation of the IP management enabling categories and the key enabling criteria) and relationships between the general IP management practices and the IP management performance excellence. With the validation from the questionnaire survey, prioritization of the relative importance of the IP management enabling categories and key enabling criteria is required for development of an IP management excellence audit model for the HK-GD based manufacturing organizations. Prior to the development of the audit system, an audit framework in IP management for the HK-GD based industrial organizations needs to be formulated. The final step is to conduct case studies with participants in the HK-GD based manufacturing organizations to validate the audit system in IP management for the HK-GD based manufacturing organizations.

Following this overview of the methodologies of the research, the next section reviews the major tools that are employed in this study: the statistical analysis method, the AHP approach and the ER approach with IDS.

## 3.2 Statistical Analysis Method

The questionnaire survey of Stage two of the study employs various statistical analysis methods, the details of which are discussed below:

### 3.2.1 Independent-sample *t-test*

According to Lambert & Harrington (1990) and Armstrong & Overton (1977), non-response bias is the difference between the answers of respondents and non-respondents; the opinions of late respondents are somewhat representative of the opinions of non-respondent. It is a common approach by researchers (Lambert & Harrington 1990; Armstrong & Overton 1977; Lam & Chin 2004; McDonough III 2000) to employ independent-samples *t-test* to compare the mean scores of two different groups of conditions. The questionnaire data were collected in two waves (early and late waves), thus it required testing the non-response bias by independent-samples *t-test* to review if there was any difference between responses of early and late waves of the returned survey.

### 3.2.2 Reliability and Validity

Reliability and validity are employed to validate the data of ratings on the measurement items obtain from questionnaire survey.

Reliability (Cronbach's coefficient alpha) is a consistency index for measuring the correlation between the measures of the same concept (Churchill & Iacobucci 2005). Alpha values of 0.7 or higher are acceptable but a lower scale of 0.6 for new scales is also accepted (Nunnally & Bernstein 1994). Using the data generated by the measurement items, the alpha coefficient is calculated for each subscale.

According to Churchill & Iacobucci (2005) and Zikmund (2003), validity refers to the degree to which it measures what the researcher proposes to measure. Kline (1994) recommends that a minimum factor loading value of 0.6 is acceptable. Content validity and within-scale factor analysis were employed to measure the validity of the research.

i. Content validity is defined by examining the literature in the domain of content to determine how the measurement items have been defined and used previously.

ii. Within-scale factor analysis is used to measure the convergent validity to confirm that each group of measurement items was a valid measurement of construct (Humphreys *et al.* 2004). In analyzing construct validity of within-scale factors, exploratory factor analysis and confirmatory factor analysis are employed to verify the construct validity of each scale. This approach allows a stringent test of convergent validity. The data is first examined by an exploratory factor analysis using the principle components extraction method, followed by varimax rotation. The software SPSS is employed. With confirmatory factor analysis, each subscale is examined using the software AMOS. The Bentler-Bonett Normal Fit Index (NFI) obtained from confirmatory factor analysis can be used to assess

convergent validity. This index measures the extent to which different approaches to measuring a construct produces the same results (Ahire *et al.* 1996). According to a rule of thumb, NFI values of 0.90 or greater indicate an adequate model fit (Bentler 1995).

### 3.2.3 Correlation Analysis

Correlation analysis is employed in this study to investigate the relationship between the extent of implementation of key IP management enabling criteria and IP management excellence.

Correlation analysis is employed to depict the strength and direction (positive or negative) of the linear relationship between two variables (Pallant 2001). Pearson product-moment correlation coefficient (*r*) is presented to indicate the strength of the relationships between two variables. The value of (*r*) is ranged from -1.00 to 1.00. Cohen (1988) suggests the guideline to interpret the (*r*) values between 0 and 1 as below:

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| *r* = | .10 | to | .29 | or | *r* = | -.10 | to | -.29 | → | small |
| *r* = | .30 | to | .49 | or | *r* = | -.30 | to | -.49 | → | medium |
| *r* = | .50 | to | 1.00 | or | *r* = | -.50 | to | -1.00 | → | large |

### 3.2.4 Path Analysis

Though the subscale factor analysis provided a sub-structure that might influence IP management excellence, it still needs to be further verified in the whole structure.

Path analysis is employed to predict how well the IP management enabling categories developed through the literature can contribute to IP management result categories. Path analysis is a multivariate analysis method to examine sets of relationships represented by linear causal models (Li 1975; Jöreskog and Sörbom 1993). A path analytic model decomposes the observed correlations or covariances among the scale variables to estimate the path coefficients in the model. The IP management framework represents the causal relationships between the IP management practices and IP management excellence. Therefore, this methodology is suitable for measuring such a relationship.

In this research, an IP management excellence model is presented. We, therefore, used confirmatory analysis to analyze the model. AMOS is used to estimate the strength of the path coefficients and the adequacy of the whole model. In this study, the interpretation of goodness-of-fit was based on the following fit indexes: Chi-square, the Comparative fit index (CFI), and the root mean square error of approximation (RMSEA) (Steiger 1990). The following are explanations of indexes:

Chi-square ( $c^2$ ): AMOS outputs it as CMIN. The chi-square index evaluates the fit of the model to the data, under the null hypothesis that the population covariances are equal to the covariances' prediction from the model estimates. Thus a good fit is indicated by failing to reject the null at a specified alpha level. In fact, because of this interpretation, Jöreskog (1993) suggested that chi-square may more approximately be considered a badness-of-fit measure. It is also has become common to interpret the relative size of the chi-square rather than its significance. One method suggests that if the chi-square/*df* is less than the ratio of five (Marsch and Hocevar 1985), the model may be acceptable. AMOS lists relative chi-square as CMIN/DF.

Comparative fit index (CFI): Also known as the Bentler Comparative Fit Index (Bentler 1990). CFI varies from 0 to 1 (if outside this range it is reset to 0 or 1). CFI close to 1 indicates a very good fit. By convention, CFI should be equal to or greater than .90 to accept the model, indicating that 90% of the covariation in the data can be reproduced by the given model.

Root mean square error of approximation (RMSEA): The RMSEA estimate has been suggested by Browne and Cudeck (1993) as a useful fit index that measures the discrepancy between the hypothesized model and the data per degree of freedom specified for the model. As a summary of systematic error, an RMSEA value of 0 would be indicative of an exact fit to the data. According to Browne and Cudeck, an RMSEA value of 0.08 or less indicates a reasonable error of approximation, and values of 0.05 or less indicate a close fit relative to the degrees of freedom.

## 3.3 Analytic Hierarchy Process (AHP) Approach

Stage three of the study employs the AHP approach to achieve the objective of prioritizing the relative importance of IP management enabling categories and key enabling criteria that have been identified and examined in Stage one and two of the study, respectively. The AHP is developed by Saaty (1980) and it is extensively applied in different areas with thousands of AHP applications that have been reported during the last twenty-six years (Wasil and Golden 2003). Vaidya & Kumar (2006) review 150 articles that cover ten different applications such as: selection, evaluation, benefit-cost, allocation, planning and development, priority and ranking, decision making, forecasting, medicine and QFD; and across nine different areas such as:

personal, social, manufacturing, political, engineering, education, industry, government and others. Priority and ranking is one of the applications widely used in different areas such as manufacturing and engineering, and it is employed in this study.

The AHP is designed to decompose a complex, multi-criteria problem into multiple levels of hierarchy with the top level as the goal or objective, and the intermediate levels as the categories and criteria while the lowest level is alternatives. It is a subjective methodology that requires expert in that particular field as evaluators by providing their expertise knowledge. Experts are interviewed and pairwise comparison judgments are applied to pairs of homogeneous criteria, to eventually generate the overall priorities for ranking the alternatives (Saaty & Vargas 1994).

As reference to AHP modeling process by Chin *et al.* (2002a) and Tam & Tummala (2001), three phase processes are proposed, namely, Phase I, Structuring IP management AHP hierarchy; Phase 2, Measurement and data collection; and Phase 3, Determination of normalized weights.

- ***Phase 1 - Structuring IP management AHP hierarchy***

  This phase is to structure the hierarchy of the AHP model that comprises of the goal, categories and criteria (since the purpose of the study is "priority and ranking", so no "alternatives" level in the AHP hierarchy is required). Prior to structuring the AHP hierarchy model, the goal, categories and criteria should be pre-defined. The goal of the problem is placed on level 1 of the hierarchy. Level 2 of the hierarchy is the categories that contribute to the goal. Level 3 of the hierarchy is criteria with

respect to the categories in level 2. A generic hierarchy model of IP management implementation is shown in Figure 3.2.

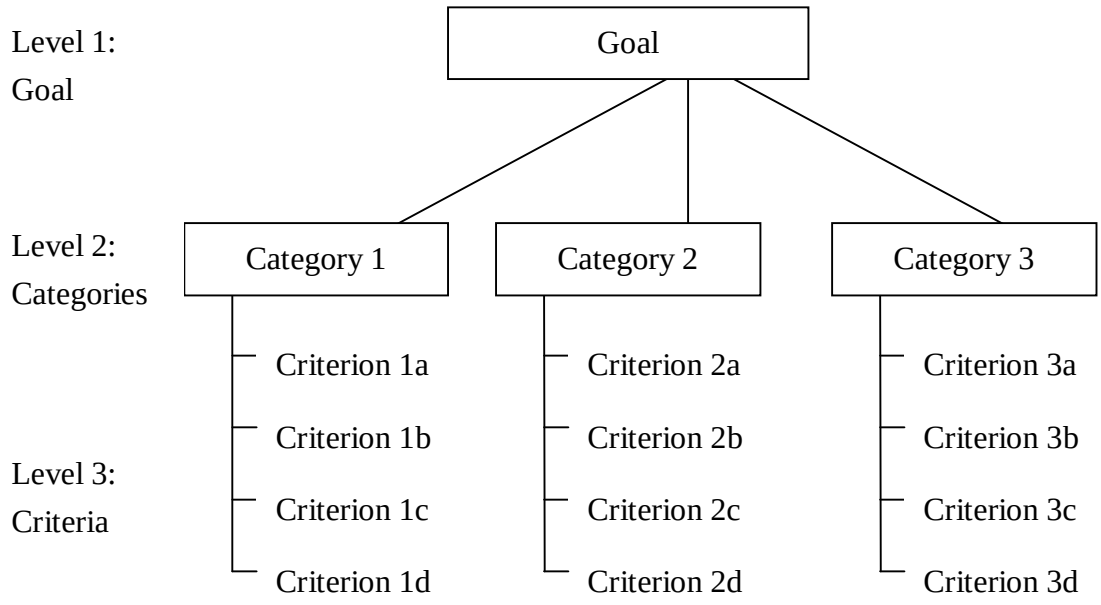



Figure 3.2 A generic AHP hierarchy model

- ***Phase 2 - Measurement and data collection***

This phase involves the invitation of evaluators (IP expert) to assign pairwise comparison judgment to categories and criteria of the hierarchy model. The nine-point scale suggested by Saaty & Vargas (1994) was used for evaluators to assign pairwise comparison judgments to all the categories/criteria in each hierarchy level (see Table 3.1).

| Intensity of importance | Definition | Explanation |
|---|---|---|
| 1 | Equal importance | Two activities contribute equally to the objective |
| 2 | Weak | |
| 3 | Moderate importance | Experience and judgment slightly favor one activity over another |
| 4 | Moderate plus | |
| 5 | Strong importance | Experience and judgment strongly favor one activity over another |
| 6 | Strong plus | |
| 7 | Very strong or demonstrated | An activity is favored very strongly over another; its dominance demonstrated in practice |
| 8 | Very, very strong | |
| 9 | Extreme importance | The evidence favoring one activity over another is of the highest possible order of affirmation |
| Reciprocal of above numbers | If activity *i* has one of the above numbers assigned to it when compared with activity *j*, then *j* has the reciprocal value when compared with *i* | |

Table 3.1 The nine-point scale (Saaty & Vargas 1994)

Table 3.2 shows an example of the pairwise comparison matrix. Category I has four criteria from A to D, by reference to Table 3.1, criteria A is moderate plus more important than criteria B, then input a number of 4; then criteria A is compared with criteria C which is moderate plus more important than criteria A, then input a number of reciprocal of 4, i.e., 1/4; and so on for the rest.

| Category I | A | B | C | D |
|---|---|---|---|---|
| A | 1 | 4 | 1/4 | 1/3 |
| B | 1/4 | 1 | 1/5 | 1/4 |
| C | 4 | 5 | 1 | 2 |
| D | 3 | 4 | 1/2 | 1 |

Table 3.2 A pairwise comparison matrix

- ***Phase 3 – Determination of normalized weights***

This phase involves the computing of data obtained from phase 2. As suggested by Saaty & Vargas (1994), the geometrics mean approach was used at each hierarchy level to consolidate the data obtained from evaluators in phase 2 which, in turn, compute to one united pairwise comparison judgment matrices. Table 3.3 shows the normalizing method. To calculate a good estimate of the principal eigenvector (relative priority weight) of a pairwise comparison matrix, each column was normalized and then the geometric average of each row was taken. Pairwise comparison matrix in Table 3.2 was taken for an example.

| | A | B | C | D | | A | B | C | D | | Relative priority |
|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 1 | 4 | 1/4 | 1/3 | A | 0.12 | 0.29 | 0.13 | 0.09 | A | 0.15 |
| B | 1/4 | 1 | 1/5 | 1/4 | B | 0.03 | 0.07 | 0.10 | 0.07 | B | 0.06 |
| C | 4 | 5 | 1 | 2 | C | 0.48 | 0.36 | 0.51 | 0.56 | C | 0.48 |
| D | 3 | 4 | 1/2 | 1 | D | 0.37 | 0.29 | 0.26 | 0.28 | D | 0.31 |
| Sum | 8.25 | 14.0 | 1.95 | 3.58 | | Normalized | | | | | Geometric mean |

Table 3.3 Calculation of relative priority weight of pairwise comparison matrix in Table 3.2

According to Saaty & Vargas (1994), the Consistency Ratio (CR) value is employed to evaluate the consistency; and the CR value of 0.1 or below by the judgment is acceptable. Table 3.4 shows the calculation of CR. According to Saaty (1980) consistency ratio is the ratio of consistency index to the corresponding random index $RI_n$ (random index values can be found in Saaty 1980). The value of maximum eigenvalue ($\lambda_{max}$) was calculated by multiplying the normalized matrix with the priorities vector (principle eigenvector of matrix-relative priority weight matrix) in Table 3.3; and then substituted $\lambda_{max}$ and $RI_n$ to the equation of CR, then CR value was calculated.

CR=CI/RI, Saaty (1980)

where CI = Consistency index = $(\lambda_{max} - n)/(n-1)$

$\lambda_{max}$ = maximum eigenvalue,

n = size of matrix

RI = Random index value

*Step 1: Calculation of* $\lambda_{max}$ (maximum eigenvalue)

$$\begin{pmatrix} 0.12 & 0.29 & 0.13 & 0.09 \\ 0.03 & 0.07 & 0.10 & 0.07 \\ 0.48 & 0.36 & 0.51 & 0.56 \\ 0.37 & 0.29 & 0.26 & 0.28 \end{pmatrix} \times \begin{pmatrix} 0.15 \\ 0.06 \\ 0.48 \\ 0.31 \end{pmatrix} \rightarrow \begin{pmatrix} \frac{0.63}{0.15} & \frac{0.27}{0.06} & \frac{1.91}{0.48} & \frac{1.20}{0.31} \end{pmatrix} \downarrow \begin{pmatrix} 4.2 & 4.5 & 3.98 & 3.87 \end{pmatrix} \quad \lambda_{max} = 4.14$$

*Step 2: Calculation of Consistency Ratio*

CI = (4.14-4)/(4-1) = 0.0467

$RI_4$ = 0.90, Saaty (1980)

CR = 0.0467/0.90 = 0.052 < 0.1 (CR is accepted)

Table 3.4 Calculation of Consistency Ratio (CR)

In this study, "Expert Choice" software was employed. By using the software, the pairwise comparison judgment matrices were translated into the corresponding largest eigenvalue problem; they were solved to determine the normalized and unique priority weights for each of categories and criteria as in the AHP model, as shown in Figure 3.2. The priority weights were divided into local weight, which was the priority weights with respect to the preceding hierarchy; and global weight, which was the priority weights with respect to the highest hierarchy level - the goal.

## 3.4 Evidential Reasoning (ER) Approach

Stage four of the study employs the ER approach with IDS to develop the audit system in IP management for the HK-GD based manufacturing organizations. The details of the ER approach and IDS are reviewed in this and next section respectively.

The ER approach is developed to deal with uncertain and subjective multi-attribute decision making (MADM) problems that have both quantitative and qualitative attributes (Yang and Singh 1994; Yang and Xu 2002a; Yang 2001). Instead of providing a single average score for attributes in a MADM problem, the ER approach provides a distributed assessment result using a belief structure. For example, the distributed assessment result of the concept creation capability of an organization is presented as {(Excellent, 40%), (Good, 50%), (Average, 0%), (Poor, 0%), (Worst, 0%)}; this implies that the concept creation capability of an organization is assessed to be Excellent with 40% of belief degree, Good with 50% of belief degree and remaining 10% is unknown/uncertain. Moreover, instead of aggregating scores of all attributes and presenting them in an average score in MADM problems, the ER approach employs an evidential reasoning algorithm by employing the decision theory and the evidence combination rule of Dumpster-Shafer (D-S) theory to aggregate attributes from a lower level to a higher level of the ER hierarchy framework which is presented as a distributed assessment result. This provides a panoramic view about the diversity of the performance to help the decision maker to identify areas for improvement, and to map out the course of action to make necessary improvements in the organization (Xu and Yang, 2001). In recent years, the ER approach had been widely applied in engineering design decision problems, safety and risk assessment, organizational audit and supplier assessment (Yang and Xu 2002b). The detail of the

ER approach (Yang and Singh 1994; Yang and Xu 2002a; Yang 2001) is described below.

### 3.4.1 Distributed Assessment Result with Uncertainty

As described earlier, the ER approach presents a distributed assessment result in belief structure; the example of concept creation capability of an organization in the above section can be expressed as the following distribution:

$$S(\text{concept creation capability}) = \{(\text{Excellent}, 0.4), (\text{Good}, 0.6)\} \quad (1a)$$

where $S$ (concept creation capability) means the concept creation capability of an organization, “Excellent” and “Good” are the evaluation grades, and the real number of 0.4 and 0.6 means the degree of belief of 40% and 60% respectively.

In order to assess other attributes of organization, the following distributions are presented as below examples:

$$S(\text{internal design documentation}) = \{(\text{Good}, 0.5), (\text{Average}, 0.3)\} \quad (1b)$$

$$S(\text{patent application}) = \{(\text{Good}, 0.6), (\text{Poor}, 0.3), (\text{Worst}, 0.05)\} \quad (1c)$$

Distribution (1a) shows a complete assessment as the total degree of belief is 0.4+0.6=1 while distribution (1b) and (1c) show an incomplete assessment as the total degree of belief is 0.5+0.3<1 and 0.6+0.3+0.05<1, respectively. It is desirable to have all attributes have complete assessment, but in reality, it is inevitable that some attributes are incomplete due to lack of evidence and information. By using the

distributed assessment result as (1a)-(1c), the precise assessment can be presented as evaluation grades distribution together with degree of belief. Moreover, the ER approach is flexible to allow different attributes to use different sets of evaluation grades to have better meaning to suit with the attributes.

### 3.4.2 The ER Computational Steps

The concepts in decision theory, set theory, probability theory and the D-S theory are employed by the ER approach for aggregating multiple attributes. The ER algorithm can be summarized as follows:

*Step 1: Presentation of a multi-attribution decision problem*

In an ER framework, a MADM problem with $L$ attributes $e_i$ $(i=1\ldots, L)$, and $N$ evaluation grades $H_n$ $(n=1,\ldots., N)$ for each attribute is represented by using the following distribution:

$$S(e_i) = \{( H_n , \beta_{n,i}), n = 1, \ldots., N\}, i = 1, ...., L \qquad (2)$$

where $\beta_{n,i}$ represents a degree of belief where $1 \geq \beta_{n,i} \geq 0$. $S(e_i)$ can be considered to be a complete distributed assessment if $\sum_{n=1}^{N} b_{n,i} = 1$ and an incomplete distributed assessment if $\sum_{n=1}^{N} b_{n,i} < 1$.

*Step 2: Basic probability assignments for each basic attribute*

In order to aggregate all assessment results of attributes to an overall assessment result, the basic probability mass $m_{n,\,i}$ must be assigned to the evaluation grade $H_n$ for attributes $e_i$. On the other hand, $m_{H,\,i}$ is the remaining probability mass to unassign any individual grade. Detail of $m_{n,\,i}$ and $m_{H,\,i}$ are as follows:

$$m_{n,\,i} = \omega_i \beta_{n,i} \qquad n = 1, \ldots., N, \quad i = 1, ...., L \qquad (3)$$

$$m_{H,\,i} = 1 - \sum_{n=1}^{N} m_{n,i} = 1 - \omega_i \sum_{n=1}^{N} b_{n,i} \qquad n = 1, \ldots., N, \quad i = 1, ...., L \qquad (4)$$

where $\omega_i$ is the relative weights of the $L$ attributes and $0 \leq \omega_i \leq 1$ and $\sum_{i=1}^{L} w_i = 1$.

*Step 3: Combined probability assignment for a general attribute*

The probability mass $m_{n,\,i}$ and the remaining probability mass $m_{H,\,i}$ are aggregated to a combined probability mass by the following equations:

$$m_{n,I(i+1)} = K_{I(i+1)} \left[ m_{n,I(i)}\, m_{n,i+1} + m_{H,I(i)}\, m_{n,i+1} + m_{n,I(i)}\, m_{H,i+1} \right], \quad n = 1,\ldots., N \qquad (5)$$

$$m_{H,I(i+1)} = K_{I(i+1)}\, m_{H,I(i)}\, m_{H,i+1} \qquad (6)$$

$$K_{I(i+1)} = \left[ 1 - \sum_{t=1}^{N} \sum_{\substack{j=1 \\ j \neq t}}^{N} m_{t,I(i)} m_{j,i+1} \right]^{-1}, \quad i = 1, \ldots., L\text{-}1 \qquad (7)$$

*Step 4: Calculation of the combined degrees of belief for a general attribute*

The $\beta_n$ represents the degree of belief assesses to the grade $H_n$ while $\beta_H$ represents the degree of belief for the unassigned grade, the calculation of $\beta_n$ and $\beta_H$ are as follows:

$$\beta_H = C_2 = \sum_{i=1}^{L} w_i \left[ 1 - \sum_{n=I}^{N} b_{n,I} \right]$$

$$\beta_n = \frac{(1 - C_2) m_{n,I(L)}}{1 - m_{H,I(L)}} \quad , n = 1, \ldots, N \tag{9}$$

*Step 5: Presentation of the distributed overall assessment and calculation of expected utility*

The distributed overall assessment of an attribute $A$ is given by the following distribution:

$$S(A) = \{(H_n , \beta_{n,i}), n = 1, ...., N \} \tag{10}$$

Let $u(H_n)$ is the utility of a grade $H_n$, where $0 \leq u(H_n) \leq 1$, then the expected utility of an option (alternative) $O$ is calculated as follow:

$$u(O) = \sum_{n=1}^{N} b_n u(H_n) \tag{11}$$

*Step 6: Calculation of the utility interval for an option O*

By using the utility interval to present the incomplete assessment, the maximum, minimum and average utilities of an option $O$ are calculated as follows:

$$u_{\max}(O) = \sum_{n=1}^{N-1} b_n u(H_n) + (b_N + b_H) u(H_N) \quad (12)$$

$$u_{\min}(O) = (b_1 + b_H) u(H_1) + \sum_{n=2}^{N} b_n u(H_n) \quad (13)$$

$$u_{avg}(O) = \frac{u_{\max}(O) + u_{\min}(O)}{2} \quad (14)$$

It should be noted that if the assessment result is complete, then $u(S(O)) = u_{max}(O) = u_{min}(O) = u_{avg}(O)$, otherwise, $u_{min}(O) \leq u(S(O)) \leq u_{max}(O)$. It should be noted that the above utilities are used to characterize an assessment and generate a ranking for an assessment.

## 3.5 Intelligent Decision System (IDS)

IDS is window-based software developed by Yang and his collaborators (Xu and Yang 2001); it is a general-purpose multiple attributes decision analysis tool based on the ER approach. Yang and his colleagues have applied the IDS in business performance assessment and organization self-assessment and found the results to have significant advantages against conventional methods such as improving the consistency, transparency and objectiveness in the assessments (Xu *et al.* 2005). The IDS software is designed to present the MADM problem into hierarchy of attributes, and by assessment/self-assessment, the ratings are input and results are generated by computation of the software with ER approach. According to Xu *et al.* (2005), there are three steps to apply the IDS for assessment: model implementation, assessment information input, and assessment result report.

# Chapter 4 Criteria-based Intellectual Property Management Model

The objective of this chapter is to develop a criteria-based IP management model through the literature review and studies of good systems and practices in organizations, which is the first objective of this research. Thus a criteria-based IP management model becomes the foundation for developing the questionnaire survey, achieving the second objective of this research. There are three sub-objectives as stated in section 1.2.2, page 18: first, to identify the core values in IP management; second, to define the key criteria in IP management; and lastly, to develop the criteria-based IP management model by grouping the key enabling criteria into enabling categories according to their nature. This new model is then validated by the HK-GD based manufacturing industry through questionnaire survey which is described in detail in Chapter five.

## 4.1 Introduction

After a full review and evaluation of the IP management elements in the literature, they are found to be built in core values, namely, “Defensiveness”, “Cost Reduction”, “Profit Generation”, “Integration” and lastly, “Visionary Approach”; above all, these five core values are under the support of “Leadership for IP”.

| Core values | | Key IP Management Enabling Criteria - Systems and Practices | Authors |
|---|---|---|---|
| Leadership for IP | Defensiveness | Creativity generation, concept selection and prototyping | Bader (2006); Einhorn (2006); Siskind (2006); Zhang *et al.* (2006); Graham and Bachman (2004); Berman (2001); Davis and Harrison (2001); Ettlie (2000); Sullivan (2000); Khalil (2000); Trott (1998); Teece (1998); Altshuller (1996); Levin *et al.* (1987); Mansfield (1986); Scherer (1983); Mansfield *et al.* (1981) |
| | | Internal IP security | Lu (2007); Erbisch (2005); Hannah (2005); Wood and Brownlee (2005); Philpott and Jolly (2004); Berman (2001); Rivette and Kline (2000); Berreth (1996) |
| | | IP application/registration | Basnet *et al.* (2004); Litwin and Kolodka (2001); Cohen *et al.* (2000); Levin *et al.* (1987); Mansfield (1986) |
| | | IP commercial development and marketing | Reitzig (2004a); Glazier (2000); Rivette and Kline (2000); Teece (1998); Parr and Sullivan (1996) |
| | | IP defense and enforcement system | Zhou *et al.* (2007); Zhao and Huang (2006); Elmslie and Portman (2006); Rivette and Kline (2000); Miele (2000) |
| | Cost Reduction | IP intelligence and advisory support | Taylor and Germeraad (2008); Haug (2007); Philpott (2004); Xu (2004); Miele (2000); Hitchcock (2000); Moore (1999); Granstrand (1999a and b); Horstmann *et al.* (1985) |
| | | Internal IP audit and evaluation | Rose *et al.* (2007); Tao *et al.* (2005); Sikora (2005); Decarlo (2005); Reitzig (2004b); Bhaduri and Mathew (2003); Davis and Harrison (2001); Harhoff *et al.* (1997); Scherer (1983) |
| | Profit Generation | IP licensing and acquisition | Sterling and Murray (2007); Goldscheider and Gordon (2006); Goldheim *et al.* (2005); Smith and Parr (2003); Arora and Fosfuri (2003); Fosfuri (2003); Choi *et al.* (2003); Davis and Harrison (2001); Pitkethly (2001); Anable (1996) |
| | Integration | Internal IP management function, knowledge and skill | Wook *et al.* (2008); Shearer (2007); Yu and Chen (2006); Tao *et al.* (2005); Gibbs and DeMatteis (2003); Andersen (2003); Lynn (1998); Edvinsson and Malone (1997); Sveiby (1997); Brooking (1996) |
| | | External IP security, agreement and partners matching | Shearer (2007); Bender (2006); Goldscheider and Gordon (2006); KPMG (2006); Peeters and Potterie (2006); Slowinski and Sagal (2006); Tang and Molas-Gallart (2005); Erbisch (2005); Lyons (2004); Smith and Parr (2003) |
| | Visionary Approach | Strategic Management Plan for IP Activities | Shearer (2007); Reitzig (2007); Tietze *et al.* (2006); Reitzig (2004a); Miele (2000); Rivette and Kline (2000); Sullivan (2000) |
| | | Research venture and IP holding business startup/spinout | Ferington (2007); Zhang and Wang (2007); Bader (2006); Hu and Tsai (2006); Quan (2006); Smith and Parr (2003); Rivette and Kline (2000); Cohen *et al.* (1998) |

Table 4.1 Core values and key enabling criteria in IP management

Embedded in the core values, there are twelve key enabling criteria in IP management - systems and practices. Table 4.1 shows the relationships between the core values and key enabling criteria in IP management - systems and practices that have been retrieved from the literature review.

All these core values need to be supported by “Leadership for IP”. Business leaders are nowadays increasingly aware of the importance of IP to a successful organization (Shearer 2007). The IP-savvy CEOs will certainly regard an organizational vision that drives for IP management excellence as one of the most important pieces of intangible assets (Rivette and Kline 2000).

IP is no longer a legal function for product protection only. It is used to develop and sustain current competitive advantage, and to build competitive advantage for the future. Research studies have found that top management commitment and involvement in IP provide a driving force for employees to participate so as to achieve the set target (Sullivan 2000). This is why it requires top management commitment in IP management. Indeed, any IP-savvy CEOs must take leadership, both in setting the IP policies in line with the mission and vision and in creating commitment needed to implement the strategies throughout the organization (Shearer 2007). Leadership for IP requires top management to clearly articulate the core values, i.e. “Defensiveness”, “Cost Reduction”, “Profit Generation”, “Integration” and “Visionary Approach”, which implies that the top management needs to set and communicate the key enabling criteria in IP management to all levels of related employees.

All key enabling criteria are embedded in the five core values. Criteria of “Creativity Generation, Concept Selection and Prototyping”, “Internal IP Security”, “IP Application/Registration”, “IP Commercial Development and Marketing” and “IP Defense and Enforcement System” are embedded in the core value “Defensiveness”. In addition, criteria of “IP Intelligence and Advisory Support” and “Internal IP Audit and Evaluation” are embedded in the core value “Cost Reduction”. The criterion of “IP Licensing and Acquisition” is embedded in the core value “Profit Generation”. Criteria of “Internal IP Management Function, Knowledge and Skill” and “External IP Security, Agreement and Partners Matching” are embedded in the core value “Integration”. And lastly, the criteria of “Strategic Management Plan for IP Activities”

and “Research Venture and IP Holding Business Startup/Spinout” are embedded in the core value “Visionary Approach”. Details of the core values and the key enabling criteria in IP management - systems and practices are discussed in the following sections.

## 4.2 Core Values in Intellectual Property Management

This section addresses the first sub-objective as stated in section 1.2.2, page 18, of the research which is to identify the core values in IP management. In light of the literature review, a set of core values in IP management of organizations is proposed.

### 4.2.1 Defensiveness

Organizations are concerned with the creation and management of sufficient numbers of IP portfolios protecting the organization’s technologies to ensure defense against potential infringers. As shown in Table 4.1, page 88, the core value “Defensiveness” embeds five key enabling criteria which drive an organization to accomplish the following five principles:

*Principle 1: Initiate basic processes for product creation and development*

In any organization, it is essential to have creativity generation (Graham and Bachman 2004; Ettlie 2000; Khalil 2000; Trott 1998). Many organizations focus on IP creation in R&D. Their investment of time, money and efforts enables the organizations to achieve business growth through new technology or product development (Bader 2006; Siskind 2006; Teece 1998; Levin *et al.* 1987; Mansfield 1986; Scherer 1983; Mansfield *et al.* 1981). As a matter of fact, commitment to creativity is treated as a competitive necessity, rather than a competitive advantage, in management of technology or product development and commercialization (Einhorn 2006).

Creativity generation can initiate new R&D projects that may be vital to sustain the future business growth of an organization. It is critical to ensure novelty in new idea generation (Altshuller 1996). The objective of a new concept is able to address

various market needs from a business or technical standpoint. When an alternative design is used to get around the others' products, it requires precautions to minimize the risk of infringement.

In making concept selection decision, the management level of the relevant business units often use a number of evaluation criteria such as profitability of the invention and the market potential of the new concept. The decision to pursue a concept or not may not based on economic considerations only. Sometimes, whether the invention is qualified for IP protection is a decisive factor in making a concept selection decision (Davis and Harrison 2001).

In order to make its development and commercialization efforts productive, an organization goes through many different stages in product testing, engineering prototyping and pilot-production prototyping. In fact, an innovative organization achieves business growth by turning an idea into a product and adding value from IP rights in product (Sullivan 2000).

*Principle 2: Formalize internal security control measures for safeguarding the content of IP portfolios*

All organizations that produce innovative products want to identify, protect and control their IP better by integrating IP management into an organization's management process (Philpott and Jolly 2004). To effectively manage IP, an organization can focus on monitoring and controlling any operational processes that may involve IP (Erbisch 2005). IP issues influence the security control process of an organization. An operational process that is based on a standardized IP management system can ensure higher level of IP security.

Each piece of IP is like a portion of valuable organizational resource. The organization needs to ensure the exact organizational IP right ownership in hold. The issues behind IP rights ownership can occur internally or externally to an organization. Some organizations use a standardized agreement in the control process to clarify ownership of IP rights with all related parties. So it prevents potential disputes of IP right ownership in the future (Erbisch 2005).

IP is often generated from R&D activities. Without a standardized control process on documentation, it is unable to uncover potential IP rights from technological innovations developed by employees (Berman 2001). A good control process is not only useful in records management for all inventive creations, it can also avoid loss of knowledge due to staff turnover. A secured documentation control process is essential for preventing loss of confidential information such as technical know-how or business trade secrets.

*Principle 3: Develop basic processes for identifying, protecting and controlling the organization's own IP*

An innovative organization will certainly set up a rigorous IP protection control process for various forms of IP such as patent, design, trademarks or copyrights (Cohen *et al.* 2000; Levin *et al.* 1987; Mansfield 1986). In accordance to the different forms of IP, an organization can establish standardized control processes for any application filings and examination procedures required for IP protection in local and foreign countries. As the occurrence of infringement is common in a competitive environment, an organization can gain competitive edge over its competitors through the proper use of protection control processes on its IP rights (Rivette and Kline 2000).

*Principle 4: Embedded IP in technology, product and service*

In order to stake a claim on the future and gain the "first mover's advantages" to access the markets, an organization produces new products that are embedded with IP, safeguarded with strong IP protection and cleared from potential infringement risks (Rivette and Kline 2000). The resulting innovative products, services and brands with huge IP portfolios fend off any new entrants to the markets and generate revenue for the organization.

*Principle 5: Establish IP defense and enforcement system*

Leading products or technologies that dominate the market can generate large profits. Infringement can occur in the marketing stage and causes the profit to erode rapidly

(Miele 2000). An organization's IP litigation supports play a key role in determining the defensive and offensive actions. A litigation process is like a daily competitive battle and a business leader should not overlook the risk of a lawsuit on business (Rivette and Kline 2000). In a defensive role, an organization should provide adequate internal support from employees to undertake the appropriate actions to defense against a third party IP accuser. Similarly, in an offensive role, an organization should have adequate skill to take the appropriate actions against an alleged IP infringer (Elmslie and Portman 2006).

### 4.2.2 Cost Reduction

Organizations have realized that IP is an expensive form of defense and they are looking for ways to manage the cost-benefit relationship so that they get greater return on investment for their IP. As shown in Table 4.1, page 88, the core value "Cost Reduction" embeds two key enabling criteria which drive an organization to accomplish the following two principles:

*Principle 6: Avoid costs due to reinvention efforts and potential infringement*

In R&D of new product, an organization should allocate adequate resources to IP intelligence and advisory support. Through competitive intelligence monitoring, an organization is not only able to keep abreast of technology development, but also to assess risk of infringement in its new concept (Berman 2001). The opportunities to identify rivals and allies at an early stage of R&D process are just too great to be ignored. Moreover, the amount of R&D duplication is formadable (Horstmann ***et al.*** 1985). For many organizations, the growth in IP issues and workload makes them demand more from IP attorney. Consultation with a skilled and fully qualified patent attorney is important in the R&D process and is absolutely essential to obtain a strong and valuable patent portfolio (Miele 2000).

*Principle 7: Reduce costs associated with the organization's IP portfolios by using internal audit and evaluation*

In its auditing efforts, an organization not only just reveals the hidden organizational

IP, but it also enhances its ability to prevent loss of IP ownership due to failure to renew and ensures that royalty payment is accurate. The audit can also show whether the core and non-core IP is able to be used effectively (Davis and Harrison 2001). The valuation efforts aim to determine the financial value of IP so that an organization can make use of the value of IP as financing and investment vehicles. In cost/benefit analysis efforts, an organization evaluates what is considered to be the corporation's greatest value of IP (Tao *et al.* 2005). It focuses on assessing the commercial viability of IP through accounting the up-front development cost and the future income earnings.

### 4.2.3 Profit Generation

Organizations begin to focus on proactive strategies to generate revenue through selling or licensing of IP while continue efforts to cut costs. As shown in Table 4.1, page 88, the core value "Profit Generation" embeds a key enabling criterion which drives an organization to achieve the following principle:

*Principle 8: Extract value directly from IP as quickly and inexpensively as possible*

The organization that wants to enhance its IP exploitation control process looks at ways to maximize the benefit of its IP to increase market shares and expand business (Davis and Harrison 2001). There are distinctive economic advantages in reinforcing an organization's IP exploitation control process. In transforming IP portfolio into new business, an organization opens up licensing opportunities for its IP asset and capture additional revenue (Goldscheider and Gordon 2006).

There are various ways of exploiting IP rights. When a holder of IP right wishes to permit another person to do something that is within its control as the IP owner, a license may be agreed. A license is effectively a contractual agreement and should set out precisely what the licensee is permitted to do and any payment or royalty to be paid to the licensor (the IP owner). Another way of benefiting from IP is to sell it to someone else. IP is a form of property, and it can be sold just like physical property. If the organization assigns its IP rights, it normally loses any possibility of further licensing or commercially exploiting its IP rights. Therefore, the amount it charges for

an assignment is usually considerably higher than the licensing fee it would charge for a patent license (Smith and Parr, 2003).

### 4.2.4 Integration

Organizations define the activities of their IP departments broadly and extend their reach to other parts of the organizations to serve greater goals for their organizations. As shown in Table 4.1, page 88, the core value "Integration" embeds two key enabling criteria which drive an organization to achieve the following two principles:

*Principle 9: Ensure that core competence in IP knowledge and skill is adequate in all functions*

People are unique competitive advantage for an organization (Lynn 1998; Edvinsson and Malone 1997; Sveiby 1997; Brooking 1996). Their knowledge, skill and leadership are the key to organizational success. To become more competitive and profitable, the organization can capitalize on people by developing and deploying the full potential of the workforce in the area of IP and assigning the right people in IP management functions.

To begin with IP training, the organization can educate the role and importance of IP to employees and encourage them to share and upgrade IP knowledge and skill (Shearer 2007). An organization often relies on employees to develop its IP. To avoid the potential dispute in IP, the organization should make use of employment contract to clarify the issues of confidentiality and ownership of IP rights. In a highly-structured organization, people specialized in IP are deployed to IP management functions and assigned the responsibilities to handle IP matters.

*Principle 10: Become more sophisticated in managing external relationship with IP requirements*

The concept of keeping all IP development activities within an organization is beginning to change. In developing in-house IP, relationship management has not been paid due attention since all IP management practices belongs to internal

processes. As soon as the global supply chain management spreads throughout the world, organizations have no choice but to do more outsourcing (Peeters and Potterie 2006). The relationship management practices are no longer overlooked for participants in collaborative projects with IP rights ownership (KPMG 2006). As the organization collaborate with the business partners to implement a new project, it is essential for the organization to clarify the ownership of IP rights in agreements with involved parties (Goldscheider and Gordon 2006; Smith and Parr 2003).

Relationship management requires an organization to have more serious attitudes towards IP protection (Shearer 2007; Bender 2006; KPMG 2006). In developing new business relationship, suppliers attempt to leverage IP to promote organizational reputation that can enhance trust and confidence relationship with buyers (Erbisch 2005). From a beneficial perspective, suppliers are encouraged to do more increasingly sophisticated works as their buyers come to trust them more (Molas-Gallart 2005; Tang and Lyons 2004).

### 4.2.5 Visionary Approach

Organizations begin to identify future consumers and industrial trends so that they can use IP as a tool to bridge the gap and create the future of the organization. As shown in Table 4.1, page 88, the core value "Visionary Approach" embeds two key enabling criteria which direct an organization to achieve the following two principles:

*Principle 11: Embedded IP management in visionary leadership and develop strategic management plan for IP activities*

An organization that effectively deals with the alignment of IP strategies with the business strategies can open up new strategy options, which have impacts on the organizational plan to create, protect and exploit an IP portfolio. The strategy options employed by an organization to support the business development programmes will vary greatly depending on its market share, strength and strategies of its competitors, the phase of industry growth and so on (Miele 2000). Depending on the competitive challenges, the organization may use a defensive strategy to protect the commercialization of ideas or an offensive strategy for developing new product lines

or expanding into new markets (Sullivan 2000).

In integrating the IP requirements into the organization's business plan, an organization needs to look at the basic tasks of prioritizing the activities in IP action plan and allocating appropriate resources in supporting the IP portfolios (Shearer 2007).

*Principle 12:* *Stake a claim on the future with encouragement of research ventures and IP holding business startups or spinouts*

It is considered that, in some circumstances, the organization's research output is best maximized by exploitation through the formation of a new organization to commercialize the research (Smith and Parr 2003; Rivette and Kline 2000). Indeed, as the organization grows so large in size that it encourages the IP holding business spinouts and establishes research ventures and startups independently. R&D collaborations can eventually fulfill the needs of lowered costs to reach customers as well as increase efficiency within the supply chain.

## 4.3 Key Enabling Criteria in Intellectual Property Management - Systems and Practices

This section addresses the second sub-objective as stated in section 1.2.2, page 18, of the research which is to define the key enabling criteria in IP management. In light of the literature review in sections 2.2.2 and 4.2, and further study of good systems and practices in organizations from this section, a set of enabling criteria in support of IP management excellence of organizations is proposed as shown in Table 4.2.

| Core values | | Key IP Management Enabling Criteria - Systems and Practices | Enabling Categories | | | |
|---|---|---|---|---|---|---|
| | | | Management Support | Innovation Development | Intellectual Property Capitalization | External Relationship Management |
| Leadership for IP | Defensiveness | Creativity generation, concept selection and prototyping | | ü (see 4.3.4) | | |
| | | Internal IP security | | | ü (see 4.3.6) | |
| | | IP application/registration | | | ü (see 4.3.7) | |
| | | IP commercial development and marketing | | | | ü (see 4.3.10) |
| | | IP defense and enforcement system | ü (see 4.3.3) | | | |
| | Cost Reduction | IP intelligence and advisory support | | ü (see 4.3.5) | | |
| | | Internal IP audit and evaluation | | | ü (see 4.3.8) | |
| | Profit Generation | IP licensing and acquisition | | | ü (see 4.3.9) | |
| | Integration | Internal IP management function, knowledge and skill | ü (see 4.3.2) | | | |
| | | External IP security, agreement and partners matching | | | | ü (see 4.3.11) |
| | Visionary Approach | Strategic Management Plan for IP Activities | ü (see 4.3.1) | | | |
| | | Research venture and IP holding business startup/spinout | | | | ü (see 4.3.12) |

Table 4.2 A matrix diagram that shows the relationships for core values, key enabling criteria and enabling categories in IP management

### 4.3.1 Strategic Management Plan for Intellectual Property Activities

This criterion is concerned with how an organization embeds IP management in visionary leadership and develops strategic management plan for IP activities (Shearer 2007; Reitzig 2007; Tietze *et al.* 2006; Reitzig 2004a; Miele 2000; Rivette and Kline 2000; Sullivan 2000). Assessment should demonstrate how the organization establishes:

***Mission and vision*** *- How the organization formulates strategic direction on IP based on its mission & vision?* An example of good systems and practices can be found in Hewlett-Packard (HP). The organization's vision and core values statement on IP focuses on IP creation in R&D. The management's strategy on IP is to institute a formal "innovation initiative" and adopts an imperative slogan, "INVENT" under the HP signage. The organization communicates its message through print and television ads focused on the organization's history of invention and innovation (HP 2007; Davis and Harrison 2001).

***Top Management Commitment*** *- How the top management sets IP policies and practices? How the top management is committed and involved in the implementation of the strategic direction, policies and practices on IP?* An example of good systems and practices can be found in IBM. The top management of IBM supports and commits to use IP rights not only to benefit itself, but also other organizations. IBM communicated the message through its corporate policy in 2006. In a statement of the organization's IP policies and practices, IBM: (i) makes available over 100 of its business-method patents to the public, where they can be used openly to stimulate innovation; and (ii) implements an award system for IBM's employees to share the benefits of submitting their inventions for patenting. The organization makes its award system available to all employees worldwide (IBM 2006; Wan 2006b).

***Total Commitment in all Relevant Levels*** *- Are employees at all levels well-aware of the organization's IP policies and practices? Is relevant staff committed and abide to the IP policies and practices?* An example of good systems and practices can be found in Haier. The organization's IP policies and practices incorporate the values and philosophy of Strategic Business Unit (SBU). It is not only every division, but also

every employee is a SBU. The desired organizational culture is developed from Haier's business strategy which is carried out and shouldered by all employees. The innovation of every employee will ensure that Haier's strategy is successfully implemented. The activities motivate the participation of employees at all levels as every employee will have to carry out technical innovation for production or management efficiency improvement for customer need satisfaction (Haier 2007).

***IP Action Plans*** *- How the organization sets implementation plan for IP management activities and set action items with performance monitoring for its IP plan?* An example of good systems and practices can be found in the work of Gibbs and Dematteis (2003). The theme of the IP plan is to develop a Patent Quality Management (PQM) System. The objective of the system is to perform the responsibilities to manage, develop and exploit patents in every functional department in the organization. A core staff is appointed to initiate the system and sets some action items on what staff should achieve. It also establishes performance metrics that will allow staff to track the achievement of the system; and a reward or recognition programme for good performing staff.

### 4.3.2 Internal Intellectual Property Management Function, Knowledge and Skill

This criterion is concerned with how the organization ensures that core competence in IP knowledge and skill is adequate in all functions (Wook *et al.* 2008; Shearer 2007; Yu and Chen 2006; Tao *et al.* 2005; Gibbs and DeMatteis 2003; Andersen 2003; Lynn 1998; Edvinsson and Malone 1997; Sveiby 1997; Brooking 1996). Assessment should demonstrate how the organization establishes:

***IP Manual*** *- How the organization updates and disseminates new changes in IP policies and laws/regulations to its staff? How the organization reinforces the IP policies and practices through reminding its employees periodically?* An example of good systems and practices can be found in Sany Holding Co. Ltd., a major producer of engineering machinery in China. The organization compiles a collection of reference resources that include a manual to explain the patents of Sany, protected objects and the ways of judging patent infringement; and a database for quick access

to domestic and foreign patent information and standards, related periodicals, IP laws, regulations and other industrial information. The database is updated on a weekly or monthly basis. The manual and database are provided and disseminated to both R&D staff and a special working group that file lawsuits against infringing organizations after market survey (IPR in China 2007a; Wei 2005).

***Employee Contract*** *- How the organization makes clear statements in employment contract on IP policies and practices?* An example of good systems and practices can be found in Microsoft. In 2005, a former Microsoft vice-president left Microsoft and sought a position in Google to head Google's research business in China. Microsoft began to sue the former employee and Google in a Washington state court, contending that the former employee's job at Google would violate confidentiality and non-competition clauses in his employee contract (Xinhua 2005).

***IP Training*** *- How the organization provides training to relevant staff on IP management?* An example of good systems and practices can be found in Sany Holding Co. Ltd., a major producer of engineering machinery in China. The organization organizes regular training courses to broaden researcher's IP knowledge. Twelve training courses were held in the first nine months of 2005. Approximately 400 engineers participated, including a special working group that are trained to initiate the action for patent protection (IPR in China 2007a; Wei 2005).

***Internal IP Manager*** *- How the organization appoints dedicated staff/ team/ department for managing IP?* An example of good systems and practices can be found in Xerox. The past CEO Rick Thoman, an outsider from IBM with expertise in IP management, was appointed by Xerox to lead the organization to develop a new organizational structure with all its IP assets being centralized in the Xerox IP Operations unit (XIPO). The IP manager of XIPO had profit-and-loss responsibility for managing the organization's patent portfolio. XIPO, in close cooperation with the IP Law Department, manages the protection and commercialization of Xerox's IP and plays a significant role in the patent filing process (Xerox 2007; Rivette and Kline 2000).

### 4.3.3 Intellectual Property Defense and Enforcement System

This criterion is concerned with how the organization establishes IP defense and enforcement system (Zhou *et al.* 2007; Zhao and Huang 2006; Elmslie and Portman 2006; Rivette and Kline 2000; Miele 2000). Assessment should demonstrate how the organization performs:

***IP Defense*** *- How the organization checks if it infringes on other's IP periodically?* An example of good systems and practices can be found in Sony. In 2004, Kodak sued Sony for violating its 10 digital camera patents. Sony then took an approach to countersued, alleging Kodak's infringement of its 10 patents related to digital still camera, and Kodak filed a counterclaim. Sony denied violating any of Kodak's patents and said it would "vigorously defend" the charges against it. After more than a year of talks between the two organizations regarding the patents, Kodak came to sign a licensing pact with Sony, settling a lawsuit over digital camera and imaging technology patents and granting each organization access to the other's patents (Yan 2007; ITworld 2004).

***IP Enforcement*** *- How the organization continuously monitors external environment to ensure no infringing acts against its IP?* An example of good systems and practices can be found in Fonar Corp., a small organization that developed the patented magnetic resonance imaging (MRI) for detecting cancers and other diseases in human body. Fonar continuously sought supports of legal advice on actions against the infringing organizations. In 1997, Fonar sued General Electric for patent infringement and it was forced to pay Fonar USD 128.7 million for the settlement. This was an amount equal to ten times the small organization’s annual revenues at the time - which Fonar then distributed to its shareholders in the form of “patent infringement” dividends (Fonar 2005; Rivette and Kline 2000).

### 4.3.4 Creativity Generation, Concept Selection and Prototyping

This criterion is concerned with how the organization initiates basic processes for product creation and development that lead to IP generation (Bader 2006; Einhorn 2006; Siskind 2006; Zhang *et al.* 2006; Graham and Bachman 2004; Berman 2001;

Davis and Harrison 2001; Ettlie 2000; Sullivan 2000; Khalil 2000; Trott 1998; Teece 1998; Altshuller 1996; Levin *et al.* 1987; Mansfield 1986; Scherer 1983; Mansfield *et al.* 1981). Assessment should demonstrate how the organization performs:

***Concept Creation*** - *How the organization undertakes R&D initiatives on new technologies/ products/ services?* An example of good systems and practices can be found in Procter & Gamble (P&G). The idea of a wet floor cleaning mop with super-absorbency took shape at the "Seminar of Dreams", a session which brought together the P&G's best technologists to "cross-fertilize" many of the organization's core competencies. This idea combined the insight of the floor cleaning chemistry from HomeCare group and diaper technologies from the Paper Division (Davis and Harrison 2001).

***Design Around*** - *How the organization takes precautions in modifying its design to avoid its new product infringing the IP rights of others?* An example of good systems and practices can be found in Rohm and Haas, and Cabot Corporation; which undertook a venture business in a technology field. An old concept patented by a major competitor blocked growth in certain sector. The venture used the "TRIZ direct evolution" analysis to create new concept to get around the competitor's patents and yielded future product scenarios that allowed for the filing of early-stage patents on the basis of the TRIZ results. What the venture had achieved was a patent wall that afforded them legal protection and a strong position from which to capture growth during the next phase of development of the technology. In effect, competitors were frozen out of the market (Smith 2004).

***Concept Evaluation*** - *How the organization conducts market feasibility and technical assessment of new concepts/ inventions? How the organization evaluates the patentability of its inventions?* An example of good systems and practices can be found in Hewlett-Packard (HP). Thousands of invention disclosures from HP's R&D group are reviewed every year. In evaluation of market feasibility, HP focuses on time to market which is a critical factor, as the technology life cycle is continually shrinking. In evaluation of patentability, HP uses tight screening criteria for its patent portfolio and focuses on filing on inventions that could be commercialized within the next five years. To help business unit managers prioritize their technology goals, HP

creates a Patenting Survey Form to determine not only which patents to eliminate, but also which type of patents to encourage (Davis and Harrison 2001).

***Concept Vetting Procedure*** *- How the top/ senior management performs vetting procedures to select new inventions?* An example of good systems and practices can be found in IBM which operates an invention selection process. IBM uses a committee comprising an IP attorney, a business manager, at least one technical expert, and at least one inventor from the subject invention disclosure. The vetting procedure uses a Patent Value Tool (PVT), IBM's expert system that asks a series of structured questions about the invention: market size, market maturity, claim scope, fit of solution to problem, standards applicability, prestige factor, etc. Using the answers input by the committees, the PVT generates a numerical score for the invention to improve decision-making efficiency (Davis and Harrison 2001).

***Prototype Testing and Development*** *- How the organization develops and tests its engineering prototype?* An example of good systems and practices can be found in 3M, which encourages technical staff members to spend up to 15 percent of their time on projects of their own choosing. In 1968 Dr. Spencer Silver, a scientist of 3M, invented a non-obvious sticky polymer. But, Silver's colleague, Mr. Arthur Fry invented Post-it® Notes by applying the polymer for repositionable notes. Fry used a portion of his working hours to develop a solution to his problem. After years of product development and testing procedures, 3M engineers invented paper coating that needed to make Post-it idea work with paper surfaces and Post-it production machinery. 3M finished the prototypes and introduced the product of Post-it® Notes in four major markets in 1977 but it failed as consumers had not tried the product. A year later, 3M issued free samples with very good market response. In 1980, Post-it® Notes introduced nation-wide (3M 2007; Wikipedia 2007).

### 4.3.5 Intellectual Property Intelligence and Advisory Support

This criterion is concerned with how the organization avoids costs due to reinvention efforts and potential infringement litigations in early design cycle by using IP intelligence and advisory support (Taylor and Germeraad 2008; Haug 2007; Philpott 2004; Xu 2004; Miele 2000; Hitchcock 2000; Moore 1999; Granstrand 1999a and b;

Horstmann *et al.* 1985). Assessment should demonstrate how the organization performs:

***IP Search*** *- How the organization performs searches and analysis on IP?* An example of good systems and practices can be found in Gillette which was developing its twin-blade Sensor. The engineers had come up with seven different designs for mounting the blades in a floated angle geometry. While Gillette had protected all of them with patents, it conducted a full patent search on all seven versions of the design. The purpose of the search was to decide which of these seven designs should its engineers built the product around. Based on the search results, the final design was selected so that potential competitors would have the most difficulty in getting around (Rivette and Kline 2000).

***IP Information Database*** *- Does the organization develop internal database on IP? Does the organization subscribe to external database on IP (e.g. existing patent databases in the market)?* An example of good systems and practices can be found in Aurigin Systems, Inc. (now under Thomson) which has developed a powerful visual tool called Aureka. The theme maps produced by Aureka show patent portfolio and compare portfolio strengths across competitors. Using this software tool, IP professionals can construct graphs for strategic planning, improve decision making, and ultimately reduce the time and expense associated with IP management (Davis and Harrison 2001).

***External IP Consultant*** *- How the organization seeks advice on legal matters for its IP from legal advisor/ IP consultant?* An example of good systems and practices can be found in Shenzhen Zhongcai Union Technological Co. Ltd., which is an IP consulting organization being formed by ten major Chinese television makers including TCL, Changhong, Haier and Xoceco and other manufacturers. The IP consulting organization will help Chinese TV makers negotiate digital TV patent fees with foreign patent holders, including Sony, Thomson and Tri-Vision. The fees are a heavy burden for China's TV industry as its profit margin is very thin. The new IP consulting organization will compile a pool of digital TV patents and integrate domestic and international IP right resources for China's TV industry and improve the bottom line by negotiating reductions in patent fees with foreign patent holders (China

Daily 2007b).

***IP Budget*** *- Does the organization provide adequate budget and resources for supporting its IP portfolio?* An example of good systems and practices can be found in Siemens which now employs more than 47,000 researchers and developers worldwide, a figure that represents 10 percent of the organization's global workforce. The total R&D spending in fiscal year 2005 was 5.2 billion euros (US$6.66 billion), representing 6.8 percent of the organization's sales. In 2005, Siemens filed for more than 1,000 patents in China, becoming one of the multinationals with the largest number of patent filings in the country. The spirit of discovery drives Siemens to bring new scientific knowledge into practical use and generate products that will shape and enhance its top position around the world. Many of China's most advanced technologies are "Made by Siemens" (Hausmann 2006; Yao 2006).

### 4.3.6 Internal Intellectual Property Security

This criterion is concerned with how the organization formalizes internal security control measures for safeguarding the content of IP portfolios (Lu 2007; Erbisch 2005; Hannah 2005; Wood and Brownlee 2005; Philpott and Jolly 2004; Berman 2001; Rivette and Kline 2000; Berreth 1996). Assessment should demonstrate how the organization performs:

***Confidential Information*** *- How the organization strictly implements its policies and practices to govern confidential information?* An example of good systems and practices can be found in UK defense industry which requires managing IP in the context of inter-organizational collaborative projects. The confidential information being restricted of access includes a large amount of technical data, comprising designs, product specifications, manufacturing processes, etc. To prevent unauthorized disclosure of confidential information, the UK defense industry adopts a wide choice of DEFCONs ("Defence Conditions") and DEFFORMS (templates for annexes that can be appended to contracts) which are available for contract officers to include in contracts. These control measures provide detailed contractual clauses and provisions applicable to a wide set of situations and improve the consistency in application of policy and good practices in "Shared Digital Environment" (AOF 2007; Tang and

Molas-Gallart 2005).

***Copyright Protection*** *- How the organization manages and controls the copyright issues?* An example of good systems and practices can be found in the Japanese Yamaha Corporation which created a collection of synthesized music resources. As these are copyrightable works with investment of its time, money and effort, Yamaha takes measures to protect the IP contained in these works. In 2007, the accompany music preinstalled in Yamaha electronic keyboards which belong to Yamaha was found to be copied or imitated in six types of keyboards manufactured by four Chinese organizations. Yamaha instituted a proceeding against the four Chinese organizations for copyright infringement (IPR in China 2007b).

***Internal Design Documentation*** *- How the organization maintains documentations and records for all original works created? How the organization maintains inventory list for all its IP?* An example of good systems and practices can be found in Ford Global Technologies, LLC (FGTL) which is a subsidiary of Ford Motor Company to handle all of the IP for Ford worldwide. Ford has 11,000 active patents with licensing activities. It produces one patent every single hour somewhere around the globe. FGTL uses an "Innovation Acceleration Centre" to facilitate creativity and invention of employees and uses IP management software to provide lifecycle management for all types of IP from idea through legal filing to monetization. The top management uses the software to perform disclosure controls and procedures; and reviews profit-and-loss annually (Coughlin 2007; Ureel 2005).

### 4.3.7 Intellectual Property Application/Registration

This criterion is concerned with how the organization develops basic processes for identifying, protecting and controlling its own IP (Basnet *et al.* 2004; Litwin and Kolodka 2001; Cohen *et al.* 2000; Levin *et al.* 1987; Mansfield 1986). Assessment should demonstrate how the organization performs:

***Patent Application*** *– Does the organization apply for patent protection in the local market? Does the organization apply for patent protection in its overseas markets?* An example of good systems and practices can be found in Amazon which, in 1997,

submitted a patent application entitled "A Method and System for Placing a Purchase Order Via a Communications Network". In 1999, Amazon was granted US Patent 5,960,411. It is now known as Amazon's "1-Click" patent. Amazon patented the business method because it did not want to see an innovation that it spent time and money developing be adopted by its competitors. The patent shows the organization's vision of a monopoly space for taking orders from online customers without asking them to repeat key information (Davis and Harrison 2001).

***Design Application*** *- Does the organization apply for design protection?* An example of good systems and practices can be found in Nokia which developed a new mobile phone with good appearance. The design of the mobile phone was protected as registered designs in China. Nokia obtained grant of three designs, including the mobile phone, the front cover of the mobile phone and the back cover of mobile phone. The registered design gave Nokia exclusive right over production and commercialization of the product with the protected design in China. In 2006, Nokia found that, without any authorization, four organizations in China used the mentioned designs to manufacture and sell a similar mobile phone. Nokia sued the organizations for infringement of its design before the court in Beijing (IPR in China 2006).

***Trademark or Service Mark Registration*** *- Does the organization register for trademark/service mark?* An example of good systems and practices can be found in IBM which owns one of the most recognized logotypes in the world, and a design that has been widely imitated by others. In 1972, IBM made the decision to re-brand its logo. Designed by noted graphic designer Paul Rand, the old logo trading under the clunky banner of International Business Machines was replaced with the now famous design of "split-line" IBM logo. The horizontal stripes now add distinctiveness and suggest "speed and dynamism". In the past three decades, the basic design has remained constant and successful (IBM 2007; Pike 2001).

### 4.3.8 Internal Intellectual Property Audit and Evaluation

This criterion is concerned with how the organization reduces costs associated with its IP portfolios by using internal audit and evaluation (Rose *et al.* 2007; Tao *et al.* 2005; Sikora 2005; Decarlo 2005; Reitzig 2004b; Bhaduri and Mathew 2003; Davis and

Harrison 2001; Harhoff *et al.* 1997; Scherer 1983). Assessment should demonstrate how the organization performs:

***IP Audit*** - *How the organization performs IP royalty audit?* An example of good systems and practices can be found in Dow Chemical which conducted its first organization-wide audit of IP assets in 1994. As Dow was historically aggressive in asserting patents, the IP audit covered the organization's 29,000 patents. The contents of IP assets were identified, valued and assigned to one of 15 major business units, which thereafter assumed financial responsibility for its use. Dow achieved an immediate savings of USD 50 million in taxes and maintenance fees on unneeded patents, and earnings in licensing revenues skyrocketed from USD 25 million to more than USD 125 million (Rivette and Kline 2000).

***IP Valuation*** - *How the organization evaluates the financial value of its IP?* An example of good systems and practices can be found in Dow Chemical which, in 1990's, hired Arthur D. Little consultants to support its valuation efforts. In managing the intellectual assets for the organization, Dow created new processes of intellectual asset management. A tool called the "Tech Factor Method" invented by Arthur D. Little consultants was used to quantify the monetary contribution of each patent as a percentage of the business's total net present value. Dow capitalized on its intellectual assets and has heightened the value of its patents by more than 400% (Poh and Yeo 2004; Rivette and Kline 2000).

***IP Cost/Benefit Analysis*** - *How the organization performs cost and benefit analysis for maintaining its IP?* An example of good systems and practices can be found in IBM which has a very large patent portfolio generating equally large maintenance fees. In performing cost/benefit analysis, IBM's management uses selective pruning to control maintenance expenses and ensures that the organization's portfolio is maximally tuned to the marketplace. The criteria for the phase of pruning may include location of manufacturing facilities, markets where products are sold, activities of competitors, local customs and attitudes regarding enforcement, and - last but not least - the cost of filing for patent renewal (Davis and Harrison 2001).

### 4.3.9 Intellectual Property Licensing and Acquisition

This criterion is concerned with how the organization extracts value directly from IP as quickly and inexpensively as possible (Sterling and Murray 2007; Goldscheider and Gordon 2006; Goldheim *et al.* 2005; Smith and Parr 2003; Arora and Fosfuri 2003; Fosfuri 2003; Choi *et al.* 2003; Davis and Harrison 2001; Pitkethly 2001; Anable 1996). Assessment should demonstrate how the organization performs:

***IP Out-licensing*** *- How the organization licenses out or abandons the non-core IP?* An example of good systems and practices can be found in Cadtrak which started licensing-out its non-core patent to other organizations. Cadtrak owned a patent relating to a means for improving speed of graphic processing using "selective erase". In 1984, the "selective erase" technology was written into the EGA graphic specification. Since then, Cadtrak gave up its money losing engineering design services and concentrated on licensing its patent as its major business (Rivette and Kline 2000).

***IP In-licensing*** *- How the organization licenses in partners' IP?* An example of good systems and practices can be found in the Taiwan Princeton Technology Corp., a world-famous IC design company. Princeton was looking for dynamic backlight control technology which was applied to the flat panel TV display. In 2006, Princeton signed a patent licensing agreement with TCL to acquire the right to use the patent of LCD-TV digital video and dynamic backlight control technology, which could greatly upgrade the dynamic contrast gradient of the flat panel TV, mitigate visual fatigue, and decrease 30% of television power consumption (Nanfang Daily 2006).

***IP Ownership Acquisition*** *- How the organization acquires IP ownership from others?* An example of good systems and practices can be found in Texas Instruments (TI) which believed that the modem business was shifting to high-speed digital subscriber line (DSL). In 1997, TI acquired Amati Communications together with 25 seminal DSL patents. The combination of Amati's DSL technology and TI's digital signal processing solutions will enable faster, more reliable access to the Internet and the ability to use a single, existing phone line to simultaneously access voice, data and video (Rivette and Kline 2000).

### 4.3.10 Intellectual Property Commercial Development and Marketing

This criterion is concerned with how the organization embeds IP in technology, product and service (Reitzig 2004a; Glazier 2000; Rivette and Kline 2000; Teece 1998; Parr and Sullivan 1996). Assessment should demonstrate how the organization addresses to:

***IP Commercialization Conversion*** *- How the organization uses its core IP in new products/ services?* An example of good systems and practices can be found in Haier, which sets a good approach on how to uses IP right to shield their products in order to extend their market share. Every new product of Haier will own one or even more patents. Haier's detergent-free washing machine is a high-tech product developed by the organization itself. The organization has obtained 32 patents, and 17 are patents for invention. In 2002, Haier began to produce this kind of washing machine. In 2006, it started a two-month marketing campaign in more than 100 cities in China to promote the concept of detergent-free washer (Wan 2006a).

***Brand Positioning*** *- How the organization builds and reinforces its brand in the market?* An example of good systems and practices can be found in Apple which launched its new brand iTunes Music Store (iTMS) in 2003. The brand began to quickly establish a clear lead in the digital music space. With innovation in digital rights management (DRM), Apple's iTMS was the first service with content from all five major labels to sell songs without subscription fees. Within two weeks of its launch, iTMS sold two million tracks and more than 70 million downloads in its first year. The iTunes service, initially available only to Macintosh users in the United States, became available to users on the PC platform within a few months after launch. Apple launched iTMS for Europeans in selected markets in 2004 (Goldscheider and Gordon 2006).

***Advertising Channel*** *- How the organization promotes its products with identification of its patent, design or trademark in all advertising and communication materials?* An example of good systems and practices can be found in Lenovo Group Ltd., the leading Chinese PC maker. In 2006, Lenovo signed up as the "Official PC Partner" of

the National Basketball Association (NBA). As the NBA's "Official PC Partner", Lenovo will be able to use the NBA brand and player images in its marketing campaigns and TV commercials. Meanwhile, the NBA will use Lenovo products, while its official website and TV channel will promote the Lenovo brand. The deal establishes a long-term marketing partnership and is a bid of the world's third-largest PC manufacturer to raise brand awareness through sports events (Wang 2006).

### 4.3.11 External Intellectual Property Security, Agreement and Partners Matching

This criterion is concerned with how the organization becomes more sophisticated in managing external relationship with IP requirements (Shearer 2007; Bender 2006; Goldscheider and Gordon 2006; KPMG 2006; Peeters and Potterie 2006; Slowinski and Sagal 2006; Tang and Molas-Gallart 2005; Erbisch 2005; Lyons 2004; Smith and Parr 2003). Assessment should demonstrate how the organization addresses to:

***IP Right Ownership*** *- How the organization clarifies IP rights ownership in written agreements before entering into a partnership?* An example of good systems and practices can be found in China National Offshore Oil Corporation (CNOOC), which adopts a step-by-step approach to achieving deep-sea drilling capability. In 2007, CNOOC has signed a $13 million contract with Aker Kvaener ASA, a Norwegian engineering and offshore service company, for delivery of an ultra-deepwater drilling rig, which is expected in early 2011. The drilling vessel to be built by Aker Kvaener ASA is jointly designed by CNOOC and F&G Company of the US, capable of operating at 3,000 meters under water and drilling up to 10,000 meters under the sea bed. CNOOC will own the IP right of the vessel. With the IP right, CNOOC can develop its own deep-sea drilling facilities in future (Wang 2007).

***Non-disclosure Agreement*** *- Does the organization sign Non-disclosure Agreement (NDA) with partners before commencement of any projects involving IP?* An example of good systems and practices can be found in Microsoft. In 1980, Jack Sams, head of the Software side of IBM's secret personal computer project, contacted Microsoft and met with Gates and Ballmer in Redmond. Gates and Ballmer immediately agreed to sign a non-disclosure agreement. Since Microsoft had never written an operating

system before, Gates had suggested IBM investigate an OS called CP/M (Control Programme for Microcomputers), written by Gary Kildall of Digital Research. IBM contacted Kildall for a meeting, executives met with Mrs. Kildall who refused to sign a non-disclosure agreement. IBM soon returned to Bill Gates and gave Microsoft the contract to write the new operating system, one that Gates eventually make a fortune from the licensing of MS-DOS developed from this contract (Bellis 2007).

***Business Collaboration*** *- How the organization collaborates with relevant business/strategic partners on developing new markets for its new technologies/products/services?* An example of good systems and practices can be found in IBM, which cross-licensed its patent portfolio with Dell's. In 1999, the collaborating partners signed a strategic USD16 billion deal which enabled Dell to purchase storage, microelectronics, networking, and display technology from IBM for integration into Dell computer systems. As part of the contract, Dell will have royalty-free access to the IBM components in needs while IBM will have access to the patented technologies that Dell employed in running its world-leading direct sales operation (Rivette and Kline 2000; Dell 1999).

***Technology Collaboration*** *- Does the organization provide provisions in commercial contracts to ensure its IP rights are protected from infringement by the contractual party and others?* An example of good systems and practices can be found in Microsoft and Lenovo Group. In 2007, the technology collaborators set up a joint research facility in Beijing with an investment of several million dollars a year. The facility is based in Lenovo's R&D centre with around 40 engineers from Lenovo and tools, training and some staff from Microsoft. The joint centre develops products for Lenovo in areas like corporate computing, digital homes, Windows value-added services, as well as ultra-portal computing devices and smart handheld devices. The two collaborators will share IP generated from the joint centre and Lenovo will also be able to use the results in its R&D facilities in the United States and Japan (Liu 2007).

### 4.3.12 Research Venture and Intellectual Property Holding Business Startup/Spinout

This criterion is concerned with how the organization stakes a claim on the future with encouragement of research ventures and IP holding business startups or spinouts (Ferington 2007; Zhang and Wang 2007; Bader 2006; Hu and Tsai 2006; Quan 2006; Smith and Parr 2003; Rivette and Kline 2000; Cohen *et al.* 1998). Assessment should demonstrate how the organization addresses to:

***Research Collaboration*** *- How the organization collaborates with research institutes (e.g. Universities) to develop new technologies/ products/ services?* An example of good systems and practices can be found in Hisense, which is one of the largest electronics and information organizations in China. Hisense R&D established "Hisense Research Institute of Shandong University", a platform on which Hisense co-operates with renowned higher education institutes, and the Hisense Academy located at Hisense R&D Center which offers good opportunities for knowledge updating and development of its R&D staff. It has entered into cooperative relation with Beijing University of Aeronautics and Astronautics to set up an engineering postgraduate program. Hisense has invested more than 5 per cent of annual sales revenue in R&D. All these measures serve as a guarantee for the supply of talents to Hisense (Hisense 2007; Xiao 2006).

***Startup/Spinout*** *- Does the organization use some forms of IP to start up separate business entities?* An example of good systems and practices can be found in Lockheed. By 1997, the organization had some patent portfolios on 3D flight simulators which were not linked with any business. Working with an investment bank, Lockheed formed a new venture called Real3D that built around those patents and then spun it off to PC graphics and video game business. It attracted investments from Intel and Silicon Graphics and the patents were used to get 40 percent ownership in Real3D (Rivette and Kline 2000; CBR 1999).

## 4.4 Criteria-based Intellectual Property Management Model

This section addresses the third sub-objective as stated in section 1.2.2, page 18, of the research which is to develop the criteria-based IP management model by grouping the key enabling criteria into enabling categories according to their nature. A glance at the criteria-based IP management model - systems and practices in Figure 4.1 shows that the twelve enabling criteria (as described in section 4.3 and Table 4.2, page 98) are grouped into four enabling categories according to their nature, namely: management support, innovation development, IP capitalization and external relationship management. Management support category is associated with executive responsibilities (strategy, structure and culture), especially the running of the IP department and managing its interaction with other departments in defense and enforcement actions. Innovation development category addresses how an organization translates an idea into its own new product, and evaluates IP right issues surrounding the commercialization of the product in market. IP capitalization category emphasizes the use of IP rights as barriers to preserve competitive advantage as well as the licensing opportunities to exploit IP to the organization's advantage. External relationship management category is associated with the external management of IP rights, primarily how an organization interacts with other organization's IP rights and vice versa. While these categories are drawn as distinct, in reality there are many areas of overlap. Management support category provides a foundation for the activities of the other three major enabling categories. IP capitalization category, innovation development category and external relationship management category are functionally related, often cyclic in practices throughout the process. The inter-relationships of enabling categories and criteria are investigated later using factor analysis and path analysis in Chapter 5.

The enabling categories provide performance measures for each function to plan actionable IP management activities that can finally address to the organization's business goal. Therefore, an effective internal IP operation structured by enabling categories creates the sustainable IP management excellence, which, in turn, improves the two IP management result categories (i.e. IP outcomes and external relationship satisfaction).

The criteria-based IP management model can be used as the basis of an audit to summarize those areas where IP management is well practiced, and identify areas for improvement where management attention should be focused. Examples of the IP management excellence audit reports are provided later in Chapter 7. Importantly, management uses the model for two purposes: a) to ensure all four enabling categories are integrated, working synergistically to achieve common objectives; and b) to identify areas of strengths and weakness within each of the four enabling categories. Although the four enabling categories have been reviewed in detail in section 2.2.2, and the twelve enabling criteria have been described in section 4.3, they are briefly discussed below.

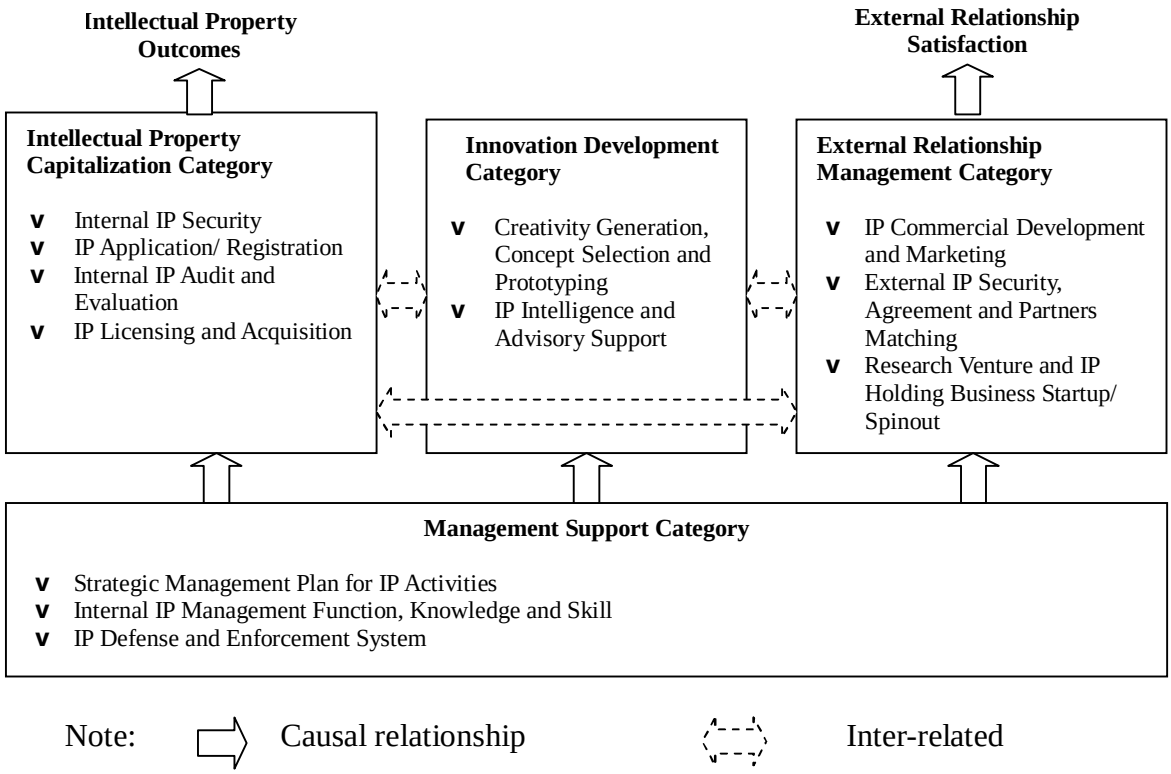



Figure 4.1 Criteria-based intellectual property management model

### 4.4.1 Category MS- Management Support

Management support category is concerned with "Strategic Management Plan for IP Activities", "Internal IP Management Function, Knowledge and Skill", and "IP

Defense and Enforcement System".

An organization develops its purpose, vision and core values to achieve IP management excellence. A CEO shall communicate top management's commitment and involvement in the implementation of the strategic direction, policies and practices on IP to employees, customers, suppliers, partners and other external parties. To translate core values into desired employee behaviors, an organization sets its IP policies and abides the employees to them. An organization develops action plans aligned to IP strategies and goals and set action items with performance monitoring for IP plan.

To facilitate knowledge sharing within business units, an organization provides staff with training manual in IP management and exploitation. Content of manuals and reference booklets should increase the staff member's ability to create, protect and leverage IP of the organization. An organization always relies on staff to develop its IP assets. To avoid dispute in IP ownership, an organization makes clear statements in internal official documents, such as employment contract, regarding the confidentiality requirement, ownership of IP, and incentive for invention. To begin with any training policies and programmes, an organization identifies what related departments require the IP knowledge and skills and put the training system in place to develop what the organization needs in the related departments. To ensure the right people in managing IP, an organization appoints suitable staff or collective team/department with dedicated responsibilities for IP portfolio management and extraction of value from IP.

When dealing with issues of IP infringement, in particular in the actions for defending against an aggressive accuser, an organization seeks legal support with involvement of relevant departments such as marketing, engineering and administration. Similarly, an organization seeks legal support with appropriate involvement of relevant departments in the actions for pursuing an infringer.

The configuration of enabling criteria in management support category that affects IP management excellence in an organization comprises:

***Criterion MS1- Strategic Management Plan for IP Activities***

*How the leaders embed IP management in visionary leadership and develop strategic management plan for IP activities?* Based on study of organizations in section 4.3.1, it is possible to classify four good systems and practices for this enabling criterion. They are:

- The organization formulates strategic direction on IP based on its mission & vision.
- The top management sets IP policies and practices and is committed and involved in the implementation of the strategic direction, policies and practices on IP.
- The organization's employees at all levels are well-aware of the organization's IP policies and practices. The relevant staff is committed and abided to the IP policies and practices.
- The organization sets implementation plan for IP management activities and set action items with performance monitoring for its IP plan.

***CriterionMS2- Internal IP Management Function, Knowledge and Skill***

*How the organization ensures that core competence in IP knowledge and skill is adequate in all functions?* Based on study of organizations in section 4.3.2, it is possible to classify four good systems and practices for this enabling criterion. They are:

- The organization updates and disseminates new changes in IP policies and laws/regulations to its staff. The organization reinforces the IP policies and practices through reminding its employees periodically.
- The organization makes clear statements in employment contract on IP policies and practices.
- The organization provides training to relevant staff on IP management.
- The organization appoints dedicated staff/ team/ department for managing IP.

***Criterion MS3- IP Defense and Enforcement System***

*How the organization establishes IP defense and enforcement system?* Based on study of organizations in section 4.3.3, it is possible to classify two good systems and practices for this enabling criterion. They are:

- The organization checks if it infringes on other's IP periodically.
- The organization continuously monitors external environment to ensure no infringing acts against its IP.

### 4.4.2 Category ID- Innovation Development

Innovation development category is concerned with “Creativity Generation, Concept Selection and Prototyping” and “IP Intelligence and Advisory Support”.

An organization generates new ideas that can create new products with increased IP value through activities such as brainstorming, creative thinking methodologies and R&D initiatives. In order to avoid infringement in bringing a new product to market, an organization develops a solution to get around IP rights owned by other organizations. Once an organization generates workable new designs, they are analyzed and evaluated. An internal business proposal or customer-oriented studies are prepared for analyzing the technology concept, market needs and business model. An organization performs vetting procedure of the inventions in review meetings and provides to management the necessary information required to make informed decisions as to proceed with trade secrets, patent protection or publishing as “Prior Arts”, etc. In turning an idea into a product, an organization goes through many different stages in product testing, engineering prototyping and pilot-production prototyping.

An organization makes use of patent information as an important source of technological intelligence for invention assessment, infringement clearance search, monitoring of latest technological development, etc. As a form of information tool, an organization develops or utilizes internal or external IP knowledgebase to reveal insights into patent technology and gain strategic advantage in technology and competitive intelligence. Some IP tasks such as studying patentability of the invention and acquiring IP rights from other parties are out of the employees’ capability to handle; and an organization seeks advice from professional IP consultant for those matters. In order to support its IP portfolios, an organization allocates resources for paying the cost incurred in the creation, protection and maintenance of its IP and determines commercial viability of the IP.

The configuration of enabling criteria in the innovation development category that affects IP management excellence in an organization comprises:

***Criterion ID1- Creativity Generation, Concept Selection and Prototyping***

*How the organization initiates basic processes for product creation and development that lead to IP generation?* Based on study of organizations in section 4.3.4, it is possible to classify five good systems and practices for this enabling criterion. They are:

- The organization undertakes R&D initiatives on new technologies/ products/ services.
- The organization takes precautions in modifying its design to avoid its new product infringing the IP rights of others.
- The organization conducts market feasibility and technical assessment of new concepts/ inventions. The organization evaluates the patentability of its inventions.
- The top/ senior management performs vetting procedures to select new inventions.
- The organization develops and tests its engineering prototype.

***Criterion ID2- IP Intelligence and Advisory Support***

*How the organization avoids costs due to reinvention efforts and potential infringement litigations in early design cycle by using IP intelligence and advisory support?* Based on study of organizations in section 4.3.5, it is possible to classify four good systems and practices for this enabling criterion. They are:

- The organization performs searches and analysis on IP.
- The organization develops internal database on IP. The organization subscribes to external database on IP (e.g. existing patent databases in the market).
- The organization seeks advice on legal matters for its IP from legal advisor/ IP consultant.
- The organization provides adequate budget and resources for supporting its IP portfolio.

### 4.4.3 Category IP- Intellectual Property Capitalization

IP capitalization category is concerned with “Internal IP Security”, “IP Application/Registration”, “Internal IP Audit and Evaluation” and “IP Licensing and Acquisition”.

To control the access and prevent premature disclosure of the confidential information, an organization uses confidentiality agreements and makes clear statements in internal official documents regarding the confidentiality requirement. It is preferably for an organization to record in any form of the works that has been created to prove that materials belonged to the organization. An organization should take steps to protect the original literary and artistic works which are resulted from creative skill, significant labor and investment. It is important that any developed technology is documented in either hard or digital forms within an organization. As a good practice, an organization or business unit uses invention disclosure form or design document in internal communication as a means to recover unrealized potential technological innovation developed by employees and to avoid the loss of knowledge due to staff turnover.

An organization protects an invention or utility model by applying for patent application; giving the patent owner exclusive rights to produce, use or sell the protected innovation. Similarly, when an organization applies for design application to protect distinctive appearance of products, the design owner has exclusive rights to produce, import or sell the protected design. An organization can protect valuable symbols, logos or words by applying trademark or service mark that can help identifying its products or services and prevents others from infringing.

An organization performs IP audit to review its policies and procedures concerning IP with an aim to identify potential areas of deficiency for consideration and correction. In valuation effort, an organization uses proper tools, procedures and methods to determine the financial value of IP for various reasons including IP licensing, IP litigation, sale of IP, acquisitions/mergers, cost/benefit analysis for R&D and accounting purpose. It is important that the organization evaluates what is considered to be the organization’s greatest value of IP and assess its commercial viability.

An organization identifies and pursues licensing opportunities. In licensing out its own IP portfolio in non-competing ways, an organization can capture revenue, market share and competitive edge. Similarly, by licensing in its partner’s IP portfolio, an organization can create new products, services or market. Another way of benefiting from IP is to acquire/sell it from/to someone else. An organization balances the benefit

and risk of using internal resources to develop its own IP or acquiring IP ownership from the relevant party; and then makes appropriate decision so as to conform to the organizations' IP exploitation policy.

The configuration of enabling criteria in the IP capitalization category that affects IP management excellence in an organization comprises:

***Criterion IP1- Internal IP Security***

*How the organization formalizes internal security control measures for safeguarding the content of IP portfolios?* Based on study of organizations in section 4.3.6, it is possible to classify three good systems and practices for this enabling criterion. They are:

- The organization strictly implements its policies and practices to govern confidential information.
- The organization manages and controls the copyright issues.
- The organization maintains documentations and records for all original works created. The organization maintains inventory list for all its IP.

***Criterion IP2- IP Application/Registration***

*How the organization develops basic processes for identifying, protecting and controlling its own IP?* Based on study of organizations in section 4.3.7, it is possible to classify three good systems and practices for this enabling criterion. They are:

- The organization applies for patent protection in the local market. The organization applies for patent protection in its overseas markets.
- The organization applies for design protection.
- The organization registers for trademark/service mark.

***Criterion IP3- Internal IP Audit and Evaluation***

*How the organization reduces costs associated with its IP portfolios by using internal audit and evaluation?* Based on study of organizations in section 4.3.8, it is possible to classify three good systems and practices for this enabling criterion. They are:

- The organization performs IP royalty audit.
- The organization evaluates the financial value of its IP.
- The organization performs cost and benefit analysis for maintaining its IP.

***Criterion IP4- IP Licensing and Acquisition***

*How the organization extracts value directly from IP as quickly and inexpensively as possible?* Based on study of organizations in section 4.3.9, it is possible to classify three good systems and practices for this enabling criterion. They are:

- The organization licenses out or abandons the non-core IP.
- The organization licenses in partners' IP.
- The organization acquires IP ownership from others.

### 4.4.4 Category ER- External Relationship Management

External relationship management category is concerned with "IP Commercial Development and Marketing", "External IP Security, Agreement and Partners Matching" and "Research Venture and IP Holding Business Startup/Spinout".

To develop and launch the new products with IP incorporation, an organization makes every effort to accomplish all the technical steps, up to full-scale production, establish sales and distribution and achieve business growth. An organization spends money, time and effort to position its brand in market, and capitalizes on a name or logo that defines and conveys its message to its target market segment. To project the image of the product with IP right(s), an organization uses advertising and communication materials to promote the product with patent, registered design and/or trademark to all contact points of the market.

An organization addresses specific issue of IP rights and clarifies the ownership of IP and other relevant rights in written agreements with involved parties. By means of non-disclosure agreement (NDA) signed by parties involved, an organization ensures the recipient to keep information of the owner confidential. An organization collaborates with the business partners to implement a new project. With collaboration, the partners are able to come together to pursue a business opportunity, which they would not have been able to pursue independently. An organization matches the owner of IP rights with the exploiter of technology for mutual advantages of both parties.

In order to develop novel products, an organization establishes a cooperative R&D relationship with research institutes such as universities. An organization starts up an IP holding company by developing a business plan, financial model, investor/venture capital relationship and customer base for the successful commercialization of identified IP.

The configuration of enabling criteria in the external relationship management category that affects IP management excellence in an organization comprises:

***Criterion ER1- IP Commercial Development and Marketing***

*How the organization embeds IP in technology, product and service?* Based on study of organizations in section 4.3.10, it is possible to classify three good systems and practices for this enabling criterion. They are:

- The organization uses its core IP in new products/ services.
- The organization builds and reinforces its brand in the market.
- The organization promotes its products with identification of its patent, design or trademark in all advertising and communication materials.

***Criterion ER2- External IP Security, Agreement and Partners Matching***

*How the organization becomes more sophisticated in managing external relationship with IP requirements?* Based on study of organizations in section 4.3.11, it is possible to classify four good systems and practices for this enabling criterion. They are:

- The organization clarifies IP rights ownership in written agreements before entering into a partnership.
- The organization sign Non-disclosure Agreement (NDA) with partners before commencement of any projects involving IP.
- The organization collaborates with relevant business/strategic partners on developing new markets for its new technologies/products/services.
- The organization provides provisions in commercial contracts to ensure its IP rights are protected from infringement by the contractual party and others.

***Criterion ER3- Research Venture and IP Holding Business Startup/Spinout***

*How the organization stakes a claim on the future with encouragement of research ventures and IP holding business startups or spinouts?* Based on study of

organizations in section 4.3.12, it is possible to classify two good systems and practices for this enabling criterion. They are:

- The organization collaborates with research institutes (e.g. Universities) to develop new technologies/ products/ services.
- The organization use some forms of IP to start up separate business entities.

Based on the literature review in sections 2.2.2 and 4.2, the four IP management enabling categories of twelve key enabling criteria are identified as critical to the good systems and practices of IP management in organizations. This assumes that the higher extent of implementation of these key enabling criteria should be the better of the IP management performance, which, in turn, improves the two IP management result categories (i.e. IP outcomes and external relationship satisfaction). The next chapter shall present an empirical investigation to validate these findings. To theorize the IP management model, the relationships of the four enabling categories and the two result categories, are represented in Figure 5.1 by the arrows leading to and from the six constructs. The data obtained from a questionnaire survey about the current IP management practice in the HK-GD based manufacturing industry are used for the testing of the following hypotheses:

- Hypotheses *H1a* to *H1l* test the relationship between the twelve enabling criteria and IP management excellence.
- Hypotheses *H2a1* to *H2c2* test the relationship between the enabling categories.
- Hypotheses *H3a1* to *H3b2* test the contribution of the four enabling categories to IP management result categories.

The discussions on the formulation of each of these hypotheses shall be presented in section 5.1 of the next chapter.

## 4.5 Concluding Remarks

Five core values and twelve enabling criteria in IP management are identified through the literature review, which include studying good systems and practices of organizations; and then the criteria-based IP management model, which groups twelve enabling criteria in four enabling categories, is developed. The objective of this Chapter is thus achieved.

The model integrates most enabling criteria from different researchers and literature review in IP management, including the support that is found in the studies of good systems and practices of organizations in section 4.3. The enabling criteria in the criteria-based model are system works and general practices which provide organizations with guidelines so as to operate IP management strategy, policies, systems and practices to achieve IP management excellence. In addition to the current research, the model also places emphasis on how do organizations learn to adjust from product-oriented decisions and management practices to those that can accommodate the intangibles such as IP. It also provides the organizations necessary supports to upgrade their operation mode from OEM to ODM and OBM. The project attempts to make contributions in both theoretical and practical areas to fill the current gap as follow:

Management Support Category - Poor IP management can suppress patent awareness and harvesting. The good performing organization is able to focus on IP awareness in organization in order to better coordinate among technical, legal, and financial functions and manage the present and future impacts of IP.

Innovation Development Category - The traditional way of doing business focuses too heavily on product refinement and improvement while ignoring new technological development, in particular, IP. The good performing organization shifts from the traditional way to the new course of technological development in order to create the next generation patents and stay ahead of the competition.

Intellectual Property Capitalization Category - IP has accounting and financial attributes that influence the valuation and financial reporting of an organization. The good performing organization is able to focus on new ways to convert IP assets to cash flow in order to establish IP monopoly space and obtain revenues from IP licensing.

External Relationship Management Category - The traditional way of doing business focuses too heavily on marketing strategies while ignoring the market needs that might create IP advantage. The good performing organization shifts from the

traditional way to the new focus on the product differentiation and use IP to enhance the commercial value of new products, attract new capital and, more importantly, grow by way of increasing buyers, sellers, collaborators and investors confidence.

In order to validate this model developed through the literature review, measurement items are developed from the criteria-based IP management model and a questionnaire survey is conducted in the HK-GD based manufacturing industry. The next chapter discusses in detail the IP management in the HK-GD based manufacturing industry. The objective of the next chapter is to investigate the IP management in the HK-GD based manufacturing industry by adopting this model. The next chapter also shows the hypothesis setting, questionnaire design, data collection, results and analysis and finally the discussion.

# Chapter 5 Intellectual Property Management in the Hong Kong-Guangdong Based Manufacturing Industry

The last chapter has identified the criteria-based IP management model which consisted of four enabling categories with twelve enabling criteria. The aim of this Chapter is to achieve objective two as described in section 1.2.2, page 18, of Chapter 1, by providing the HK-GD based manufacturing industry with the criteria-based IP management model in order to improve their IP management excellence, which in turn, improves their competitiveness. The objective of this chapter is to investigate the general IP management practices of the HK-GD based manufacturing industry. There are three sub-objectives: first, to examine the current situation of IP management enabling categories and key enabling criteria in HK-GD based manufacturing industry; second, to investigate the general IP management practices (extent of implementation of IP management enabling categories and key enabling criteria) of HK-GD based manufacturing industry; and lastly, to investigate the relationships between general IP management practices and IP management performance excellence of HK-GD based manufacturing industry.

## 5.1 Hypotheses Setting

There are three research works in this Chapter:

a. The twelve IP management enabling criteria, identified in section 4.3, will be validated, followed by an investigation of the extent to which these criteria are

implemented in the HK-GD based manufacturing industry.

b. Based on the literature review in section 4.3, the twelve IP management enabling criteria are supported by the study on the good systems and practices of IP management in organizations; this assumes that the higher extent of implementation of these enabling criteria should be the better of the IP management excellence. Although the twelve criteria have been reviewed in detail in section 4.3, they are briefly discussed below for hypotheses setting.

(i) The implementation of strategic management plan for IP activities is concerned with how an organization embeds IP management in visionary leadership and develops strategic management plan for IP activities that affects IP management excellence in an organization structure (Shearer 2007; Reitzig 2007; Tietze *et al.* 2006; Reitzig 2004a; Miele 2000; Rivette and Kline 2000; Sullivan 2000). It focuses on vision, strategy and policy setting (HP 2007; IBM 2006; Wan 2006b; Davis and Harrison 2001) and total commitment to action (Haier 2007; Gibbs and Dematteis 2003), which serve to improve the IP management excellence. An organization that formulates strategic direction on IP based on its mission and vision delivers the outcome of IP management excellence. It can be reflected from an organization that sets implementation plan for IP management activities and action items with performance monitoring for its IP plan.

*H1a: The extent of implementation of strategic management plan for IP activities is positively related to the IP management excellence*

(ii) The implementation of internal IP management function, knowledge and skill is concerned with how the organization ensures that core competence in IP knowledge and skill is adequate in all functions (Wook *et al.* 2008; Shearer 2007; Yu and Chen 2006; Tao *et al.* 2005; Gibbs and DeMatteis 2003; Andersen 2003; Lynn 1998; Edvinsson and Malone 1997; Sveiby 1997; Brooking 1996). It focuses on IP manual (IPR in China 2007a; Wei 2005), employee contract (Xinhua 2005), IP training (IPR in China 2007a; Wei 2005) and internal IP manager (Xerox 2007; Rivette and Kline 2000), which serve to improve the IP management excellence. An organization that updates and disseminates new changes in IP policies and laws/regulations to its staff produces the outcome of IP management excellence. It can be reflected from an organization that provides training to relevant staff on IP management. The outcome of IP management excellence rests upon the ability of an organization to appoint dedicated staff/team/department for managing IP.

*H1b: The extent of implementation of internal IP management function, knowledge and skill is positively related to the IP management excellence*

(iii) The implementation of IP defense and enforcement system is concerned with how the organization deals with issues of IP infringement in the marketing stage of a leading product or technology (Zhou *et al.* 2007; Zhao and Huang 2006; Elmslie and Portman 2006; Rivette and Kline 2000; Miele 2000). It focuses on IP defense (Yan 2007; ITworld 2004) and enforcement system (Fonar 2005; Rivette and Kline 2000), which serve to improve the IP

management excellence. An organization that checks if it infringes on other's IP periodically delivers the outcome of IP management excellence. It can be reflected from an organization that continuously monitors external environment to ensure no infringing acts against its IP.

*H1c: The extent of implementation of IP defense and enforcement system is positively related to the IP management excellence*

(iv) The implementation of creativity generation, concept selection and prototyping is concerned with how the organization initiates basic processes for product creation and development that lead to IP generation (Bader 2006; Einhorn 2006; Siskind 2006; Zhang *et al.* 2006; Graham and Bachman 2004; Berman 2001; Davis and Harrison 2001; Ettlie 2000; Sullivan 2000; Khalil 2000; Trott 1998; Teece 1998; Altshuller 1996; Levin *et al.* 1987; Mansfield 1986; Scherer 1983; Mansfield *et al.* 1981). It focuses on concept creation (Davis and Harrison 2001), design around (Smith 2004), concept evaluation (Davis and Harrison 2001), concept vetting procedure (Davis and Harrison 2001) and prototype testing and development (3M 2007; Wikipedia 2007), which serve to improve the IP management excellence. An organization that undertakes R&D initiatives on new technologies/products/services produces outcome of IP management excellence. It can be reflected from an organization that takes precautions in modifying its design to avoid its new product infringing the IP rights of others. The outcome of IP management excellence rests upon the ability of an organization to conduct market feasibility and technical assessment of new concepts/inventions. An organization that evaluates the patentability of its inventions delivers IP

management excellence. It is the outcome of the top/senior management that performs vetting procedures to select new inventions.

*H1d:* *The extent of implementation of creativity generation, concept selection and prototyping is positively related to the IP management excellence*

(v) The implementation of IP intelligence and advisory support is concerned with how the organization avoids costs due to reinvention efforts and potential infringement litigations in early design cycle by using IP intelligence and advisory support (Taylor and Germeraad 2008; Haug 2007; Philpott 2004; Xu 2004; Miele 2000; Hitchcock 2000; Moore 1999; Granstrand 1999a and b; Horstmann *et al.* 1985). It focuses on IP search (Rivette and Kline 2000), IP information database (Davis and Harrison 2001), external IP consultant (China Daily 2007b) and IP budget (Hausmann 2006; Yao 2006), which serve to improve the IP management excellence. An organization that performs searches and analysis on IP delivers the outcome of IP management excellence. It is the outcome of an organization that develops internal database on IP or subscribes to external database on IP. The outcome of IP management excellence rests upon the ability of an organization to seek advice on legal matters for its IP from legal advisor/ IP consultant. It can be reflected from an organization that provides adequate budget and resources for supporting its IP portfolio.

*H1e:* *The extent of implementation of IP intelligence and advisory support is positively related to the IP management excellence*

(vi) The implementation of internal IP security is concerned with how the organization formalizes internal security control measures for safeguarding the content of IP portfolios (Lu (2007; Erbisch 2005; Hannah 2005; Wood and Brownlee 2005; Philpott and Jolly 2004; Berman 2001; Rivette and Kline 2000; Berreth 1996). It focuses on confidential information (AOF 2007; Tang and Molas-Gallart 2005), copyright protection (IPR in China 2007b) and internal design documentation (Coughlin 2007; Ureel 2005), which serve to improve the IP management excellence. An organization that strictly implements its policies and practices to govern confidential information produces the outcome of IP management excellence. It is the outcome of an organization that manages and controls the copyright issues. The outcome of IP management excellence rests upon the ability of an organization to maintain documentations and records for all original works created, and maintains inventory list for all its IP.

*H1f: The extent of implementation of internal IP security is positively related to the IP management excellence*

(vii) The implementation of IP application/registration is concerned with how the organization develops basic processes for identifying, protecting and controlling its own IP (Basnet *et al.* 2004; Litwin and Kolodka 2001; Cohen *et al.* 2000; Levin *et al.* 1987; Mansfield 1986). It focuses on patent application (Davis and Harrison 2001), design application (IPR in China 2006) and trademark or service mark registration (IBM 2007; Pike 2001), which serve to improve the IP management excellence. An organization that applies for patent protection in the local and overseas market produces the

outcome of IP management excellence. It is the outcome of an organization that applies for design protection and can be reflected from an organization that registers trademark/service mark.

*H1g: The extent of implementation of IP application/registration is positively related to the IP management excellence*

(viii) The implementation of internal IP audit and evaluation is concerned with how the organization reduces costs associated with its IP portfolios by using internal audit and evaluation (Rose *et al.* 2007; Tao *et al.* 2005; Sikora 2005; Decarlo 2005; Reitzig 2004b; Bhaduri and Mathew 2003; Davis and Harrison 2001; Harhoff *et al.* 1997; Scherer 1983). It focuses on IP audit, IP valuation and IP cost/benefit analysis, which serve to improve the IP management excellence. It is the outcome of an organization that performs IP royalty audit and can be reflected from an organization that evaluates the financial value of its IP. The outcome of IP management excellence rests on the ability of an organization to perform cost and benefit analysis for maintaining its IP.

*H1h: The extent of implementation of internal IP audit and evaluation is positively related to the IP management excellence*

(ix) The implementation of IP licensing and acquisition is concerned with how the organization extracts value directly from IP as quickly and inexpensively as possible (Sterling and Murray 2007; Goldscheider and Gordon 2006; Goldheim *et al.* 2005; Smith and Parr 2003; Arora and

Fosfuri 2003; Fosfuri 2003; Choi *et al.* 2003; Davis and Harrison 2001; Pitkethly 2001; Anable 1996). It focuses on IP out-licensing, IP in-licensing and IP ownership, which serve to improve the IP management excellence. An organization that licenses out or abandons non-core IP delivers the outcome of IP management excellence. It rests on the ability of an organization that licenses in partner' IP and acquires IP ownership from others.

*H1i: The extent of implementation of IP licensing and acquisition is positively related to the IP management excellence*

(x) The implementation of IP commercial development and marketing is concerned with how the organization embeds IP in technology, product and service (Reitzig 2004a; Glazier 2000; Rivette and Kline 2000; Teece 1998; Parr and Sullivan 1996). It focuses on IP commercialization conversion (Wan 2006a), brand positioning (Goldscheider and Gordon 2006) and advertising channel (Wang 2006), which serve to improve the IP management excellence. An organization that uses its core IP in new products/services produces the outcome of IP management excellence. It is the outcome of an organization that builds and reinforces its brand in the market; and can be reflected from an organization that promotes its products with identification of its patent, design or trademark in all advertising and communication materials.

*H1j: The extent of implementation of IP commercial development is positively related to the IP management excellence*

(xi) The implementation of external IP security, agreement and partners matching is concerned with how the organization becomes more sophisticated in managing external relationship with IP requirements (Shearer 2007; Bender 2006; Goldscheider and Gordon 2006; KPMG 2006; Peeters and Potterie 2006; Slowinski and Sagal 2006; Tang and Molas-Gallart 2005; Erbisch 2005; Lyons 2004; Smith and Parr 2003). It focuses on IP right ownership (Wang 2007), non-disclosure agreement (Bellis 2007), business collaboration (Rivette and Kline 2000; Dell 1999) and technology collaboration (Liu 2007), which serve to improve the IP management excellence. It requires an organization to clarify IP rights ownership in written agreements before entering into a partnership. It is the outcome of an organization that signs Non-disclosure Agreement (NDA) with partners before commencement of any projects involving IP. The outcome of IP management excellence rests on the ability of an organization to collaborate with relevant business/strategic partners on developing new markets for its new technologies/products/services. It can be reflected from an organization that provides provisions in commercial contracts to ensure its IP rights are protected from infringement by the contractual party and others.

*H1k: The extent of implementation of external IP security, agreement and partners matching is positively related to the IP management excellence*

(xii) The implementation of research venture and IP holding business startup/spinout is concerned with how the organization stakes a claim on the

future with encouragement of research ventures and IP holding business startups or spinouts (Ferington 2007; Zhang and Wang 2007; Bader 2006; Hu and Tsai 2006; Quan 2006; Smith and Parr 2003; Rivette and Kline 2000; Cohen *et al.* 1998). It focuses on research collaboration (Hisense 2007; Xiao 2006) and startup/spinout (Rivette and Kline 2000; CBR 1999), which serve to improve the IP management excellence. It requires an organization to collaborate with research institutes (e.g. Universities) to develop new technologies/products/services. It rests upon the ability of an organization to use some forms of IP to start up separate business entities.

*H1l:* *The extent of implementation of research venture and IP holding business startup/spinout is positively related to the IP management excellence*

c. Through the literature review, it is clear that the implementation of the four IP management enabling categories (i.e. management support, innovation development, IP capitalization and external relationship management) identified in sections 2.2.2 and 4.4 can contribute to IP management excellence, which, in turn, improves the two IP management result categories (i.e. IP outcomes and external relationship satisfaction). The relationships indicated in Figure 5.1 are derived from the IP management model as described in the literature review in Chapter 2 and 4. To theorize the IP management model, the relationships of the four enabling categories and the two result categories, are represented in Figure 5.1 by the arrows leading to and from the six constructs. Previous research shows that the constructs identified by the categories of management support, innovation development, IP capitalization and external relationship management

are connected with each other (Shearer 2007; Gibbs and DeMatteis 2003; Pike 2001; Davis and Harrison 2001). These inter-relationships indicate that IP management improvement efforts concentrated on only one or a few of these categories would be less effective. Managers will need to plan and execute a concerted effort to improve several areas of organizational IP management in order to achieve IP management excellence. However, does one of these categories affect an organization's performance more than the other categories? Further, does each IP management construct influence organizational IP management excellence directly or is the influence indirect through the impact on other constructs? In the process of validating the IP management model, this research addresses the effect of the four IP management enabling categories on the two IP management result categories.

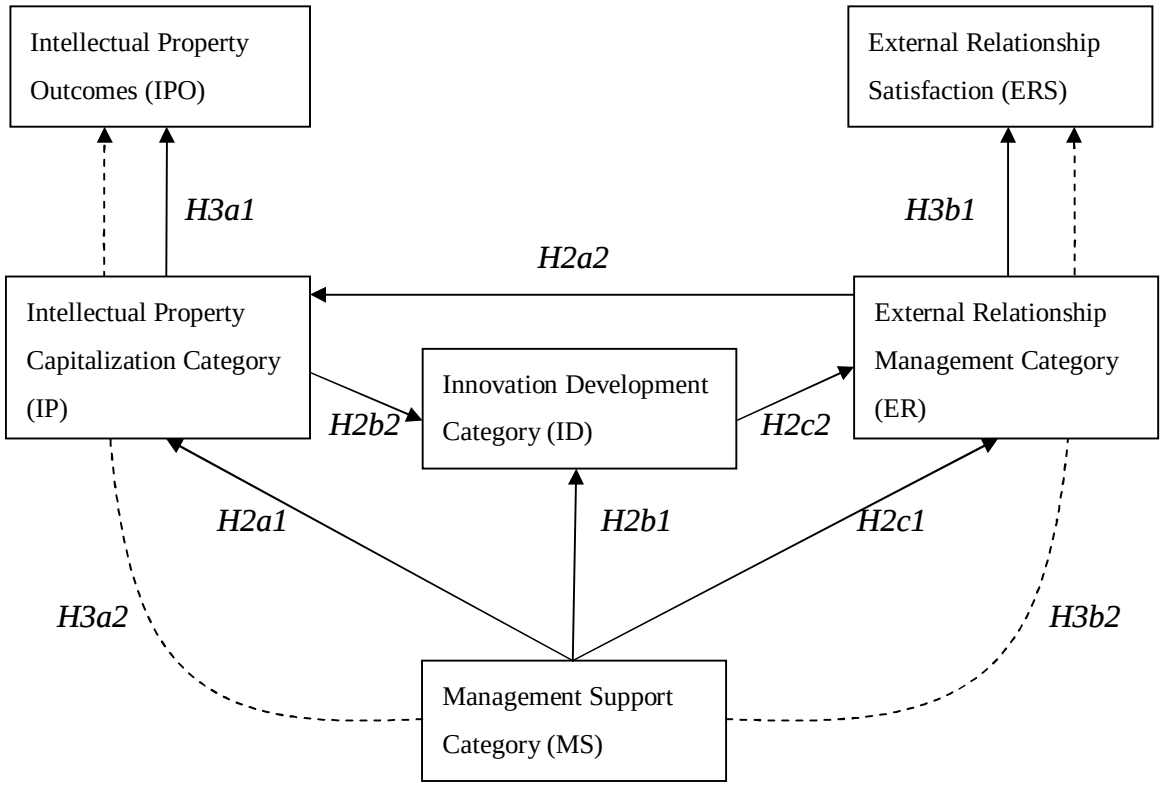



Figure 5.1 The IP management excellence model

The objective of this research is to test the IP management excellence model as presented in Figure 5.1. The hypotheses tested in this research can be broken down into two subsets. These hypotheses are represented by the links provided in Figure 5.1.

(i) Hypotheses about enabling categories

Management support category focuses on leadership, strategy and core competencies for managing IP which supports the IP capitalization category (Shearer 2007; Miele 2000; Rivette and Kline 2000; Sullivan 2000). It provides advice and supports to IP capitalization category in order to ensure that IP management issues are handled in the creation of IP.

*H2a1: IP capitalization category is directly related to management support category.*

External relationship management category focuses on market development, strategic alliances and buyer-seller relationship based on IP requirements, which feedbacks the market needs to the IP capitalization category (Reitzig 2004a; Glazier 2000; Rivette and Kline 2000; Teece 1998; Parr and Sullivan 1996). It informs the IP capitalization category about the requirements for commercialization of new products in the market in order to ensure that the creation of IP is addressed to the market need.

*H2a2: IP capitalization category is directly related to external relationship management category.*

Management support category focuses on leadership, strategy and core competencies for managing IP which supports the innovation development category (Shearer 2007; Tao *et al.* 2005; Gibbs and DeMatteis 2003; Lynn 1998; Edvinsson and Malone 1997; Sveiby 1997; Brooking 1996). It provides advice and supports to innovation development category in order to ensure that IP management issues are handled in the new product development.

*H2b1: Innovation development category is directly related to management support category.*

IP capitalization category focuses on identification, protection and controlling the exploitation of IP, which inputs IP solutions for innovation development category (Cohen *et al.* 2000; Levin *et al.* 1987; Mansfield 1986). It provides IP solutions to the innovation development category in order to ensure that the innovative concept is developed into new products embedded with IP.

*H2b2: Innovation development category is directly related to IP capitalization category.*

Management support category focuses on leadership, strategy and core competencies for managing IP which supports the external relationship management category (Elmslie and Portman 2006; Rivette and Kline 2000; Miele 2000). It provides advice and supports to the external relationship management category in order to ensure that IP management issues are handled in the commercialization of products.

*H2c1: External relationship management category is directly related to management support category.*

Innovation development category focuses on commitment for product development and commercialization, which produces products protected by IP rights to enhance external relationship management category (Bader 2006; Einhorn 2006; Siskind 2006; Graham and Bachman 2004; Berman 2001; Davis and Harrison 2001; Ettlie 2000; Sullivan 2000; Khalil 2000; Trott 1998; Teece 1998; Altshuller 1996; Levin *et al.* 1987; Mansfield 1986; Scherer 1983; Mansfield *et al.* 1981). It provides new products embedded with IP to external relationship management category in order to commercialize these products in market.

*H2c2: External relationship management category is directly related to innovation development category.*

(ii) Hypotheses about result categories

IP capitalization category focuses on identification, protection and controlling the exploitation of IP, which drives the growth of IP outcomes (Cohen *et al.* 2000; Levin *et al.* 1987; Mansfield 1986). This leads to development of IP outcomes such as patents, designs, trademarks, service marks and licenses, etc. The successful implementation of IP capitalization category can maximize the results of IP portfolio.

*H3a1: IP outcome is directly related to IP capitalization category.*

Management support category focuses on leadership, strategy and core competencies for managing IP which has an indirect effect on IP outcomes (Shearer 2007; Miele 2000; Rivette and Kline 2000; Sullivan 2000). It is engaged to guide the IP capitalization category and provide advice and supports where appropriate. Thus, its influence on the IP outcomes can be felt through the IP capitalization category.

*H3a2: IP outcome is indirectly related to management support category through the mediating effects of IP capitalization category.*

External relationship management category focuses on market development, strategic alliances and buyer-seller relationship based on IP requirements, which improves the organization's performance in external relationship satisfaction (Bender 2006; Shearer 2007; Goldscheider and Gordon 2006; Bender 2006; KPMG 2006; Peeters and Potterie 2006; Tang and Molas-Gallart 2005; Erbisch 2005; Lyons 2004; Smith and Parr 2003). This leads to development of external relationship satisfaction such as compliance, liability reduction, trust, etc. The successful implementation of external relationship management category can improve the comfort level of external relationship.

*H3b1: External relationship satisfaction is directly related to external relationship management category.*

Management support category focuses on leadership, strategy and core

competencies for managing IP which has an indirect effect on external relationship satisfaction (Elmslie and Portman 2006; Rivette and Kline 2000; Miele 2000). It is engaged to guide the external relationship management category and provide advice and supports where appropriate. Thus, its influence on the external relationship satisfaction can be felt through the external relationship management category.

*H3b2: External relationship satisfaction is indirectly related to management support category through the mediating effect of external relationship management category.*

## 5.2 Questionnaire Design

The questionnaire design focused on achieving the research issues as described in section 5.1; thus, the mail survey was conducted to collect data in IP management in the HK-GD based manufacturing industry. The questionnaire consisted of four parts as shown in Appendix B:

Part one asked 2 questions to validate the responding companies and respondents.

a. The first question asked whether the respondent's company owns at least one form of IP (including self-developed, license in others' IP or IP acquired such as patent, design, trademark or copyright of original works)? If the answer was no, then there was no need to further proceed and the response was not valid for analysis.

b. The second question asked the respondent's roles in the company's IP

management by selecting the listed statements.

i. The first statement asked was regarding the involvement of the respondent in decision making on IP management matters. As it was considered IP management practices and the response was valid.

ii. The second statement asked was regarding the responsibility undertaken by the respondent in IP management matter. As it was related to IP management practices, the response would be considered valid.

Part two of the questionnaire fulfilled the sub-objectives one and two or research issue one in section 5.1, i.e., to examine the current situation of IP management enabling categories and key enabling criteria in HK-GD based manufacturing industry; and to investigate the general IP management practices (extent of implementation of IP management enabling categories and key enabling criteria) of HK-GD based manufacturing industry. As shown in Table 5.1, each category, namely: "Management Support", "Innovation Development", "Intellectual Property Capitalization" and "External Relationship Management" was measured by at least two enabling criteria. Each enabling criterion was measured by at least two indicators. Each indicator was a parcel, which was simply the average of responses on items corresponding to an indicator. The use of parcels reduced the 47 items to a manageable level (37 indicators). It also provided indicators with higher reliability than that of single items (Rushton *et al.* 1983).

| Enabling categories | Number of enabling criteria | Number of indicators | Number of measurement items |
|---|---|---|---|
| Management support | 3 | 8 | 13 |
| Innovation development | 2 | 9 | 11 |
| Intellectual property capitalization | 4 | 12 | 14 |
| External relationship management | 3 | 8 | 9 |
| Total | 12 | 37 | 47 |

Table 5.1 Enabling criteria, indicators and measurement items of enabling categories

The details of the enabling criteria, indicators and measurement items that were grouped into the four enabling categories are shown in Tables 5.2 to 5.5. The construction of the IP management measurement items was based on the structure of the criteria-based IP management model as described in Chapter 4. Each survey item was measured in this section with "the extent of implementation" of the IP management in the organization. A rating scale ranging from "Not yet implement and have no plan to implement", "Not yet implement but have plan to implement", "Implemented, to a small extent", "Implemented by halves", "Implemented, to a large extent" and "Fully implemented" was used to measure the extent of implementation of each measurement item in his/her own company.

| Enabling Criteria, Indicators and Measurement Items | **Authors** |
|---|---|
| **MS1 - Strategic Management Plan for IP Activities** | (see section 4.3.1) |
| MS1_1- Vision, Strategy and Policy Setting | |
| • We formulate strategic direction on intellectual property based on our company's mission & vision.<br>• We set intellectual property polices & practices.<br>• Top management is committed and involved in the implementation of the strategic direction, policies and practices on intellectual property. | HP 2007; Davis and Harrison 2001;<br>IBM 2006; Wan 2006b<br>IBM 2006; Wan 2006b |
| MS1_2- Total Commitment to Action | |
| • Relevant staff are committed and abide to the intellectual property polices & practices.<br>• Our employees at all levels are well-aware of the company's intellectual property policies & practices.<br>• We set implementation plan for intellectual property management activities & set action items with performance monitoring for our intellectual property plan. | Haier 2007<br>Haier 2007<br>Gibbs and Dematteis 2003 |
| **MS2 - Internal IP Management Function, Knowledge and Skill** | (see section 4.3.2) |
| MS2_1- IP Manual | |
| • We update & disseminate new changes in intellectual property policies & laws/regulations to our staff.<br>• We reinforce the intellectual property polices & practices through reminding our employees periodically. | IPR in China 2007a; Wei 2005<br>IPR in China 2007a; Wei 2005 |
| MS2_2 - Employee Contract | |
| • We have clear statements in employment contract on intellectual property policies & practices. | Xinhua 2005 |
| MS2_3 - IP Training | |
| • We provide training to relevant staff on intellectual property management. | IPR in China 2007a; Wei 2005 |
| MS2_4 - Internal IP Manager | |
| • We have dedicated staff/team/department for managing intellectual property. | Xerox 2007; Rivette and Kline 2000 |
| **MS3 - IP Defense and Enforcement System** | (see section 4.3.3) |
| MS3_1 - IP Defense | |
| • We check if our company infringes on other's intellectual property periodically. | Yan 2007; ITworld 2004 |
| MS3_2 – IP Enforcement | |
| • We continuously monitor external environment to ensure no infringing acts against our intellectual property. | Fonar 2005; Rivette and Kline 2000 |

Table 5.2 Enabling criteria, indicators and measurement items of management support category (MS)

| Enabling Criteria, Indicators and Measurement Items | **Authors** |
|---|---|
| **ID1 - Creativity Generation, Concept Selection and Prototyping** | (see section 4.3.4) |
| ID1_1 - Concept Creation | |
| • We undertake Research & Development initiatives on new technologies/products/services. | Davis and Harrison 2001 |
| ID1_2 - Design Around | |
| • We take precautions in modifying our design to avoid our new product infringe the intellectual property rights of others. | Smith 2004 |
| ID1_3 - Concept Evaluation | |
| • We conduct market feasibility and technical assessment of new concepts/inventions.<br>• We evaluate the patentability of our inventions. | Davis and Harrison 2001<br>Davis and Harrison 2001 |
| ID1_4 - Concept Vetting Procedure | |
| • Top/senior management performs vetting procedures to select new inventions. | Davis and Harrison 2001 |
| ID1_5 - Prototype Testing and Development | |
| • We develop and test our engineering prototype. | 3M 2007; Wikipedia 2007 |
| **ID2 - IP Intelligence and Advisory Support** | (see section 4.3.5) |
| ID2_1 - IP Search | |
| • We perform searches & analysis on intellectual property. | Rivette and Kline 2000 |
| ID2_2 - IP Information Database | |
| • We develop internal database on intellectual property.<br>• We subscribe to external database on intellectual property (e.g. existing patent databases in the market). | Davis and Harrison 2001<br>Davis and Harrison 2001 |
| ID2_3 - External IP Consultant | |
| • We seek advice on legal matters for our intellectual property from legal advisor/IP consultant. | China Daily 2007b |
| ID2_4 - IP Budget | |
| • We have adequate budget and resources for supporting our intellectual property portfolio. | Hausmann 2006; Yao 2006 |

Table 5.3 Enabling criteria, indicators and measurement items of innovation development category (ID)

| Enabling Criteria, Indicators and Measurement Items | **Authors** |
|---|---|
| **IP1 - Internal Intellectual Property Security** | (see section 4.3.6) |
| IP1_1 – Confidential Information | |
| • We strictly implement our policies and practices to govern confidential information. | AOF 2007; Tang and Molas-Gallart 2005 |
| IP1_2 – Copyright Protection | |
| • We manage and control the copyright issues. | IPR in China 2007b |
| IP1_3 – Internal Design Documentation | |
| • We maintain documentations and records for all original works created.<br>• We maintain inventory list for all our intellectual properties. | Coughlin 2007; Ureel 2005<br>Coughlin 2007; Ureel 2005 |
| **IP2 – Intellectual Property Application/Registration** | (see section 4.3.7) |
| IP2_1 – Patent Application | |
| • We apply for patent protection in Hong Kong or mainland China.<br>• We apply for patent protection in our overseas markets. | Davis and Harrison 2001<br>Davis and Harrison 2001 |
| IP2_2 – Design Application | |
| • We apply for design protection. | IPR in China 2006 |
| IP2_3 – Trademark or Service Mark Registration | |
| • We register for trademark/service mark. | IBM 2007; Pike 2001 |
| **IP3 – Internal Intellectual Property Audit and Evaluation** | (see section 4.3.8) |
| IP3_1 – IP Audit | |
| • We perform intellectual property royalty audit. | Rivette and Kline 2000 |
| IP3_2 – IP Valuation | |
| • We evaluate the financial value of our intellectual property. | Poh and Yeo 2004; Rivette and Kline 2000 |
| IP3_3 – IP Cost/Benefit Analysis | |
| • We perform cost and benefit analysis for maintaining our intellectual property. | Davis and Harrison 2001 |
| **IP4 – Intellectual Property Licensing and Acquisition** | (see section 4.3.9) |
| IP4_1 – IP Out-licensing | |
| • We license out or abandon the non-core intellectual property. | Rivette and Kline 2000 |
| IP4_2 – IP In-licensing | |
| • We license in partners' intellectual property. | Nanfang Daily 2006 |
| IP4_3 – IP Ownership Acquisition | |
| • We acquire intellectual property ownership from others. | Rivette and Kline 2000 |

Table 5.4 Enabling criteria, indicators and measurement items of intellectual property capitalization category (IP)

| Enabling Criteria, Indicators and Measurement Items | **Authors** |
|---|---|
| **ER1 - Intellectual Property Commercial Development and Marketing** | (see section 4.3.10) |
| ER1_1 – IP Commercialization Conversion | |
| • We use our core intellectual property in new products/services. | Wan 2006a |
| ER1_2 – Brand Positioning | |
| • We build & reinforce our brand in the market. | Goldscheider and Gordon 2006 |
| ER1_3 – Advertising Channel | |
| • We promote our products with identification of our patent, design or trademark in all advertising & communication materials. | Wang 2006 |
| **ER2 - External Intellectual Property Security, Agreement and Partners Matching** | (see section 4.3.11) |
| ER2_1 – IP Right Ownership | |
| • We clarify intellectual property rights ownership in written agreements before entering into a partnership. | Wang 2007 |
| ER2_2 – Non-disclosure Agreement | |
| • We sign Non-disclosure Agreement (NDA) with partners before commencement of any projects involving intellectual property. | Bellis 2007 |
| ER2_3 – Business / Technology Collaboration | |
| • We collaborate with relevant business/strategic partners on developing new markets for our new technologies/products/services.<br>• We have provisions in commercial contracts to ensure our intellectual property rights are protected from infringement by the contractual party and others. | Rivette and Kline 2000; Dell 1999<br><br>Liu 2007 |
| **ER3 - Research Venture and Intellectual Property Holding Business Startup/Spinout** | (see section 4.3.12) |
| ER3_1 – Research Collaboration | |
| • We collaborate with research institutes (e.g. Universities) to develop new technologies/ products/services. | Hisense 2007; Xiao 2006 |
| ER3_2- Startup/Spinout | |
| • We use some forms of intellectual property to start up separate business entities. | Rivette and Kline 2000; CBR 1999 |

Table 5.5 Enabling criteria, indicators and measurement items of external relationship management category (ER)

Part three of the questionnaire related to the IP management excellence of respondents which fulfilled the sub-objective three or research issue two and three in section 5.1. As shown in Table 5.6, each result category, namely: “IP Outcomes” and “External Relationship Satisfaction” was measured by at least one performance dimension. Each performance dimension was measured by at least four measurement items. The three performance dimensions with 15 measurement items were used to lead the respondents to review what the IP management excellence should be; and then the overall IP management excellence was the average of three performance dimensions, which were simply the average of responses on items corresponding to each performance dimension.

| Result categories | Number of performance dimensions | Number of measurement items |
|---|---|---|
| Intellectual property outcomes | 2 | 9 |
| External relationship satisfaction | 1 | 6 |
| Overall IP management excellence | 3 | 15 |

Table 5.6 Result categories, performance dimensions and measurement items of IP management excellence

The two result categories, namely, “IP Outcomes” (as shown in Table 5.7) and “External Relationship Satisfaction” (as shown in Table 5.8) have been identified through the literature review in section 2.2.1.

Two different scales were used in the survey. The first scale, with a rating scale ranging from “0%”, “20%”, “40%”, “60%”, “80%” and “100%” was used to measure the IP Outcomes - Percentage of the Outcome that Generated Profits (%) of each measurement item in his/her own company. The second scale, with a rating scale ranging from “Strongly disagree”, “Disagree”, “Average”, “Agree” and “Strongly agree” was used to measure the External Relationship Satisfaction – Current Performance of each measurement item in his/her own company.

The data obtained in this part and part two would be employed for hypotheses testing of *H1a-H1l*, *H2a1-H2c2* and *H3a1-H3b2* in section 5.1 in order to obtain the relationship between the twelve enabling criteria and IP management excellence, the relationship between the enabling categories, and the contribution of the four enabling categories to result categories, respectively.

| Performance Dimensions and Measurement Items | Authors |
|---|---|
| **IPO1 – Internal Intellectual Property Capitalization Outcomes** | (see section 2.2.1.1) |
| • Patent granted | Shearer (2007); Tao *et al.* (2005); Bollen *et al.* (2005); Delain (2003); Streater (2002); Ch'ang and Yastreboff (2002); Retsky (2002); Bratic *et al.* (2001); Davis and Harrison (2001); Sullivan (2000); Bontis (1998); Roos and Roos (1997); Sveiby (1997); Brooking (1996) |
| • Design granted | Streater (2002); Sullivan (2000); Roos and Roos (1997) |
| • Trademarks & service marks registered | Shearer (2007); Tao *et al.* (2005); Delain (2003); Streater (2002); Ch'ang and Yastreboff (2002); Retsky (2002); Bratic *et al.* (2001); Sullivan (2000); Roos and Roos (1997); Sveiby (1997) |
| • Out-licensed intellectual property | Shearer (2007); Tao et al. (2005); Bollen *et al.* (2005); Delain (2003); Retsky (2002); Bratic *et al.* (2001); Davis and Harrison (2001); Sullivan (2000); Bontis (1998); Roos and Roos (1997) |
| **IPO2 - External Intellectual Property Capitalization Outcomes** | (see section 2.2.1.2) |
| • Separate business entities based on invention & some form of intellectual property | Andersen and Konzelmann (2008); Amadi-Echendu and John (2008); Tao *et al*. (2005); Bratic *et al*. (2001) |
| • Licensed-in others' intellectual property | Andersen and Konzelmann (2008); Amadi-Echendu and John (2008); Tao *et al*. (2005); Bratic *et al*. (2001) |
| • Intellectual property ownership acquired | Andersen and Konzelmann (2008); Amadi-Echendu and John (2008); Tao *et al.* (2005); Bratic *et al*. (2001) |
| • Established long-term business partnership based on intellectual property | Fitzpatrick and DiLullo (2005); Saunders (2003); Lynn (1998); Edvinsson and Malone (1997); Roos and Roos (1997); Brooking (1996) |
| • Established long-term customer relationship based on intellectual property | Fitzpatrick and DiLullo (2005); Saunders (2003); Lynn (1998); Edvinsson and Malone (1997); Roos and Roos (1997); Brooking (1996) |

Table 5.7 Performance dimensions and measurement items of intellectual property outcomes (IPO)

| Performance Dimension and Measurement Items | Authors |
|---|---|
| **ERS1 – Intellectual Property Comfort Level with Business Partners** | (see section 2.2.1.2) |
| • Our partners did not infringe our intellectual property rights. | Shearer (2007); Berrell and Wrathall (2007); Bender (2006); KPMG (2006) |
| • We did not infringe the intellectual property rights of others. | Shearer (2007); Berrell and Wrathall (2007); Bender (2006); KPMG (2006) |
| • We have reduced liability of intellectual property issues to the contractual parties in a business relationship. | Andersen and Konzelmann (2008); Greenwood (2006); Bender (2006); KPMG (2006); Barren *et al.* (2005) |
| • We have built long-term and good business relationship with our partners based on mutual trust in intellectual property management. | Shearer (2007); Bender (2006); KPMG (2006); Shinozaki and Nagata (2006); Bollen *et al.* (2005); Barren *et al.* (2005); Blomqvist *et al.* (2005) |
| • We have built long-term and good business relationship with our customers based on trust in our intellectual property management. | Shearer (2007); Bender (2006); KPMG (2006); Shinozaki and Nagata (2006); Bollen *et al.* (2005); Barren *et al.* (2005); Blomqvist *et al.* (2005) |
| • We are mutually benefited from developing and launching deliverables with intellectual property rights in the collaborative relationship. | Shearer (2007); Bender (2006); Shinozaki and Nagata (2006); Bollen *et al.* (2005); KPMG (2006); Barren *et al.* (2005); Blomqvist *et al.* (2005) |

Table 5.8 Performance dimension and measurement items of external relationship satisfaction (ERS)

Part 4 of the questionnaire asked for the background information of respondents.

Since the questionnaire survey was conducted in Hong Kong, it was appropriate to have the questionnaire in both English and Chinese as they are the major languages in Hong Kong. Both language versions of the questionnaire were sent to respondents for their selection to complete the questionnaire. The questionnaire was developed in English and the measurement items were validated by four industrial experts in IP management who has working experience ranging from 10 to 25 years. Then the questionnaire was translated into Chinese; both the English and Chinese

questionnaires were then further validated by five industrial practitioners who had working experience in the IP management from 12 to 25 years. All of these five industrial practitioners had academic qualifications of undergraduate or above; this was to ensure that both language versions were equivalent and they were duly reviewed by the industrial practitioners for readability, ambiguity and completeness. Lastly, the questionnaire was pilot-tested with 20 respondents with an average of 15 years working experience involving in IP management in Hong Kong manufacturing industry to review the questionnaire for readability, ambiguity and completeness. Several minor changes were made to the questionnaire based on validation stages and the pre-test stage.

In order to create a smooth flow, the sequence of some questions was re-organized to avoid jumping around from one topic to another in a questionnaire. The questions about the same things, or require similar kinds of responses were placed together in sections. The heading of each section was edited in the style for easy interactions between the researcher and the respondents. The results of pre-test demonstrated that the changes did not influence the answers from respondents.

## 5.3 Data Collection

### 5.3.1 Sample Frame and Response Rate

The study was focused on the HK-GD based manufacturing industry, so the sample frame was based on HK-GD based manufacturing companies with registered patent in the past 10 years. According to the patent search conducted by the Hong Kong Productivity Council, there were 16,546 HK companies holding patents as at January

of 2006. A total of 1,578 target responding companies were selected from the patent databases for Hong Kong, USA and Europe. These companies were registered in Hong Kong and were manufacturers with offices in Hong Kong and factories located in China; others were manufacturing-related companies such as importers or exporters, while some companies had business nature of wholesaler, retailer, etc.

Regarding the target sample size, there were two issues to be addressed:

a. As is evident from recent research studies in the Hong Kong industry, the response rate has varied a lot, as shown in Table 5.9, which lists the response rate and numbers of usable responses. The lowest response from the table is 11% and maximum number of valid responses is 251.

b. The survey was conducted from February, 2006 to the end of March, 2006 which was at the start of busy period in production for the Hong Kong manufacturing industry. So it was assumed that most of the respondents would be busy, resulting in a low response rate.

Based on these two issues, an assumption was made to obtain at least 200-250 responses with 15%-20% response rate, so the target samples was set to be 1,500 plus three percentage tolerance as safety factors.

| Authors | Industry | No. of questionnaire sent | Received valid response | Response rate (%) |
|---|---|---|---|---|
| Panayides, 2007 | Logistic Service providers | 1083 | 251 | 23 |
| Sun and Wong, 2005 | Toys | 90 | 51 | 57 |
| Woo & Ennew, 2005 | Consulting engineering | 640 | 185 | 29 |
| Humphreys *et al.*, 2004 | Electronic | 450 | 142 | 32 |
| Lam & Chin, 2004 | Manufacturing | 1403 | 193 | 14 |
| Chin *et al.*, 2002 | Toys & Electronic | 650 | 71 | 11 |

Table 5.9 Response rate of recent research studies in Hong Kong

Target samples of 1,578 companies were randomly selected from the record of the Hong Kong Productivity Council, an initial mailing included a cover letter and survey questionnaire were sent to the companies at the beginning of February, 2006. After 3 weeks of the initial mailing, questionnaires with reminder letters were mailed to the non-respondent. (Copies of the cover letter and questionnaire are shown in Appendix A and B, respectively).

A total of 317 responses were received and 95 responses were discarded because of the following reasons:

a. Responding companies do not own any form of IP at the moment

b. Too many missing data.

Another 98 surveys were undeliverable and returned, thus the effective responses were 222 and the response rate was 15.0% (222/1480). The detail of the data collection is shown in Table 5.10.

| No. of questionnaires sent | No. of mal-delivery of questionnaires | No. of questionnaires returned | No. of valid questionnaires | Response rate (%) |
|---|---|---|---|---|
| 1578 | 98 | 317 | 222 | 15.0 |

Note: Response rate = No. of valid questionnaire/(No. of questionnaire sent-No. of mal-delivery)

Table 5.10 Response rate in questionnaire survey

### 5.3.2 Non Response Bias

Non-response bias is the difference between the answers of respondents and non-respondents; the opinions of late respondents are somewhat representative of the opinions of non-respondents, thus it is required to test the non-response bias by testing the significant difference between responses of early and late waves of returned surveys (Lambert & Harrington 1990; Armstrong & Overton 1977; Krause *et al.* 2001; and Chen & Paulraj 2004). In this study some enabling criteria were randomly selected for analysis and responses from the first and last waves were chosen, and the independent-samples *t-test* was used to measure whether there was any difference between them. As shown in Table 5.11, the test yields no statistically significant difference among the measured enabling criteria.

| Enabling criteria | Phase | N | Mean | SD | t-value | Sig. (2-tailed) |
|---|---|---|---|---|---|---|
| Strategic Management Plan for IP Activities | 1 | 111 | 2.89 | 1.60 | 0.296 | 0.767 |
| | 2 | 111 | 2.82 | 1.57 | | |
| Internal IP management function, knowledge and skill (1 missing data) | 1 | 110 | 2.06 | 1.52 | 0.493 | 0.623 |
| | 2 | 111 | 1.96 | 1.52 | | |
| Creativity generation, concept selection and prototyping | 1 | 111 | 3.33 | 1.43 | 0.429 | 0.668 |
| | 2 | 111 | 3.25 | 1.40 | | |
| Internal IP security | 1 | 111 | 3.47 | 1.30 | 0.847 | 0.398 |
| | 2 | 111 | 3.32 | 1.31 | | |
| IP licensing and acquisition (1 missing data) | 1 | 110 | 1.76 | 1.41 | 0.459 | 0.647 |
| | 2 | 111 | 1.67 | 1.39 | | |
| IP Commercial Development and Marketing (1 missing data) | 1 | 110 | 2.964 | 1.36 | -0.730 | 0.466 |
| | 2 | 111 | 3.099 | 1.40 | | |

Table 5.11 Independent-samples *t-test* on non-response bias

### 5.3.3 Respondent's Profile

Table 5.12 shows the details of respondents' profiles. As shown in the table, about 80% of respondents had executive and managerial positions. About 53% of the respondents had both involved in decision making and undertaken responsibility in IP

management matters. About 18% and 29% of the remaining respondents had either involved in decision making or undertaken responsibilities in IP management matters respectively. Table 5.13 shows that the responding companies included both manufacturers and manufacturing-related companies such as importer/exporters that had staff and workers ranging from less than 50 to more than 1,000 and ranging from less than 50 to more than 500, respectively. Moreover, about 70% of the companies had been running business in the manufacturing industry for more than 10 years. This implies that the respondents' were knowledgeable about IP management in the HK-GD based manufacturing industry.

| **Position (23 missing data)** | **No. of respondents** | **Percentage (%)** |
|---|---|---|
| CEO/ Chairman/ President/ Managing Director/ Executive Director | 39 | 20 |
| Vice President/ General Manager/ Director | 59 | 30 |
| Senior Manager/ Manager | 59 | 30 |
| Technical Staff | 16 | 8 |
| Administrative Staff | 26 | 13 |
| Total | 199 | 100 |
| **Involvement in IP Management (2 missing data)** | **No. of respondents** | **Percentage (%)** |
| The respondents had BOTH involved in decision making and undertaken responsibility in IP management matters | 117 | 53 |
| The respondents had ONLY involved in decision making on IP management matters | 40 | 18 |
| The respondents had ONLY undertaken responsibility in IP management matters | 63 | 29 |
| Total | 220 | 100 |

Table 5.12 Respondents profile

| **Business Nature** | **Total number of staff and worker (incl. HK, mainland and other overseas countries)** | **No. of responding companies** | **Percentage** |
|---|---|---|---|
| Manufacturers | Less than 50 | 21 | 21% |
| | 50 to 99 | 8 | 8% |
| | 100 to 499 | 25 | 24% |
| | 500-999 | 13 | 13% |
| | Over 1,000 | 35 | 34% |
| | Total | 102 | 100% |
| Manufacturing-related companies (including importers/ exporters) | Less than 50 | 24 | 34% |
| | 50 to 99 | 5 | 7% |
| | 100 to 499 | 16 | 23% |
| | Over 500 | 26 | 36% |
| | Total | 71 | 100% |
| Others | Less than 50 | 35 | 71% |
| | 50 to 499 | 9 | 18% |
| | Over 500 | 5 | 11% |
| | Total | 49 | 100% |
| **Number of years in manufacturing or related businesses (3 missing data)** | | | |
| Less than 5 years | | 26 | 12% |
| 5 to 9 years | | 41 | 19% |
| 10 years to 14 years | | 33 | 15% |
| 15 years to 24 years | | 55 | 25% |
| 25 years and more | | 64 | 29% |
| | Total | 219 | 100% |

Table 5.13 Profile of responding companies

## 5.4 Results and Analysis

### 5.4.1 Reliability

Cronbach's coefficient alpha was employed to measure the reliability of the key

enabling criteria. As shown in Table 5.14, the measured Cronbach's Alpha values ranged from the lowest of "Research Venture and Intellectual Property Holding Business Startup/Spinout, 0.614" to the highest of "Strategic Management Plan for IP Activities, 0.943". Since all the measurement items are newly developed, according to Nunnally & Bernstein (1994), it is accepted as the lower scale of 0.6. Thus, the measures of the key enabling criteria are reliable.

| | **Enabling criteria** | **No. of items** | **Cronbach's coefficient alpha** |
|---|---|---|---|
| MS1 - | Strategic Management Plan for IP Activities | 6 | 0.943 |
| MS2 - | Internal IP Management Function, Knowledge and Skill | 5 | 0.887 |
| MS3 - | IP Defense and Enforcement System | 2 | 0.745 |
| ID1 - | Creativity Generation, Concept Selection and Prototyping | 6 | 0.913 |
| ID2 - | IP Intelligence and Advisory Support | 5 | 0.781 |
| IP1 - | Internal Intellectual Property Security | 4 | 0.801 |
| IP2 - | Intellectual Property Application/Registration | 4 | 0.660 |
| IP3 - | Internal Intellectual Property Audit and Evaluation | 3 | 0.775 |
| IP4 - | Intellectual Property Licensing and Acquisition | 3 | 0.671 |
| ER1 - | Intellectual Property Commercial Development and Marketing | 3 | 0.630 |
| ER2 - | External Intellectual Property Security, Agreement and Partners Matching | 4 | 0.883 |
| ER3 - | Research Venture and Intellectual Property Holding Business Startup/Spinout | 2 | 0.614 |

Table 5.14 Reliability test

## 5.4.2 Validity

Content validity and within-scale factor analysis were employed in this study.

### 5.4.2.1 Content Validity

Content validity is defined by examining the literature in the domain of content to determine how the measurement items have been defined (Churchill & Iacobucci 2005; and Zikmund 2003). In this study, the key enabling criteria and measurement items were developed through the literature review as shown in section 4.3. In addition, all the measurement items in the questionnaire were reviewed and validated by industrial experts and practitioners and pre-tested by industrial practitioners in the HK-GD based manufacturing industry (details please refer to section 5.2). Thus the content validity of the research is supported.

### 5.4.2.2 Within-scale Factor Analysis

In addition to content validity, construct validity was employed to measure the validity of constructs (Churchill & Iacobucci 2005; and Zikmund 2003). Construct validity is to validate that the measurement items measure what they are supposed to measure. It measures the relationship among all the constructs in terms of convergent validity (high correlation of measures in the same construct) and discriminant validity (low correlation of measure in dissimilar construct) (Pallant 2001). Factor analysis was employed to measure the construct validity; Tabachnick & Fidell (2001) suggested that at least 300 cases were more comfortable for factor analysis. On the

other hand, Nunnally (1978) recommended a guideline for factor analysis, i.e., the number of cases should be 10 times more than the measurement items. Unfortunately, the cases in this study had only 222 and the ratio of cases to measurement items was 5.5 to 1; both conditions could not meet with the minimum requirements as suggested by Tabachnick & Fidell (2001) and Nunnally (1978).

Although construct validity was not appropriate to be employed in this study, within-scale factor analysis was conducted to measure the convergent validity so as to validate that each group of measurement items was a valid measurement of each key enabling criteria. Factor loading, which is the correlation of the measurement items within the factor, was employed to measure the validity of each set of variables of each factor (Zikmung 2003). The two primary classes of factor analytic methods are exploratory factor analysis and confirmatory factor analysis. Unlike confirmatory factor analysis, exploratory factor analysis isolates factor structures without consideration of the theoretical expectations of the researchers, even when such expectations are available (Thompson and Danniel 1996).

A. Within-scale exploratory factor analysis

An exploratory factor analysis of the four sub-constructs, namely, management support, innovation development, IP capitalization and external relationship management was employed. The statistical software SPSS was used to perform the following analysis:

The data were examined using factor analysis, with a varimax rotation, which used an eigenvalue criterion of 1.00, and variable factor loading criterion of 0.45. Tables

5.15, 5.16, 5.17 and 5.18 show the within-scale exploratory factor analysis results of the key enabling criteria in groups of enabling categories, i.e., management support, innovation development, IP capitalization and external relationship management. The total variance explained by the factors ranged from 62.2% to 75.3%. Through the exploratory factor analysis, we found that the lowest factor loading of “extent of implementation” in analysis was 0.520, which suggested that the factor analysis of all items demonstrated a clear separation, with each item loading highest on the factor it was hypothesized to measure.

| Key enabling criteria | Implementation | | | | |
|---|---|---|---|---|---|
| | Mean | Alpha | Factor loading | | |
| | | | Factor 1 | Factor 2 | Factor 3 |
| **MS1 - Strategic Management Plan for IP Activities** | 2.859 | 0.943 | - | - | - |
| • We formulate strategic direction on intellectual property based on our company's mission & vision. | - | - | 0.854 | | |
| • We set intellectual property polices & practices. | - | - | 0.801 | | |
| • Top management is committed and involved in the implementation of the strategic direction, policies and practices on intellectual property. | - | - | 0.900 | | |
| • Relevant staff are committed and abide to the intellectual property polices & practices. | - | - | 0.848 | | |
| • Our employees at all levels are well-aware of the company's intellectual property policies & practices. | - | - | 0.737 | | |
| • We set implementation plan for intellectual property management activities & set action items with performance monitoring for our intellectual property plan. | - | - | 0.796 | | |
| **MS2 - Internal IP Management Function, Knowledge and Skill** | 1.997 | 0.887 | - | - | - |
| • We update & disseminate new changes in intellectual property policies & laws/regulations to our staff. | - | - | | 0.849 | |
| • We reinforce the intellectual property polices & practices through reminding our employees periodically. | - | - | | 0.742 | |
| • We have clear statements in employment contract on intellectual property policies & practices. | - | - | | 0.668 | |
| • We provide training to relevant staff on intellectual property management. | - | - | | 0.786 | |
| • We have dedicated staff/team/department for managing intellectual property. | - | - | | 0.655 | |
| **MS3 - IP Defense and Enforcement System** | 2.406 | 0.745 | - | - | - |
| • We check if our company infringes on other's intellectual property periodically. | - | - | | | 0.826 |
| • We continuously monitor external environment to ensure no infringing acts against our intellectual property. | - | - | | | 0.898 |

% of variance explained: 75.3 %

Table 5.15 Factor loadings in Management Support Category (MS)

| Key enabling criteria | Implementation | | | |
|---|---|---|---|---|
| | Mean | Alpha | Factor loading | |
| | | | Factor 1 | Factor 2 |
| **ID1 - Creativity Generation, Concept Selection and Prototyping** | 3.259 | 0.913 | - | - |
| • We undertake Research & Development initiatives on new technologies/products/services. | - | - | 0.683 | |
| • We take precautions in modifying our design to avoid our new product infringe the intellectual property rights of others. | - | - | 0.842 | |
| • We conduct market feasibility and technical assessment of new concepts/inventions. | - | - | 0.828 | |
| • We evaluate the patentability of our inventions. | - | - | 0.771 | |
| • Top/senior management performs vetting procedures to select new inventions. | - | - | 0.797 | |
| • We develop and test our engineering prototype. | - | - | 0.832 | |
| **ID2 - IP Intelligence and Advisory Support** | 2.464 | 0.781 | - | - |
| • We perform searches & analysis on intellectual property. | - | - | | 0.646 |
| • We develop internal database on intellectual property. | - | - | | 0.794 |
| • We subscribe to external database on intellectual property (e.g. existing patent databases in the market). | - | - | | 0.722 |
| • We seek advice on legal matters for our intellectual property from legal advisor/IP consultant. | - | - | | 0.702 |
| • We have adequate budget and resources for supporting our intellectual property portfolio. | - | - | | 0.602 |

% of variance explained: 64.0 %

Table 5.16 Factor loadings in Innovation Development Category (ID)

| Key enabling criteria | Implementation | | | | | |
|---|---|---|---|---|---|---|
| | Mean | Alpha | Factor loading | | | |
| | | | Factor 1 | Factor 2 | Factor 3 | Factor 4 |
| **IP1 - Internal Intellectual Property Security** | 3.534 | 0.801 | - | - | - | - |
| • We strictly implement our policies and practices to govern confidential information. | - | - | 0.730 | | | |
| • We manage and control the copyright issues. | - | - | 0.643 | | | |
| • We maintain documentations and records for all original works created. | - | - | 0.744 | | | |
| • We maintain inventory list for all our intellectual properties. | - | - | 0.812 | | | |
| **IP2 - Intellectual Property Application/Registration** | 3.063 | 0.660 | - | - | - | - |
| • We apply for patent protection in Hong Kong or mainland China. | - | - | | 0.678 | | |
| • We apply for patent protection in our overseas markets. | - | - | | 0.520 | | |
| • We apply for design protection. | - | - | | 0.720 | | |
| • We register for trademark/service mark. | - | - | | 0.600 | | |
| **IP3 - Internal Intellectual Property Audit and Evaluation** | 1.828 | 0.775 | - | - | - | - |
| • We perform intellectual property royalty audit. | - | - | | | 0.760 | |
| • We evaluate the financial value of our intellectual property. | - | - | | | 0.847 | |
| • We perform cost and benefit analysis for maintaining our intellectual property. | - | - | | | 0.701 | |
| **IP4 - Intellectual Property Licensing and Acquisition** | 1.742 | 0.671 | - | - | - | - |
| • We license out or abandon the non-core intellectual property. | - | - | | | | 0.638 |
| • We license in partners' intellectual property. | - | - | | | | 0.801 |
| • We acquire intellectual property ownership from others. | - | - | | | | 0.783 |

% of variance explained: 62.2 %

Table 5.17 Factor loadings in IP Capitalization Category (IP)

| Key enabling criteria | Implementation | | | | |
|---|---|---|---|---|---|
| | Mean | Alpha | Factor loading | | |
| | | | Factor 1 | Factor 2 | Factor 3 |
| **ER1 - Intellectual Property Commercial Development and Marketing** | 3.051 | 0.630 | - | - | - |
| • We use our core intellectual property in new products/services. | - | - | 0.761 | | |
| • We build & reinforce our brand in the market. | - | - | 0.638 | | |
| • We promote our products with identification of our patent, design or trademark in all advertising & communication materials. | - | - | 0.739 | | |
| **ER2 - External Intellectual Property Security, Agreement and Partners Matching** | 3.076 | 0.883 | - | - | - |
| • We clarify intellectual property rights ownership in written agreements before entering into a partnership. | - | - | | 0.892 | |
| • We sign Non-disclosure Agreement (NDA) with partners before commencement of any projects involving intellectual property. | - | - | | 0.856 | |
| • We collaborate with relevant business/strategic partners on developing new markets for our new technologies/products/services. | - | - | | 0.727 | |
| • We have provisions in commercial contracts to ensure our intellectual property rights are protected from infringement by the contractual party and others. | - | - | | 0.837 | |
| **ER3 - Research Venture and Intellectual Property Holding Business Startup/Spinout** | 1.248 | 0.614 | - | - | - |
| • We collaborate with research institutes (e.g. Universities) to develop new technologies/ products/services. | - | - | | | 0.789 |
| • We use some forms of intellectual property to start up separate business entities. | - | - | | | 0.857 |

% of variance explained: 68.5 %

Table 5.18 Factor loadings in External Relationship Management Category (ER)

B. Within-scale confirmatory factor analysis

A confirmatory factor analysis of the four sub-constructs, management support, innovation development, IP capitalization and external relationship management was employed. Confirmatory factor analysis can be used to measure the extent to which the items in a scale all measure the same construct (Venkatraman 1989). The statistical software AMOS was used to perform the following analysis:

As mentioned in Table 5.1, there were a total of 47 items in the questionnaire measuring four sub-constructs with a total of 37 indicators. These indicators were created using the relevant literature to cover the content domain of the variable that was being measured (Bohrnstedt 1983). The selection of indicators and enabling criteria in this confirmatory factor analysis was based on an extensive review of the literature, giving a strong content validity to the variables being measured (see Tables 5.2 to 5.5). A confirmatory factor analysis was conducted for each of the four sub-constructs (see Figures 5.2 to 5.5) to determine whether the 37 indicators measured the construct they were assigned to adequately. Maximum likelihood estimation was employed to estimate the four sub-construct models.

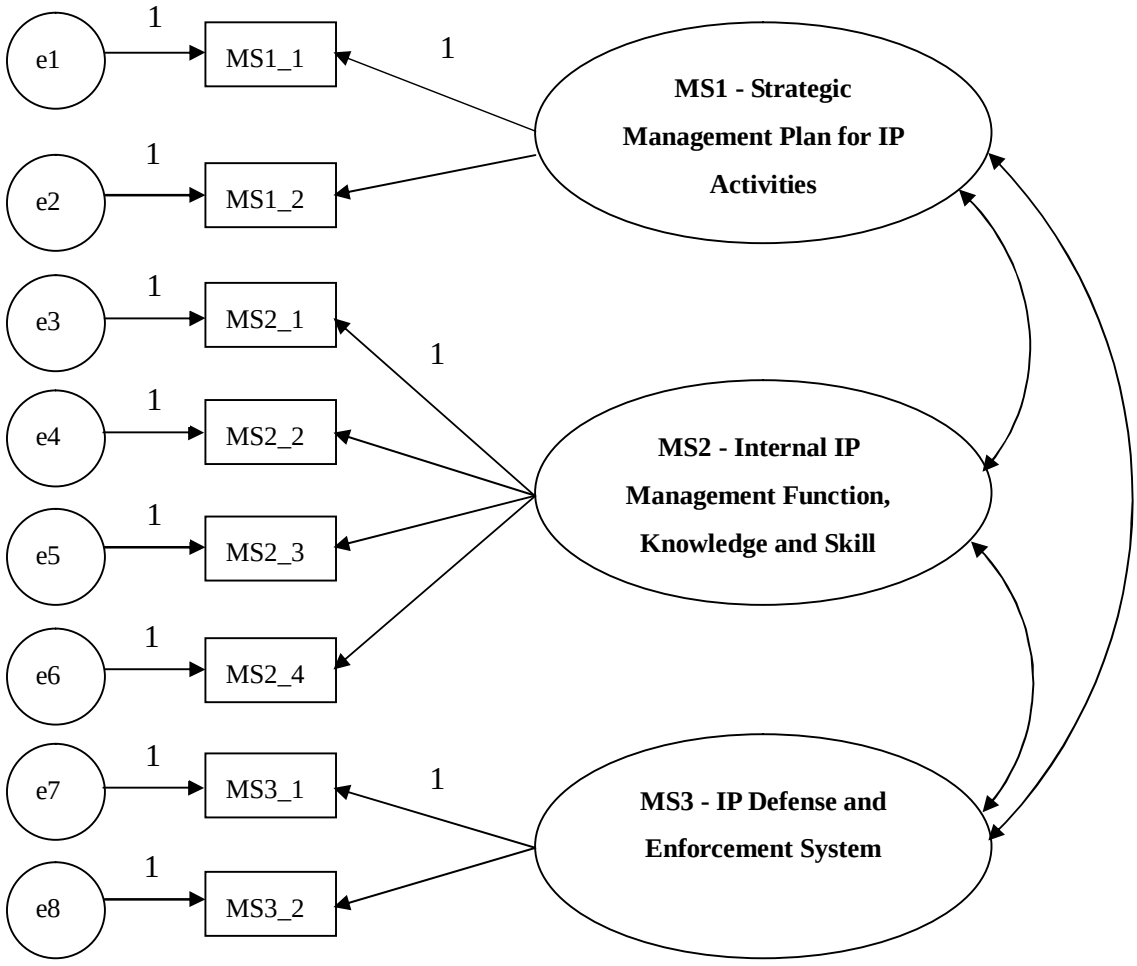



Figure 5.2 Confirmatory factor analysis: indicators and enabling criteria in management support category (MS)

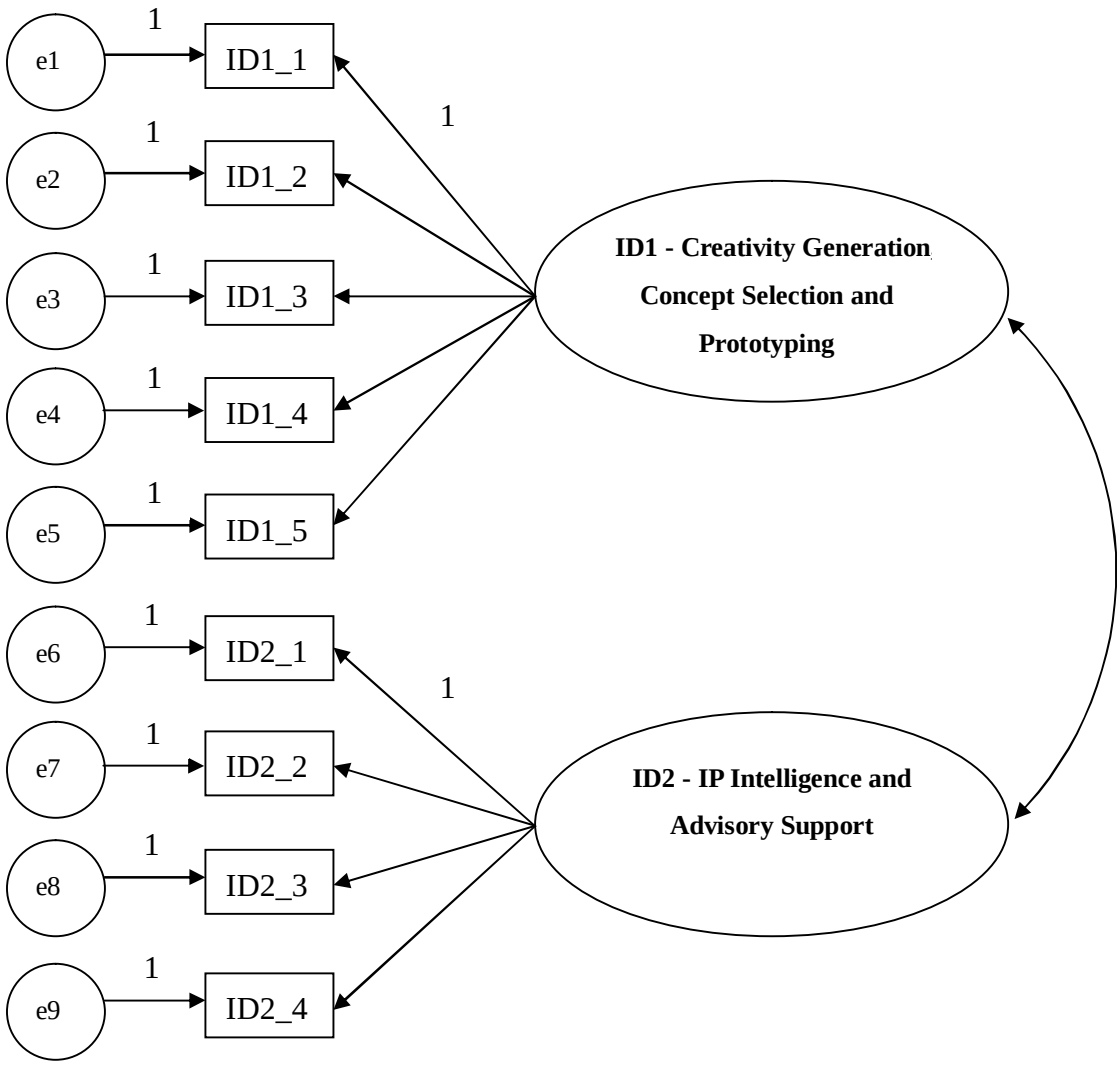



Figure 5.3 Confirmatory factor analysis: indicators and enabling criteria in innovation development category (ID)

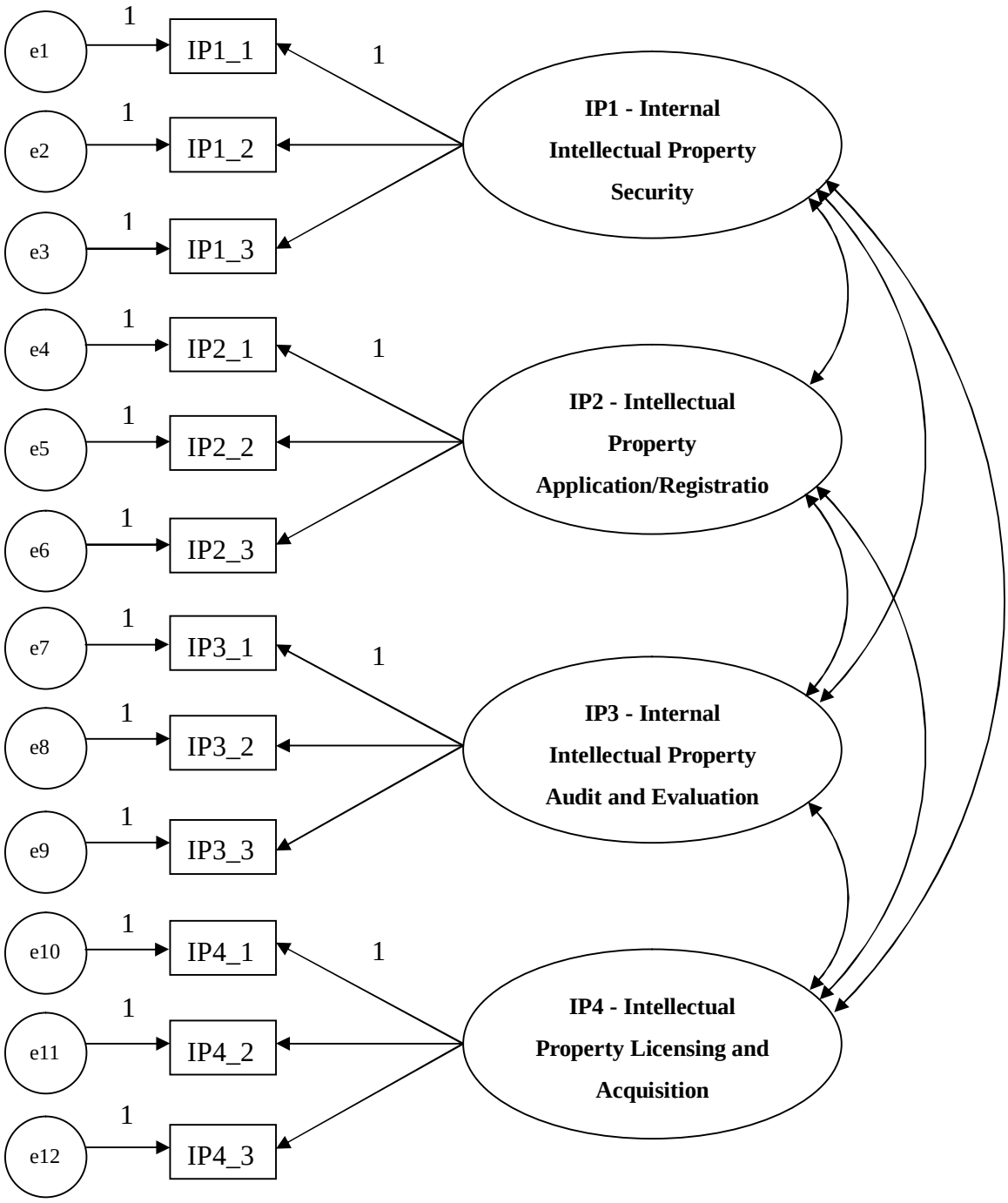



Figure 5.4 Confirmatory factor analysis: indicators and enabling criteria in intellectual property capitalization category (IP)

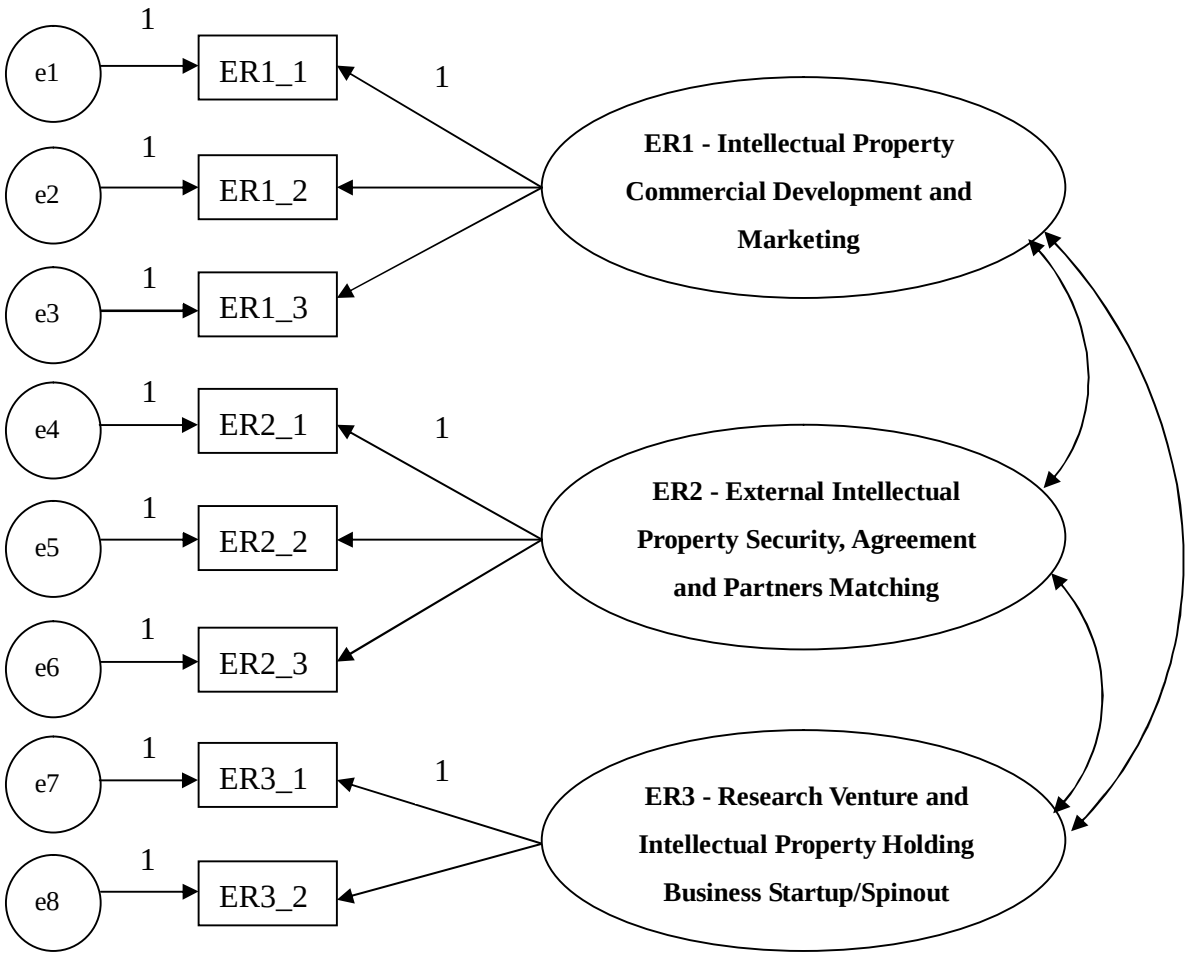



Figure 5.5 Confirmatory factor analysis: indicators and enabling criteria in external relationship management category (ER)

Empirical evidence in confirmatory factor analysis is generally assessed using criteria such as chi-square statistics ($\chi^2$), the comparative fit index (CFI), the root-mean square error of approximation (RMSEA), the significance of parameter estimates, and the amount of explained variance. Tables 5.19 to 5.21 summarized the results of these tests.

a. The conventional chi-square statistics ($\chi^2$) is the most fundamental measure of

overall fit. The $\chi^2$ values for the four sub-constructs in Table 5.19 were small, though still statistically significant (p= 0.000 to 0.012) due to the large sample size. The $\chi^2/df$ ranged from 1.935 to 2.427, which is less than the ratio of five suggested in the literature (Marsch and Hocevar 1985).

b. CFI. This index compares a proposed model with the null model assuming that there are no relationships between the measures. CFI values close to 1 are generally accepted as being indications of well-fitting models (Raykov and Marcoulides 2000). A CFI value greater than 0.9 indicates an acceptable fit to the data (Bentler 1992). The CFI values for the four confirmatory factor analyses are displayed in Table 5.19. An analysis of the table reveals that all the CFI values are very high ranging from 0.957 to 0.982, which suggest very good model fits.

c. RMSEA. The RMSEA is an index used to assess the residues. It adjusts the parsimony in the model and is relatively insensitive to sample size. According to Hu and Bentler (1999), RMSEA must be equal to or less than 0.08 for an adequate model fit. Table 5.19 shows that all the RMSEA values are below 0.08 and indicate adequate model fits.

d. Parameter estimates. Table 5.20 shows that all the parameter estimates (i.e. factor loadings) are statistically significant and range from 0.501 to 0.973.

e. Amount of explained variance. Squared factor loadings (analogues to $R^2$) indicate the percentage of variance in an indicator explained by a factor. As can be seen from Table 5.20, all 37 indicators have satisfactory squared factor

loadings ranging from 0.251 to 0.946.

f. The Bentler-Bonett Normal Fit Index (NFI) obtained from confirmatory factor analysis can be used to assess convergent validity. This index measures the extent to which different approaches to measuring a construct produces the same results (Ahire *et al.* 1996). According to a rule of thumb, NFI values of 0.90 or greater indicate an adequate model fit (Bentler 1995). Table 5.21 shows that all the NFI values are greater than 0.90 indicating strong convergent validity.

Thus, based on these indexes, all of the four sub-constructs have very good fits.

| Fit measures | $\chi^2$ | *df* | P | $\chi^2/df$ | CFI | RMSEA |
|---|---|---|---|---|---|---|
| Sub-construct of Management Support (MS) | 36.175 | 17 | 0.004 | 2.128 | 0.982 | 0.071 |
| Sub-construct of Innovation Development (ID) | 63.090 | 26 | 0.000 | 2.427 | 0.962 | 0.080 |
| Sub-construct of Intellectual Property Capitalization (IP) | 80.785 | 48 | 0.002 | 1.683 | 0.957 | 0.056 |
| Sub-construct of External Relationship Management (ER) | 32.898 | 17 | 0.012 | 1.935 | 0.972 | 0.065 |

Table 5.19 Summary of goodness-of-fit statistics for confirmatory factor analysis

| Parameter estimates and amount of explained variance | | Cronbach's $\alpha$ | Factor loading* | $R^2$ |
|---|---|---|---|---|
| Sub-construct of Management Support (MS) | | | | |
| MS1 | | 0.943 | - | - |
| | MS1–1 | - | 0.921 | 0.849 |
| | MS1–2 | - | 0.973 | 0.946 |
| MS2 | | 0.887 | - | - |
| | MS2–1 | - | 0.837 | 0.700 |
| | MS2–2 | - | 0.787 | 0.619 |
| | MS2–3 | - | 0.736 | 0.542 |
| | MS2–4 | - | 0.760 | 0.578 |
| MS3 | | 0.745 | - | - |
| | MS3–1 | - | 0.901 | 0.811 |
| | MS3–2 | - | 0.660 | 0.436 |
| Sub-construct of Innovation Development (ID) | | | | |
| ID1 | | 0.913 | - | - |
| | ID1–1 | - | 0.671 | 0.450 |
| | ID1–2 | - | 0.833 | 0.694 |
| | ID1–3 | - | 0.918 | 0.842 |
| | ID1–4 | - | 0.721 | 0.520 |
| | ID1–5 | - | 0.803 | 0.644 |
| ID2 | | 0.781 | - | - |
| | ID2–1 | - | 0.741 | 0.549 |
| | ID2–2 | - | 0.670 | 0.449 |
| | ID2–3 | - | 0.555 | 0.308 |
| | ID2–4 | - | 0.669 | 0.448 |
| Sub-construct of Intellectual Property Capitalization (IP) | | | | |
| IP1 | | 0.801 | - | - |
| | IP1–1 | - | 0.816 | 0.666 |
| | IP1–2 | - | 0.804 | 0.646 |
| | IP1–3 | - | 0.639 | 0.408 |
| IP2 | | 0.660 | - | - |
| | IP2–1 | - | 0.677 | 0.458 |
| | IP2–2 | - | 0.528 | 0.279 |
| | IP2–3 | - | 0.504 | 0.254 |
| IP3 | | 0.775 | - | - |
| | IP3–1 | - | 0.580 | 0.337 |
| | IP3–2 | - | 0.832 | 0.692 |
| | IP3–3 | - | 0.799 | 0.638 |
| IP4 | | 0.671 | - | - |
| | IP4–1 | - | 0.501 | 0.251 |
| | IP4–2 | - | 0.727 | 0.528 |
| | IP4–3 | - | 0.703 | 0.494 |
| Sub-construct of External Relationship Management (ER) | | | | |
| ER1 | | 0.630 | - | - |
| | ER1–1 | - | 0.564 | 0.318 |
| | ER1–2 | - | 0.709 | 0.503 |
| | ER1–3 | - | 0.536 | 0.287 |
| ER2 | | 0.883 | - | - |
| | ER2–1 | - | 0.899 | 0.809 |
| | ER2–2 | - | 0.836 | 0.699 |
| | ER2–3 | - | 0.813 | 0.662 |
| ER3 | | 0.614 | - | - |
| | ER3–1 | - | 0.768 | 0.590 |
| | ER3–2 | - | 0.576 | 0.332 |

Note: * All factor loadings were significant at $p < 0.001$

Table 5.20 Parameter estimates and amount of explained variance

| | Bentler-Bonett Normal Fit Index (NFI) |
|---|---|
| Sub-construct of Management Support (MS) | 0.967 |
| Sub-construct of Innovation Development (ID) | 0.938 |
| Sub-construct of Intellectual Property Capitalization (IP) | 0.903 |
| Sub-construct of External Relationship Management (ER) | 0.945 |

Table 5.21 Bentler-Bonett Normal Fit Index (NFI)

### 5.4.3 The Extent of Implementation of the Intellectual Property Management Enabling Categories and Key Enabling Criteria in Hong Kong-Guangdong based Manufacturing Industry

When the data from questionnaire responses have been measured for reliability and validity prior to further analysis and the results of reliability and validity are positive, and then they can be used for further analysis. The results in this section aim to achieve the first two sub-objectives of this study, i.e., first to examine the current situation of IP management enabling categories and key enabling criteria in HK-GD based manufacturing industry; and second, to investigate the general IP management practices (extent of implementation of IP management enabling categories and key enabling criteria) of HK-GD based manufacturing industry. In order to achieve the two sub-objectives, two steps are employed for analysis. First, to examine that the

four IP management enabling categories and twelve key enabling criteria have been implemented by companies (section 5.4.3.1) by conducting data analysis on their mean values; and second, to investigate the general IP management practices (extent of implementation of the four IP management enabling categories and twelve key enabling criteria) in HK-GD based manufacturing industry by analyzing frequency statistics on the measurement items (sections 5.4.3.2 to 5.4.3.5).

#### 5.4.3.1 Examine the Current Situation of Intellectual Property Management Enabling Categories and Key Enabling Criteria

The results from the questionnaire responses are shown in Table 5.22. The mean values of the extent of implementation of all key enabling criteria exceeded 2.0, except “Internal IP Audit and Evaluation”, “IP Licensing and Acquisition” and “Research Venture and IP Holding Business Startup/Spinout”, which had mean values of 1.83, 1.73 and 1.24, respectively. As all key enabling criteria are implemented (as shown in Figure 5.6) with the lowest mean value of 1.24, this indicates that all key enabling criteria from the literature have been implemented by respondents from the HK-GD based manufacturing industry as general IP management practices. Moreover, the mean values of the four IP management enabling categories ranged from 2.43 to 2.87 (as shown in Table 5.22 and Figure 5.7) and are examined as general IP management practices. Thus the results support that the four enabling categories and twelve key enabling criteria that have been identified in Stage one of the study have been examined as general IP management practices of HK-GD based manufacturing industry and have achieved the sub-objective one of this study.

| Extent of Implementation* | Mean | |
|---|---|---|
| **MS- Management Support** | - | 2.43 |
| MS1- Strategic Management Plan for IP Activities | 2.86 | - |
| MS2- Internal IP management function, knowledge and skill | 2.01 | - |
| MS3- IP defense and enforcement system | 2.41 | - |
| **ID- Innovation Development** | - | 2.87 |
| ID1 - Creativity generation, concept selection and prototyping | 3.27 | - |
| ID2 - IP intelligence and advisory support | 2.47 | - |
| **IP- Intellectual Property Capitalization** | - | 2.54 |
| IP1 - Internal IP security | 3.54 | - |
| IP2 - IP application/registration | 3.05 | - |
| IP3 - Internal IP audit and evaluation | 1.83 | - |
| IP4 - IP licensing and acquisition | 1.73 | - |
| **ER- External Relationship Management** | - | 2.46 |
| ER1- IP commercial development and marketing | 3.05 | - |
| ER2- External IP security, agreement and partners matching | 3.09 | - |
| ER3- Research venture and IP holding business startup/spinout | 1.24 | - |

Note: * 0 – Not yet implement and have no plan to implement, 1 – Not yet implement but have plan to implement, 2 – Implemented to a small extent, 3 – Implemented by halves, 4 – Implemented to a large extent, 5 – Fully implemented

Table 5.22 Mean values of the extent of implementation of IP management enabling categories and key enabling criteria

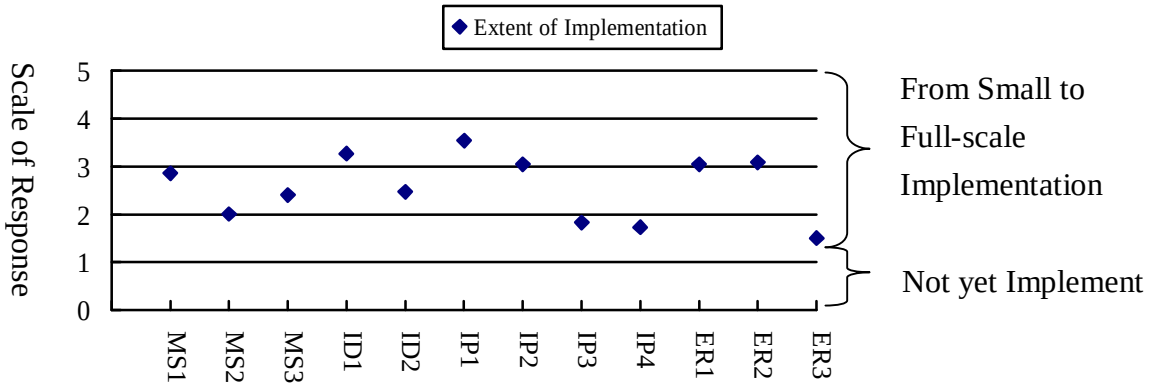



Figure 5.6 Mean values of the extent of implementation of the twelve IP management enabling criteria

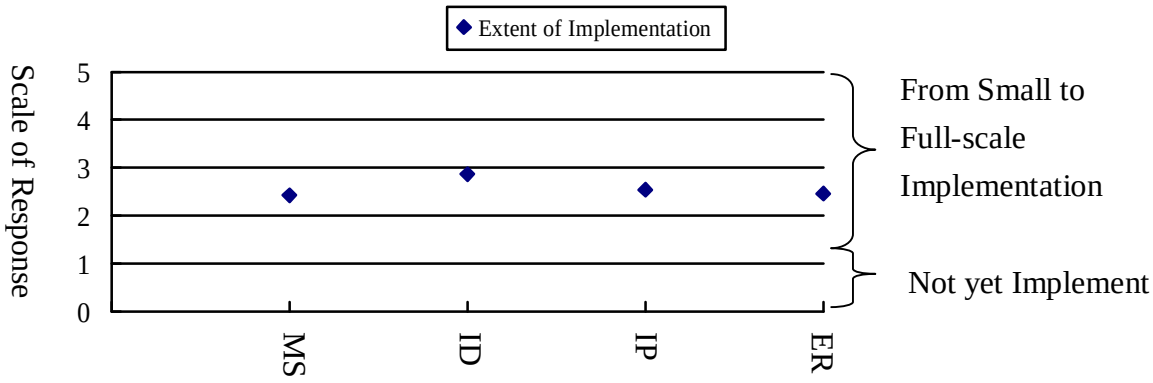



Figure 5.7 Mean values of the extent of implementation of the four IP management enabling categories

#### 5.4.3.2 Investigate the General Intellectual Property Management Practices (Extent of Implementation of Key Enabling Criteria) in Management Support Category

Table 5.23 reveals the frequency statistics of management support category. The rating of the responding companies that "largely and fully" implemented enabling criteria of "Strategic Management Plan for IP Activities" was 45%, "Internal IP Management Function, Knowledge and Skill" was 24% and "IP Defense and Enforcement System" was 26%; while the rating of responding companies that "largely and fully" implemented management support category was 32%.

The mean value for "Internal IP Management Function, Knowledge and Skill" had the lowest rating in "extent of implementation". Moreover, the frequency statistics reveal that the general practices corresponding to the following measurement items were lagging behind the others. The results are analyzed as shown below:

(a) 14% of the respondents indicated that they "largely and fully" implemented professional training to their responsible staff on IP management; 21% of the respondents indicated that they "largely and fully" implemented updating and dissemination of new changes in IP policies and laws to staff.

(b) 25% of the respondents indicated that they "largely and fully" implemented reinforcing IP policies and practices through reminding employees periodically; 32% of the respondents indicated that they "largely and fully" implemented the assignment of dedicated staff/team/department for managing IP but the resources were very minimal.

| | **Rating of extent of implementation* as "largely and fully"** |
|---|---|
| **MS – Management Support Category** | **32%** |
| **MS1 – Strategic Management Plan for IP Activities** | **45%** |
| •We formulate strategic direction on intellectual property based on our company's mission & vision. | 47% |
| •We set intellectual property polices & practices. | 37% |
| •Top management is committed and involved in the implementation of the strategic direction, policies and practices on intellectual property. | 56% |
| •Relevant staff are committed and abide to the intellectual property polices & practices. | 58% |
| •Our employees at all levels are well-aware of the company's intellectual property policies & practices. | 37% |
| •We set implementation plan for intellectual property management activities & set action items with performance monitoring for our intellectual property plan. | 32% |
| **MS2 – Internal IP Management Function, Knowledge and Skill** | **25%** |
| •We update & disseminate new changes in intellectual property policies & laws/regulations to our staff. | 21% |
| •We reinforce the intellectual property polices & practices through reminding our employees periodically. | 25% |
| •We have clear statements in employment contract on intellectual property policies & practices. | 34% |
| •We provide training to relevant staff on intellectual property management. | 14% |
| •We have dedicated staff/team/department for managing intellectual property. | 32% |
| **MS3 – IP Defense and Enforcement System** | **26%** |
| •We check if our company infringes on other's intellectual property periodically. | 26% |
| •We continuously monitor external environment to ensure no infringing acts against our intellectual property. | 28% |

Note: * 0 – Not yet implement and have no plan to implement, 1 – Not yet implement but have plan to implement, 2 – Implemented to a small extent, 3 – Implemented by halves, 4 – Implemented to a large extent, 5 – Fully implemented

Table 5.23 Frequency statistics of measurement items and key enabling criteria in management support category

The result of survey reflected the state of IP management in many responding companies in HK-GD based manufacturing industry. The situation can be summarized as follows:

a) Weak in fostering a culture of IP management and innovation. The major causes of the above results are consistent with the findings from Barren *et al.* (2005). It is expected that the fostering of IP culture is part of corporate strategy in order to maintain and strengthen the competitiveness of companies, while simultaneously encouraging innovation as a whole. The promotion of IP culture in a company involves the knowledge and application in three areas, i.e. law, business and technology. It is difficult for the general public, in particular people in the manufacturing sector, to grasp and integrate the knowledge and experience in law, business and technology on IP issues. The companies that is devoted to the creation of an IP culture can lead to more research and development and knowledge creation; otherwise, an absence of IP culture results in a stagnant or receding company and a reduction in creativity and inventiveness.

b) Inactive role of IP staff or department within the company. The major causes of the above results are supported by the findings from Hildebrand and Klosek (2003). The companies' staff will play an extremely important role in management of IP assets. Successful IP management strategy required dedicated staff. However, many companies put little emphasis on the role of IP staff or department; for example, they do not have frequent access to the top level executive management for support to implement IP management. As such, lack of coordination with other departments for the control of IP activities is a commonplace. Selection of staff should be undertaken with the recognition that such staff member/team/department will be required to organize, control and coordinate all the activities related to IP assets. In addition to focusing on the key staff, other relevant staff members should be trained and encouraged to take an active role in the related matters.

#### 5.4.3.3 Investigate the General Intellectual Property Management Practices (Extent of Implementation of Key Enabling Criteria) in Innovation Development Category

Table 5.24 reveals the frequency statistics of innovation development category. The rating of the responding companies that "largely and fully" implemented enabling criteria of "Creativity Generation, Concept Selection and Prototyping" was 55% and "IP Intelligence and Advisory Support" was 36%; while the rating of responding companies that "largely and fully" implemented innovation development category was 46%.

The mean value for "IP Intelligence and Advisory Support" had the lowest rating in "extent of implementation". Moreover, the frequency statistics reveal that the general practices corresponding to some measurement items were lagging behind the others. In analyzing the survey results, 10% of the respondents indicated that they "largely and fully" implemented the subscription to external database on IP; while 24% of the respondents indicated that they "largely and fully" implemented the development of internal database on IP.

The result of survey reflected the state of IP management in many responding companies in HK-GD based manufacturing industry. The situation can be attributed to the low adoption of tools & database in supporting the management of knowledge, innovation and IP portfolio. The major causes of the above results can be explained by the findings from International Bureau of World Intellectual Property Organization (2002). Entrepreneurs are still stick to the traditional ways in handling information. When doing so, they will ignore the large variety of tools and databases

offer in the market, which is indispensable to IP management. The importance of tools and databases can be reflected in different processes of business; such as patent mapping and patent search on any of those selected technology areas should be carried out prior and after the investment is made. Effective use of IP tools and databases can also assist some selected industries to better understand the technological trend and competitive environment, or before any major investment decision to be made. Sometimes it is needed when reviewing an implemented R&D project before pumping further investments or is used to justify the deliverables.

| | **Rating of extent of implementation* as "largely and fully"** |
|---|---|
| **ID - Innovation Development Category** | **46%** |
| **ID1 - Creativity Generation, Concept Selection and Prototyping** | **55%** |
| • We undertake Research & Development initiatives on new technologies/products/services. | 58% |
| • We take precautions in modifying our design to avoid our new product infringe the intellectual property rights of others. | 61% |
| • We conduct market feasibility and technical assessment of new concepts/inventions. | 56% |
| • We evaluate the patentability of our inventions. | 55% |
| • Top/senior management performs vetting procedures to select new inventions. | 45% |
| • We develop and test our engineering prototype. | 60% |
| **ID2 - IP Intelligence and Advisory Support** | **36%** |
| • We perform searches & analysis on intellectual property. | 45% |
| • We develop internal database on intellectual property. | 24% |
| • We subscribe to external database on intellectual property (e.g. existing patent databases in the market). | 10% |
| • We seek advice on legal matters for our intellectual property from legal advisor/IP consultant. | 57% |
| • We have adequate budget and resources for supporting our intellectual property portfolio. | 41% |

Note: * 0 – Not yet implement and have no plan to implement, 1 – Not yet implement but have plan to implement, 2 – Implemented to a small extent, 3 – Implemented by halves, 4 – Implemented to a large extent, 5 – Fully implemented

Table 5.24 Frequency statistics of measurement items and key enabling criteria in innovation development category

#### 5.4.3.4 Investigate the General Intellectual Property Management Practices (Extent of Implementation of Key Enabling Criteria) in Intellectual Property Capitalization Category

Table 5.25 reveals the frequency statistics of IP capitalization category. The rating of the responding companies that "largely and fully" implemented enabling criteria of "Internal IP Security" was 59%, "IP Application/Registration" was 50%, "Internal IP Audit and Evaluation" was 21% and "IP Licensing and Acquisition" was 21%; while the rating of responding companies that "largely and fully" implemented IP capitalization category was 38%.

The mean values for "Internal IP Audit and Evaluation" and "IP Licensing and Acquisition" had the lowest rating in "extent of implementation". Moreover, the frequency statistics reveal that the general practices corresponding to the following measurement items were lagging behind the others. The results are analyzed as shown below:

(a) 16% of the respondents indicated that they "largely and fully" implemented the evaluation of the financial value of their IP.

(b) 17% of the respondents indicated that they "largely and fully" implemented licensing out or abandoning the non-core IP; while 18% of the respondents indicated that they "largely and fully" implemented acquisition of IP ownership from others.

| | **Rating of extent of implementation* as "largely and fully"** |
|---|---|
| **IP - Intellectual Property Capitalization Category** | **38%** |
| **IP1 - Internal Intellectual Property Security** | **59%** |
| · We strictly implement our policies and practices to govern confidential information. | 56% |
| · We manage and control the copyright issues. | 41% |
| · We maintain documentations and records for all original works created. | 70% |
| · We maintain inventory list for all our intellectual properties. | 69% |
| **IP2 – Intellectual Property Application/Registration** | **50%** |
| · We apply for patent protection in Hong Kong or mainland China. | 62% |
| · We apply for patent protection in our overseas markets. | 48% |
| · We apply for design protection. | 40% |
| · We register for trademark/service mark. | 50% |
| **IP3 – Internal Intellectual Property Audit and Evaluation** | **21%** |
| · We perform intellectual property royalty audit. | 21% |
| · We evaluate the financial value of our intellectual properties. | 16% |
| · We evaluate the financial value of our intellectual properties. | 29% |
| **IP4 – Intellectual Property Licensing and Acquisition** | **21%** |
| · We license out or abandon the non-core intellectual property. | 17% |
| · We license in partners' intellectual property. | 29% |
| · We acquire intellectual property ownership from others. | 18% |

Note: * 0 – Not yet implement and have no plan to implement, 1 – Not yet implement but have plan to implement, 2 – Implemented to a small extent, 3 – Implemented by halves, 4 – Implemented to a large extent, 5 – Fully implemented

Table 5.25 Frequency statistics of measurement items and key enabling criteria in intellectual property capitalization category

The result of survey reflected the state of IP management in many responding companies in HK-GD based manufacturing industry. The situation can be summarized as follows:

a) Neglect the importance of IP evaluation. The attributes to the above results can be explained by the findings in Boman and Larsson (2003). In practice, IP valuations are rarely done in most companies. Entrepreneurs do not recognize

the importance of IP valuations mostly due to lack of knowledge, but also partly due to the high level of skepticism as to whether or not patents can be valued at all, and the reliability of the results from such a valuation. Despite the uncertainties related to the valuation approaches, lacking knowledge and consciousness to conduct the IP valuation should be the main hindrance for the recognition of the value, as the aim of IP valuation is to enable managers to know the value sufficiently accurately and objectively to make well-founded decisions concerning their management on a more rational basis.

b) Technology transfer activities are very minimal. The major causes of the above results are consistent with the findings from Nepal ***et al.*** (2006). SMEs tend to be relatively conservative and sometimes even suspicious of new idea and new technology. They frequently have developed a well understood routine and procedure for doing their jobs and are reluctant to change. Thus, licensing in/ out cannot be efficiently absorbed, diffused and assimilated in the system. The technology recipients in many instances lack information about different technologies available. The SME entrepreneurs are not in a position to pay for technology assessment and they also lack knowledge about the trend of technological change. Even if they afford to do so, there is a lack of appropriate mechanism as well as human resources (e.g. trained technical manpower) required for this purpose.

#### 5.4.3.5 Investigate the General Intellectual Property Management Practices (Extent of Implementation of Key Enabling Criteria) in External Relationship Management Category

Table 5.26 reveals the frequency statistics of external relationship management category. The rating of the responding companies that "largely and fully" implemented enabling criteria of "IP Commercial Development and Marketing" was 50%, "External IP Security, Agreement and Partners Matching" was 50% and "Research Venture and IP Holding Business Startup/Spinout" was 14%; while the rating of responding companies that "largely and fully" implemented external relationship management category was 37%.

The mean values for "Research Venture and IP Holding Business Startup/Spinout" had the lowest rating in "extent of implementation". Moreover, the frequency statistics reveal that the general practices corresponding to some measurement items were lagging behind the others. In analyzing the survey results, 15% of the respondents indicated that they "largely and fully" implemented collaboration with research institutes to develop new technologies and products; 11% of the respondents indicated that they "largely and fully" implemented formation of separate business entities based on some forms of IP.

The result of survey reflected the state of IP management in many responding companies in HK-GD based manufacturing industry. The situation is attributed to weak in integrating R&D and innovation in an overall business strategy. The major causes are consistent with the findings from Conceicạo *et al.* (1998). The inadequate links between research institutes (e.g. Universities) and companies are based on the

weakness in integrating R&D and innovation in an overall business strategy. New innovations can be benefited from a close interaction between research institutes and the community; however, the insufficient account of R&D in business strategies and the lack of co-ordinate strategies between businesses, universities and the public authorities impede the results achieved.

| | **Rating of extent of implementation* as "largely and fully"** |
|---|---|
| **ER - External Relationship Management Category** | **37%** |
| **ER1 - Intellectual Property Commercial Development and Marketing** | **50%** |
| · We use our core intellectual property in new products/services. | 55% |
| · We build & reinforce our brand in the market. | 43% |
| · We promote our products with identification of our patent, design or trademark in all advertising & communication materials. | 50% |
| **ER2 - External Intellectual Property Security, Agreement and Partners Matching** | **50%** |
| · We clarify intellectual property rights ownership in written agreements before entering into a partnership. | 59% |
| · We sign Non-disclosure Agreement (NDA) with partners before commencement of any projects involving intellectual property. | 49% |
| · We collaborate with relevant business/strategic partners on developing new markets for our new technologies/products/services. | 36% |
| · We have provisions in commercial contracts to ensure our intellectual property rights are protected from infringement by the contractual party and others. | 55% |
| **ER3 - Research Venture and Intellectual Property Holding Business Startup/Spinout** | **14%** |
| · We collaborate with research institutes (e.g. Universities) to develop new technologies/ products/services. | 15% |
| · We use some forms of intellectual property to start up separate business entities. | 11% |

Note: * 0 – Not yet implement and have no plan to implement, 1 – Not yet implement but have plan to implement, 2 – Implemented to a small extent, 3 – Implemented by halves, 4 – Implemented to a large extent, 5 – Fully implemented

Table 5.26 Frequency statistics of measurement items and key enabling criteria in external relationship management category

### 5.4.4 The Relationships between the General IP Management Practices and IP Management Performance Excellence

The results in this section aim to achieve the sub-objective three; i.e., investigate the relationships between the general IP management practices and IP management performance excellence of HK-GD based manufacturing organizations. In order to achieve this objective, tests of hypotheses have been set in section 5.1. Hypotheses *H1a* to *H1l* test the relationships between the twelve enabling criteria and IP management excellence. Hypotheses *H2a1* to *H2c2* test the relationships between the enabling categories. Hypotheses *H3a1* to *H3b2* test the contribution of the four enabling categories to IP management result categories. The results are shown in the following two sub-sections.

#### 5.4.4.1 Correlation Analysis of the Extent of Implementation of IP Management Enabling Criteria and IP Management Excellence

The twelve enabling criteria of IP management practices in the questionnaire survey are shown in Tables 5.2 to 5.5. The extent of implementation of each enabling criterion was measured by at least two indicators. Each indicator was a parcel, which was simply the average of responses on items corresponding to an indicator. The use of parcels reduced the 47 items to a manageable level (37 indicators). Each category, namely: “Management Support”, “Innovation Development”, “Intellectual Property Capitalization” and “External Relationship Management” was measured by at least two enabling criteria.

Performance dimensions of company’s IP management excellence in the

questionnaire survey were “Internal IP capitalization outcomes”, “External IP capitalization outcomes” and “IP comfort level with business partners” (see Tables 5.7 and 5.8). The three performance dimensions with 15 measurement items were used to lead the respondents to review what the IP management excellence should be; and then the overall IP management excellence was the average of three performance dimensions, which were simply the average of responses on items corresponding to each performance dimension. The overall IP management excellence was used as the scoring to calculate for correlation analysis in this section and multiple regression analysis in the next section.

Correlation analysis was done by employing the extent of implementation of twelve key IP management enabling criteria and the overall IP management excellence. As shown in Table 5.27, the correlation coefficient $r$ ranged from 0.233 to 0.453 with $p < 0.01$.

This implies that the extent of implementation of all twelve key IP management enabling criteria are significantly positive related to IP management excellence. All hypotheses from *H1a* to *H1l* are thus supported.

| Hypotheses *H1a to H1l* | | | |
|---|---|---|---|
| | | **Correlation (*r*)** | **Conclusion** |
| | Extent of implementation of | | |
| *H1a* | strategic management plan for IP activities is positively related to the IP management excellence | 0.275** | Supported |
| *H1b* | internal IP management function, knowledge and skill is positively related to the IP management excellence | 0.362** | Supported |
| *H1c* | IP defense and enforcement system is positively related to the IP management excellence | 0.290** | Supported |
| *H1d* | creativity generation, concept selection and prototyping is positively related to the IP management excellence | 0.347** | Supported |
| *H1e* | IP intelligence and advisory support is positively related to the IP management excellence | 0.311** | Supported |
| *H1f* | internal IP security is positively related to the IP management excellence | 0.277** | Supported |
| *H1g* | IP application/registration is positively related to the IP management excellence | 0.404** | Supported |
| *H1h* | internal IP audit and evaluation is positively related to the IP management excellence | 0.233** | Supported |
| *H1i* | IP licensing and acquisition is positively related to the IP management excellence | 0.417** | Supported |
| *H1j* | IP commercial development is positively related to the IP management excellence | 0.336** | Supported |
| *H1k* | external IP security, agreement and partners matching is positively related to the IP management excellence | 0.453** | Supported |
| *H1l* | research venture and IP holding business startup/spinout is positively related to the IP management excellence | 0.287** | Supported |

**correlation is significant at the 0.01 level (2-tailed)

Table 5.27 Correlation test results of hypotheses *H1a* to *H1l*

#### 5.4.4.2 Relative Contribution of the Extent of Implementation of IP Management Enabling Categories to IP Management Result Categories

As supported by correlation analysis that the extent of implementation of all twelve key enabling criteria are positively related to IP management excellence, the contribution of extent of the implementation of IP management enabling categories to IP management excellence is further investigated. Since the twelve key enabling criteria are closely related and interfere with each other, they cannot contribute to a good regression model. So the relative contributions of the extent of implementation of four IP management enabling categories as described in section 4.4, namely, management support, innovation development, IP capitalization and external relationship management to IP management excellence were examined by multiple regression analysis. The extent of implementation of four IP management enabling categories was measured with overall IP management excellence by multiple regression analysis.

Table 5.28 reports the relationships between the IP management enabling categories on overall IP management excellence. The multiple regression analysis reveals that the relationships between the IP capitalization category and overall IP management excellence and between the external relationship management category and overall IP management excellence are strong and statistically significant. The assumed relationships are supported. The relationships between the management support category and overall IP management excellence and between the innovation development and overall IP management excellence have statistically insignificant effect. The assumed relationships are not supported.

| **Dependent Variables (predictors)** | **Standardized Regression Coefficient: Beta** | **t** | **Sig.** | **Conclusion** |
|---|---|---|---|---|
| (Constant) | | 7.166 | 0.000 | |
| Management support category | 0.054 | 0.636 | 0.525 | Not Support |
| IP capitalization category | 0.219 | 2.293 | 0.023 | Supported |
| Innovation development category | -0.057 | -0.639 | 0.523 | Not Support |
| External relationship management category | 0.329 | 3.640 | 0.000 | Supported |
| **Independent Variable:** IP management excellence<br>$R^2$= 0.256, *F*-value= 18.715 | | | | |

Table 5.28 Multiple regression analysis of extent of implementation of IP management enabling categories and IP management excellence

Furthermore, the results of regression analysis in Table 5.29 show that management support category has a significant effect on the other three IP management enabling categories but does not have a direct effect on the overall IP management excellence. In turn, IP capitalization category and external relationship management category have a significant effect on the overall IP management excellence.

| | Intellectual Property Capitalization | Innovation Development | External Relationship Management |
|---|---|---|---|
| Management Support | $\beta = 0.372$ | $\beta = 0.300$ | $\beta = 0.173$ |
| | $p < .001$ | $p < .001$ | $p < .05$ |

Note: Multiple $R^2$ is not applicable since each predictive relationship is bivariate.

Table 5.29 Regression of management support category on the other IP management enabling categories

The regression coefficients produced by the previous analysis represent the direct effects of each individual category in the model on each other category in the model. Unfortunately, multiple regression analysis does not test the overall structure or predictive ordering assumed in the model. An analysis is needed to examine the relationships among all the categories simultaneously to determine if the IP management excellence model is supported in totality. Therefore, path analysis was used to estimate the strength of the relationship between the six constructs as shown in Figure 5.1. Path analysis is a multivariate analysis method to examine sets of relationships represented by linear causal models (Li 1975; Jöreskoj and Sörbom 1993). A path analytic model decomposes the observed correlations or covariances among the scale variables to estimate the path coefficients in the model. The IP management excellence model represents the causal relationships between the IP management practices and IP management excellence. Therefore, this methodology is suitable for measuring such a relationship.

In this research, an IP management excellence model is presented. We, therefore,

used confirmatory analysis to analyze the model. AMOS was used to estimate the strength of the path coefficients and the adequacy of the whole model. In this study, the interpretation of goodness-of-fit was based on the following fit indexes: Chi-square ($\chi^2$), the Comparative fit index (CFI), Bentler-Bonett Normal fit index (NFI) and the root mean square error of approximation (RMSEA) (Steiger 1990). The explanations of the above indexes are provided in section 3.2.4 and the values of fit indexes were available directly from the output of AMOS. They are shown in Table 5.30.

| **Fit measure** | **Default model** |
|---|---|
| Chi-square ($\chi^2$) | 15.521 |
| Degree of freedom (*df*) | 7 |
| Probability level (P) | 0.03 |
| Number of parameters | 20 |
| Chi-square/ Degree of freedom ($\chi^2$ / *df*) | 2.217 |
| Comparative fit index (CFI) | 0.985 |
| Bentler-Bonett Normal fit index (NFI) | 0.974 |
| RMSEA | 0.074 |

Table 5.30 Fit measures of IP management excellence model

From Table 5.30, we found that the Chi-square (15.521; 7 degrees of freedom) for this model was significant ($p$=0.03), and the overall fit was acceptable, because the comparative fit index (CFI) and normal fit index (NFI) was above the generally recommended 0.9 level, and the RMSEA values was below 0.08.

From Table 5.31, all regression weights of maximum likelihood estimates are significant ($p < 0.001$), and at least greater than 0.2, except "external relationship management" with external relationship satisfaction ($p$=0.016 and S.R.W.=0.163), but it is still significant.

| Paths | Estimate of regression weight | Standard error of regression weight (S.E.) | Critical ratio for regression weight (C.R.) | Level of significance for regression weight (P) | Estimate of standardized regression weight (S.R.W.) |
|---|---|---|---|---|---|
| IPO←IP | .447 | .061 | 7.334 | *** | 0.444 |
| ERS←ER | .088 | .036 | 2.408 | .016 | 0.163 |
| ID←IP | .289 | .086 | 3.352 | *** | 0.249 |
| ER←ID | .370 | .062 | 6.005 | *** | 0.399 |
| IP←ER | .352 | .056 | 6.310 | *** | 0.379 |
| IP←MS | .370 | .047 | 7.825 | *** | 0.451 |
| ID←MS | .475 | .066 | 7.148 | *** | 0.498 |
| ER←MS | .337 | .056 | 5.978 | *** | 0.381 |

Note: *** $p < 0.001$

Table 5.31 Regression weights of IP management excellence model

Figure 5.8 shows the direct effect of one construct on another by the arrow joining the two constructs. Indirect effects of constructs can be determined by following a series of forward-pointing arrows. For example, while the model does not include a direct effect of management support category on IP outcomes, we can determine any indirect effect it might have by examining the direct effect of management support category on IP capitalization category and the direct effect of IP capitalization category on IP outcomes.

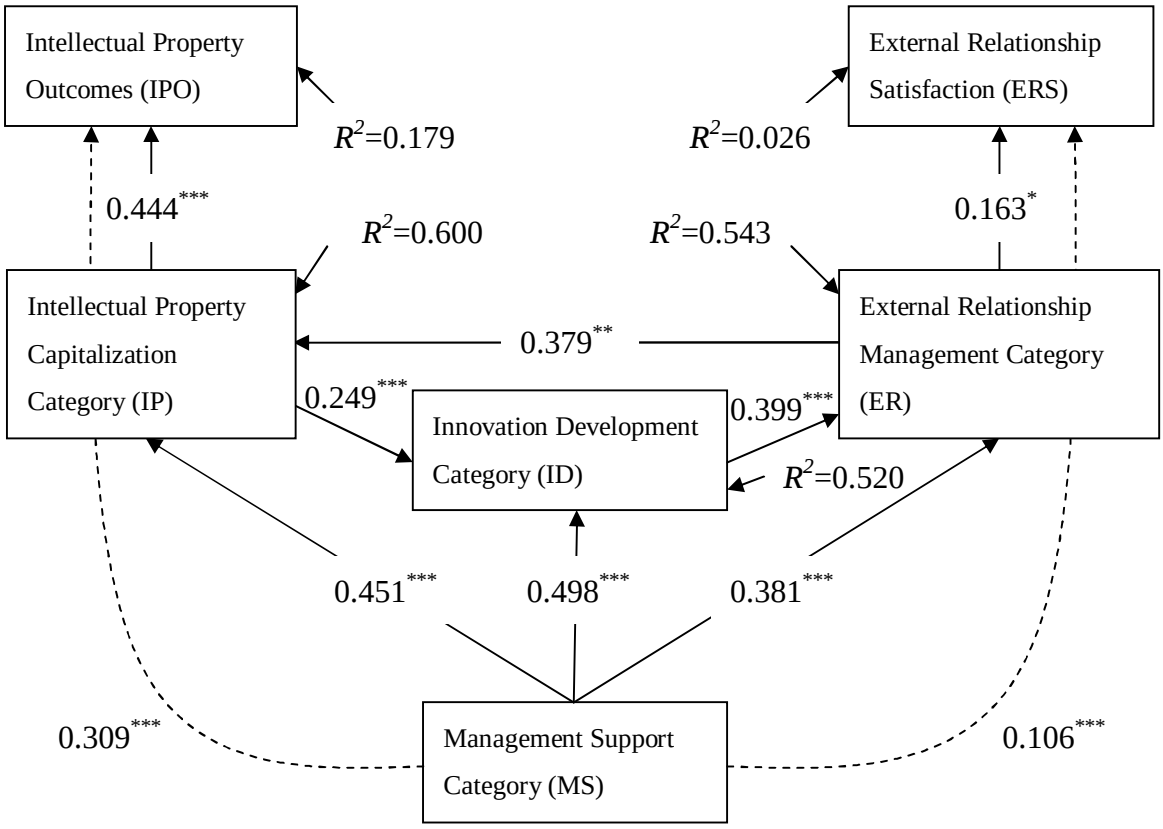



Figure 5.8 The IP management excellence model

Table 5.32 presents the indirect effects thus calculated along with the direct and total effects. The total effect of a construct is the sum of its direct and indirect effects.

*H2a1* and *H2a2* were supported by the significant path coefficients. Both management support category and external relationship management category have statistically significant direct effects on IP capitalization category. *H2b1* and *H2b2* were supported by the significant path coefficients. Both management support category and IP capitalization category have statistically significant direct effects on innovation development category. *H2c1* and *H2c2* were supported by the significant path coefficients. Both management support category and innovation development

category have statistically significant direct effects on external relationship management category.

*H3a1* and *H3a2* were supported by the significant path coefficients. IP capitalization category had a significant direct effect on IP outcomes. Although management support category did not have a significant direct effect on IP outcomes, it did have a significant indirect effect on IP outcomes primarily through IP capitalization category. *H3b1* and *H3b2* were supported by the significant path coefficients. External relationship management category had a significant direct effect on external relationship satisfaction. Although management support category did not have a significant direct effect on external relationship satisfaction, it did have a significant indirect effect on external relationship satisfaction primarily through external relationship management category.

| Hypothesis Path | | Direct effect | Indirect effect | Total effect | Path Significance |
|---|---|---|---|---|---|
| *H2a1* | IP←MS | 0.451 | 0.246 | 0.697 | Significant*** |
| *H2a2* | IP←ER | 0.379 | 0.015 | 0.394 | Significant*** |
| *H2b1* | ID←MS | 0.498 | 0.173 | 0.671 | Significant*** |
| *H2b2* | ID←IP | 0.249 | 0.010 | 0.258 | Significant*** |
| *H2c1* | ER←MS | 0.381 | 0.268 | 0.648 | Significant*** |
| *H2c2* | ER←ID | 0.399 | 0.016 | 0.414 | Significant*** |
| *H3a1* | IPO←IP | 0.444 | 0.017 | 0.461 | Significant*** |
| *H3a2* | IPO←MS | 0.000 | 0.309 | 0.309 | Significant*** |
| *H3b1* | ERS←ER | 0.163 | 0.006 | 0.169 | Significant * |
| *H3b2* | ERS←MS | 0.000 | 0.106 | 0.106 | Significant*** |

Notes: $^{*}p<0.05$; $^{***}p<0.001$

Table 5.32 Standardized direct and indirect effects

## 5.5 Discussion

The research of this Chapter adopts the criteria-based IP management model that has been developed through the literature review as described in Chapter 4. Based on the findings in the literature review, five core values and twelve key enabling criteria in IP management have been identified. The objective of this Chapter is to validate the criteria-based IP management model through questionnaire survey. Prior analyzing of the results, reliability and validity of measurement items have been measured and the results are positive.

With respect to the first sub-objective of this Chapter, the mean value of the extents of implementation of the twelve key enabling criteria was examined through questionnaire survey that was conducted in the HK-GD based manufacturing industry. Moreover, the mean value of the extents of implementation of the four IP management enabling categories was also examined. With the support of questionnaire survey results, the four IP management enabling categories and the twelve key enabling criteria have been examined as general IP management practices.

Regarding the second sub-objective, data analysis using frequency statistics was employed to investigate the measurement items of IP management enabling categories and key enabling criteria. The results indicate that the general IP management practices (extent of implementation as “largely and fully” of key enabling criteria) in the HK-GD based manufacturing industry ranged from 14% to 59%. This implies that the responding companies are focusing on those key enabling

criteria that are easy to understand, learn and use such as “Internal IP security, 59%”, “Creativity generation, concept selection and prototyping, 55%”, “External IP security, agreement and partners matching, 50%”, “IP application/registration, 50%” and “IP commercial development and marketing, 50%”. On the other hand, key enabling criteria such as “Research venture and IP holding business startup/spinout, 14%”, “IP licensing and acquisition, 21%”, “Internal IP audit and evaluation, 21%”, “Internal IP management function, knowledge and skill, 25%”, “IP defense and enforcement system, 26%” and “IP intelligence and advisory support, 36%” are neglected as these key enabling criteria get harder to understand, learn and use. Finally, it implies that there is a lot of room for the HK-GD based manufacturing industry to improve.

Regarding the third sub-objective, it was firstly measured by correlation analysis of the relationships between the extent of implementation of the twelve key enabling criteria and the IP management excellence. The result is positive. Then it was further measured by multiple regression analysis of the contributions of extent of the implementation of four IP management categories to the IP management excellence. The results show that management support category has a significant effect on the other three IP management enabling categories but does not have a direct effect on the overall IP management excellence. In turn, IP capitalization category and external relationship management category have a significant effect on the overall IP management excellence. Furthermore, path analysis was employed to examine the relationships among all the four enabling categories and two result categories simultaneously to determine if the IP management excellence model is supported in totality. The results show that direct effect of IP category on IP outcomes was empirically supported. In contrast, innovation development category, external

relationship management category and management support category have indirect effect on IP outcomes. The results also show that direct effect of external relationship management category on external relationship satisfaction is well supported. In contrast, innovation development category, IP capitalization category and management support category have indirect effect on external relationship satisfaction. Thus the analysis showed positive results in the hypothesis paths and achieved the sub-objectives.

A review of this research provides a number of valuable findings and implications about IP management. First of all, the results show that management support plays a significant role in shaping the IP management of organizations. The study establishes that IP management enabling categories and key enabling criteria are holistic in that synergies must be created among them to achieve favourable results. The study identifies management support as the category that acts as the foundation of these synergies. Management support category has indirect effects on the two IP management result categories, i.e. IP outcomes and external relationship satisfaction that are mediated through IP capitalization category and external relationship management category, respectively. Therefore, management support category has strong implications for an organization's IP management. The study also underscores the necessity of building organizational focus on management support category, which is measured by such enabling criteria as "Strategic Management Plan for IP Activities", "Internal IP Management Function, Knowledge and Skill" and "IP Defense and Enforcement System". The management support category has a very high direct effect on innovation development category, IP capitalization category and external relationship management category, highlighting the significance of the effective implementation of the enabling criteria under management support

category. These enabling criteria also have important implications for improvement of IP management excellence because of their positive correlations in relationships tested with IP management excellence. The findings of the current study provide important pointers to managers in terms of managing their organizations for IP management excellence.

A second finding is that managers need to take a multifaceted view of IP management and encourage organizations to broaden their view of IP management from a legal focus for product protection to an organizational focus for developing and sustaining competitive advantage. This research shows that the IP management enabling categories and the key enabling criteria provide a model that reflects the various aspects of management that determine an organization's IP management excellence. An organization that focuses on just its primary enabling criteria on IP capitalization category, such as "Internal IP Security", "IP Application/Registration", "Internal IP Audit and Evaluation" and "IP Licensing and Acquisition", is unlikely to be successful. A strong focus on management support category, in addition to effective implementation of innovation development category, IP capitalization category and external relationship management category are clearly shown to be essential for organizational success. In doing this, the criteria-based IP management excellence model emphasize the IP management enabling categories and the key enabling criteria as integral parts of a system that is essential to maintain and improve core IP management processes.

Thirdly, innovation development category is directly influenced by IP capitalization category; this implies that innovation category has a major effect on the decision for adopting the input of IP capitalization category. The enabling criteria under

innovation development category comprise “Creativity Generation, Concept Selection and Prototyping” and “IP Intelligence and Advisory Support”, which means that the organization needs to adopt and commercialize innovation to address needs in the external environment. In doing this, innovation category has a direct impact on external relationship management category. The results also suggested that innovation category has no significant, direct relationship between IP outcomes and external relationship satisfaction. A plausible reason for this is that innovation development category has an indirect impact on IP management result categories only when the organization adopted and commercialized innovation.

The fourth interesting discovery is that external relationship management category has significant relationship with external relationship satisfaction, but the relationship proved to be the least effective as indicated by the lowest total effect in hypothesis path *H3b1*. The enabling criteria under external relationship management category consist of “IP Commercial Development and Matching”, “External IP Security, Agreement and Partners Matching” and “Research Venture and IP Holding Business Startup/Spinout”. This means that many HK-GD based manufacturing organizations fail to recognize the importance of external influences on organizations’ management and operations. This may be because the market economy in China is primitive. The managers still weights heavily in internal operations, such as production plan and less considered outside factors. This discovery may be a surprise for the Hong Kong and Guangdong government when they make great effort to promote IP awareness in their policies.

A fifth noteworthy finding is that leaders do not have direct impact on IP management result categories. Their influence is felt through the systems and

practices they establish and manage. Leadership for IP requires top management to clearly articulate the core values, i.e. defensiveness, cost reduction, profit generation, integration and visionary approach (as discussed in sections 4.2.1 to 4.2.5). Embedded in the core values are the twelve key enabling criteria in IP management - systems and practices, which implies that the top management needs to set and communicate the key enabling criteria in IP management to all levels of related employees. These behaviors – specified in the criteria-based IP management model – are among the ways in which leaders affect the result categories in any organization. They, along with keeping an eye focused squarely on managing the management support category, innovation development category, IP capitalization category and external relationship management category, are the keys to improve effectiveness in IP outcomes as well as external relationship satisfaction. Unless leaders can influence the organization through its systems, they have little hope of affecting bottom-line results.

Sixthly, in the academic context, the current study adds to the body of literature on the key enabling criteria in IP management and their effect on IP management excellence. Using correlations cum path analysis as a strong methodology to test 22 hypotheses, it reveals that the proposed hypotheses are significant in the proposed criteria-based IP management model.

This study also suffered from several limitations common to survey research and to the use of path analysis. For instance, the data were obtained through mail survey and relied on the perceptions of the respondents. In addition, no causality had been established among the six sub-constructs of IP management enabling categories and result categories. One of the basic requirements of establishing causality is temporal

ordering (i.e. a cause must be shown to unambiguously precede an effect) (Bullock *et al.* 1994). Temporal ordering can only be established by conducting longitudinal studies. However, like most of the studies conducted in this area, this study also used cross-sectional data, which is not sufficient to establish temporal ordering.

Although several cross-country literature reviews were conducted in section 4.3, where the similarities and the differences in key enabling criteria in IP management - systems and practices across countries were analyzed, this is still an area of research in IP management that needs to be explored in more detail. This study assumes that the key enabling criteria mostly emerged as common across the compared countries because of the conviction of organizations in the investigated regions that all the IP management enabling criteria were universal as suggested by the prescriptive IP management literature. Thus this belief may have led them to adopt similar practices. In other words, certain enabling criteria may not be related to certain result dimensions in a specific country or industry or type of organization simply because they are not applicable within that context and thus are not significant predictors of IP management excellence. As a result, different patterns of relationships between IP management enabling categories and result categories in the compared countries or industries could be obtained. Therefore, these issues must be explored in more detail in future studies since it is crucial that an organization's resources and efforts be allocated to only those practices that will yield best performance for the organization, if at all. One possible way to test these differences could be through the use of multiple group analysis within a path analysis model, where the significance of paths could be tested using data from organizations in different industries and countries.

## 5.6 Concluding Remarks

The purpose of this chapter is to achieve objective two specified in Chapter 1, i.e., to investigate the general IP management practices of the HK-GD based manufacturing industry. The three sub-objectives are: to examine the current situation of IP management enabling categories and key enabling criteria in HK-GD based manufacturing industry, to investigate the general IP management practices (extent of implementation of IP management enabling categories and key enabling criteria) of the HK-GD based manufacturing industry, and lastly, to investigate the relationships between the general IP management practices and the IP management performance excellence of the HK-GD based manufacturing industry.

Objective two has been achieved. The results show that the four IP management enabling categories and twelve key enabling criteria are implemented by responding companies as general IP management practices. There are positive relationships between extents of the implementation of twelve key enabling criteria and the IP management excellence, and there are contributions on IP management result categories by implementing the four IP management enabling categories. Unfortunately, the extent of implementation as "largely and fully" of the four IP management enabling categories and twelve key enabling criteria ranged from 37% to 46% and 14% to 59%, respectively; it is therefore necessary for the HK-GD based manufacturing industry to improve its IP management excellence by implementing the four IP management enabling categories and twelve key enabling criteria.

Allocating resources in all key enabling criteria at once is not feasible due to a limit

of resources. In order to effectively and efficiently implement IP management to obtain immediate benefits and improvement, it is more practical to implement the most important factors which, in turn, provide immediate beneficial results to allow companies to further evaluate the feasibility of further implementation of other factors by allocating more resources. The purpose of the next Chapter is to achieve the third objective, i.e., to prioritize the relative importance of IP management categories and enabling criteria for the usage of the HK-GD based manufacturing industry.

# Chapter 6 The Relative Importance of Intellectual Property Management Enabling Categories and Key Enabling Criteria for the Hong Kong-Guangdong based Manufacturing Industry

Chapter 4 has identified the criteria-based IP management model which consists of four IP management enabling categories and twelve key enabling criteria, while Chapter 5 has examined the four IP management enabling categories and the twelve key enabling criteria and had investigated the general IP management practices of the HK-GD based manufacturing industry. The results indicate that the relationships of the extent of implementation of all key enabling criteria are positively related to the IP management excellence. Furthermore, the results show that the extent of implementation of four IP management categories, namely, “Management Support”, “Innovation Development”, “Intellectual Property Capitalization” and “External Relationship Management”, contribute to the IP management result categories. The aim of this Chapter is to achieve the objective three as described in section 1.2.2, page 18, of Chapter 1, by providing the relative importance of the four IP management enabling categories and twelve key enabling criteria for the HK-GD based manufacturing industry, so that they can allocate resources to the most important categories and criteria to improve their IP management excellence which, in turn, improve their competitiveness to obtain immediate beneficial results. The objective of this Chapter is to prioritize four IP management enabling categories and twelve key enabling criteria that have been identified in Chapter 4 and examined in Chapter 5.

## 6.1 Introduction

The results in Chapter 5 indicate that the four IP management enabling categories and twelve key enabling criteria are implemented by responding companies as general IP management practices, and there are positive relationships between the extents of implementation of twelve key enabling criteria and the IP management excellence; in addition, there are contributions on IP management result categories by implementing four IP management enabling categories. Thus the results provide good evidence for the HK-GD based manufacturing industry to improve their IP management excellence and also IP management result categories by implementing the twelve key enabling criteria and four IP management enabling categories.

Allocating resources in four IP management enabling categories and all key enabling criteria at once is not feasible due to the limit of resources and it requires detailed implementation planning and more time to achieve a positive improvement result. Due to keen competition, all IP management decisions and functions need to be completed very fast, which include making efforts to improve the performance dimensions as described in section 2.2.1, i.e. internal IP outcomes, external IP outcomes and IP comfort level with business partners. In order to effectively and efficiently implement IP management to obtain immediate benefits and positive results, it is more practical to implement the most important criteria which, in turn, provide positive results to allow organizations to further evaluate the feasibility for further implementation of other key enabling criteria by allocating more resources.

## 6.2 Development of Research Model by the Analytic Hierarchy Process (AHP) Approach

In order to achieve the objective, the AHP approach was employed to identify the priorities of the relative importance of the four IP management enabling categories and twelve key enabling criteria. This study was conducted in the context of HK-GD based manufacturing industry by interviewing the IP experts who were invited to study the key enabling criteria and IP management enabling categories, as described in sections 4.3 and 4.4, respectively. By obtaining their expertise opinion, software of "Expert Choice" was employed to prioritize the relative importance of the IP management enabling categories and key enabling criteria for HK-GD based manufacturing organizations. With reference to the AHP modeling process by Chin *et al.* (2002a) and Tam and Tummala (2001), three phase processes are proposed: Phase 1 - structuring IP management AHP hierarchy; Phase 2 - measurement and data collection; and Phase 3 - determination of normalized weights.

### 6.2.1 Phase 1 – Structuring IP Management AHP Hierarchy

The AHP hierarchy model is structured based on the criteria-based IP management model that has been identified through the literature review as described in Chapter 4 and examined in Chapter 5. The AHP hierarchy model is shown in Figure 6.1. The goal of the model is to implement IP management which is placed on level 1 of the hierarchy. Level 2 of the hierarchy is the enabling categories that contribute to the IP management result categories, that is, the four IP management enabling categories which are described in section 4.4. Then the level 3 of the hierarchy is the key

enabling criteria that are grouped with respect to the four IP management enabling categories in level 2. The twelve key enabling criteria which are described in section 4.3 have positive relationship with IP management excellence. All four IP management enabling categories and twelve key enabling criteria have been identified and examined in Chapter 4 and 5, respectively.

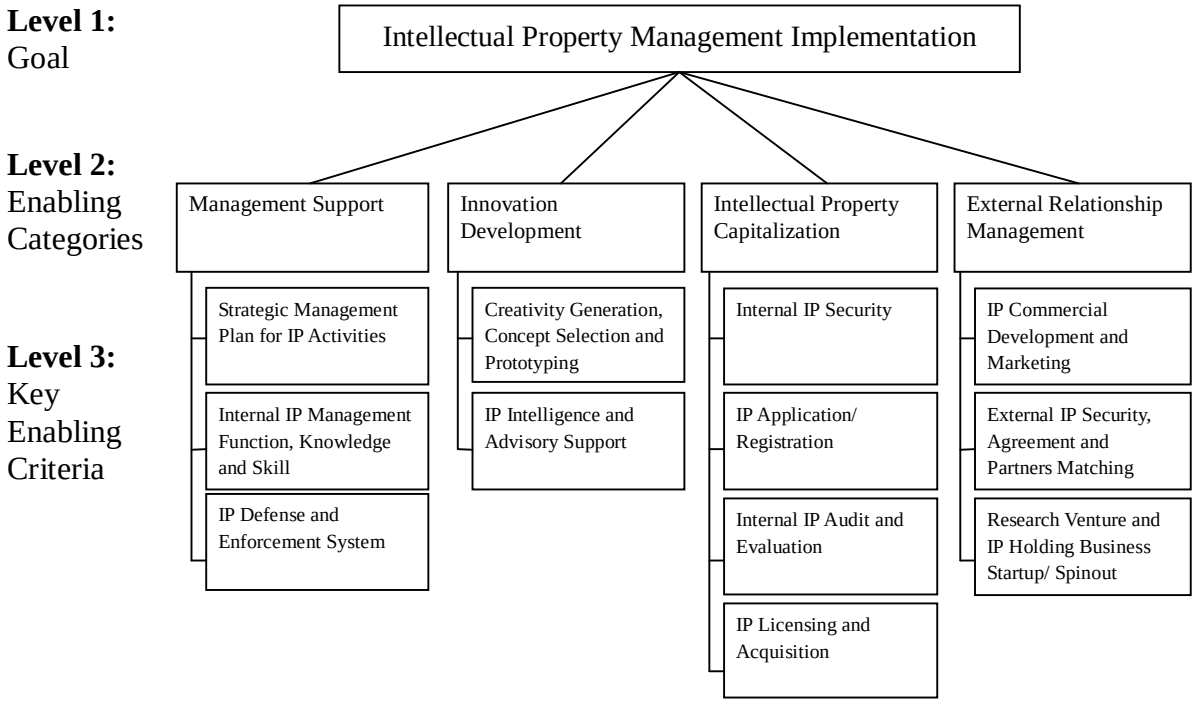



Figure 6.1 A hierarchical model of intellectual property management implementation

### 6.2.2 Phase 2 – Measurement and Data Collection

Measurement items for expert interviews (as shown in Appendix C) have been developed from the criteria-based IP management model (described in Chapter 4) that has been identified through the literature review and examined through the questionnaire survey (described in Chapter 5). So it was not necessary to provide for further validation and pre-test in this study.

AHP is a methodology of employing experts to assign pairwise comparison judgments to categories and criteria so that it is a subjective methodology; a large number of expert evaluators is not necessary (Cheng and Li 2001). It is also noted that a lot of researchers have invited a small number of expert evaluators for their research studies, such as 10 by Muralidharan and Anantharaman (2001); 13 by Chin *et al.* (2002a); 5 by Tam and Tummala (2001); 14 by Lam and Chin (2005); 4 by Cheng and Li (2001). In this study, six IP practitioners who have relevant experience in handling all regional, national and international IP matters were invited as evaluators to assign pairwise comparison judgments to determine the relative weights with respect to IP management enabling categories and key enabling criteria, as shown in the AHP model of Figure 6.1.

### 6.2.3 Phase 3 – Determination of Normalized Weights

By using the "Expert Choice" software, the pairwise comparison judgment matrices are translated into the corresponding largest eigenvalue problem and are solved to determine the normalized and unique priority weights for each IP management enabling categories and key enabling criteria in the AHP model as shown in Figure 6.1. The priority weights are divided into local weight, which is the priority weights with respect to the preceding hierarchy, and global weight, which is the priority weights with respect to the highest hierarchy level – the goal.

As suggested by Saaty and Vargas (1994), the inconsistency judgments by evaluators was allowed but should be measured and limited to 10% or less in order to ensure the consistency of judgments. The Consistency Ratio (CR) value is used to evaluate the

consistency, and the CR value of 0.1 or below is acceptable. Data from each of the six evaluators were measured for consistency. As no data with CR value higher than 0.1 were discovered, all the six sets of data were consistent and retained for analysis.

All of the six IP experts who are registered as qualified IP professionals for practices in Hong Kong, PRC, United States, Canada, United Kingdom and Australia always handle regional, national or international IP matters for manufacturing organizations in Hong Kong and Guangdong. They had been involved in IP management activities of HK-GD based manufacturing industry, particularly working in the role of the consultant with organizations. Their occupations varied from lawyers, patent agents to IP attorneys, with relevant experiences ranging from 10 to 25 years. They had sufficient knowledge and understanding of the general IP management practices in the HK-GD based manufacturing industry. This implies that this group of evaluators well represented the experts' viewpoints and opinions of the HK-GD based manufacturing industry and were thus able to evaluate the categories and criteria based on substantial relevant IP management experiences and to assign the relative importance of the categories and criteria in the AHP model as shown in Figure 6.1. Details of the evaluators' profile are listed in Table 6.1a and b.

| Expert no. | Occupation | Area of Expertise | Year of experience |
|---|---|---|---|
| 1 | Hong Kong Solicitor | ***Expert 1*** is a Solicitor of the High Court of Hong Kong. He is specialized in prosecution, licensing and protection strategies in relation to patents, designs, trade marks and copyrights in Hong Kong, the Mainland China and worldwide. He was speakers for many seminars and training courses for IP rights and was invited as an auditor for Innovation-Knowledge Enterprise Assessment & Award which was jointly organized by the HKPC and GDIPO in 2006. | 10 |
| 2 | PRC Patent Agent | ***Expert 2*** is a partner of a law firm in Guangdong. He is also a registered PRC patent and trademark attorney with wide experiences in legal services and outstanding achievement in civil law and IP law practices. He is specialized in trademark, patent, copyright, know-how, trade secret, intangible assets protection, etc. and has handled many cases in IP. He is a council member of IP committee of Guangzhou lawyer association and visiting lecturer of Guangzhou Intellectual Property Office. | 10 |
| 3 | United States IP Attorney | ***Expert 3*** is a registered U.S. patent attorney and U.S. lawyer at a law firm. He was a mechanical engineer and a computer software engineer in China and the United States. His practice areas are patent preparation and prosecution, providing legal opinions on patent validity and infringement matters, IP licensing, IP consultation in relation to R & D, designing around valid patents, IP asset evaluation and management, and IP dispute resolution. | 14 |

Table 6.1a Profile of evaluators

| Expert no. | Occupation | Area of Expertise | Year of experience |
|---|---|---|---|
| 4 | Canadian Patent Agent | ***Expert 4*** is a registered Trademark and Patent Agent at a law firm. His areas of practice include assessment and prosecution of patents, trademarks, industrial designs and trade secrets for the domestic and international clients. He frequently advises his clients in negotiating, preparing and managing licensing, technology transfer, and confidentiality agreements. As his clients' representative, he took part in two Team Canada visits to Asia. He has given workshops and authored papers in the areas of IP Laws in China; Joint Ventures and Technology Transfer in China; Enforcing IP Rights in the South East Asian Countries; U.S. Patent Law Amendments; Canadian Patents/Trademarks/Copyright practices; and other court case commentaries. | 25 |
| 5 | United Kingdom IP Attorney | ***Expert 5*** is a UK Registered Patent Attorney and is a partner of an IP firm. He holds a degree in Electrical & Electronic Engineering. He has acquired experiences in patents in many technical fields, including electronics, telecommunications, computer hardware and software, internet-related inventions, household appliance, toys, automotive systems, combustion engines and basic chemistry. He is a member of the Hong Kong Institute of Trade Mark Practitioners, the Asian Patent Attorneys Association, and the Hong Kong Intellectual Property Society. | 20 |
| 6 | Australian IP Attorney | ***Expert 6*** is a registered Australian and New Zealand patent attorney specializing in patent drafting and prosecution; providing patentability advice, infringement and validity opinion; and patent litigation and revocation proceedings. He has also worked as a patent examiner at the Australian Patent Office and an IP consultant at the Hong Kong Productivity Council. He holds a Bachelor degree in Electrical Engineering and four Master degrees in Engineering, Business, Telecommunications, and IP Laws. He was a chartered engineer (CEng) in the UK and Australia working in the areas of R&D, production and project management in the fields of electronic and telecommunications, as well as a part-time university lecturer. | 20 |

Table 6.1b Profile of evaluators

## 6.3 Results and Analysis

Table 6.2 indicates the relative weights of the four IP management enabling categories and twelve key enabling criteria that are normalized based on the AHP analysis that has been conducted by six evaluators. The rankings in both local and global weights are shown. In level 2 of the hierarchy, that is with respect to the goal of the study, “Intellectual Property Management Implementation”, evaluators consider “Intellectual Property Capitalization” as the most important enabling category, that is followed by ”Management Support”, “Innovation Development” and “External Relationship Management” (IP=0.278, MS=0.276, ID=0.268, ER=0.178). As the four enabling categories are the second level of the goal, so the local and global weights are the same. Regarding the twelve key enabling criteria, the results are reported separately below to depict their local and global weights.

| Hierarchy level | IP management enabling categories and key enabling criteria | | Local weights | | Global weights | |
|---|---|---|---|---|---|---|
| | | | weights | Ranking | weights | Ranking |
| Level 2 | With respect to IP management implementation | | | | | |
| | MS | Management Support | 0.276 | 2 | 0.276 | 2 |
| | ID | Innovation development | 0.268 | 3 | 0.268 | 3 |
| | IP | Intellectual property Capitalization | 0.278 | 1 | 0.278 | 1 |
| | ER | External relationship Management | 0.178 | 4 | 0.178 | 4 |
| Level 3 | With respect to management support | | | | | |
| | MS1 | Strategic Management Plan for IP Activities | 0.341 | 2 | 0.097 | 5 |
| | MS2 | Internal IP Management Function, Knowledge and Skill | 0.399 | 1 | 0.109 | 3 |
| | MS3 | IP Defense and Enforcement System | 0.260 | 3 | 0.069 | 8 |
| | With respect to innovation development | | | | | |
| | ID1 | Creativity Generation, Concept Selection and Prototyping | 0.598 | 1 | 0.162 | 1 |
| | ID2 | IP Intelligence and Advisory Support | 0.402 | 2 | 0.106 | 4 |
| | With respect to intellectual property capitalization | | | | | |
| | IP1 | Internal IP Security | 0.262 | 2 | 0.072 | 7 |
| | IP2 | IP Application/ Registration | 0.388 | 1 | 0.111 | 2 |
| | IP3 | Internal IP Audit and Evaluation | 0.173 | 4 | 0.047 | 11 |
| | IP4 | IP Licensing and Acquisition | 0.177 | 3 | 0.049 | 10 |
| | With respect to external relationship management | | | | | |
| | ER1 | IP Commercial Development and Marketing | 0.479 | 1 | 0.085 | 6 |
| | ER2 | External IP Security, Agreement and Partners Matching | 0.319 | 2 | 0.057 | 9 |
| | ER3 | Research Venture and IP Holding Business Startup/ Spinout | 0.202 | 3 | 0.036 | 12 |

Table 6.2 The local and global weights of the four IP management enabling categories and twelve key enabling criteria

### 6.3.1 Local Weights of the Twelve Key Enabling Criteria

Regarding the key enabling criteria with respect to “Management Support” (level 3 of the hierarchy as shown in Figure 6.1), evaluators consider “Internal IP Management Function, Knowledge and Skill” as the most important enabling criteria, and “Strategic Management Plan for IP Activities”, as the next most important enabling criteria. This is followed by “IP Defense and Enforcement System” (MS2=0.399, MS1=0.341, MS3=0.260).

With respect to “Innovation Development”, all two key enabling criteria show priorities of “Creativity Generation, Concept Selection and Prototyping” and “IP Intelligence and Advisory Support” (ID1=0.598, ID2=0.402).

With respect to “Intellectual Property Capitalization”, all four enabling criteria show priorities of “IP Application/ Registration”, “Internal IP Security”, “IP Licensing and Acquisition” and “Internal IP Audit and Evaluation” (IP2=0.388, IP1=0.262, IP4=0.177, IP3=0.173).

The last group of key enabling criteria with respect to “External Relationship Management” has the priorities of “IP Commercial Development and Marketing”, “External IP Security, Agreement and Partners Matching” and “Research Venture and IP Holding Business Startup/ Spinout” (ER1=0.479, ER2=0,319, ER3=0.202).

### 6.3.2 Global Weights of the Twelve Key Enabling Criteria

The global weights results indicate that “Creativity Generation, Concept Selection and

Prototyping" (ID1=0.162) is the most important factor among the twelve key enabling criteria. This is followed by "IP Application/ Registration" (IP2=0.111) and "Internal IP Management Function, Knowledge and Skill" (MS2=0.109). These three key enabling criteria are the most important success factors and their weights are close. The 4$^{th}$ prioritized factor is "IP Intelligence and Advisory Support" (ID2=0.106) and this is followed by "Strategic Management Plan for IP Activities" (MS1=0.097), "IP Commercial Development and Marketing" (ER1=0.085) and "Internal IP Security" (IP1=0.072). The last five key enabling criteria, "IP Defense and Enforcement System" (MS3=0.069), "External IP Security, Agreement and Partners Matching" (ER2=0.057), "IP Licensing and Acquisition" (IP4=0.049), "Internal IP Audit and Evaluation" (IP3=0.047) and "Research Venture and IP Holding Business Startup/ Spinout" (ER3=0.036), are the lowest but this does not imply that they are not important, as they are still important.

## 6.4 Discussion

The objective of this Chapter is to prioritize the relative importance of the four IP management enabling categories and twelve key enabling criteria in the HK-GD based manufacturing industry that have been identified and examined as described in Chapter 4 and 5, respectively. The results of Chapter 5 indicate that the extents of implementation of the twelve key enabling criteria are positively related to the IP management excellence and the implementation of four IP management enabling categories contribute to the IP management result categories which are measured in terms of IP outcomes and external relationship satisfaction in the study. This provides evidence that implementation of the four IP management enabling categories and twelve key enabling criteria can improve the IP management result categories and also

IP management excellence of the HK-GD based manufacturing industry. In addition, as shown in section 2.2.3, Pike (2001) finds three development stages of organization structures, in which the evolutionary pathway moves through “classic creative”, “IP company” and “virtual monopoly”. This indicates that the evolutionary process of organization structures reflects the changing focuses on the IP management enabling categories and key enabling criteria for each development stage. By implementing their relative importance in priority, HK-GD based manufacturing organizations can allocate resources and efforts in these IP management enabling categories and key enabling criteria for implementation based on their current situation in order to improve their IP management result categories and also IP management excellence.

### 6.4.1 Examine the Local Priority Rankings of the Twelve Key Enabling Criteria

A review of the local priority rankings in Table 6.2 provides a number of valuable findings and implications about IP management. Firstly, with respect to “Management Support” category, the preference of evaluators is “Internal IP Management Function, Knowledge and Skill”. This implies that top management recognizes people are unique competitive advantage for an organization. Their knowledge, skill and leadership are the key to organizational success. The organization can capitalize on people by developing and deploying the full potential of the workforce in the area of IP and assigning the right people in IP management functions. The second priority ranking is “Strategic Management Plan for IP Activities” which implies that the organization needs to look at the basic tasks of prioritizing the activities in IP action plan and allocating appropriate resources in supporting the IP portfolios. “IP Defense and Enforcement System” is the lowest ranking which may indicate that the evaluators emphasize immediate and short term return or benefits and ignored the

importance of managing the impacts of an IP lawsuit on business.

Secondly, with respect to “Innovation Development” category, evaluators rank “Creativity Generation, Concept Selection and Prototyping” to be the first priority. This suggests that the organization is required to generate new ideas, create new products and develop new technology in order to create the next generation IP and stay ahead of the competition. “IP Intelligence and Advisory Support” is the second ranking and this implies that it is beneficial to the organization to allocate resources for subscribing IP information tools, seeking advice from professional IP consultant and supporting its IP portfolios in order to enhance development and commercialization function.

Thirdly, with respect to “Intellectual Property Capitalization” category, evaluators prefer “IP Application/ Registration”. It is important that the organization applies for patent, registered design and trademark to prevent others from infringing the protected innovation. The second rank is “Internal IP Security” which shows that management relies on a systematic approach to manage the IP, recover unrealized potential technological innovation developed by employees and avoid the loss of knowledge due to staff turnover. “Internal IP Audit and Evaluation” and “IP Licensing and Acquisition” are the two lowest ranking which may indicate that the evaluators emphasize immediate and short term return or benefits and ignored the importance of identifying value of IP and pursuing ways to convert IP assets to cash flow.

Fourthly, with respect to “External Relationship Management” category, evaluators prefer “IP Commercial Development and Marketing”, implying that the organization is required to make every effort to accomplish the product commercialization that

might create IP advantage. Also by differentiating products or service with IP, the organization is required to spend money, time and effort to position its brand in market and achieve business growth. The second ranking is "External IP Security, Agreement and Partners Matching" which shows that management relies on collaborating with business partners to implement a new project based on some form of IP rights. "Research Venture and IP Holding Business Startup/ Spinout" is the lowest ranking which may indicate that the evaluators emphasized immediate and short term return or benefits and ignored the importance of establishing a cooperative R&D relationship with research institutes.

### 6.4.2 The Difference in Global Priority Rankings and the Implementation Rate as "Largely and Fully"

An interesting discovery is found from reviewing the global weights of the twelve key enabling criteria in this Chapter and the questionnaire survey results in Chapter 5. As shown in Table 6.3, it is clear that two of the four highest ranking enabling criteria have a low implementation rate of "largely and fully" by respondents in the survey conducted in Chapter 5. Only the 1st rank, "Creativity Generation, Concept Selection and Prototyping" and the 2nd rank "IP Application/ Registration" have an implementation rate of 55% and 50%, respectively, and that can be considered to be high extent of implementation. The 3rd rank, "Internal IP Management Function, Knowledge and Skill" and the 4th rank, "IP Intelligence and Advisory Support" have implementation rate of 25% and 36%, respectively, and that are low extent of implementation. On the other hand, the rates of responding companies that "largely and fully" implemented "Internal IP Security" and "External IP Security, Agreement and Partners Matching" are 59% and 50%, respectively, while their AHP priority

rankings in this study are 7th and 9th respectively.

| Key enabling criteria | | Priority rankings by AHP in study of Stage 3 | Rating of extent of implementation as implemented to a large and full extent in study of Stage 2 |
|---|---|---|---|
| ID1 | Creativity Generation, Concept Selection and Prototyping | 1 | 55% |
| IP2 | IP Application/ Registration | 2 | 50% |
| MS2 | Internal IP Management Function, Knowledge and Skill | 3 | 25% |
| ID2 | IP Intelligence and Advisory Support | 4 | 36% |
| MS1 | Strategic Management Plan for IP Activities | 5 | 45% |
| ER1 | IP Commercial Development and Marketing | 6 | 50% |
| IP1 | Internal IP Security | 7 | 59% |
| MS3 | IP Defense and Enforcement System | 8 | 26% |
| ER2 | External IP Security, Agreement and Partners Matching | 9 | 50% |
| IP4 | IP Licensing and Acquisition | 10 | 21% |
| IP3 | Internal IP Audit and Evaluation | 11 | 21% |
| ER3 | Research Venture and IP Holding Business Startup/ Spinout | 12 | 14% |

Table 6.3 Comparison of studies result in Stage 2 and Stage 3

By reviewing Table 6.3, “Internal IP Management Function, Knowledge and Skill” is the key enabling criterion that has a high ranking in the AHP study but has low extent of implementation in questionnaire survey. Section 5.4.3.2 has provided a detailed analysis of frequency statistics of the measurement items in the survey and discussed the current situation. The result indicates that most HK-GD based manufacturing

organizations are weak in fostering a culture of IP management and innovation and have inactive role of IP staff or department within the organization.

Regarding the key enabling criterion of “IP Intelligence and Advisory Support”, it has a high ranking in AHP study but has low extent of implementation in questionnaire survey. Section 5.4.3.3 has provided a detailed analysis of frequency statistics of the measurement items in the survey and discussed the current situation. The result indicates that most HK-GD based manufacturing organizations are still stick to the traditional ways in handling information. When doing so, they will ignore the large variety of tools and databases offer in the market, which is indispensable to IP management and require resources allocation by the organization for making improvement, thus reduce the interest of organizations to implement.

Although the key enabling criteria of “IP Commercial Development and Marketing”, “Internal IP Security” and “External IP Security, Agreement and Partners Matching” have high extent of implementation, they have positions after the fifth priority ranking in AHP study. The result indicates that the IP experts suggest focusing on the other enabling criteria in advance would be better for utilizing the limited resources.

Bases on these findings, it is noteworthy that most HK-GD based manufacturing organizations are not focused on the most important enabling criteria as identified by the evaluators. Thus, it is recommended that the HK-GD based manufacturing industry should evaluate their own situation and reallocate their resources to implement the most important enabling criteria as suggested by the IP experts of the study of this Chapter which could help them improve the IP management result categories and IP management excellence.

### 6.4.3 Steps to Implement IP Management

In order to recommend the HK-GD based manufacturing industry to implement IP management, this Chapter empirically identifies the priorities rankings of the four IP management enabling categories and the twelve key enabling criteria for the HK-GD based manufacturing industry. By implementing their relative importance in priority, HK-GD based manufacturing organizations can allocate resources and efforts in these IP management enabling categories and key enabling criteria for implementation based on their current situation to improve their IP management excellence which, in turn, enhance the effectiveness of their IP outcomes and external relationship satisfaction for the IP management result categories. Detail discussion and recommendations for HK-GD based manufacturing industry are given below and in Table 6.4:

The approach to achieve successful IP management implementation should be seen as an evolutionary process with three steps. The first step focuses on three enabling criteria of the 1$^{st}$ to 3$^{rd}$ priority rankings in this AHP study. The organization is required to generate new ideas, create new products and develop new technology in order to create the next generation IP and stay ahead of the competition. Moreover, the organization is required to consistently apply for patent, registered design and trademark to prevent others from infringing the protected innovation. From time to time, the organization is required to provide training to relevant staff on IP management and appoint dedicated staff for managing IP. All these are easy ways to start improve the internal IP capitalization outcomes. This implies that the management relies on these enabling criteria to produce immediate and short term return or benefits.

| | Evolutionary Process of IP Management Implementation | | |
|---|---|---|---|
| | **STEP ONE** | **STEP TWO** | **STEP THREE** |
| **Enabling Categories:** | **(Priority Rankings 1-3)** | **(Priority Rankings 4-7)** | **(Priority Rankings 8-12)** |
| **Intellectual Property Capitalization** | - IP Application/ Registration | - Internal IP Security | - Internal IP Audit and Evaluation<br>- IP Licensing and Acquisition |
| **Management Support** | - Internal IP Management Function, Knowledge and Skill | - Strategic Management Plan for IP Activities | - IP Defense and Enforcement System |
| **Innovation Development** | - Creativity Generation, Concept Selection and Prototyping | - IP Intelligence and Advisory Support | |
| **External Relationship Management** | | - IP Commercial Development and Marketing | - External IP Security, Agreement and Partners Matching<br>- Research Venture and IP Holding Business Startup/ Spinout |
| **Result Categories:** | **(Short-term Benefits)** | **(Medium-term Benefits)** | **(Long-term Benefits)** |
| **IP Outcomes** | - Internal IP Capitalization Outcomes | | |
| | | - External IP Capitalization Outcomes | |
| **External Relationship Satisfaction** | | - IP Comfort Level with Business Partners | |

Table 6.4 The three steps in evolutionary process of IP management implementation

The second step focuses on four enabling criteria of the 4$^{th}$ to 7$^{th}$ priority rankings. It

is important that the organization allocates resources for subscribing IP information tools, seeking advice from professional IP consultant and supporting its IP portfolios in order to enhance development and commercialization function. It is essential that top management sets and communicates clear IP management objectives and performance expectations to all levels of related employees; in addition, by linking IP strategy to corporation strategy, thus help organization to better manage the present and future impacts of IP. The organization is required to make every effort to accomplish the product commercialization that might create IP advantage. Also by differentiating products or service with IP, the organization spends money, time and effort to position its brand in market and achieve business growth. It also requires the organization to develop a systematic approach to manage the IP, recover unrealized potential technological innovation developed by employees and avoid the loss of knowledge due to staff turnover. All these tasks get harder and help the organization improve internal IP capitalization outcomes, external IP capitalization outcomes and IP comfort level with business partners. This indicates that the management relies on these enabling criteria to produce results and benefits that can only be found after a medium range of implementation period.

The third step focuses on five enabling criteria of the $8^{th}$ to $12^{th}$ priority rankings. The organization is required to deal with issues of infringement that can occur in the marketing stage of a leading product or technology. A litigation process is costly and a business leader should not overlook the risk of a lawsuit on business. In addition, the organization should have a robust relationship management practices in place that allows them to oversee collaborative projects with IP right ownership. It is essential for the organization to clarify the ownership of IP rights in agreements with involved parties. Moreover, the organization is required to focus on innovation-driven

development in a timely fashion in order to identify value of IP and pursue ways to convert IP assets to cash flow. By establishing a cooperative R&D relationship with research institutes, the organization is able to attract new capital and, more importantly, grow by way of increasing investor confidence. All these tasks are difficult; but they help the organization to continuously improve internal IP capitalization outcomes, external IP capitalization outcomes and IP comfort level with business partners. This implies that the management performs these enabling criteria to achieve results and benefits that can only found after a long implementation period.

## 6.5 Concluding Remarks

IP management, as described in sections 4.3 and 4.4, is an integration of good systems and practices in organization. It is not feasible for organizations to allocate equal effort or resources into each individual system or practice due to the limit of human and monetary resources. The findings of this study are very important and provide implications for the HK-GD based manufacturing industry. First of all, the priority rankings of the four IP management categories and twelve key enabling criteria are examined by IP experts, they are the group of IP practitioners who take the role of the consultants with the HK-GD based manufacturing organizations, that is, those who can present experts' view on the study issues; moreover, the successful implementation of IP management in the HK-GD based manufacturing industry is dependent on the IP advice given by this international network of professional group. The results allow HK-GD based manufacturing organizations to implement the most important key enabling criteria according to the priority in the initial stage of IP management implementation. After the implementation of the most important key enabling criteria for a certain period of time, organizations can review and evaluate

the results of the implementation in order to consider if it is feasible to further apply the rest of key IP management enabling criteria. Second, by comparing the questionnaire survey results that have been conducted in Chapter 5 and the AHP results of this chapter, most of HK-GD based manufacturing organizations are not implementing some of the most important enabling criteria identified by this study (see section 6.4.2). Based on the expertise opinions of evaluators, HK-GD based manufacturing organizations should focus and reallocate their efforts and resources to implement the most important key enabling criteria which could improve the IP management excellence.

Based on these findings, it is noteworthy that the study on IP management excellence model in section 5.5 establishes that IP management enabling categories and key enabling criteria are holistic in that synergies must be created among them to achieve favourable results. The study indentifies “Management Support” as the category that acts as the foundation of these synergies. Thus, implementation of IP management requires the whole organization to get involve; it is not only the responsibility of management, but requires the involvement of all employees in the organization. Management’s role is to establish an environment to facilitate the processes; eventually, the involvement of employees is the crucial element for success. In general, employees work under the guidelines and directions from management; a good plan or system can allow the employees to improve the IP management excellence and also the IP management result categories. As a matter of fact, implementation of a new system requires a lot of changes; in general, people are reluctant and fear change. In order to effectively implement IP management, organizations can focus on the most important key enabling criteria and then address other key enabling criteria at a later stage which can smooth and relieve the resistance

of people's fear of change. Moreover, it can also resolve the problem of limitation of resources.

Furthermore, identification and prioritizing of the IP management enabling categories and key enabling criteria are the first steps to providing the HK-GD based manufacturing industry with a guide to improve IP management in a step by step approach. By taking the empirical results in the studies of Chapter 5 and this Chapter as a foundation, the next Chapter is to develop an audit system in IP management for the HK-GD based manufacturing industry to systematically assess their current IP management. It can identify the weaknesses of organizations in IP management; thus, the organizations can improve IP management based on the assessment results.

# Chapter 7 Intellectual Property Management Excellence Audit Model for the Hong Kong-Guangdong based Manufacturing Industry

The last three Chapters have identified the criteria-based IP management model through the literature review, and have examined the criteria-based IP management model and four IP management enabling categories with twelve key enabling criteria through the questionnaire survey conducted in the HK-GD based manufacturing industry. The results in Chapter 5 indicate that the implementation of the four IP management enabling categories contributes to the IP management result categories; moreover, the implementation of the twelve key enabling criteria is positively related to the IP management excellence. By employing the results from the literature review and questionnaire survey as described in Chapter 4 and 5, respectively, an Analytic Hierarchy Process (AHP) hierarchy model in IP management was developed and expert interviews were conducted in the HK-GD based manufacturing industry and thus the priority rankings of relative importance of the four IP management enabling categories and twelve key enabling criteria by the AHP approach were identified in Chapter 6. The aim of this Chapter is to achieve objective four, as described in section 1.2.2, page 18, of Chapter 1, by employing the findings and results from the last three Chapters to develop and implement an IP management excellence audit model for the HK-GD based manufacturing industry to assess organizations in order to clearly understand their IP management strengths and weaknesses and provide a guideline for making improvement. This Chapter also aims to investigate the effectiveness of the audit system through conducting the case studies in the HK-GD based manufacturing industry.

## 7.1 Introduction

According to the statistics of GDIPO (2009) as shown in Figure 1.2, there was indication that the manufacturing industry in Guangdong province will tend to have larger number of IP-related infringement litigations in the future; but the economic conditions as shown in Figure 1.3 show that the industry in the Guangdong province still had the competitiveness; and by comparing the patenting activities of organizations in the past and present as shown in Figure 1.4, it is suggested that the HK-GD based manufacturing organizations should be encouraged to strengthen their IP management, which is the dominant factor in organizations' national and global success. Since emphasis on the cost and functionality of a product is not the only factor that enables manufacturing industry in Guangdong province to complete in the global market, HK-GD based manufacturing organizations should properly and effectively use IP system for achieving the full potential and the competitiveness position of their businesses.

The criteria-based IP management model as described in Chapters 4 and 5 addresses a number of the aforementioned challenges. Although prioritization of the relative importance of the four IP management categories and twelve key enabling criteria have been conducted (described in Chapter 6) and the results can provide industrial practitioners with immediate beneficial results for improvement in IP management, it is necessary to systematically assess the organization's activities to investigate the IP management strengths and weaknesses for making improvement. Audit has been accepted as a comprehensive, systematic, and regular review of an organization's activities, and results are referenced against a specific model. The benefits an organization gains from carrying out an audit include measuring performance,

highlighting areas that require immediate action, and involving people at the strategic, tactical, and operational levels in developing a process improvement approach to IP management. Thus, there are three research works in this Chapter:

1. The first research work involves developing an "Intellectual Property Management Excellence Audit Model" (details to be discussed in section 7.2) with assessment hierarchy consisting of categories, criteria and performance dimensions for the HK-GD based manufacturing industry and determine the relative weights of these elements of hierarchy.

2. The second research work involves developing a rapid audit system (details to be discussed in section 7.3) which provides general IP management "Health Check" for HK-GD based manufacturing organizations. In this research, the six IP management enabling and result categories are directly assessed based on the attributes of "Approach", Deployment" and "Result".

    2.1 By implementing the rapid audit system and self-assessment processes in three case studies, investigate the IP management excellence of the HK-GD based manufacturing organizations.

    2.2 Evaluate the effectiveness of the rapid audit system by comparing the extent to which the self-assessment rankings from the three case studies parallel the third-party evaluation results by a local Award.

3. The third research work involves developing a comprehensive audit system (details to be discussed in section 7.4) for HK-GD based manufacturing

organizations. In this research, the twelve enabling criteria are directly assessed based on 37 indicators.

3.1 By implementing the comprehensive audit system and external audit processes in a case study, investigate the strengths and areas for improvement in each enabling criterion in IP management.

3.2 Evaluate the effectiveness of the comprehensive audit system by predicting different improvement scenario results without undergoing real implementation and changes. In this way, the decision model can be used as a strategic planning tool.

## 7.2 Development of IP Management Excellence Audit Model

According to the research work one, this section uses the results obtained from the study in the last three chapters to develop an evaluation framework in IP management named as “Intellectual Property Management Excellence Audit Model” for the HK-GD based manufacturing industry. It is important that organizations evaluate, using an appropriate performance measurement system, on a regular basis to monitor: what activities are doing well?; which has potential for greater achievement?; what needs to be improved?; and what goes below standard? In Europe and the USA, the European Foundation for Quality Management (EFQM, 2007) and Malcolm Baldrige National Quality Award (MBNQA) (United States Department of Commerce, 2007) respectively provide this type of evaluation framework consisting of “Enablers” and “Results”. The proposed IP management excellence audit model is also designed with two parts; one is to audit the “Systems and Practices” and the other is to audit the

"Results". The part of "Systems and Practices", called "Enablers", helps to examine the IP system and deployment issues in the organization while the "Results" part is directly related to the actual outcome of IP management. The elements of the IP management excellence audit model, presented in Figures 7.1 and 7.2, are elaborated below.

### 7.2.1 Hierarchy of IP "Enablers"

Enablers are defined as the critical managerial and operational elements of good IP management systems and practices. Figure 7.1 shows the development of the "Enablers" part of the proposed IP management excellence audit model which describes the hierarchical relationships between attributes from the top level through intermediate levels to the lowest level in IP management. In this model, "IP Management Implementation - Systems and Practices" is the top level attribute of the evaluation framework. According to the audit model, the "IP Management Implementation - Systems and Practices" is assessed based on the evaluation of four IP management enabling categories "Management Support", "Innovation Development", "Intellectual Property Capitalization" and "External Relationship Management" which have been examined by the questionnaire survey (described in Chapter 5). These IP management enabling categories are considered to be level 2 attributes. Each of the IP management enabling categories consists of several key enabling criteria and there are totally twelve enabling criteria, which are considered to be level 3 attributes. The extents of implementation of these twelve enabling criteria have been examined by the questionnaire survey conducted in the HK-GD based manufacturing industry to be positively related to the IP management excellence as described in Chapter 5.

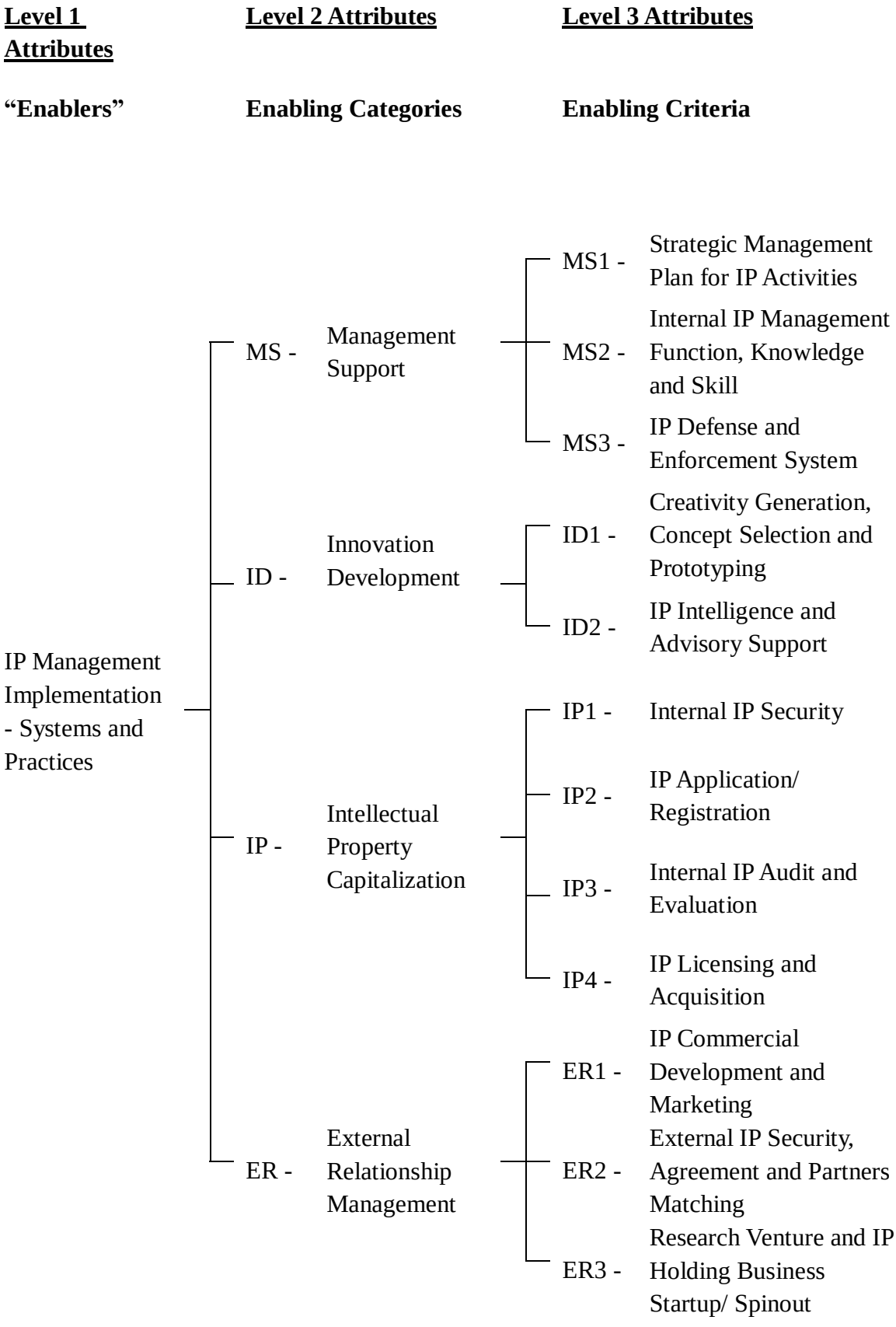



Figure 7.1 IP Management Excellence Audit Model for Enablers

### 7.2.2 Hierarchy of IP "Results"

Figure 7.2 shows the development of "Results" part of the proposed IP management excellence audit model which describes the hierarchical relationship between attributes from the top level attributes of IP management results to the lower level. According to the audit model, the IP management results are assessed based on two IP management result categories "IP Outcomes" and "External Relationship Satisfaction" which have been examined by the questionnaire survey (described in Chapter 5). These two result categories are considered to be level 2 attributes. Under these two result categories, there are lower-level attributes, called "performance dimensions", which detail the relevant result categories and are considered as level 3 attributes. The "IP Outcomes" has two performance dimensions, namely, Internal IP Capitalization Outcomes (IPO1) and External IP Capitalization Outcomes (IPO2), while the "External Relationship Satisfaction" has one performance dimension of IP Comfort Level with Business Partners (ERS1). There are total three performance dimensions which have been identified through the literature review in Chapter 2 and have been examined through the questionnaire survey as described in Chapter 5.

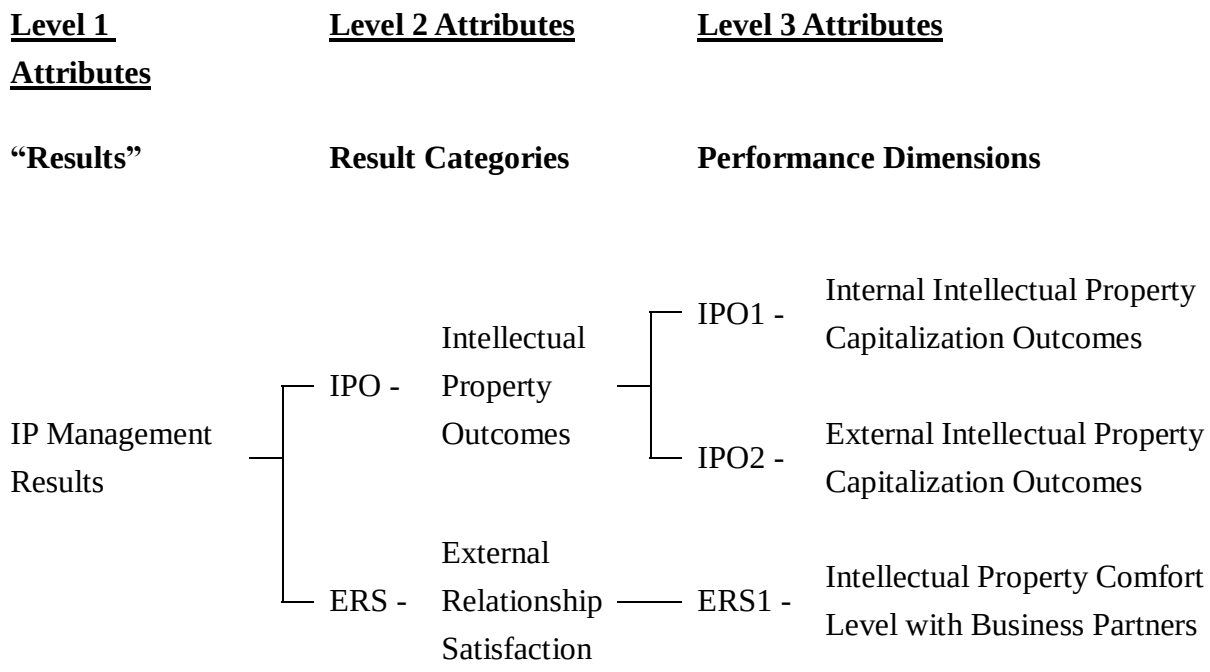



Figure 7.2 IP Management Excellence Audit Model for Results

### 7.2.3 Determining Weights of Different Elements in Hierarchy

Although the measurement items in audit model for enablers have been identified and examined as general IP management practices from questionnaire survey as described in Chapter 4 and 5, respectively, there are differences in priorities of relative importance. In any audit model, different attributes will have varying importance, i.e., they should have different relative weights (such as audit model of EFQM or MBNQA). In order to identify the priorities of the four IP management enabling categories and the twelve key enabling criteria, an AHP hierarchy model in IP management was developed and six IP experts who provide advisory support to the HK-GD based manufacturing industry were invited to conduct interviews as described in Chapter 6. By obtaining their expertise opinions, the relative importance of IP management enabling categories and enabling criteria for HK-GD based manufacturing organizations to implement these enabling criteria in priorities was identified by using an AHP approach. Then these relative weights were used to assign weights for the measurement items in the audit model for enablers in Figure 7.1. In this research, Table 7.1 shows the relative weights of the IP management enabling categories and criteria in audit model for enablers as a result of the AHP study as described in Chapter 6.

| | | | Normalized Rating | |
|---|---|---|---|---|
| | | | Criterion | Category |
| MS | Management Support | | | 276 |
| | MS1 | Strategic Management Plan for IP Activities | 97 | |
| | MS2 | Internal IP Management Function, Knowledge and Skill | 109 | |
| | MS3 | IP Defense and Enforcement System | 69 | |
| ID | Innovation Development | | | 268 |
| | ID1 | Creativity Generation, Concept Selection and Prototyping | 162 | |
| | ID2 | IP Intelligence and Advisory Support | 106 | |
| IP | Intellectual Property Capitalization | | | 278 |
| | IP1 | Internal IP Security | 72 | |
| | IP2 | IP Application/ Registration | 111 | |
| | IP3 | Internal IP Audit and Evaluation | 47 | |
| | IP4 | IP Licensing and Acquisition | 49 | |
| ER | External Relationship Management | | | 178 |
| | ER1 | IP Commercial Development and Marketing | 85 | |
| | ER2 | External IP Security, Agreement and Partners Matching | 57 | |
| | ER3 | Research Venture and IP Holding Business Startup/ Spinout | 36 | |
| | | Total | | 1000 |

Table 7.1 Relative weights of the IP management enabling categories and criteria in audit model for enablers

Regarding the identification of the relative weights on the audit model for results in Figure 7.2, they were assigned by six IP experts who had been working in the HK-GD based manufacturing industry ranging from 10 to 25 years and validated the content of the IP management excellence audit model described in this section. Table 7.2 shows the relative weights of IP management result categories and performance dimensions as a result of consultation of the IP experts.

| | | | Normalized Rating | |
|---|---|---|---|---|
| | | | Dimension | Category |
| IPO | Intellectual Property Outcomes | | | 500 |
| | IPO1 | Internal Intellectual Property Capitalization Outcomes | 250 | |
| | IPO2 | External Intellectual Property Capitalization Outcomes | 250 | |
| ERS | External Relationship Satisfaction | | | 500 |
| | ERS1 | Intellectual Property Comfort Level with Business Partners | 500 | |
| | | Total | | 1000 |

Table 7.2 Relative weights of the IP management result categories and performance dimensions in audit model for results

“Systems and Practices” and “Results” in the IP management excellence audit model, representing the “Enablers” and “Results”, respectively, should have their own weightings related to the overall IP management performance. With reference to MBNQA and EFQM, the worldwide recognized audit models, the scoring ratio of “Enablers” and “Results” is 0.55:0.45 and 1:1, respectively. In determining the

relative weights between the “enablers” and “results”, the six IP experts suggested that the ratio of “enablers” and “results” should be initially set to 1:1 and it will be re-evaluated when more measurement data are available from case studies. Hence, the ratio of “Systems and Practices” and “Results” is set to 1:1 in the proposed model which implies that “Systems and Practices” and “Results” have the same importance of reflecting the effectiveness and efficiency of the IP management of organizations.

### 7.2.4 Content Validity of the Model

The “Enablers” is defined as the critical managerial and operational elements of good IP management “Systems and Practices”. Four IP management enabling categories and twelve key enabling criteria have been identified through the literature review in Chapters 2 and 4; and have been examined as general IP management practices in the questionnaire survey (described in Chapter 5); thus, they can represent the general systems and practices in IP management by the HK-GD based manufacturing industry which are then used to measure the “Systems and Practices” in IP management of the organization.

The “Results” is used to measure the overall IP management results of the organization. Two result categories and three performance dimensions have been identified through the literature review in Chapter 2 and have been examined through the questionnaire survey as described in Chapter 5; thus they can represent the results in IP management by the HK-GD based manufacturing industry, which are then used to measure the “Results” in IP management of the organization.

Both the interviewed industrial experts and the respondents to the mass questionnaire

survey supported the “Enablers” criteria are important to the IP management and positively related to the IP results. With the identified enabling categories, enabling criteria, result categories and performance dimensions of the “Enablers” and “Results”, used as measurement items, an IP management excellence audit model can be formed and proposed as shown in Figures 7.1 and 7.2.

### 7.2.5 Discussion

In the construction of an evaluation framework with respect to the “Intellectual Property Management Excellence Audit Model” for the HK-GD based manufacturing industry the following are the key points.

- A correct model of the “Enablers” and “Results” must be provided.
- If the attributes on the same level are not of the same importance, then relative weights can be given to attributes.
- An attribute can be broken down to an infinite number of levels but there is a point at which further breakdown will not provide any additional accuracy. On the other hand, too little breakdown can result in an evaluation that is subjective and inaccurate.

The researchers must make the decision where to stop the breakdown of attributes and produce different frameworks for various purposes. For example, the framework that stops at level 2 attributes allows experienced assessors to conduct a general “Health Check” of the organization’s IP management excellence against the four enabling categories and two result categories, which matches with the purposes in the case studies of research work two in section 7.1. Alternatively, the framework that stops at level 3 attributes best describes the strengths and areas for improvement against each

enabling criterion in terms of accuracy and complexity and, therefore, maps with the purposes in the case studies of research work three in section 7.1.

There are various ways of conducting assessment of an organization to fulfill the objectives of an audit. The self-assessment approach and external audit approach will be applied in the case studies in sections 7.3.2 and 7.4.2, respectively.

- In research work two in section 7.1, the case studies aim to give organizations a head start in their path to excellence and, therefore, it is appropriate to use the rapid audit system with the self-assessment ratings evaluated by respondents of the organizations. Self-assessment approach is popular among organizations, since thousands of organizations across the world use self-assessment on a regular basis (Porter and Tanner, 1998) to measure their performance.
- In research work three in section 7.1, the case studies aim to conduct a more accurate and complicated diagnosis for the organizations and assign scores to each audit items that are summarized from the findings of an on-site visit. As a result, external assessor ratings provided by the comprehensive audit system are good surrogates for the self-assessment ratings in this kind of research (Pannirselvam and Ferguson 2001). The objectivity of the trained external assessors may lead to a less biased data set than self-assessment ratings. Depending on practical appropriateness, different research works may use different audit approach. According to the MBNQA (United States Department of Commerce, 2007) and EFQM (2007), the examiners for MBNQA and EFQM make site visits to organizations and apply the standard criteria to verify and clarify information for the award.

## 7.3 Development of a General Intellectual Property Management "Health Check" System for the Hong Kong-Guangdong based Manufacturing Industry

As described in research work two in section 7.1, the purpose of this section is to introduce a rapid audit system to investigate the IP management excellence of the HK-GD based manufacturing organizations. This is achieved by undertaking evaluation against the four enabling categories and two result categories of the "Intellectual Property Management Excellence Audit Model".

The rapid audit system can provide a general IP management "Health Check" of the HK-GD based manufacturing organizations. Figure 7.3 outlines the rapid audit system proposed in this research. The framework consists of three levels of attribute hierarchy. "IP Management Excellence" is the top level attribute of the evaluation framework. The "IP Management Implementation - Systems and Practices" and "IP Management Results" are referred to as level 1 attributes, the four enabling categories and two result categories as level 2 and the "Approach", "Deployment" and "Result" as level 3. The assessment of "IP Management Excellence" is conducted by the evaluation of four enabling categories and two result categories, which are directly assessed based on the "Approach", Deployment" and "Result".

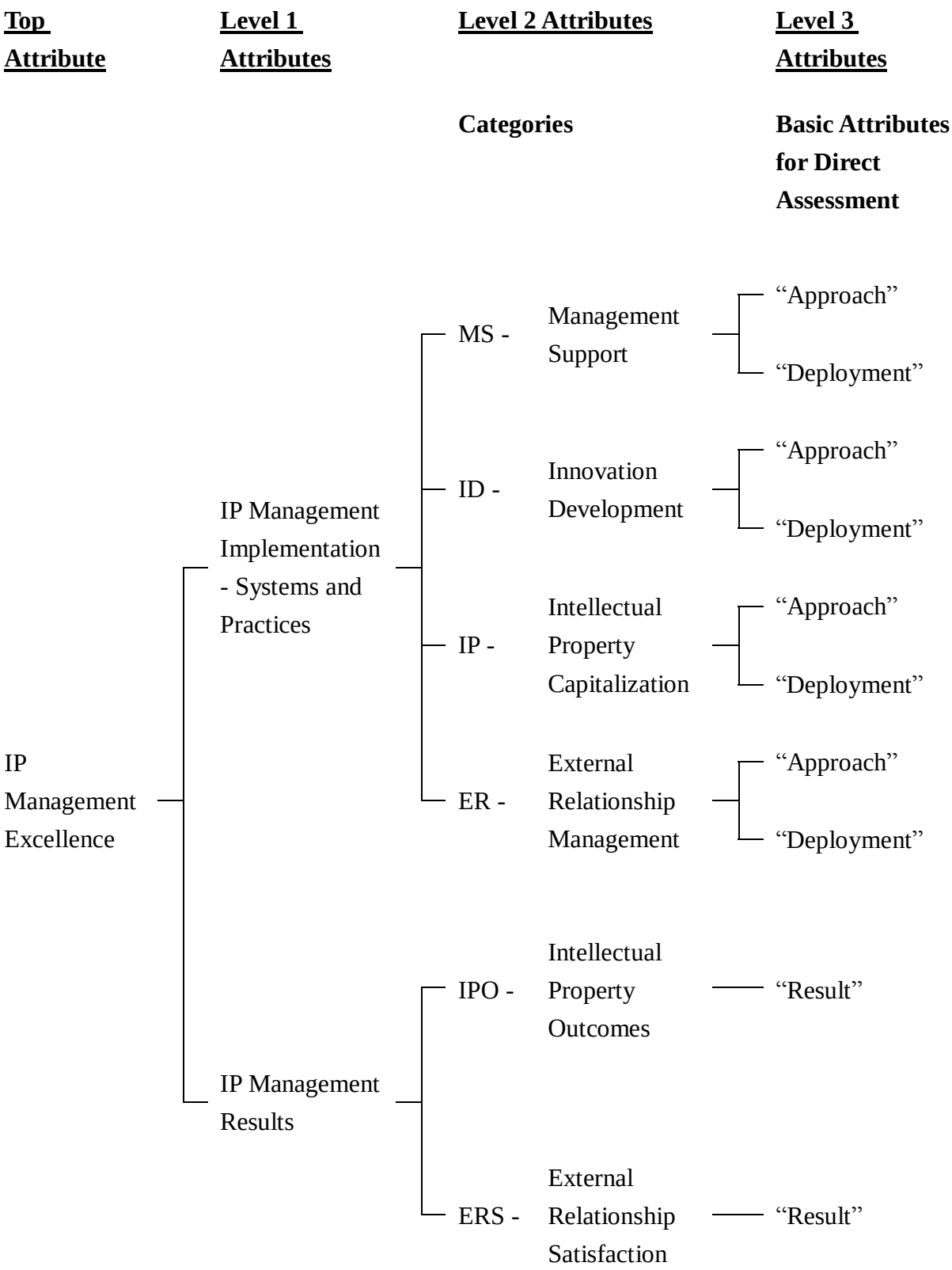



Figure 7.3 A rapid audit system which is broken down into three levels

The rapid audit system is developed by adopting the Evidential Reasoning (ER) Approach, which is supported by the "Intelligent Decision System (IDS)" software, as a scoring method for the system. According to Xu *et al*. (2005), there are three steps to apply the IDS for audit: model implementation, audit information input, and the audit result report. This section focuses on model implementation only and the other two steps will be described in section 7.3.2 – case studies of three companies for general IP management "Health Check".

### 7.3.1 Model Implementation

This step is to structure the rapid audit system in IP management by adopting the hierarchy as shown in Figure 7.3. The audit system consists of the sections of "Systems and Practices" and "IP Management Results" in hierarchy by IDS. As shown in Figure 7.4, the IDS main window consists of a left side panel which shows the alternative companies to be audited, while the right side panel is the hierarchy framework of the model. There are some minor differences of the two sections:

1. "Systems and Practices" section: The attributes and sub-attributes or measurement items as shown in Figure 7.4 have been described in Chapters 4 and 5. Each measurement item asks for two answers; the first is "Approach: It measures the degree of the approach used to address the issue", and the next is "Deployment: It measures the extent to which the approach has been implemented to the relevant areas and activities of the organization.

2. "IP Management Results" section: The attributes or measurement items in "IP Management Results" as shown in Figure 7.4 have been discussed in Chapters 2

and 5. Each measurement item asks for an answer to “Result: It measures how favourable the results are”.

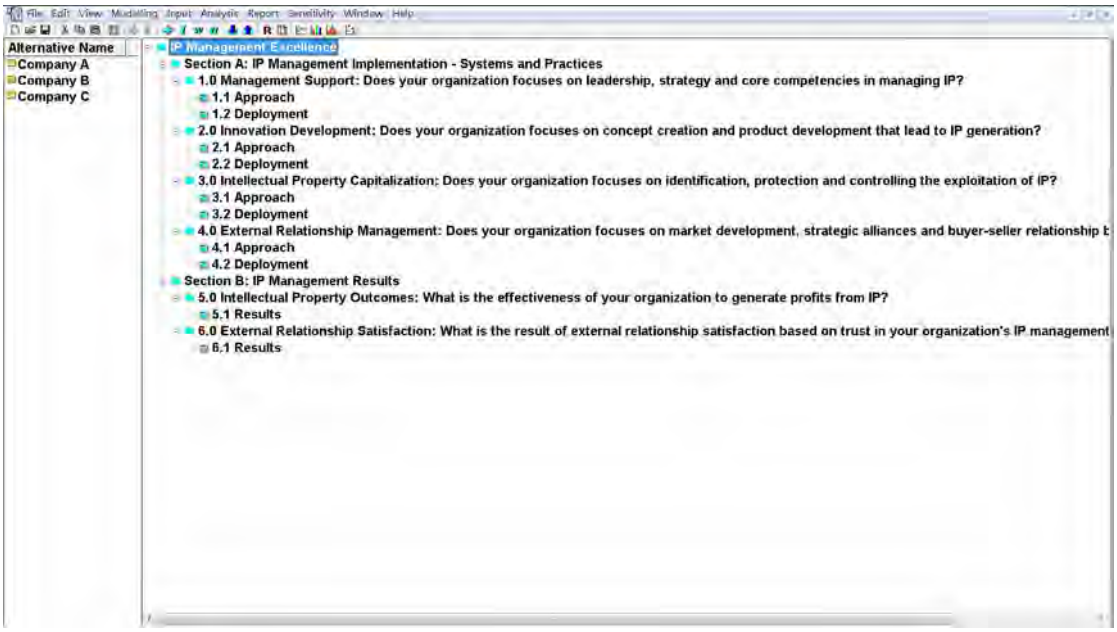



Figure 7.4 IDS main window for “Systems and Practices” and “IP Management Results” sections

The attributes in both sections are defined by using the IDS dialog windows as quantitative or qualitative. As shown in Figure 7.5, it shows the IDS dialog window which allows the user to input the name of attribute, define the nature of attribute as quantitative or qualitative. The IP management enabling and result categories are qualitative attributes. Thus, for this study, all attributes and sub-attributes are defined as qualitative, and then the number of assessment grades is input and the description of attributes and sub-attributes is provided. By pressing the icon of “Describe” on the right side of Figure 7.5, a dialog box as shown in Figure 7.6 will appear for the user to input the description of the attribute. The description of all attributes for the rapid audit system is included in Appendix D.

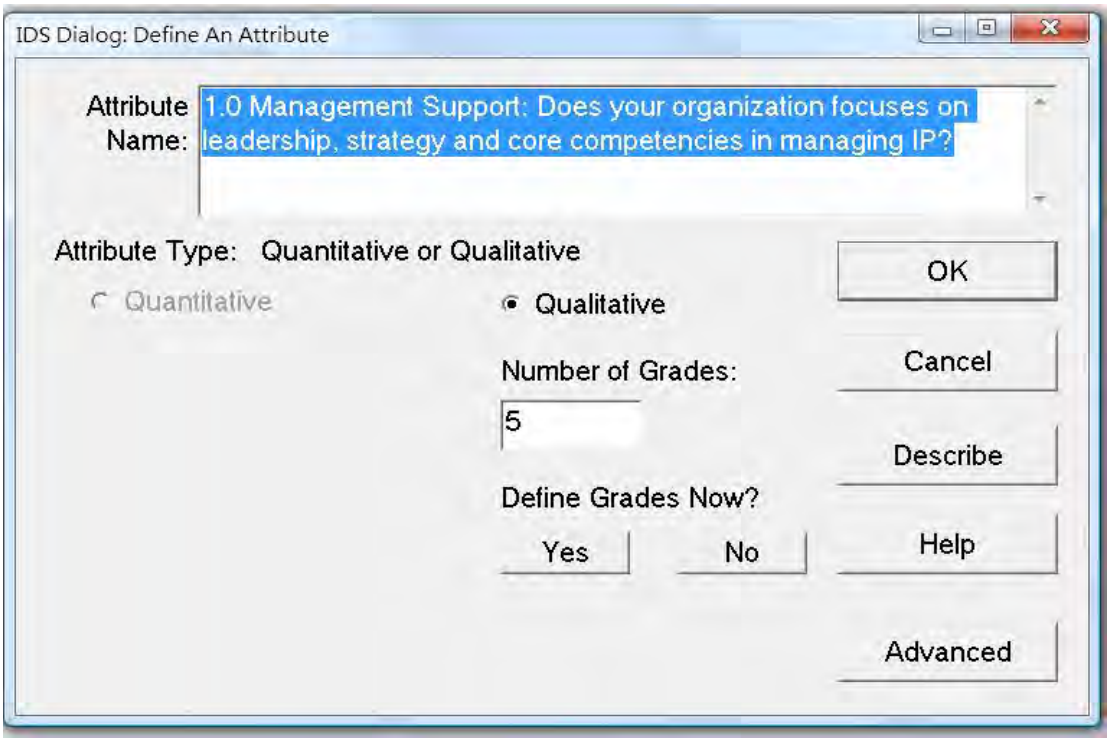



Figure 7.5 Define a qualitative attribute

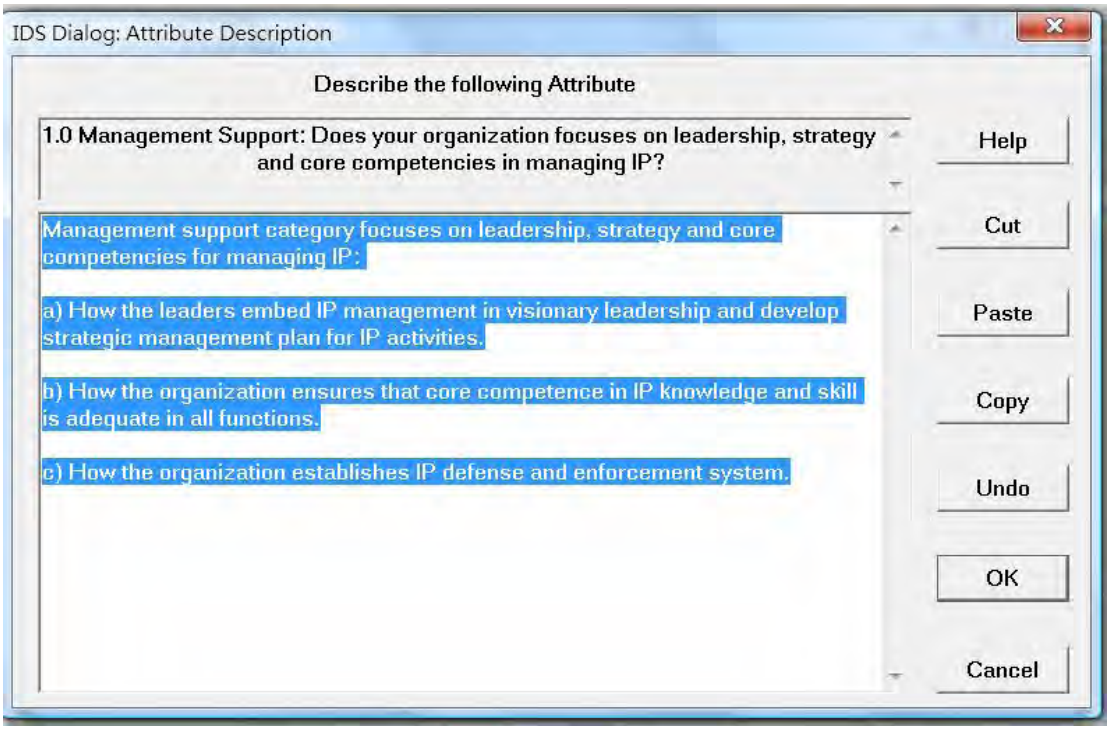



Figure 7.6 Attribute description

Moreover, the evaluation grades are user defined or software defaulted. By pressing the "Yes" icon on dialog box in Figure 7.5, a new dialog box will appear as shown in Figure 7.7 for the user to input the names of the evaluation grades.

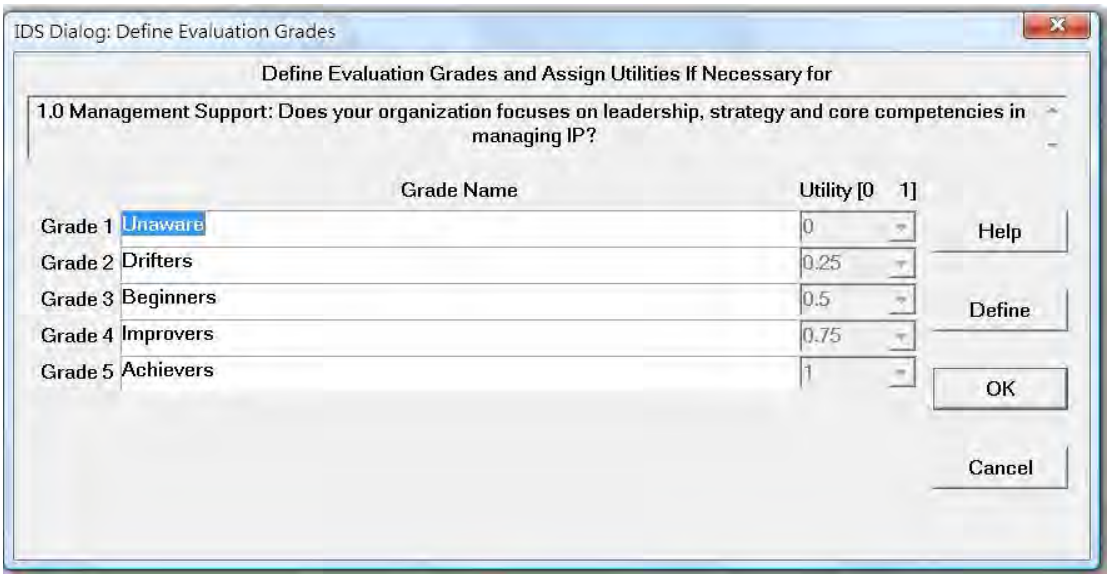



Figure 7.7 Define evaluation grades

In order to measure the IP management excellence of HK-GD based manufacturing organizations, the audit scores of the lower levels are aggregated to an overall score and then organizations can identify their IP management excellence. Since the ratio of "Systems and Practices" and "IP Management Results" was set to 1:1 by agreement of six IP experts as explained in section 7.2.3, by taking the average scores of both "Systems and Practices" and "IP Management Results", the IP management excellence of the audited manufacturing organizations can be identified as described in Table 7.3.

| Levels | Description of IP management excellence | Score |
|---|---|---|
| 1 | Unaware<br>Unaware organizations are those not familiar with the concept, practices in IP management. They are unaware that IP management can improve their IP management performance. | 0-125 |
| 2 | Drifters<br>Drifters are those who have some understanding of the importance of IP management. However, they don't commit resources and efforts to develop and implement IP management. | 126-375 |
| 3 | Beginners<br>Beginners are those who have understanding of the importance of IP management and its positive relation with IP management performance. They are still in early stage of implementation; clear guidance for improvement in IP management is required. | 376-625 |
| 4 | Improvers<br>Improvers are those who have implemented IP management and have positive progress; they can manage IP management in an effective way. | 626-875 |
| 5 | Achievers<br>Achievers are those who have implemented IP management and have reached a point of maturity in their companies. Their IP management performance has reached the international standard which in turn improves their business performance. | 876-1000 |

Table 7.3 Description of IP management excellence

| Evaluation grade | Utility | Approach | Deployment | Result |
|---|---|---|---|---|
| Unaware | 0 | No approach at all. | No deployment at all. | No results or poor results. |
| Drifters | 0.25 | The approach is unsystematic and inconsistent. | Applied to about 1/4 of the potential when considering all relevant areas and activities. | Few results show positive trends.<br>Some favourable comparisons with own targets. |
| Beginners | 0.5 | The approach is prevention-based and systematic.<br>The approach is subject to occasional review and improvement. | Applied to about 1/2 of the potential when considering all relevant areas and activities. | Some results show positive trends.<br>Favourable comparisons with the targets. |
| Improvers | 0.75 | The approach is sound, prevention-based and systematic.<br>The approach is subject to regular review and improvement. | Applied to about 3/4 of the potential when considering all relevant areas and activities. | Most results show strongly positive trends.<br>Favourable comparisons with own targets and external organizations. |
| Achievers | 1 | The approach is exceptionally well-defined, sound, prevent-based and systematic.<br>The approach is subject to regular review and improvement. | Applied to full potential in all relevant areas and activities. | All results show strongly positive trends.<br>Excellent comparisons with own targets and external organizations. |

Table 7.4 Guidelines for evaluation grades in models of “Systems and Practices” and “IP Management Results”

With reference to Table 7.4, five evaluation grades are employed for the sections of "Systems and Practices" and "IP Management Results" from grade 1 to grade 5 which are: "Unaware" (the worst), "Drifters", "Beginners", "Improvers" and "Achievers" (the best), respectively. They are generated based on literature reviewed in the field of quality management in line with the EFQM (2000) scoring guideline. Table 7.4 also shows the guidelines for the evaluation grades in sections of "Systems and Practices" and "IP Management Results", respectively.

Figure 7.7 shows the dialog box for inputting the evaluation grades on the left hand column, while the right side column indicates the utility values which range from 0 to 1 from grade 1 to 5, respectively, which are user defined or software defaulted. By pressing the icon of "Define" on the right side, the description of the evaluation grades can be input on a new dialog box as shown in Figure 7.8.

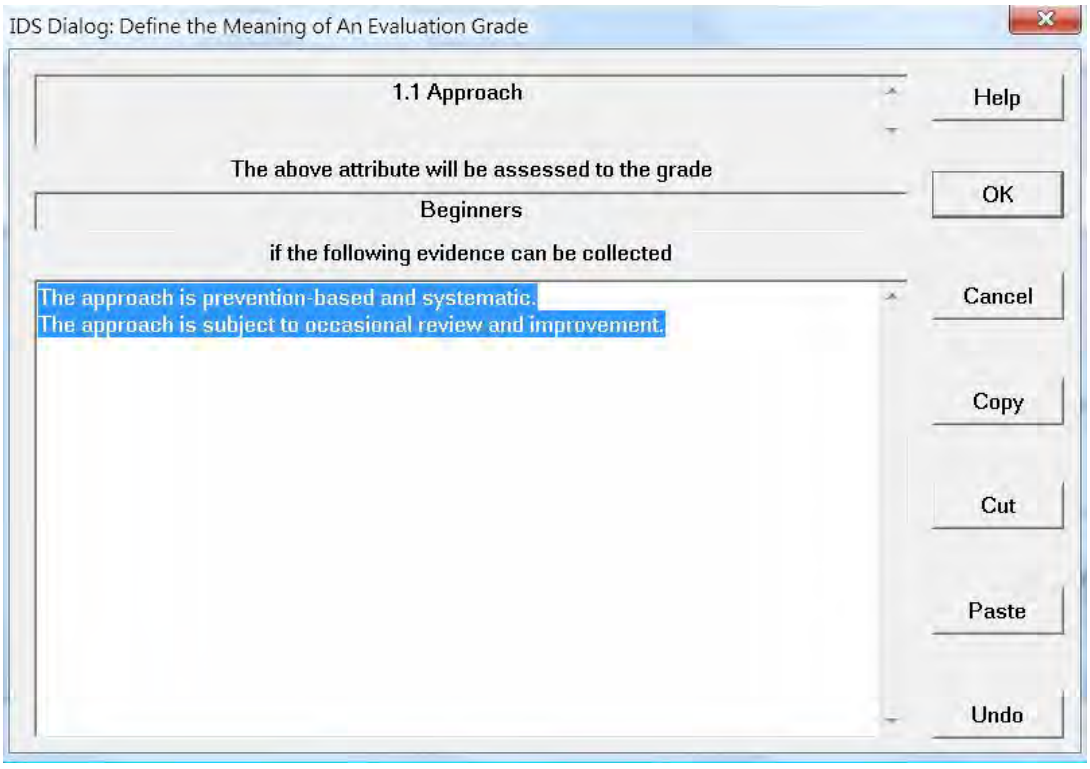



Figure 7.8 Define the meaning of an evaluation grade

By having the normalized rating of attributes and sub-attributes in Table 7.1 and 7.2, the weights are assigned to attributes of the upper hierarchy and all sub-attributes of the lower hierarchy in IDS. Figure 7.9 shows the example of the IDS dialog for assigning the relative weights to four attributes in the "System and Practices" section.

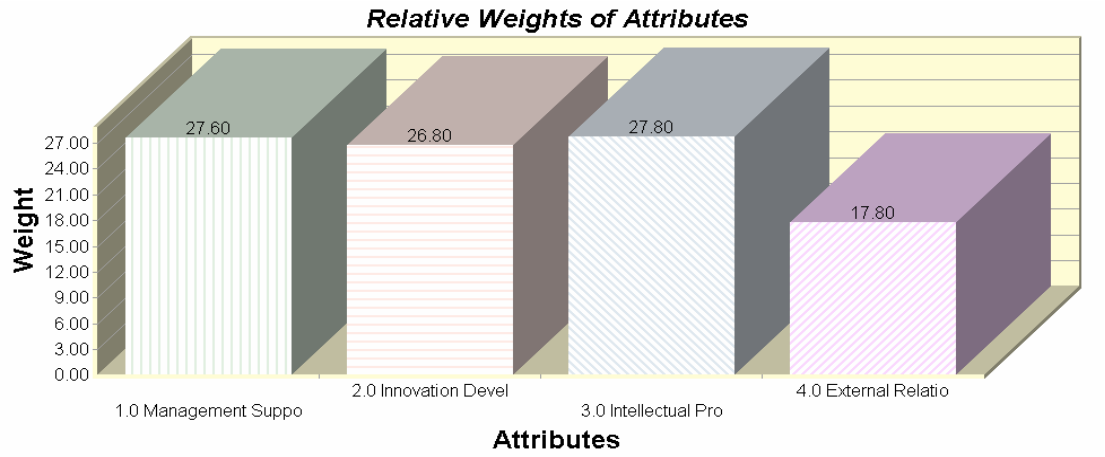



Figure 7.9 Assign relative weights for attributes in IDS

Finally, the audit System was developed. In order to implement the System, two steps were employed:

First, all the measurement items were reviewed and validated by the six IP experts who had reviewed and validated the content of the evaluation framework, as described in section 7.3.

Second, a pre-test was conducted by three industrial practitioners in the manufacturing industry who had working experience of more than 10 years, and were at managerial level, involved in decision making in IP management.

Minor adjustments were made during the validation stage and pre-test prior to case studies. Then the assessment system was developed and ready for the case studies.

### 7.3.2 Case Study of Three Companies for General Intellectual Property Management "Health Check"

In this section, the case studies on rapid audit system for IP management excellence are reported and the overall results are presented. In particular, section 7.3.2.1 describes the audit information input; section 7.3.2.2 describes the audit report of case studies; and section 7.3.2.3 describes the overall assessment results of IP management excellence. From these results, section 7.3.2.4 evaluates the effectiveness of the general IP management "Health Check" system.

#### 7.3.2.1 Audit Information Input

Three HK-GD based manufacturing organizations were invited to conduct the rapid audit trial. The three organizations included an electronic company (Company A), a chemical company (Company B) and a plastic company (Company C). Company A, B and C had staff of around 200, 70 and 100, respectively.

In the case studies on Company A, B and C, a self-assessment approach as explained in section 7.2.5 is used to fulfill the objective of a rapid audit. The profiles of respondents from the three companies are shown in Table 7.5. They were at managerial level with overall responsibilities on IP matters within their companies and had long years of working experience in HK-GD based manufacturing industry; they had been working in their specific companies for more than 10 years, thus

implying that they were knowledgeable in IP management and were the appropriate persons to represent their companies to conduct the audit. As a preliminary step in the audit trial, they were provided assessor training to apply the criteria of the evaluation framework so as to ensure they truly understand and were able to work as assessors to evaluate and assign scores to each audit item.

| | Company | No. of staff & worker | Position | No. of years in the company | Working experience (years) |
|---|---|---|---|---|---|
| A | Electronic | 200 | IP Manager | 10 | 17 |
| B | Chemical | 70 | Managing Director | 12 | 30 |
| C | Plastic | 100 | Chairman | 20 | 20 |

Table 7.5 Respondents' profile in audit

The purpose of the audit trial by three companies with different industrial profiles was to validate whether the audit system was applicable for the HK-GD based manufacturing industry to audit their IP management excellence (Systems and Practices and IP Management Results), and to help them understand current status of IP management implementation, and then to choose the appropriate starting point to implement IP management themselves for making improvements.

The IDS allows the assessor to review the definition of the attribute by pressing the icon of "Attribute Definition", and then another dialog box will be shown with the definition of that attribute (Figure 7.10). For example, question number 1.0 which is in the category of "Management Support" asks for "Does the organization focus on leadership, strategy and core competencies in managing IP?" This type of question is

on the section of “Systems and Practices”. Thus it is directly assessed by two basic attributes “Approach” and “Deployment”.

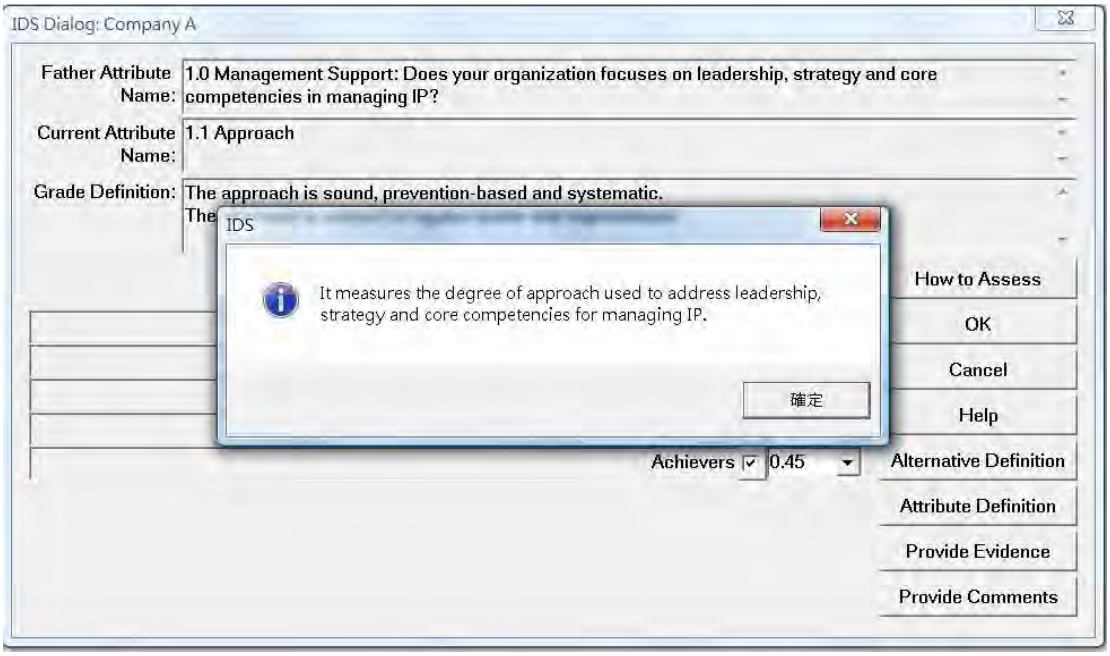



Figure 7.10 Attribute Definition

Figure 7.11 shows the IDS dialog for the assessor to input their grade and the degree of belief for the basic attributes: i.e. “Approach” and “Deployment” for enabling categories or “Result” for result categories. The IDS allows the assessor to input more than one grade. If the assessor finds it is quite good most of the time but occasionally poor for some special reasons, then the assessor can select the grades “Beginners” and “Improvers” together by assigning the degree of belief (the software could default values(s) of degree(s) of belief if the assessor does not assign any, but the software limits the sum of degree(s) of belief to be one or less than one). Once the assessor checks the box of a grade, the definition of the grade will be shown in the title box of “Grade Definition” for the assessor to review as reference (Figure 7.11).

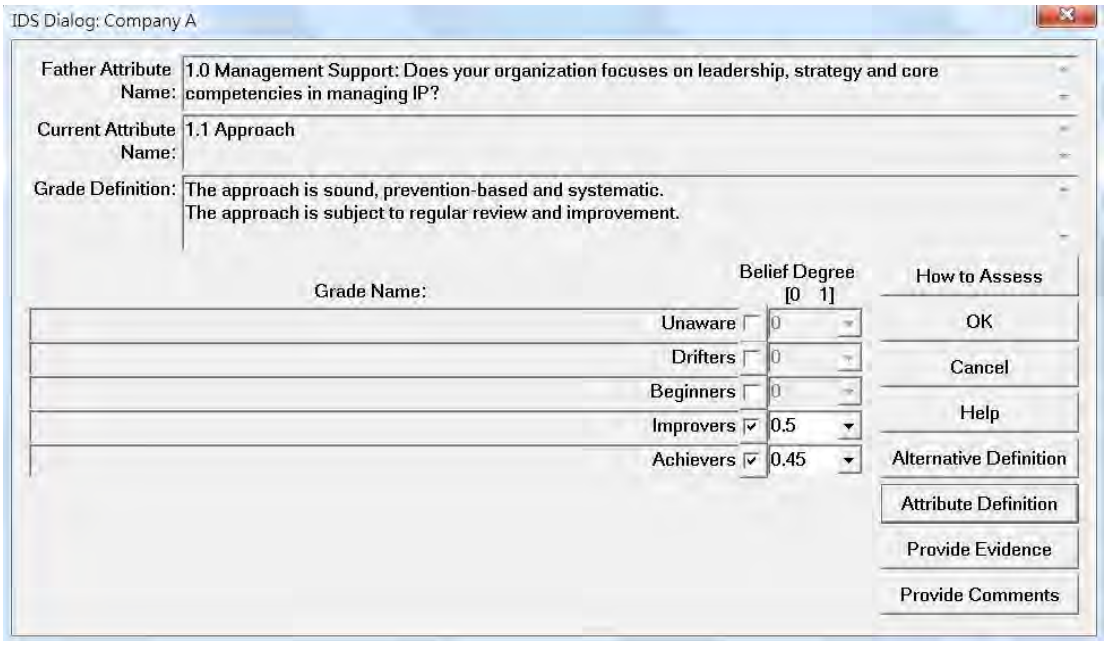



Figure 7.11 Enter assessment using IDS dialog

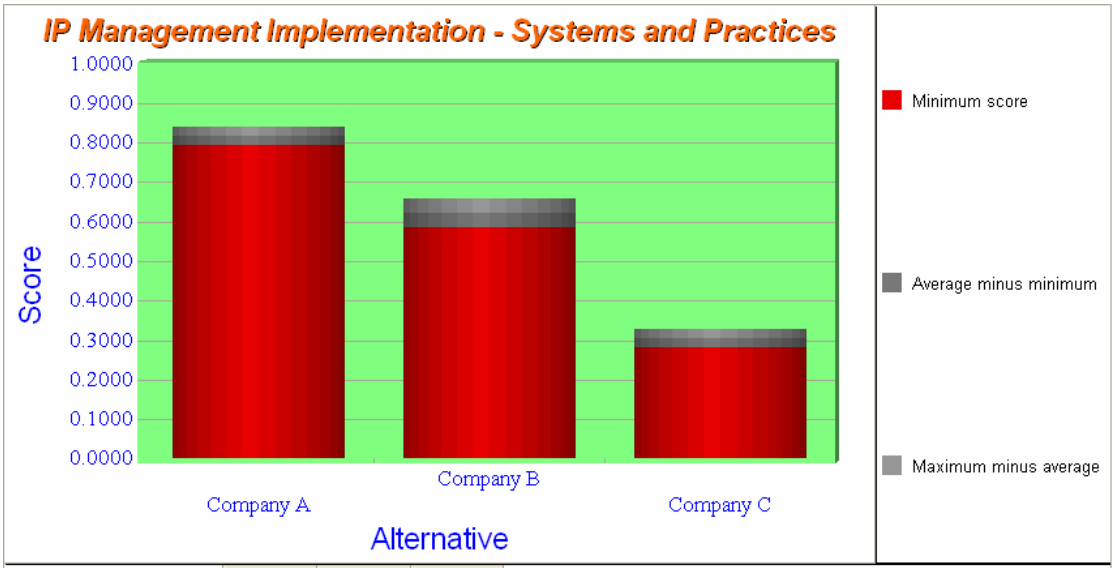
#### 7.3.2.2 Audit Report

Once the assessor has input the data, IDS can generate different types of assessment results in graphical format, such as performance ranking (Figure 7.12a and 7.12b), performance score range (Figure 7.13a and 7.13b), distributed assessment results (Figure 7.14a and 7.14b) and strength and weakness analysis (Figure 7.15a and 7.15b) for review and analysis. The assessment results on all attributes of rapid audit system for Company A, B and C are included in Appendix E, G and I, respectively.

A. Performance ranking report

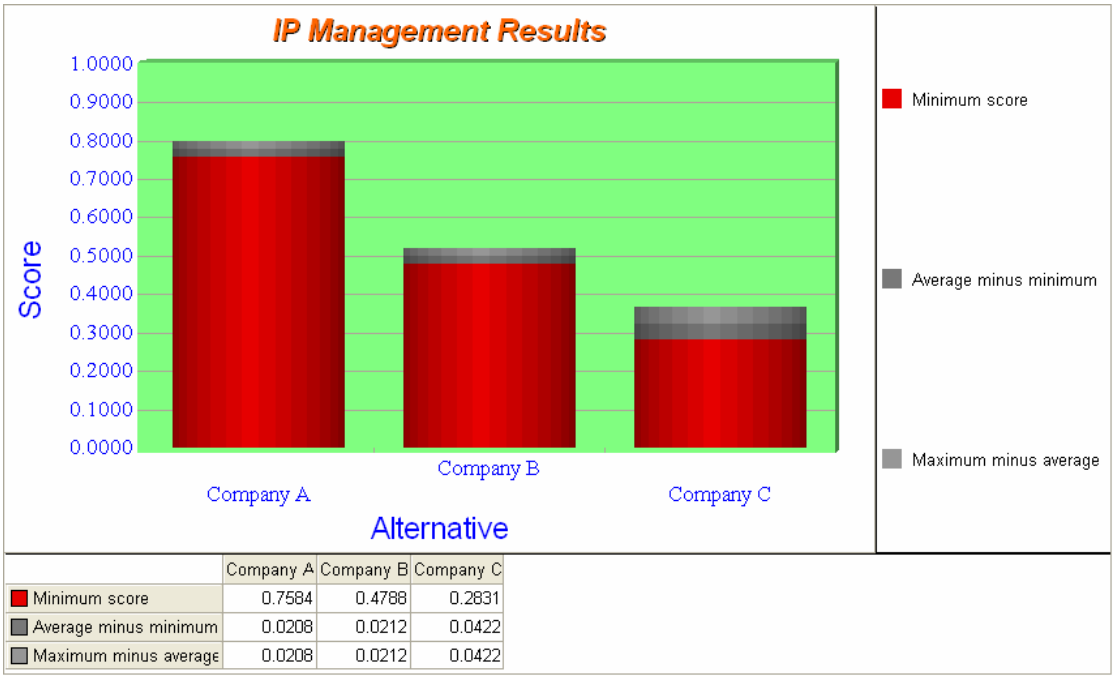
IDS can generate a simple ranking report similar to other MADM tools. The performance score on sections of “Systems and Practices” and “IP Management

Results" are shown in Figure 7.12a and 7.12b, respectively. The results show that Company A has the highest percentage scores in both the sections of "Systems and Practices" and "IP Management Results" which are 82% and 78%, respectively. In the middle ranking position, Company B has the percentage scores in both sections of "Systems and Practices" and "IP Management Results" with 62% and 50%, respectively. On the other hand, Company C has the lowest percentage scores in both sections of "Systems and Practices" and "IP Management Results" with 30% and 33%, respectively. The trend of audit results of the two sections indicates that the better the management of "Systems and Practices", the better the "IP Management Results" is obtained.




| | Company A | Company B | Company C |
|---|---|---|---|
| Minimum score | 0.7928 | 0.5860 | 0.2811 |
| Average minus minimum | 0.0233 | 0.0356 | 0.0236 |
| Maximum minus average | 0.0233 | 0.0356 | 0.0236 |

Figure 7.12a Performance ranking in "Systems and Practices" section



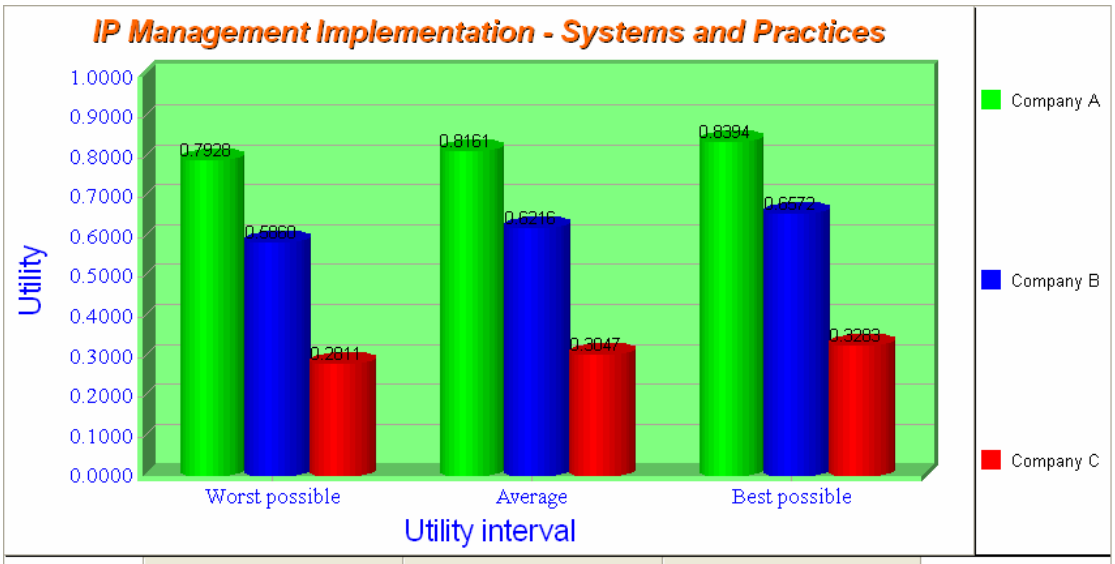

| | Company A | Company B | Company C |
|---|---|---|---|
| Minimum score | 0.7584 | 0.4788 | 0.2831 |
| Average minus minimum | 0.0208 | 0.0212 | 0.0422 |
| Maximum minus average | 0.0208 | 0.0212 | 0.0422 |

Figure 7.12b Performance ranking in "IP Management Results" section

B. Performance Score Range

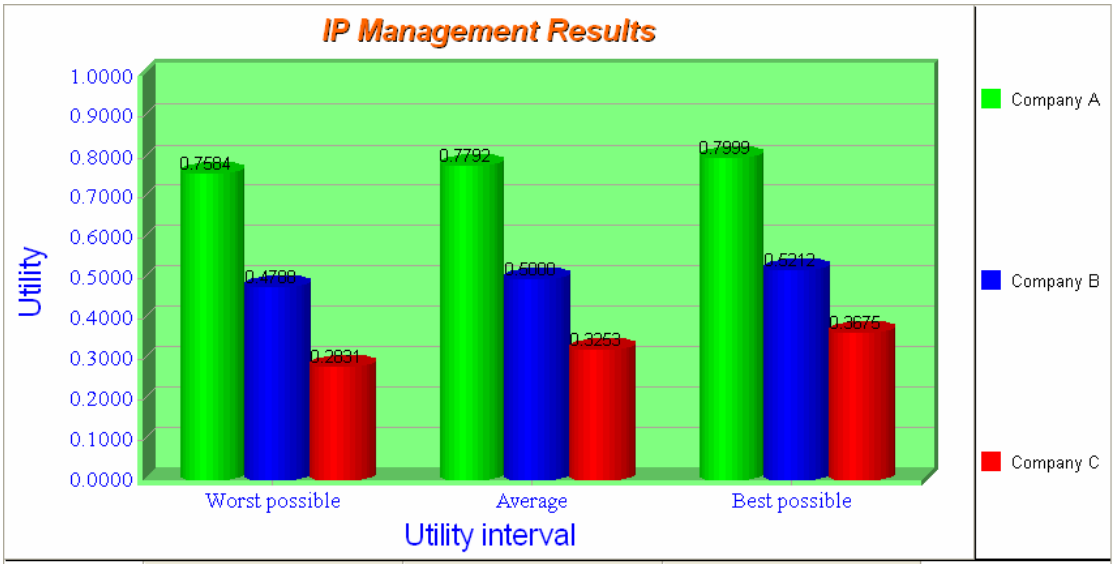
IDS allows the assessment of uncertainty by input values of degree(s) of belief. As described in section 3.4.2 in Chapter 3, the ER computational steps, if the sum of the degree of belief of any attribute is equal to 1, then this is a complete assessment, so that the utilities of "Worst possible", "Average" and "Best possible" are the same as "Average". On the contrary, if the sum of degrees of belief is less than one for any attribute, that means the assessor has some information missing or it is not good enough to make the accurate judgement, then the degree of belief is good enough to reflect how certain the attribute can be rated; thus the performance score will be presented in an interval of utility to present a range of performance. By reviewing the performance score in Figure 7.13a and 7.13b, all Company A, B and C have incomplete assessment which means that there is missing information and unknowns during the audit. The utility interval difference is minor and is reflected from

"unknown" with low percentage, ranging from 4.2% to 8.4%, which implies that the assessor is quite certain of providing audit grading.




| | Worst possible | Average | Best possible |
|---|---|---|---|
| Company A | 0.7928 | 0.8161 | 0.8394 |
| Company B | 0.5860 | 0.6216 | 0.6572 |
| Company C | 0.2811 | 0.3047 | 0.3283 |

Figure 7.13a Performance score range in "Systems and Practices" section

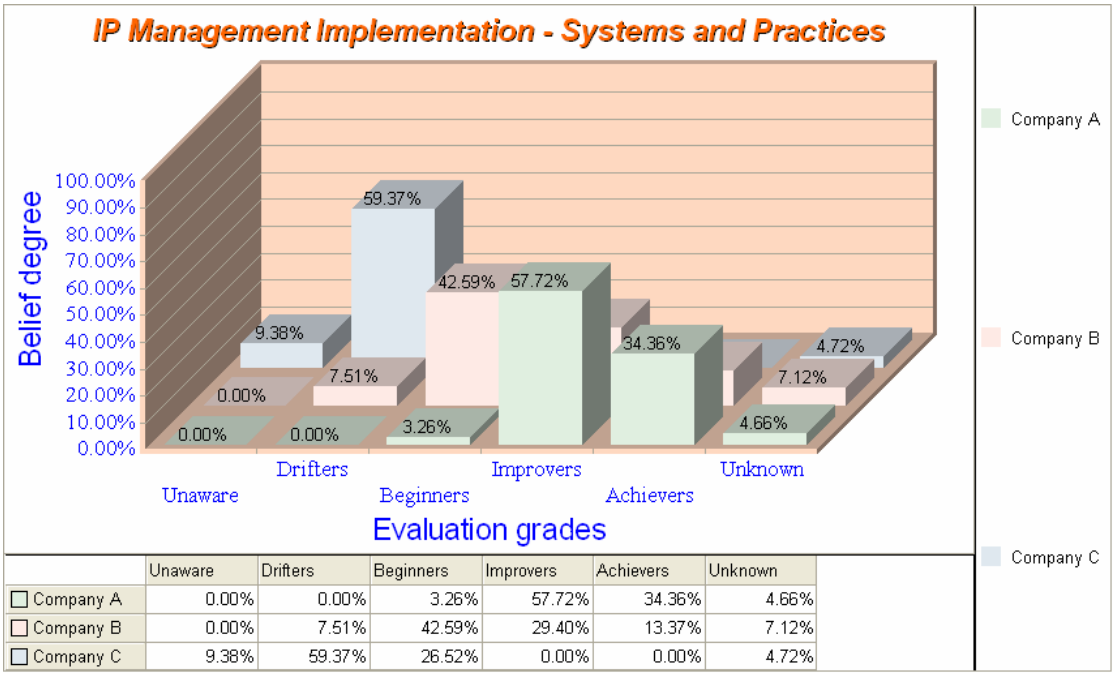



| | Worst possible | Average | Best possible |
|---|---|---|---|
| Company A | 0.7584 | 0.7792 | 0.7999 |
| Company B | 0.4788 | 0.5000 | 0.5212 |
| Company C | 0.2831 | 0.3253 | 0.3675 |

Figure 7.13b Performance score range in "IP Management Results" section

C. Performance Distribution

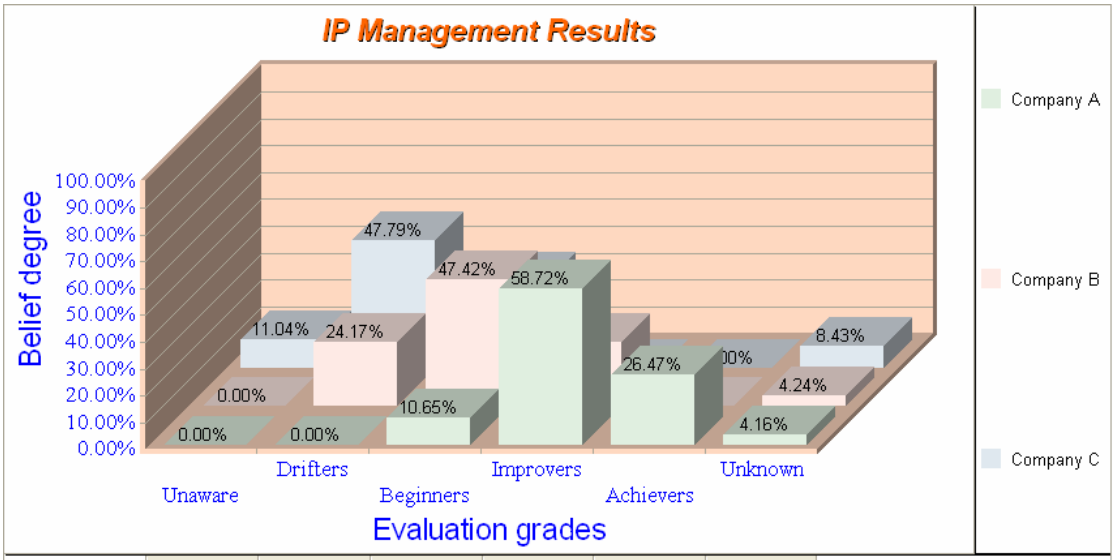
The difference of IDS from conventional MADM is that it can present the assessment result not only in a single number but in a diversity of performance. As described in section 3.4 and 3.5, IDS employs the ER approach to aggregate assessment results in lower level hierarchy to higher level hierarchy, thus IDS can present any distributed assessment of attributes or sub-attributes of any alternative (audited company). Figure 7.14a shows the distributed assessment on "Systems and Practices" section. Company A has 34% in "Achievers", 58% in "Improvers", 3% in "Beginners" and 5% in "Unknown". The assessment results indicate that Company A does not have many weakness areas but has a chance to further improve the area of strengths to achieve the grade of "Achievers". Company B has 13% in "Achievers", 29% in "Improvers", 43% in "Beginners", 8% in "Drifters" and 7% in "Unknown". Thus, the results indicate that Company B is in the middle performance range and can make further improvement to achieve the grades of "Improvers" and "Achievers". On the other hand, Company C has 27% in "Beginners", 59% in "Drifters", 9% in "Unaware" and 5% in "Unknown". Furthermore, the results indicate that Company C has a lot of weaknesses that show up as lower grades and then attention should be paid to these areas.




| | Unaware | Drifters | Beginners | Improvers | Achievers | Unknown |
|---|---|---|---|---|---|---|
| Company A | 0.00% | 0.00% | 3.26% | 57.72% | 34.36% | 4.66% |
| Company B | 0.00% | 7.51% | 42.59% | 29.40% | 13.37% | 7.12% |
| Company C | 9.38% | 59.37% | 26.52% | 0.00% | 0.00% | 4.72% |

Figure 7.14a Distributed performance “Systems and Practices” section

Figure 7.14b shows the distributed assessment on the “IP Management Results” section. The assessment distribution results of Company A and B are on the higher and middle grades, respectively, while the assessment distribution results are on the lower grades for Company C. By reviewing the results of the two sections, there is an indication that there is a positive relationship between results in sections of “Systems and Practices” and “IP Management Results”.

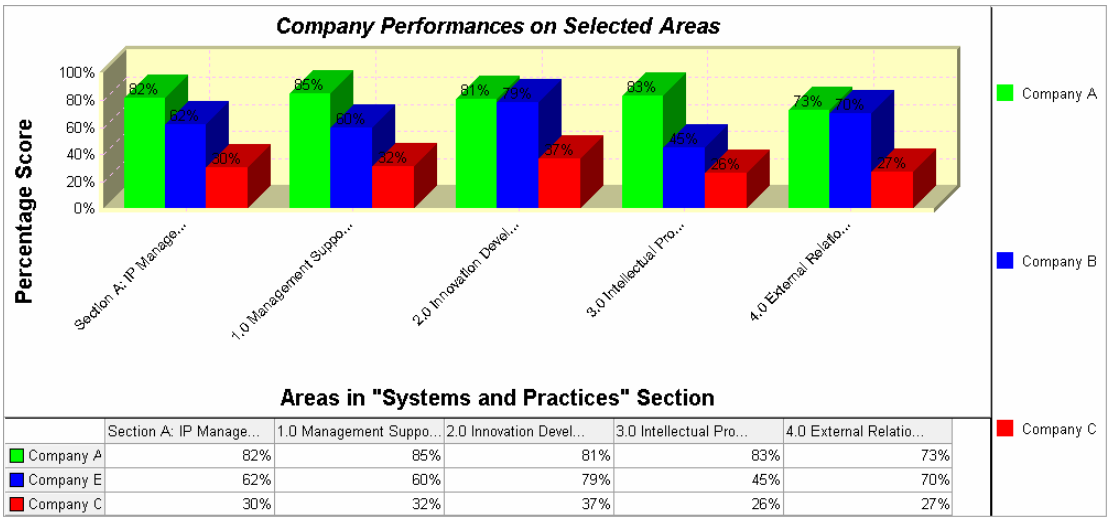



| | Unaware | Drifters | Beginners | Improvers | Achievers | Unknown |
|---|---|---|---|---|---|---|
| Company A | 0.00% | 0.00% | 10.65% | 58.72% | 26.47% | 4.16% |
| Company B | 0.00% | 24.17% | 47.42% | 24.17% | 0.00% | 4.24% |
| Company C | 11.04% | 47.79% | 32.73% | 0.00% | 0.00% | 8.43% |

Figure 7.14b Distributed performance of “IP Management Results” section

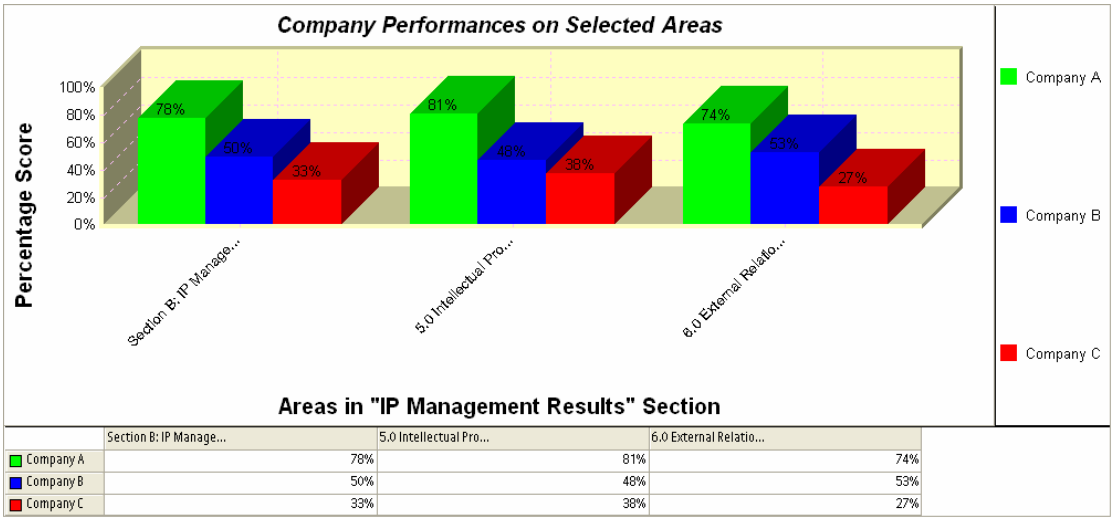
D. Strengths and Weakness analysis

Figure 7.15a and 7.15b show the individual percentage scores of all sub-attributes and attributes of the two sections, respectively. IDS provides the bar charts and also the detailed values of sub-attributes and attributes of the assessment. By reviewing the data, the strength and weakness areas are shown so that the decision maker could evaluate and decide upon the course of action.




| | Section A: IP Manage... | 1.0 Management Suppo... | 2.0 Innovation Devel... | 3.0 Intellectual Pro... | 4.0 External Relatio... |
|---|---|---|---|---|---|
| Company A | 82% | 85% | 81% | 83% | 73% |
| Company E | 62% | 60% | 79% | 45% | 70% |
| Company C | 30% | 32% | 37% | 26% | 27% |

Figure 7.15a Strength and weakness analysis in “Systems and Practices” section




| | Section B: IP Manage... | 5.0 Intellectual Pro... | 6.0 External Relatio... |
|---|---|---|---|
| Company A | 78% | 81% | 74% |
| Company B | 50% | 48% | 53% |
| Company C | 33% | 38% | 27% |

Figure 7.15b Strength and weakness analysis in “IP Management Results” section

### 7.3.2.3 Overall Assessment Results of Intellectual Property Management Excellence

The overall assessment results of three companies are summarized in Table 7.6. The assessment results indicate that Company A has the highest score (average utilities) of 816 in “Systems and Practices” and 779 in “IP Management Results”; the middle ranking position is Company B with the score of 622 in “Systems and Practices” and

500 in “IP Management Results”; the lowest is Company C which has score of 305 in “Systems and Practices” and 325 in “IP Management Results”.

As described in sections 7.2.3 and 7.3.1, the scoring ratio of “Systems and Practices” and “IP Management Results” was 1:1, and then the average scores of three companies are calculated by the IDS. By referring to Table 7.3 – “Description of IP Management Excellence”, it can be seen that the IP Management Excellence of Company A is “Improver”, Company B is “Beginner” and Company C is “Drifter”. In addition, the scores of the attributes of the “Systems and Practices” (Management Support, Intellectual Property Capitalization, Innovation Development and External Relationship Management) are shown in Table 7.6.

| | Company A | Company B | Company C |
|---|---|---|---|
| “Systems and Practices” | 816 | 622 | 305 |
| *Management Support* | *853* | *600* | *315* |
| *Innovation Development* | *809* | *785* | *370* |
| *Intellectual Property Capitalization* | *830* | *449* | *261* |
| *External Relationship Management* | *729* | *702* | *271* |
| “IP Management Results” | 779 | 500 | 325 |
| IP Management Excellence | 798 | 558 | 312 |
| Levels of IP Management Excellence | ← Improvers → | ← Beginners → | ← Drifters → |

Table 7.6 Assessment results (average utilities) of three HK-GD based manufacturing organizations

Based on the assessment results in Table 7.6, a scatter chart in Figure 7.16 is plotted with “IP Management Results” against “Systems and Practices”.

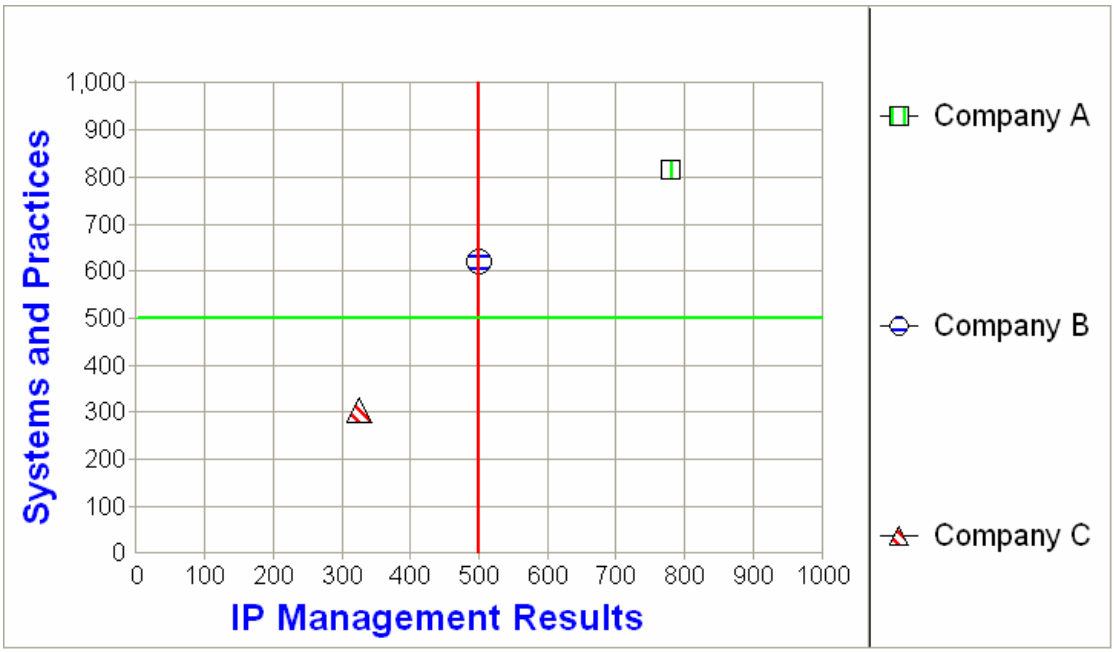



Figure 7.16 The assessment results of three HK-GD based manufacturing organizations

The scatter chart indicates positive relationships which coincide with the findings of the questionnaire survey as described in Chapter 5 where the “Systems and Practices” are positively related to “IP Management Results”.

After the case studies of a rapid audit system were carried out for the three companies, the detailed reports in graphics and text format were submitted to the companies for evaluation. The reports which were prepared using the data sets provided by the assessors in the IDS software for Company A, B and C are included in Appendix F, H and J, respectively. It was encouraging that the content of assessment results in the reports was completely accepted by the three companies, thus implying that this rapid

audit system was an appropriate tool to assess and measure the organizations' IP management excellence.

#### 7.3.2.4 Evaluation of the General Intellectual Property Management "Health Check" System

Although the work reported in this research is based on the rapid audit system of the "Intellectual Property Management Excellence Audit Model", the principle of audit modelling and the tools can be applied to support assessment in awards. For examples, the three companies selected in this research have participated in the Innovation-Knowledge Enterprise Assessment and Award, which is a project being undertaken by the Hong Kong Productivity Council (HKPC) and the Guangdong Provincial Intellectual Property Office (GDIPO). The focus of the award is based on four categories "Intellectual Property Management System", "Inventions and Ideas", "Intellectual Property Capitalization" and "Industrialization and Commercialization". Although the terms and words used by the Innovation-Knowledge Enterprise Assessment and Award are not the same, these four categories deal with the same qualitative issues under the four enabling categories of the rapid audit system: "Management Support", "Innovation Development", "Intellectual Property Capitalization" and "External Relationship Management". Therefore, the four enabling categories on the "Systems and Practices" section of the rapid audit system are consistent with the four categories of the Innovation-Knowledge Enterprise Assessment and Award. Independent of this research, a team of four experienced external assessors assessed the same companies (Company A, B and C) as part of the assessment process for all companies participated in the award. The final assessment results and relative ranking positions given by the external assessors of Company A, B

and C are shown in Table 7.7. The final assessment results on “Systems and Practices” generated using the rapid audit system and the final assessment results given by the external assessors in awards are different because two dissimilar scoring systems are used to identify strengths and areas for improvement during the assessment. However, both scoring systems are logical and systematic ways to fulfil the objectives of assessing the relative ranking positions of companies. By benchmarking with the final assessment results, the relative ranking positions of Company A, B and C are consistent. It is clear in Table 7.7 that Company A has the highest score, Company B falls in the mid-range and Company C has the lowest score in IP management. Thus, the results can be regarded as accurate.

| Company | The “Systems and Practices” Section of the Rapid Audit System | | The Innovation-Knowledge Enterprise Assessment and Award | |
|---|---|---|---|---|
| | Final Assessment Results | Ranking Positions | Final Assessment Results | Ranking Positions |
| A | 816 | 1 | Award-winning | 1 |
| B | 622 | 2 | Award-winning | 2 |
| C | 305 | 3 | Award failed | 3 |

Table 7.7 Comparison of the final assessment results and relative ranking positions generated from the rapid audit system and the award

Many HK-GD based manufacturing organizations have experienced difficulties in putting the principles of IP management into practices. With the variety of starting points and motivations for continuous improvement, it is often difficult for organizations to specify a plan detailing the order in which introduction should be

undertaken. With the rapid audit system proposed in this research, it is advisable for organizations to carry out a general audit of their current status in terms of organizational performance and resources available before starting IP management implementation. According to their current status of IP management implementation, individual organizations can choose the appropriate starting point to implement IP management. It is recommended that individual organizations can use the rapid audit system to understand the current status of IP management implementation themselves and then to identify the areas for making improvement using the comprehensive audit system introduced in the next section.

## 7.4 Development of a Comprehensive Intellectual Property Management Audit System for the Hong Kong-Guangdong based Manufacturing Industry

As described in research work three in section 7.1, the purpose of this section is to introduce a comprehensive IP management audit system to investigate the strengths and areas for improvement of the enabling criteria in IP management. This is achieved by undertaking evaluation against the twelve enabling criteria of the "Intellectual Property Management Excellence Audit Model".

Figures 7.17a and 7.17b outline the evaluation framework proposed in this research. The framework accurately describes the relationship between attributes from top level through intermediate levels to the lowest level. In this research, "IP Management Implementation – Systems and Practices" is the top level attribute of the evaluation framework. According to the framework, the "Systems and Practices" is assessed based on the evaluation of four enabling categories. These enabling categories are considered to be level 2 attributes. Under these level 2 attributes, the framework is broken down to enabling criteria, which are considered to be level 3 attributes. Under these level 3 attributes, the framework is broken down to lower attributes – indicators, which detail relevant enabling criteria and are considered as level 4 attributes.

The comprehensive IP management audit system can provide more accuracy for evaluation of strengths and areas for improvement in each criterion for the HK-GD based manufacturing organizations. It uses a hierarchical framework to breakdown attributes to the point where they can be assessed in a logical manner to reduce the subjectivity and improve the logic underlying decisions.

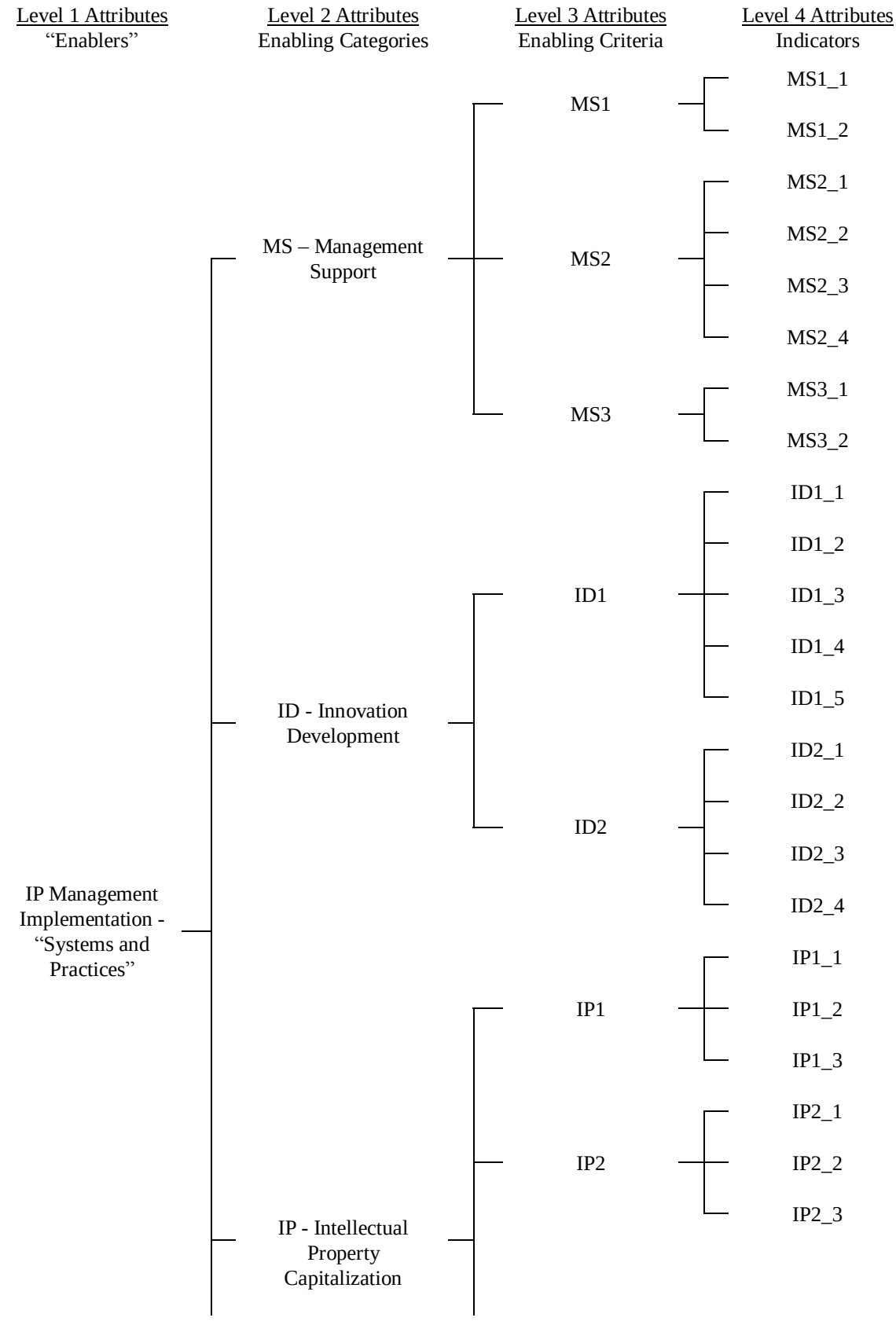



Figure 7.17a A comprehensive audit system which is broken down into four levels

(to be continued in Figure 7.17b)

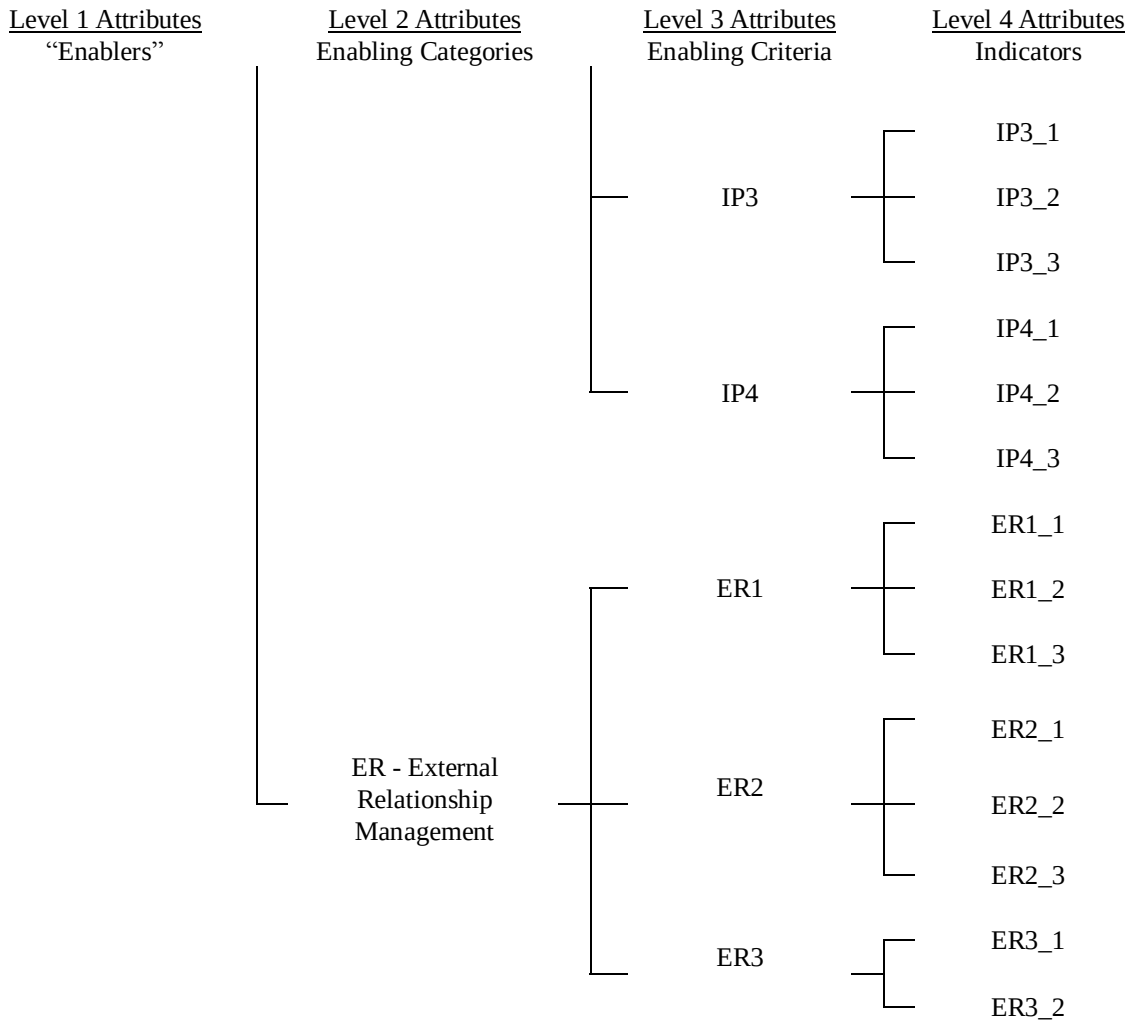



Figure 7.17b A comprehensive audit system which is broken down into four levels (continuation of Figure 7.17a)

The application of the comprehensive audit system involves the most important stage which is the design of the enabling criteria and their underlying indicators. There are total 37 indicators which have been discussed in Chapter 4 and have been examined through the questionnaire survey as described in Chapter 5. For examples, the management support category has three enabling criteria and eight indicators (see Table 5.2); the innovation development category has two enabling criteria and nine indicators (see Table 5.3); the intellectual property capitalization category has four

enabling criteria and twelve indicators (see Table 5.4); and the external relationship management category has three enabling criteria and eight indicators (see Table 5.5). As the comprehensive audit system is developed by adopting studies from literature review and questionnaire survey of the criteria-based IP management model, it is suitable to be used as a fundamental framework for the development of the audit system in the IP management for the HK-GD based manufacturing industry.

In this research, the level 4 attributes which are the indicators are assessed directly. As the indicators directly measure how well organizations are performing in terms of "Approach" and "Deployment", they will take into account two factors:

(a) the degree of excellence of the approach used to address the issue;
(b) the extent to which the approach has been implemented to the relevant areas and activities of the organization.

The scores for direct assessment of each indicator are grouped into five grades. They are namely, the "Achievers", "Performers", "Beginners", "Drifters" and "Unaware". They are generated based on literature reviewed in the field of quality management in line with the EFQM (2000) scoring guideline. Each level represents a different IP management excellence level (as explained in Tables 7.3 and 7.4). The evidence based mapping is adopted to directly assess each indicator and the scores are input into a PC window based IDS software that models the comprehensive IP management audit system.

### 7.4.1 Model Implementation

This step is to structure a comprehensive audit system using the IDS software. The method of model implementation is substantially similar to that described in section 7.3.1, and the attribute description of comprehensive audit system is included in Appendix K. The IDS software is designed to transform the lengthy and tedious model building and result analysis process into an easy window-based click and design activity. The main window of the IDS software is shown in Figure 7.18, which has menus, a tool bar and model display areas. The main window provides access to all functions for building, modifying, saving and opening MADM models, entering numerical data and descriptive information, conducting decision analysis and reporting analysis results using text files, bar charts or curves. The right window in Figure 7.18 displays part of the attribute hierarchy of the decision model for enabling criteria of the comprehensive audit system.


Figure 7.18 Main window of the IDS software for comprehensive audit system

Once the evaluation framework is established, two further steps were employed: First, all the measurement items were reviewed and validated by the six IP experts who had reviewed and validated the content of the evaluation framework, as described in section 7.4 and Appendix K. Second, a pre-test was conducted by three industrial practitioners in the manufacturing industry who had working experience of more than 10 years, and were at managerial level, involved in decision making in IP management. Minor adjustments were made during the validation stage and pre-test prior to case studies. Then the assessment system was developed and ready for the case studies.

### 7.4.2 Case Study of a Company for Comprehensive Intellectual Property Management Audit

The purpose of the audit process is to provide the organization with a clear understanding of its strengths and weaknesses which provides organizations with information to formulate the improvement action plan and monitor the improvement progress (EFQM 2007). As a result of the audit, preventive action can be taken to make sure the same problems do not happen again.

Since the purpose of this case study is to show how the comprehensive audit system measures both the strengths and weaknesses, it is natural to use a middle ranking company rather than a high or low ranking company for case study. In section 7.3.2, three companies have been used to test the rapid audit system. Company A is an electronic company, Company B is a chemical company and Company C is a plastic company. The initial assessment results in section 7.3.2.2 indicate that Company B is assessed to be a “Beginner” of IP management excellence. Thus Company B will be

suitable for further test with comprehensive audit system to identify strengths and areas for improvement.

In this case study for Company B, an external audit approach as explained in section 7.2.5 is used to fulfill the objective of a comprehensive audit. An audit team was formed by four experienced external assessors who were selected from business, professional, university and government subvented organization. The profiles of the four external assessors are shown in Table 7.8. They included a lead auditor (External Assessor 1), an IP lawyer (External Assessor 2), a professor (External Assessor 3) and an IP consultant (External Assessor 4). All external assessors had working experience from 10 to 20 years and were recognized experts in the field of business, innovation or IP management; thus the industry background and the areas of expertise of the four external assessors are matched to Company B and they are the appropriate persons to conduct the audit.

| External Assessor | Occupation | Industry Background | Areas of Expertise | Year of Experience |
|---|---|---|---|---|
| 1 | Lead Auditor | Business | Quality Management Systems | 10 |
| 2 | IP Lawyer | Professional | IP Laws | 15 |
| 3 | Professor | University | Innovation Management | 20 |
| 4 | IP Consultant | Government Subvented Organization | IP Management | 18 |

Table 7.8 External assessors' profile in audit

As part of the effort to prepare for the audit exercise, the four external assessors were trained in various key aspects, covering the assessment system as provided by the IDS

software, the evidence collection from the companies being assessed and the objective judgment why a specific criterion is assessed to a certain grade for a company. By applying the ER approach, it is relatively easy to help the team of external assessors to implement audit exercises and to reach consensus on their scores. For example, there is no limit on how many of the defined grades can be assessed to an attribute, as long as the total degree of belief is equal to or less than 1 (100%). In a group decision making situation experienced by several external assessors in a company, the degrees of belief may represent the percentage of people who have assessed the grades to the attribute (Xu and Yang 2003). Therefore, the overall assessment results shall draw the experiences and opinions from all the external assessors of the company and not rely on a particular person even though he or she is knowledgeable in certain aspects.

The measurement items (as shown in Appendix K) of the comprehensive audit system with the guidelines were sent to the participants of Company B two weeks before the site visit and interview were undertaken by the external assessors in order to give them enough time to review the items and to ask any questions. The detailed description of the audit models were introduced and explained to the participants to make sure that they understand all the measurement items, guidelines and description of the evaluation grades at the time of conducting the audit.

In this section, the case study of Company B is reported and the overall results are presented. In particular, section 7.4.2.1 describes the audit information input; section 7.4.2.2 describes audit reports of case studies; section 7.4.2.3 describes the strengths and weakness analysis of each enabling criterion; and from these results, section 7.4.2.4 evaluates the effectiveness of the comprehensive audit system and implications for IP management improvement.

### 7.4.2.1 Audit Information Input

An IDS data input dialog window is shown in Figure 7.19 with the examples of information displayed for the Company B with respect to the indicator "1.2.1 IP Manual". Clicking the 'Alternative Info', the 'Attribute Info' or the 'Grade Info' button, information can be read about the alternative (Company B), about the attribute (1.2.1 IP Manual) or about the evaluation grade (Beginners).

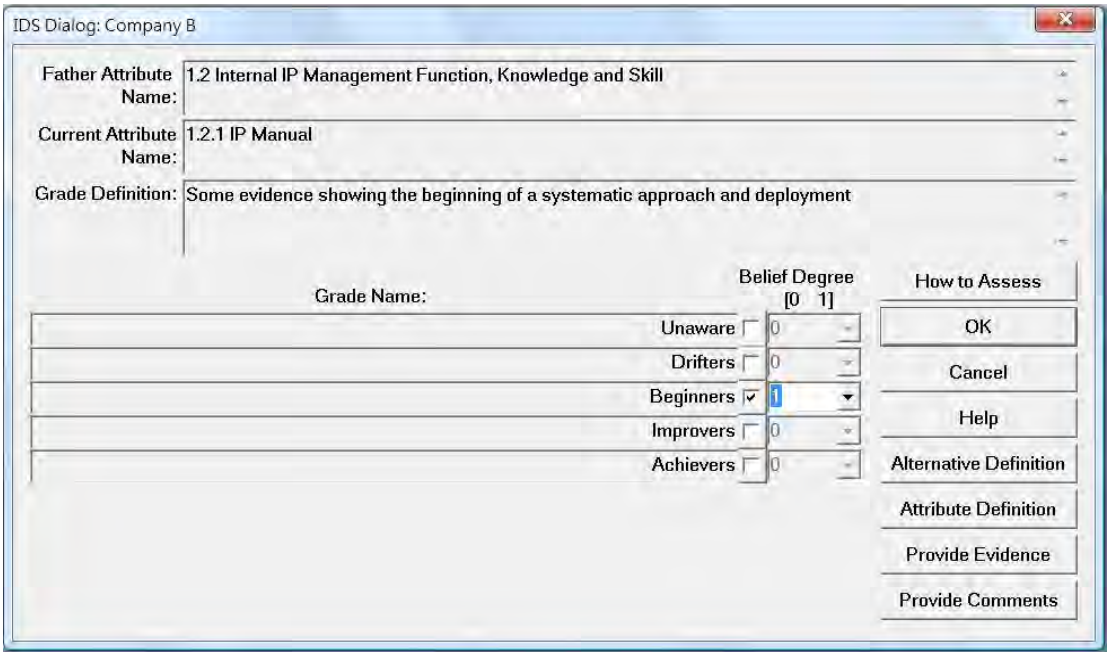



Figure 7.19 IDS dialogue window for information display of comprehensive audit system

Clicking the 'Evidence' or the 'Comments' button, another dialog window as shown in Figure 7.20 will prop up where text information can be entered to support assessments in a notepad type of editing environment. The IDS dialogue window is shown with the examples of information input for the Company B with respect to the indicator "1.2.1 IP Manual"

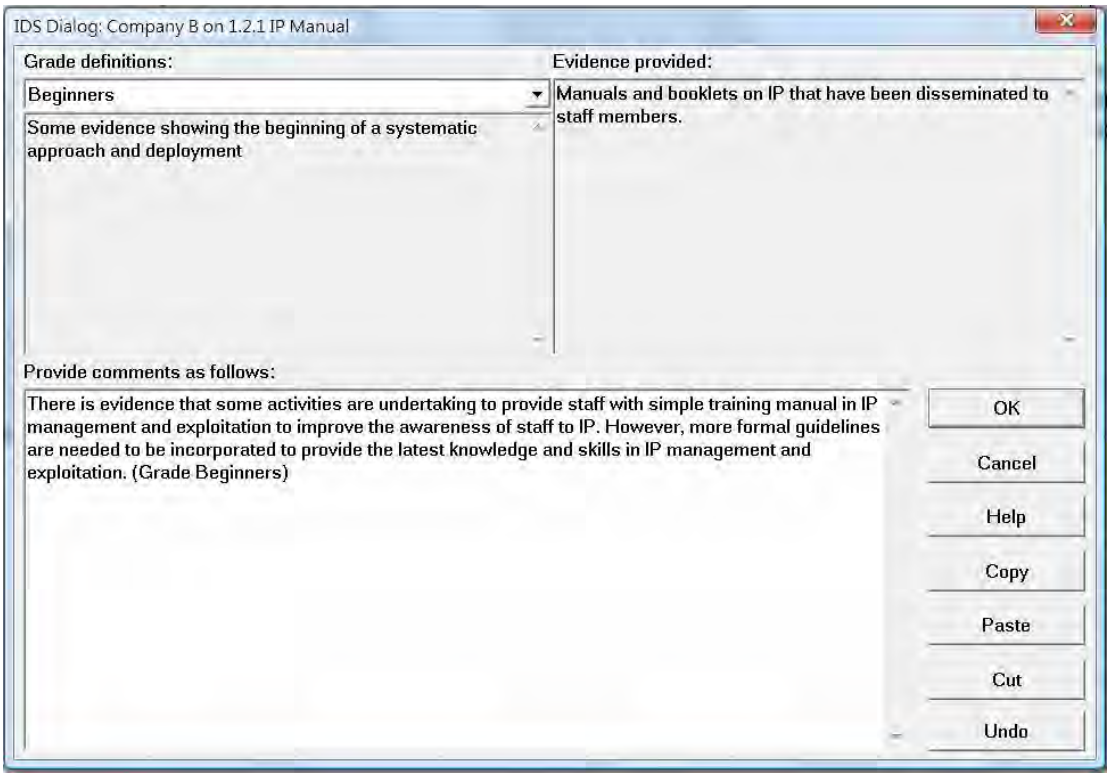



Figure 7.20 IDS dialogue window for data input of comprehensive audit system

Based on the ER framework the degree to which a criterion is evaluated, with respect to one of the five evaluation grades, is directly dependent on the evidence that supports the evaluation. With the ER approach, there is little compromise between the data collection process and effective evaluation, since the accuracy of the evaluation is directly proportional to the amount of accumulated evidence.

#### 7.4.2.2 Audit Report

Once the evaluation framework is established and input information entered, IDS will process the information using the ER approach and display the assessment results graphically. Assessment results on all attributes of comprehensive audit system for Company B is included in Appendix L. Figure 7.21a shows the final distributed

assessment of Company B's evidence of strength and weakness in "Systems and Practices". It is clear that the company made excellent achievements at both the "Improvers" and the "Beginners" levels, though it was "Achievers" and "Drifters" in some areas. This is the reason why the company's average performance is close to the "Beginners" category.

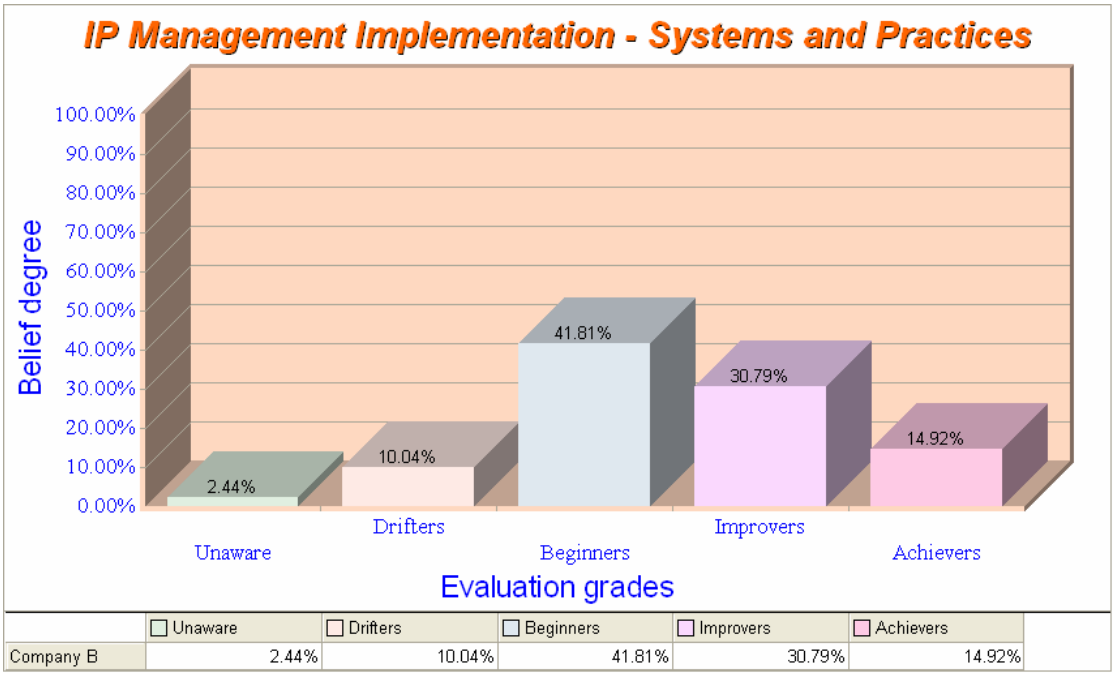



Figure 7.21a Distributed performance in "Systems and Practices"

By reviewing the performance score range in Figure 7.21b, Company B has complete assessment which means that there is no missing information and no unknowns during the audit.

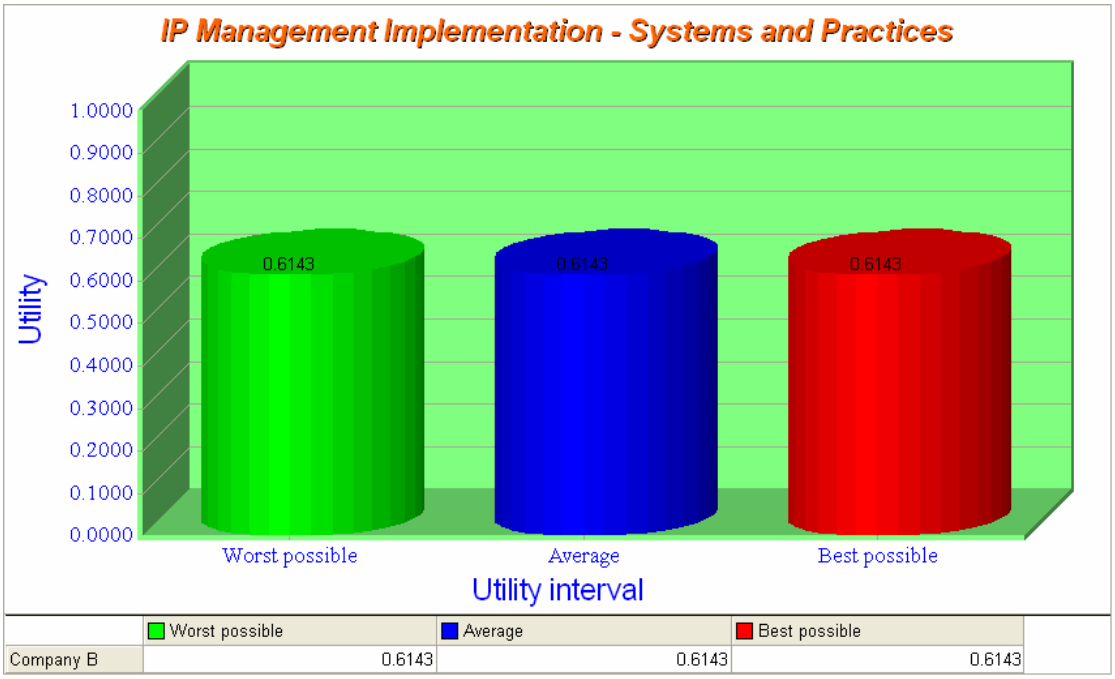



Figure 7.21b Performance score range in "Systems and Practices"

IDS is capable of providing a distributed assessment for any attribute, which makes areas for improvement clear and linked precisely to the assessment and in this way provides a basis to establish action plans and linkage.

Figure 7.22 shows the strength and weakness analysis chart. It is clear that the company shows its strength and weakness in different areas. The lowest score is 7% in "IP Licensing and Acquisition" and highest score is 87% in "Creativity Generation, Concept Selection and Prototyping". Accordingly, Company B should evaluate different enabling criteria to understand its strengths and improve its weaker areas.

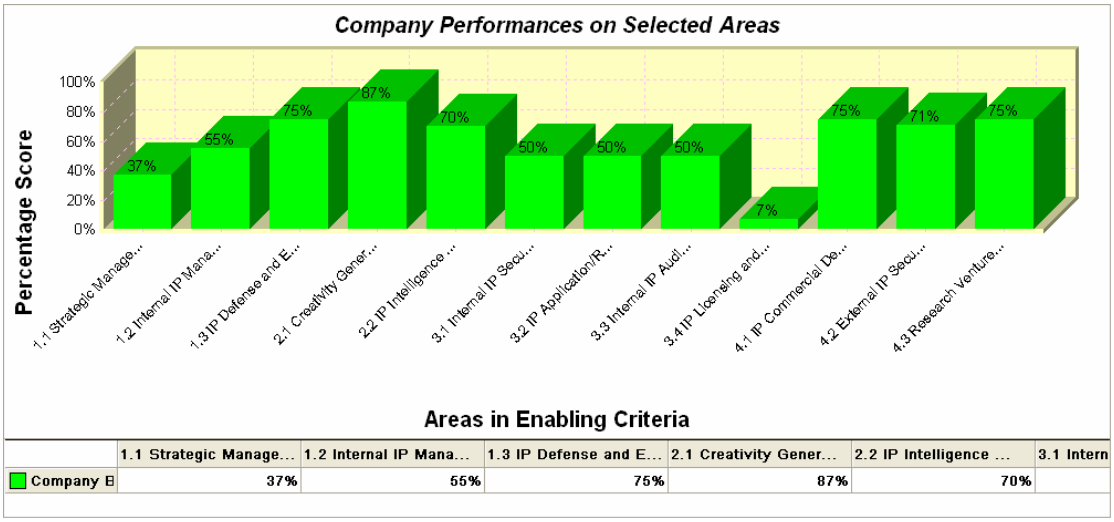



Figure 7.22 Strengths and weaknesses of Company B in the twelve enabling criteria

Test reports in text format are available by the IDS. The questionnaire, explanation of questions and answers, assessment data and aggregate results on every attribute are saved in a text file. By using this detail assessment report, it can help companies to understand their strengths and to improve upon their weaker areas.

### 7.4.2.3 Strengths and Weakness Analysis of Each Enabling Criterion

The following is the assessment report in text format for the twelve enabling criteria and their underlining indicators. For each enabling criterion, the data analysis was conducted according to the definitions of evaluation grades and the results consist of three main sections. First, the total degree of believe for each enabling criterion is analysed and the average utility is provided. Second, the examples of evidence obtained from Company B are described. Finally, the assessor's comments on evaluation grades and belief degree for each indicator are summarized.

1. MS1 - Strategic Management Plan for IP Activities

Belief Degree:

| | |
|---|---|
| Unaware | 0.000 |
| Drifters | 0.500 |
| Beginners | 0.500 |
| Improvers | 0.000 |
| Achievers | 0.000 |

Average Utility: 0.375

Evidence Gathered:

(a) Internal document, corporate website and newsletters showing the organization's vision, strategy and policy on IP.

(b) Written action plans that encourage development of organizational culture on IP with the participation of employees at all levels.

Comments Provided:

(a) There is evidence that some activities are undertaking to develop vision, strategy and policy on IP, but more communication are needed to convey the top management's commitment to employees, customers, suppliers, partners and other external parties. (Grade: Beginners, 50%)

(b) The organization is aware of the need to develop total commitment to action on IP management; and the activities are limited to the stage of planning only. No actual work has yet undertaken. (Grade: Drifters, 50%)

2. MS2 - Internal IP Management Function, Knowledge and Skill

Belief Degree:

| | |
|---|---|
| Unaware | 0.000 |
| Drifters | 0.000 |
| Beginners | 0.804 |
| Improvers | 0.196 |
| Achievers | 0.000 |

Average Utility: 0.549

Evidence Gathered:

(a) Manuals and booklets on IP that have been disseminated to staff members.

(b) Employee contract, employee manual and code of practice that are used to clarify confidentiality requirement, ownership of IP and incentive for invention.

(c) A list of the past and future training activities on IP and the attendance record.

(d) The expertise and years of experience of relevant staff on IP management.

Comments Provided:

(a) Company B has undertaken some activities to provide staff with a simple training manual in IP management and exploitation to improve the awareness of staff to IP. However, more formal guidelines are needed to be incorporated to provide the latest knowledge and skills in IP management and exploitation. (Grade: Beginners, 25%)

(b) There is sufficient evidence showing the organization has substantial provisions in contracts with employees at the time of hiring for safeguarding confidential information and knowledge and assigning patentable inventions to employer, but the processes still need time to be mature and fully integrated into business

activities. (Grade: Improvers, 25%)

(c) The organization has some activities to implement an IP training policy for staff. However, the approach is implemented in a structured way in an early stage. More training programmes are needed to be developed. (Grade: Beginners, 25%)

(d) To appoint suitable staff for IP portfolio management and extraction of value from IP, the organization has an organization chart showing the designation of IP management roles to managerial levels and only a few development groups have participated within the organization. Thus further aligning IP strategy with business goals across a wide range of development groups and activities is needed. (Grade: Beginners, 25%)

3. MS3 - IP Defense and Enforcement System

Belief Degree:

| | |
|---|---|
| Unaware | 0.000 |
| Drifters | 0.000 |
| Beginners | 0.000 |
| Improvers | 1.000 |
| Achievers | 0.000 |

Average Utility: 0.750

Evidence Gathered:

(a) A list of legal cases on IP defense faced by the organization.

(b) A list of legal cases on IP enforcement initiated by the organization.

Comments Provided:

(a) There is sufficient evidence showing the organization has on more than one

occasions sought legal support with appropriate involvement of marketing, engineering and administration departments when dealing with the case of IP defense. The processes are sound, prevention-based and systematic for expediting fact finding activities and defending against an aggressive accuser, but more time is needed to be mature. (Grade: Improvers, 50%)

(b) The organization has on more than one occasions sought legal support with appropriate involvement of marketing, engineering and administration departments in the actions for pursuing an infringer. With effective strategy advised by legal counsel, the processes are sound, prevention-based and systematic, but a more well-functioning IP enforcement mechanism is needed to be fully integrated with business activities. (Grade: Improvers, 50%)

4. ID1 - Creativity Generation, Concept Selection and Prototyping

Belief Degree:

| | |
|---|---|
| Unaware | 0.000 |
| Drifters | 0.000 |
| Beginners | 0.172 |
| Improvers | 0.172 |
| Achievers | 0.656 |

Average Utility: 0.871

Evidence Gathered:

(a) A list of products with original ideas from the organization.

(b) A list of the others' IP protected products that have been circumvented by the organization.

(c) Business proposals, patentability of IP rights evaluation and market study on new

projects being prepared by the organization.

(d) Documents showing regular meetings held by management to discuss the exploitation of inventions made by employees.

(e) Testing reports and prototypes on projects developed by the organization.

Comments Provided:

(a) Company B has a process in the maturing stage for developing originally invented products to achieve the objective of maximizing the number of new IP assets. (Grade: Achievers, 20%)

(b) To achieve the objective of maximizing output of new products without infringing on other's IP rights, the organization has a process in the maturing stage for designing around relevant prior art documents. (Grade: Achievers, 20%)

(c) There is sufficient evidence showing the organization has repeatedly performed concept evaluation, including technology concept analyzing, market needs assessment and business model investigation, but the processes still need time to be mature and achieve the objective of maximizing market share of products, minimizing business risk and ensuring optimal profits. (Grade: Improvers, 20%)

(d) There is evidence that some activities are undertaking to conduct concept reviewing and vetting procedures to select suitable protection forms to secure IP rights. However, it is unclear how managers from different departments have participated. A systematic approach and deployment needs to be sought. (Grade: Beginners, 20%).

(e) To achieve the objective of assuring product's marketability, cost-effectiveness in manufacturing and evolving products to next generation, the organization has a process in the maturing stage to go through a continual development and testing of the existing product prototypes. (Grade: Achievers, 20%)

5. ID2 - IP Intelligence and Advisory Support

Belief Degree:

| | |
|---|---|
| Unaware | 0.000 |
| Drifters | 0.000 |
| Beginners | 0.196 |
| Improvers | 0.804 |
| Achievers | 0.000 |

Average Utility: 0.701

Evidence Gathered:

(a) A list of IP search reports obtained by the organization.

(b) A list of IP databases being used by the organization.

(c) A list showing the typical IP matters handled by external IP consultant.

(d) A list showing the typical IP matters with annual budget of expenditure and income.

Comments Provided:

(a) There is sufficient evidence showing the organization has repeatedly obtained IP search reports or other IP related information for most of the projects to ascertain risk in business. However, the processes still need time to be mature and achieve the objective of minimizing risk in business. (Grade: Improvers, 25%)

(b) The organization has repeatedly utilized IP knowledgebase as an information tool among many product lines. However, the processes identified still need to achieve the objective of revealing insights into patent technology and gaining strategic advantage, competitiveness and intelligence. (Grade: Improvers, 25%)

(c) The organization has more than one occasion allocated resources and sought advice from the external IP consultant for those matters which are out of its employees' capability to handle. However, the processes still need to be fully integrated with business activities. (Grade: Improvers, 25%)

(d) There is evidence that some activities are undertaking to allocate sufficient budget and resources for supporting its IP portfolio; and a beginning of systematic approach and deployment is in place. (Grade: Beginners, 25%)

6. IP1 - Internal Intellectual Property Security

Belief Degree:

| | |
|---|---|
| Unaware | 0.000 |
| Drifters | 0.000 |
| Beginners | 1.000 |
| Improvers | 0.000 |
| Achievers | 0.000 |

Average Utility: 0.500

Evidence Gathered:

(a) Documents showing internal controls in place to prevent unauthorized disclosure of confidential information.

(b) Agreements with commissioned third parties showing the works are created by third parties with the intention that copyright shall be owned by the organization.

(c) Design documentation system used by the employees.

Comments Provided:

(a) Company B has undertaken some activities to restrict and control staff access to

confidential information in relation to inventive products or technologies. However, it is not clear how. Internal rules and various security protection procedures need to be imposed. (Grade: Beginners, 33.3%)

(b) The organization has undertaken some activities on protection of copyrighted works and the use of copyright statement on original work to claim ownership. However, it is unclear how. (Grade: Beginners, 33.3%)

(c) There is evidence that some activities are undertaking for utilizing a simple internal design documentation system. The approach is implemented in a structured way at an early stage. However, improved documentation systems to manage and store various types of design documents need to be used. (Grade: Beginners, 33.3%)

7. IP2 - Intellectual Property Application/Registration

Belief Degree:

| | |
|---|---|
| Unaware | 0.000 |
| Drifters | 0.333 |
| Beginners | 0.333 |
| Improvers | 0.333 |
| Achievers | 0.000 |

Average Utility: 0.500

Evidence Gathered:

(a) A list of patents which have been filed by the organization.

(b) No evidence of design application which has been filed by the organization.

(c) A list of trademarks which have been filed by the organization.

Comments Provided:

(a) There is sufficient evidence showing the organization has repeatedly identified and filed patent/utility model applications for protection of innovation. However, the processes identified still need time to be mature and achieve the objective of maximizing the protection of innovation with patent/utility model. (Grade: Improvers, 33.3%)

(b) The organization is aware of the need to protect distinctive appearance of products by applying for design application. However, the process is limited to the stage of planning only. No actual task has yet undertaken. (Grade: Drifters, 33.3%)

(c) There is evidence that some activities are undertaking to protect valuable symbol, logo or word by applying for trademark. A beginning of systematic approach and deployment is in place. (Grade: Beginners, 33.3%)

8. IP3 - Internal Intellectual Property Audit and Evaluation

Belief Degree:

| | |
|---|---|
| Unaware | 0.000 |
| Drifters | 0.333 |
| Beginners | 0.333 |
| Improvers | 0.333 |
| Achievers | 0.000 |

Average Utility: 0.500

Evidence Gathered:

(a) An inventory list of all IP and a folder containing standard agreements involving IP.

(b) No evidence of authorized valuation reports performed by professional

organization in relation to IP.

(c) Financial evaluation performed on the potential revenue generated from IP.

Comments Provided:

(a) Company B has conducted some simple IP audits to review IP portfolio, policies and procedures, but a systematic approach and deployment is need to be sought. (Grade: Beginners, 33.3%)

(b) The organization is aware of the need to perform IP valuation or obtain IP valuation reports. The process is limited to the stage of planning only. No actual task has yet undertaken. (Grade: Drifters, 33.3%)

(c) There is sufficient evidence showing the organization has repeatedly used IP cost/benefit analysis reports to understand the value of IP assets on the project's financial performance. But the processes identified still need time to be mature and achieve good performance. (Grade: Improvers, 33.3%)

9. IP4 - Intellectual Property Licensing and Acquisition

Belief Degree:

| | |
|---|---|
| Unaware | 0.714 |
| Drifters | 0.286 |
| Beginners | 0.000 |
| Improvers | 0.000 |
| Achievers | 0.000 |

Average Utility: 0.071

Evidence Gathered:

(a) No evidence of out-licensing agreements which have been entered by the

organization.

(b) No evidence of in-licensing agreements which have been entered by the organization.

(c) No evidence of IP assignment which has been entered by the organization with contracting parties.

Comments Provided:

(a) The organization is aware of the need to make IP out-licensing agreements. The process is limited to the stage of planning only. No actual task has yet undertaken. (Grade: Drifters, 33.3%)

(b) Not aware of any need to make any IP in-licensing or franchising agreements. (Grade: Unaware, 33.3%)

(c) Not aware of any need to acquire/transfer any IP ownership from/ to relevant parties. (Grade: Unaware, 33.3%)

10. ER1 - Intellectual Property Commercial Development and Marketing

Belief Degree:

| | |
|---|---|
| Unaware | 0.000 |
| Drifters | 0.333 |
| Beginners | 0.333 |
| Improvers | 0.333 |
| Achievers | 0.000 |

Average Utility: 0.750

Evidence Gathered:

(a) A list of new products with IP incorporation, technical evaluation reports showing

the competitive edge for the new products and sales performance reports.

(b) Documents that signify the market position of brand names in use by the organization.

(c) Advertisements and catalogues that show the product with IP rights.

Comments Provided:

(a) Company B has a process in the maturing stage to incorporate IP content into new product or process to achieve the objective of gaining business growth. A systematic approach and deployment is in place that allows the organization to achieve good performance. (Grade: Achievers, 33.3%)

(b) The organization has widely used its brand name in its target market segments and maintained a desired market position. The processes identified still need time to be mature and achieve the objective of successfully capitalizing its brand name. (Grade: Improvers, 33.3%)

(c) There is evidence that some activities are undertaking to project the image of its product with IP rights in the aspect under marketing process. A beginning of systematic approach and deployment is in place. Various means of marketing communication need to be used to project the image of its product with IP rights to most contact points. (Grade: Beginners, 33.3%)

11. ER2 - External Intellectual Property Security, Agreement and Partners Matching

Belief Degree:

| | |
|---|---|
| Unaware | 0.000 |
| Drifters | 0.000 |
| Beginners | 0.308 |
| Improvers | 0.539 |

Achievers 0.154

Average Utility: 0.712

Evidence Gathered:

(a) Agreements being used by the organization with involved parties that clarify the issue of IP rights ownership.

(b) Non-disclosure agreements signed by involved parties showing the obligation of keeping information confidential.

(c) A list of products which have been successfully launched in the market under the joint development with the collaborating partner. A list of projects with technology partners in collaboration.

Comments Provided:

(a) There is sufficient evidence showing the organization has on more than one occasions addressed specific issues and ascertained ownership of IP within its current portfolio and agreements. However, the processes identified still need to achieve the objective of controlling the use of IP, transferring and selling of IP, gaining benefit from IP and excluding others from the IP. (Grade: Improvers, 33.3%)

(b) The organization has undertaken some activities on the use of non-disclosure agreement to protect the confidential information disclosed to a relevant partner. However, a systematic approach and deployment is needed to be sought. (Grade: Beginners, 33.3%)

(c) There is sufficient evidence showing that the organization has repeatedly marketed its products and services with collaborating partners on the basis of IP. The processes identified still need time to be mature and fully integrated with business

activities. (Grade: Improvers, 16.7%) To achieve the objective of gaining mutual advantages of both parties in technology collaboration, the organization has a process in the maturing stage in making technology collaborations with suitable partners. (Grade: Achievers, 16.7%)

12. ER3 - Research Venture and Intellectual Property Holding Business Startup/Spinout

Belief Degree:

| | |
|---|---|
| Unaware | 0.000 |
| Drifters | 0.000 |
| Beginners | 0.500 |
| Improvers | 0.000 |
| Achievers | 0.500 |

Average Utility: 0.750

Evidence Gathered:

(a) A list of research projects in collaboration with universities.

(b) An IP holding subsidiary, with scale of operation, formed for new business development.

Comments Provided:

(a) To achieve the objective of developing new product/technology and gaining successful commercialization and market acceptance, the organization has a process in the maturing stage to collaborate with research institutes such as universities. (Grade: Achievers, 50%)

(b) There is evidence that some activities are undertaking to start up an IP holding

company. The approach is implemented in a structured way in an early stage. (Grade: Beginners, 50%)

#### 7.4.2.4 Evaluation of the Comprehensive Audit System and Implications for Intellectual Property Management Improvement

The test report is a major output from the assessment process using a comprehensive audit system. Organizations which conduct assessment against the IP management comprehensive audit system not only want to know their assessment results and scores, they also want to know their strengths and areas for improvement. Therefore the comprehensive audit system in this research should be able to assist in producing the detailed analysis.

There are various ways of identifying strengths and areas for improvement during assessments. In this case study, a benchmarking method (Li and Yang, 2003) is used to fulfil the objectives of the assessments. The method uses the average utility as a gauge to identify strengths and areas for improvement. By identifying all the basic attributes assessed higher than the average utility, the strengths can be identified. In the same way, areas for improvement can be identified by focusing on all the basic attributes assessed lower than the average utility. For example, to identify the strengths and areas for improvement of the company B's comprehensive audit test report, first of all the average score of the assessment which is 614 is chosen as the benchmark utility for company B. All the assessment results above 614 would be considered as strengths and below 614 would be considered as areas for improvement. In this way, six strengths and six areas for improvement are identified.

Strengths and weaknesses identified by using benchmarking method

*Strengths:*

- There is sufficient evidence showing that the organization establishes IP defense and enforcement system. (MS3 - IP Defense and Enforcement System)
- The organization has basic processes in fully or partially maturing stage for concept creation and development that lead to IP generation. (ID1 - Creativity Generation, Concept Selection and Prototyping)
- There is sufficient evidence showing that the organization has repeatedly avoided costs due to reinvention efforts and potential infringement litigations in early design cycle by using IP intelligence and advisory support. (ID2 - IP Intelligence and Advisory Support)
- The organization has a process in fully or partially maturing stage to embed IP in technology, product and service. (ER1 - Intellectual Property Commercial Development and Marketing)
- There is sufficient evidence showing that the organization becomes more sophisticated in managing external relationship with IP requirements. (ER2 - External Intellectual Property Security, Agreement and Partners Matching)
- There is sufficient evidence showing that the organization stakes a claim on the future with encouragement of research ventures and IP holding business startups or spinouts. (ER3 - Research Venture and Intellectual Property Holding Business Startup/Spinout)

*Weaknesses:*

- Although the organization is aware of the needs to embed IP management in visionary leadership and develop strategic management plan for IP activities, most

of the activities are limited to the stage of planning or implemented in an early stage. (MS1 - Strategic Management Plan for IP Activities)

- The organization initiates some processes to build core competence in IP knowledge and skill in all functions, but most of the activities are implemented in an early stage. (MS2 - Internal IP Management Function, Knowledge and Skill)
- The organization undertakes some activities to formalize internal security control measures for safeguarding the content of IP portfolios, but a systematic approach and deployment needs to be sought. (IP1 - Internal Intellectual Property Security)
- The organization develops basic processes for identifying, protecting and controlling the organization's own IP. However, the processes identified are repeatedly undertaken for patent protection of innovations only, other forms of IP such as design registrations and trademarks are limited to the stage of planning or implemented in an early stage. (IP2 - Intellectual Property Application/Registration)
- The organization reduces costs associated with the organization's IP portfolios by using internal audit and evaluation. But the processes identified are repeatedly undertaken for cost/benefit analysis only, other forms of audit and valuation of IP assets are limited to the stage of planning or implemented in an early stage. (IP3 - Internal Intellectual Property Audit and Evaluation)
- The organization is unaware of the needs to extract value directly from IP. No evidence of IP licensing has been undertaken. (IP4 - Intellectual Property Licensing and Acquisition)

From the weaknesses of Company B, it can be seen that the major problems of IP management are found in six enabling criteria: “Strategic Management Plan for IP Activities”, “Internal IP Management Function, Knowledge and Skill”, “Internal Intellectual Property Security”, “IP Application/ Registration”, “Internal Intellectual

Property Audit and Evaluation" and "Intellectual Property Licensing and Acquisition". Thus, different improvement scenarios or action plans can be developed to achieve different purposes of implementation.

It is noteworthy that the research results reported in Chapter 6 presents a systematic way for company B to plan its improvement strategies. According to Table 6.4, three improvement scenarios are identified based on the relative priorities rankings of the twelve enabling criteria suggested by six IP experts. By analysing evidence given by the assessor, it can be noted that some improvements can be implemented within a short period of time, such as three months, while others need a medium or longer period of time. For the short-term improvement, "Internal IP Management Function, Knowledge and Skill" and "IP Application/ Registration" can be improved immediately. As for the improvement of "Strategic Management Plan for IP Activities" and "Internal Intellectual Property Security", a medium period of time is needed to establish a cross-functional team to resolve the issues. The evidence indicates that "Internal Intellectual Property Audit and Evaluation" and "Intellectual Property Licensing and Acquisition" are not implemented or in the early stages. Therefore, a long period of time is needed to make improvements for Company B.

Based on the evidence provided, improvement scenarios for short-term, medium-term and long-term action plan are produced for simulation purposes.

Improvement scenarios for simulation

*Short-term action plan*:

1. To incorporate more formal guidelines in IP manual to provide the latest knowledge and skills in IP management and exploitation. This will improve the

assessment result of the indicator “IP Manual” to grade “Improvers”.

2. To develop more IP training programmes for staff. This will improve the assessment result of the indicator “IP Training” to grade “Improvers”.
3. To further aligning IP strategy with business goals across a wide range of development groups and activities. This will improve the assessment result of the indicator “Internal IP Manager” to grade “Improvers”.
4. To protect distinctive appearance of products by applying for design application. This will improve the assessment result of the indicator “Design Application” to at least grade “Beginners”.
5. To protect valuable symbol, logo or word by applying for trademark. This will improve the assessment result of the indicator “Trademark or Service Mark Registration” to grade “Improvers”.

*Medium-term action plan*:

1. To undertake more communication to convey the top management's commitment to employees, customers, suppliers, partners and other external parties. This will improve the assessment result of the indicator “Vision, Strategy and Policy Setting” to grade “Improvers”.
2. To develop total commitment to action on IP management. This will improve the assessment result of the indicator “Total Commitment to Action” to at least grade “Beginners”.
3. To impose internal rules and various security protection procedures. This will improve the assessment result of the indicator “Confidential Information” to grade “Improvers”.
4. To improve protection of copyrighted works and the use of copyright statement on original work to claim ownership. This will improve the assessment result of

the indicator “Copyright Protection” to grade “Improvers”.

5. To improve documentation systems to manage and store various types of design documents. This will improve the assessment result of the indicator “Internal Design Documentation” to grade “Improvers”.

*Long-term action plan*:

1. To seek a systematic approach and deployment in IP audit. This will improve the assessment result of the indicator “IP Audit” to grade “Improvers”.
2. To perform IP valuation or obtain IP valuation reports. This will improve the assessment result of the indicator “IP Valuation” to at least grade “Beginners”.
3. To make IP out-licensing agreements. This will improve the assessment result of the indicator “IP Out-licensing” to at least grade “Beginners”.
4. To make IP in-licensing or franchising agreements. This will improve the assessment result of the indicator “IP In-licensing” to at least grade “Beginners”.
5. To acquire/transfer any IP ownership from/ to relevant parties. This will improve the assessment result of the indicator “IP Ownership Acquisition” to at least grade “Beginners”.

By using the comprehensive audit system, three improvement scenarios for simulation are used for model testing in this research. From the assessment results generated by simulating the short-term improvement scenario of Company B, the predicted overall assessment result is 671. Compare with the current assessment result of 614, a 9.3 per cent improvement is achieved. The assessment results generated from the simulation of the medium-term and long-term improvement scenarios show that the predicted overall assessment results are 664 and 635, representing 8.1 and 3.4 per cent improvements, respectively.

From the illustrations of the three improvement scenarios it can be seen that the comprehensive audit system can be used as a useful planning tool for organizations to study their improvement strategies in order to achieve their improvement objectives.

## 7.5 Concluding Remarks

Based on "Intellectual Property Management Excellence Audit Model", a rapid audit system and a comprehensive audit system have been constructed. The development of the audit model has enabled a more rational approach to be introduced to the assessment measurement system. The audit model was successfully built following a sequence of steps. First, based on the criteria-based IP management model through the literature review and examination by questionnaire survey, the IP management excellence audit model was designed, which properly balanced the accuracy and complexity of the evaluation process. Second, the evaluation grades were defined based on the EFQM (2000) scoring guidelines and previous research work (Yang *et al.*, 2001; Siow *et al.*, 2001). Finally, the ER approach was chosen as the appropriate MADM approach for aggregating assessment information with uncertainty. By using the intelligent system (IDS) software (Yang and Xu, 1998; Xu and Yang, 2001), the evaluation process using the ER approach is made relatively easy to implement.

Three case studies were used for model testing of rapid audit system in this research. From the evidential reasoning analysis and comparison with external assessors' results, it was found that the new IP management excellence audit model has the potential to improve the accuracy of the measurement system of the Innovation-Knowledge Enterprises Assessment and Award and compensate for the lack of experience in

assessment.

In the case study of company B, it was also found that the new IP management excellence audit model can assist in producing a detailed analysis report by systematically identifying strengths and areas for improvement. The benchmarking method has been identified as useful tools to assist in producing the detailed analysis report. This method can be used to meet specific organizations' assessment objectives.

The simulation function of the comprehensive audit model is found useful for organizations to plan their improvement strategies. Different improvement scenario results can be predicted without undergoing real implementation and changes. In this way, the audit model can be used as a strategic planning tool.

# Chapter 8 Conclusion

## 8.1 Achievements of Research

The aim of this research is to study the critical success factors for implementing IP management related activities in organizations. These factors encompass the essential elements of an IP management excellence audit model that is used to assess the position of the organizations for achieving IP management improvements. The initiative under this project encourages the organizations to use the audit model for conducting assessment programmes in order to give the organizations a head start in their paths to IP management excellence. In order to accomplish the aim, four specific objectives to be achieved under the aim of this project are set in Chapter 1; first, "Develop an IP management model"; second, "Investigate the IP management practices of HK-GD based manufacturing industry"; third, "Prioritize the relative importance of enabling categories and criteria in IP management for the HK-GD based manufacturing industry", and lastly, "Develop and implement an IP management excellence audit model that is suggested for the HK-GD based manufacturing industry".

In order to achieve the objectives, the following research results are obtained by different methodologies:

First the criteria-based IP management model is developed through the literature review (Chapters 2 and 4) and five core values in IP management and four enabling categories with twelve key enabling criteria are identified.

Second, the criteria-based IP management model and four enabling categories with twelve enabling criteria are examined through conducting questionnaire survey in the HK-GD based manufacturing industry (Chapter 5). Moreover, the general IP management practices (the extent of implementation of IP management enabling categories and key enabling criteria) of the HK-GD based manufacturing industry and the relationships between general IP management practices and IP management performance excellence are investigated.

Third, by employing the results from the literature review (Chapters 2 and 4) and questionnaire survey (Chapter 5), an Analytic Hierarchy Process (AHP) hierarchy model in IP management is developed and expert interviews are conducted in the HK-GD based manufacturing industry to identify the priority rankings of the relative importance of the four enabling categories and twelve key enabling criteria by AHP approach (Chapter 6).

Fourth, by employing the findings and results from the literature review, questionnaire survey and AHP study as described in Chapters 2, 4, 5 and 6, respectively, an IP management excellence audit model for the HK-GD based manufacturing industry is developed by employing the Evidential Reasoning Approach with support by Intelligent Decision System software (Chapter 7).

Finally, the IP management excellence audit model is validated by the audited HK-GD based manufacturing organizations through conducting case studies (Chapter 7).

## 8.2 Contributions of Research

This research explores IP management in the HK-GD based manufacturing industry. The results of the research have achieved all four objectives as described in Chapter 1. The contributions are summarized as follows:

First, the research identifies five core values in IP management and four enabling categories with twelve key enabling criteria and then develops a criteria-based IP management model through literature review (section 4.2, 4.3 and 4.4 respectively). By employing the findings, the questionnaire survey is conducted (section 5.4) and the extent of implementation of the four enabling categories with twelve key enabling criteria is examined.

Second, the results indicate that the general IP management practices (extent of implementation of IP management enabling categories and key enabling criteria) in the HK-GD based manufacturing industry are lagging far behind in some key enabling criteria (sections 5.4.3.2 to 5.4.3.5). This implies that there is a lot of room for the HK-GD based manufacturing industry to improve by allocating more resources to the twelve key enabling criteria.

Third, the relationships of the extent of implementation of twelve key enabling criteria are examined to be positively related to the IP management excellence (section 5.4.4.1); moreover, four enabling categories contribute to IP management result categories (section 5.4.4.2), thus providing industrial practitioners with implications to improve IP management.

Fourth, to theorize the IP management model, the relationships of the four enabling categories and the two result categories, are represented in Figure 4.1 as described in section 4.4 and Figure 5.1 by the arrows leading to and from the six constructs as described in Chapter 5. This project confirms that the constructs identified by the categories of management support, innovation development, IP capitalization and external relationship management are connected with each other. These inter-relationships indicate that IP management improvement efforts concentrated on only one or a few of these categories would be less effective. Managers will need to plan and execute a concerted effort to improve several areas of organizational IP management in order to achieve IP management excellence.

Fifth, the criteria-based IP management model is structured in hierarchy, by employing the AHP approach to identify the priority rankings of the four enabling categories and twelve key enabling criteria in the HK-GD based manufacturing industry (section 6.3). HK-GD based manufacturing organizations can allocate resources and efforts in enabling categories or key enabling criteria in priority for implementation so as to obtain immediate changes; thus HK-GD based manufacturing organizations can utilize it as a step-by-step approach to improve their IP management, which is the dominant factor for achieving the full potential and the competitiveness position of their business.

Sixth, the research results indicate that the HK-GD based manufacturing industry can employ the IP management excellence audit model as a tool to assess, measure and diagnose its IP management and for management to develop an improvement action plan and strategy (Section 7.4.2). By interpreting the results, HK-GD based manufacturing organizations can use the audit model as a tool and guideline to

formulate appropriate strategies to improve themselves in IP management which, in turn, achieve the result categories and performance dimensions that has been discussed in the "Results" section of the IP management excellence audit model (section 7.2).

Seventh, three case studies were used for model testing of a rapid audit system in this research (section 7.3.2) and one case study was used for model testing of a comprehensive audit system (section 7.4.2). From the evidential reasoning analysis and comparison with external assessors' results, it was found that the new IP management excellence audit model has the potential to improve the accuracy of the measurement system of the Innovation-Knowledge Enterprises Assessment and Award and compensate for the lack of experience in assessment (section 7.3.2.4).

Eighth, three improvement scenarios for a comprehensive audit system in this research have illustrated the steps to implement the key IP management enabling criteria of the audit model and are found useful for organizations to plan their improvement strategies (section 7.4.2.4). Different improvement scenario results can be predicted without undergoing real implementation and changes. In this way, the audit model can be used as a strategic planning tool.

Ninth, in the theoretical areas, the model integrates most enabling criteria from different researchers and literature review in IP management, including the support that is found in the studies of good systems and practices of organizations in section 4.3. The empirical research fills up the blank spot in the current literature. In addition to the theoretical areas, the model also places emphasis on practical areas. The enabling criteria in the criteria-based model are system works and general practices

which provide organizations with guidelines so as to operate IP management strategy, policies, systems and practices to achieve IP management excellence. The model provides implications on how do organizations learn to adjust from product-oriented decisions and management practices to those that can accommodate the intangibles such as IP. It also provides the organizations necessary supports to upgrade their operation mode from original equipment manufacturing (OEM) to original design manufacturing (ODM) and original brand manufacturing (OBM).

Tenth, recently significant effort has been made by the author to introduce the IP management excellence audit model comprising the IP management enabling categories and key enabling criteria into the assessment exercises for manufacturing organizations in several new pilot projects that are funded by the Shenzhen-Hong Kong Innovation Circle and various local IP offices in the Guangdong Province. The methodology used in this research can help organizations link the areas for improvement identified from the assessment to their business' action plans at strategic, tactical, and operational levels. The IP management excellence audit model being developed has recently been put forward to the Guangdong Provincial Intellectual Property Office as a new industrial standard for describing how an audit process is carried out to provide accurate and fast scoring for a company. As a result of this research, there has been increasing interest in the area of organizational IP management audit and an increasing number of companies in Hong Kong and Guangdong have used the IP management excellence audit model as the template for assessing different IP management strategies as well as for measuring performance.

Finally, as a result of research findings, two journal papers, with the titles "Development of Key Success Factors of Intellectual Property Management with an

Examination in Hong Kong-Guangdong based Manufacturing Organizations" and "Development of Audit Model for Intellectual Property Management Excellence" have been submitted for publication and are pending for reviewing process.

## 8.3 Limitations and Suggestions for Future Research

Although this research presents significant contributions to the literature of IP management, it has several limitations, which are as follows:

First, the research is conducted through questionnaire survey by mail, expert interviews and case studies conducted in the HK-GD based manufacturing industry. Although the results are positive and promising, future research in IP management should be conducted in the HK-GD based manufacturing industry to investigate if there are any differences in different industries.

Second, the current research study focuses on HK-GD based manufacturing organizations; future research should be conducted in other cities in Mainland China, such as Shanghai to investigate the IP management of Chinese manufacturing organizations to see if there are any differences between the other cities and HK-GD based manufacturing organizations in IP management which, in turn, could provide the HK-GD based industrial practitioners with implications for improvement.

Third, the current research conducts three case studies; future research should be conducted with more case studies based on HK-GD based manufacturing organizations; by analyzing the data, a benchmark in IP management can be identified which, in turn, could provide a reference for industrial practitioners.

Fourth, the measurement items in the IP management excellence audit model is not the final version; future research should focus on refining the measurement items and develop a different set of measurement items to cope with the needs of different

industries.

Fifth, further study should be conducted on developing the indicators on measuring the performance in the results section of the criteria-based IP management model that has been developed in this study in order to measure the implementation result.

Sixth, the implementation plan of IP management by adopting the criteria-based IP management model should be developed.

Finally, the criteria-based IP management model should be validated through implementation.

## 8.4 Overall Conclusion

This research identifies and examines the importance of four enabling categories with twelve key enabling criteria, and the results indicate that the implementation of the four enabling categories and the twelve key enabling criteria contribute and are positively related to IP management excellence, respectively. Moreover, this research also investigates the general practices (extent of implementation of four IP management enabling categories and twelve key enabling criteria) of the HK-GD based manufacturing industry, the results indicating that the extents of implementation of some key enabling criteria are lagging far behind the others. This provides support that it is necessary to improve the IP management excellence by implementing the four enabling categories with the twelve enabling criteria.

Resources is one of the limitations in implementation of the four enabling categories with the twelve enabling criteria; an AHP study to prioritize the relative importance of the four enabling categories with the twelve enabling criteria is conducted, this providing HK-GD based manufacturing organizations with priority rankings of these categories with key enabling criteria. Furthermore, it helps HK-GD based manufacturing organizations to allocate resources to implement these categories with key enabling criteria in priority to improve their IP management as a step-by-step approach.

Finally, the research explores the use of the IP management excellence audit model that is recognized by the three audited HK-GD based manufacturing organizations as an audit tool to assess and to measure the organization’s IP management; moreover, it is agreed by the three audited HK-GD based manufacturing organizations that the

audited results can provide top management with data to develop an action plan for improving IP management. The audit process consumes a small amount of their resources within the company, including two weeks of preparation work to collect evidence within the company and two days of on-site audit. Yet, the company enjoys enviable business growth in the past few years by putting their investment on the intangible assets and developing strategic alliances with partners based on their IP. As for the audit fee, it costs less than a hundred thousand Hong Kong Dollars. Thus the applications of the audit model in IP management for the HK-GD based manufacturing industry in the three audited HK-GD based manufacturing organizations suggest that the model can help organizations to assess and investigate opportunities to improve their IP management and subsequently the IP management excellence.

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# Appendix A1 Cover Letter (English)

6 February, 2006

Dear sir/ madam,

**Survey on Intellectual Property Management**

With the globalization of the world economy and flourishing joint venture activities among Hong Kong, Mainland China, Asian and overseas enterprises, intellectual property (IP) management has become increasingly significant for business advancement and successful collaborations. In order to elevate the IP management capabilities of Hong Kong companies, the ABC is undertaking a survey on IP management. The main objective of the survey is to better understand the current IP management capabilities and good practices adopted in IP management among different industries.

After completion of the study, we will compile and publish the findings in the form of a research report, for sharing with you and various stakeholders *free of charge*. It is hoped that the report will allow more Hong Kong companies to better understand the importance of IP management and foster innovation among enterprises themselves. The current survey will help to develop a model to benchmark for IP management for enterprises.

We are now approaching companies in different sectors. We would be most grateful if you can **fill in the survey questionnaire and fax it back to us at 2788 XXXX or 2788 YYYY on or before February 25, 2006**. Please be assured that information provided by individual responding companies will be kept in strict confidence. If you have any queries, please do not hesitate to call our Ms. XX at 2788 XXXX or Ms. YY at 2788 YYYY.

Thank you very much in advance for your support and co-operation.

Yours sincerely,

# Appendix A2 Cover Letter (Chinese)

敬啟者：

**知識產權管理調查**

隨著世界經濟趨向全球化發展，加上本港、內地及海外企業的經貿合作十分活躍，知識產權管理已成為企業持續發展的重要功能。為推動及加強本港企業的知識產權管理，ABC 現正進行一項「知識產權管理調查」，藉以了解企業的知識產權管理水平，並找出企業在管理知識產權時所採用的良好制度和慣例。

是項調查所搜集的資料將被分析及輯錄成研究報告，免費贈閱予有關企業，令更多企業了解知識產權管理的重要性，並為有意提升知識產權管理的企業提供借鑒和參考，是項調查結果將為建立共同標準提供參考數據。

目前，我們正邀請有關企業進行訪問，現誠邀閣下或閣下之代表**填寫附上的調查問卷並於** 2006 **年** 2 **月** 25 **日前傳真至** 2788 XXXX **或** 2788 YYYY。貴公司所提供的資料將會被保密處理。如對調查有任何疑問，歡迎致電 XX 小姐(電話：2788 XXXX)或 YY 小姐(電話：2788 YYYY)查詢。

多謝閣下的支持及協助。

2006 年 2 月 6 日

# Appendix B1 Questionnaire (English)

## Survey on Intellectual Property Management

### Part A – Screening (please ask for company-in-charge or decision maker on intellectual property management)

1. Does your company own at least one form of intellectual property? (including self-developed, license in others' intellectual property or intellectual property acquired such as patent, design, trademark or copyright of original works)
   a.☐ Yes b.☐ No
   (If answer is "No", your company needs not complete and return the questionnaire. Thank you very much for your cooperation!)

2. What is your involvement in your company's intellectual property management? (can choose more than 1 answer)
   a.☐ I am involved in decision making on Intellectual Property Management matters
   b.☐ I undertake responsibility in Intellectual Property Management matters

### Part B – Extent of Implementation of Intellectual Property Management

Please circle the appropriate box to indicate the extent of implementation for each of the following intellectual property functions in your company. The scale of measure is illustrated below.

| Not yet implement and have no plan to implement | Not yet implement but have plan to implement | Implemented, to a small extent | Implemented by halves | Implemented, to a large extent | Fully implemented |
|---|---|---|---|---|---|
| 0 | 1 | 2 | 3 | 4 | 5 |

3. Intellectual Property Management — Extent of Implementation

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| a. | We formulate strategic direction on intellectual property based on our company's mission & vision | 0 | 1 | 2 | 3 | 4 | 5 |
| b. | We set intellectual property polices & practices | 0 | 1 | 2 | 3 | 4 | 5 |
| c. | We set implementation plan for intellectual property management activities & set action items with performance monitoring for our intellectual property plan | 0 | 1 | 2 | 3 | 4 | 5 |
| d. | Top management is committed and involved in the implementation of the strategic direction, policies and practices on intellectual property | 0 | 1 | 2 | 3 | 4 | 5 |
| e. | Relevant staff are committed and abide to the intellectual property polices & practices | 0 | 1 | 2 | 3 | 4 | 5 |
| f. | Our employees at all levels are well-aware of the company's intellectual property policies & practices | 0 | 1 | 2 | 3 | 4 | 5 |
| g. | We have clear statements in employment contract on intellectual property policies & practices | 0 | 1 | 2 | 3 | 4 | 5 |
| h. | We reinforce the intellectual property polices & practices through reminding our employees periodically | 0 | 1 | 2 | 3 | 4 | 5 |
| i. | We update & disseminate new changes in intellectual property policies & laws/regulations to our staff | 0 | 1 | 2 | 3 | 4 | 5 |
| j. | We have dedicated staff/team/department for managing intellectual property | 0 | 1 | 2 | 3 | 4 | 5 |
| k. | We provide training to relevant staff on intellectual property management | 0 | 1 | 2 | 3 | 4 | 5 |
| l. | We seek advice on legal matters for our intellectual property from legal advisor/IP consultant | 0 | 1 | 2 | 3 | 4 | 5 |

4. Research & Development of New Technologies/Products/Services

| | | Extent of Implementation | | | | | |
|---|---|---|---|---|---|---|---|
| a. | We perform searches & analysis on intellectual property | 0 | 1 | 2 | 3 | 4 | 5 |
| b. | We subscribe to external database on intellectual property (e.g. existing patent databases in the market) | 0 | 1 | 2 | 3 | 4 | 5 |
| c. | We develop internal database on intellectual property | 0 | 1 | 2 | 3 | 4 | 5 |
| d. | We undertake Research & Development initiatives on new technologies/products/services | 0 | 1 | 2 | 3 | 4 | 5 |
| e. | We collaborate with research institutes (e.g. Universities) to develop new technologies/ products/services | 0 | 1 | 2 | 3 | 4 | 5 |
| f. | Top/senior management performs vetting procedures to select new inventions | 0 | 1 | 2 | 3 | 4 | 5 |
| g. | We take precautions in modifying our design to avoid our new product infringe the intellectual property rights of others | 0 | 1 | 2 | 3 | 4 | 5 |
| h. | We conduct market feasibility and technical assessment of new concepts/inventions | 0 | 1 | 2 | 3 | 4 | 5 |
| i. | We evaluate the patentability of our inventions | 0 | 1 | 2 | 3 | 4 | 5 |
| j. | We develop and test our engineering prototype | 0 | 1 | 2 | 3 | 4 | 5 |

5. Intellectual Property Portfolio Management

| | | Extent of Implementation | | | | | |
|---|---|---|---|---|---|---|---|
| a. | We have adequate budget and resources for supporting our intellectual property portfolio | 0 | 1 | 2 | 3 | 4 | 5 |
| b. | We maintain inventory list for all our intellectual properties | 0 | 1 | 2 | 3 | 4 | 5 |
| c. | We apply for patent protection in Hong Kong or mainland China | 0 | 1 | 2 | 3 | 4 | 5 |
| d. | We apply for patent protection in our overseas markets | 0 | 1 | 2 | 3 | 4 | 5 |
| e. | We apply for design protection | 0 | 1 | 2 | 3 | 4 | 5 |
| f. | We perform intellectual property royalty audit | 0 | 1 | 2 | 3 | 4 | 5 |
| g. | We register for trademark/service mark | 0 | 1 | 2 | 3 | 4 | 5 |
| h. | We evaluate the financial value of our intellectual properties | 0 | 1 | 2 | 3 | 4 | 5 |
| i. | We perform cost and benefit analysis for maintaining our intellectual property | 0 | 1 | 2 | 3 | 4 | 5 |
| j. | We use our core intellectual property in new products/services | 0 | 1 | 2 | 3 | 4 | 5 |
| k. | We license out or abandon the non-core intellectual property | 0 | 1 | 2 | 3 | 4 | 5 |
| l. | We use some forms of intellectual property to start up separate business entities | 0 | 1 | 2 | 3 | 4 | 5 |
| m. | We maintain documentations and records for all original works created | 0 | 1 | 2 | 3 | 4 | 5 |
| n. | We strictly implement our policies and practices to govern confidential information | 0 | 1 | 2 | 3 | 4 | 5 |
| o. | We manage and control the copyright issues | 0 | 1 | 2 | 3 | 4 | 5 |

6. External Relationship & Market Positioning

| | | Extent of Implementation | | | | | |
|---|---|---|---|---|---|---|---|
| a. | We license in partners' intellectual property | 0 | 1 | 2 | 3 | 4 | 5 |
| b. | We acquire intellectual property ownership from others | 0 | 1 | 2 | 3 | 4 | 5 |
| c. | We sign Non-disclosure Agreement (NDA) with partners before commencement of any projects involving intellectual property | 0 | 1 | 2 | 3 | 4 | 5 |
| d. | We clarify intellectual property rights ownership in written agreements before entering into a partnership | 0 | 1 | 2 | 3 | 4 | 5 |
| e. | We have provisions in commercial contracts to ensure our intellectual property rights are protected from infringement by the contractual party and others | 0 | 1 | 2 | 3 | 4 | 5 |
| f. | We collaborate with relevant business/strategic partners on developing new markets for our new technologies/products/services | 0 | 1 | 2 | 3 | 4 | 5 |
| g. | We build & reinforce our brand in the market | 0 | 1 | 2 | 3 | 4 | 5 |
| h. | We promote our products with identification of our patent, design or trademark in all advertising & communication materials | 0 | 1 | 2 | 3 | 4 | 5 |
| i. | We check if our company infringes on other's intellectual property periodically | 0 | 1 | 2 | 3 | 4 | 5 |
| j. | We continuously monitor external environment to ensure no infringing acts against our intellectual property | 0 | 1 | 2 | 3 | 4 | 5 |

## Part C – Effectiveness of Intellectual Property Management

Please circle the appropriate boxes to indicate your company's current performance in intellectual property management.

7. Intellectual Property Capitalization Outcomes

Does your company owned any of the following intellectual property or intellectual property related outcomes? Among each of these intellectual property or intellectual property outcomes, what is the percentage that they generated profits for the company?

| Intellectual property or intellectual property related outcomes | Owned? | | Percentage of the outcome that generated profits (%) | | | | | |
|---|---|---|---|---|---|---|---|---|
| | No* | Yes @ | 0 % | 20% | 40% | 60% | 80% | 100 % |
| a. Patents granted | 0 | 1 | 0 | 1 | 2 | 3 | 4 | 5 |
| b. Design granted | 0 | 1 | 0 | 1 | 2 | 3 | 4 | 5 |
| c. Trademarks & service marks registered | 0 | 1 | 0 | 1 | 2 | 3 | 4 | 5 |
| d. Out-licensed intellectual property | 0 | 1 | 0 | 1 | 2 | 3 | 4 | 5 |
| e. Separate business entities based on invention & some form of intellectual property | 0 | 1 | 0 | 1 | 2 | 3 | 4 | 5 |
| f. Licensed-in others' intellectual property | 0 | 1 | 0 | 1 | 2 | 3 | 4 | 5 |
| g. Intellectual property ownership acquired | 0 | 1 | 0 | 1 | 2 | 3 | 4 | 5 |
| h. Established long-term business partnership based on intellectual property | 0 | 1 | 0 | 1 | 2 | 3 | 4 | 5 |
| i. Established long-term customer relationship based on intellectual property management | 0 | 1 | 0 | 1 | 2 | 3 | 4 | 5 |

*Remark:* ** If answer is "No", please skip to the next item*
*@ If answer is "Yes", please provide the percentage that the outcome generated profits for the company.*

8. Relationship with Business Partners

| Please rate the extent to which you agree with the following statements | Strongly disagree | Disagree | Average | Agree | Strongly agree |
|---|---|---|---|---|---|
| a. Our partners did not infringe our intellectual property rights | 1 | 2 | 3 | 4 | 5 |
| b. We did not infringe the intellectual property rights of others | 1 | 2 | 3 | 4 | 5 |
| c. We have reduced liability of intellectual property issues to the contractual parties in a business relationship | 1 | 2 | 3 | 4 | 5 |
| d. We have built long-term and good business relationship with our partners based on mutual trust in intellectual property management | 1 | 2 | 3 | 4 | 5 |
| e. We have built long-term and good business relationship with our customers based on trust in our intellectual property management | 1 | 2 | 3 | 4 | 5 |
| f. We are mutually benefited from developing and launching deliverables with intellectual property rights in the collaborative relationship | 1 | 2 | 3 | 4 | 5 |

## Part D – Company Profile

9. Business Nature

a.☐ Manufacturing b.☐ Import/Export c.☐ Wholesale d.☐ Retail
e.☐ Construction f.☐ Restaurants & hotels g.☐ Transport, storage & telecom
h.☐ Financing, insurance, real estate & business services
i.☐ Community, social & personal services j.☐ Others (pls. specify):_____

If your answer to Q9 is a, b, c or d, please specify type of product carried：_____

a.☐ Food & beverage b.☐ Clothing & textile
c.☐ Furniture d.☐ Footwear & leather products
e.☐ Plastics products& components f.☐ Watches & jewelry
g.☐ Toys & premiums h.☐ Printing/publishing & paper products
i.☐ Metal products & components j.☐ Electrical products & components
k.☐ Building material l.☐ Household appliances
m.☐ Machinery & equipment n.☐ Telecom products
o.☐ Office equipment p.☐ Chemical, pharmaceutical, fuel & cosmetics
q.☐ Consumer goods & groceries r.☐ General commodities
s.☐ Others (please specify:_____)

10. Total no. of employees in HK, mainland China and overseas (including manufacturing workers)?
Total no. of employees: _____ (HK: _____ Mainland China: _____Overseas: _____)

11. When was your company established? *(Year of establishment)* *Year* _____

12. Country of investment (can choose more than 1 answer)

a.☐ Hong Kong b.☐ Mainland China c.☐ Taiwan d.☐ Japan e.☐ USA
f.☐ Others (pls. specify:_____)

13. What is your job title? _____

End of Questionnaire. Thank you very much for your co-operation!
Please fax the completed questionnaire to ABC at 2788 XXXX or 2788 YYYY.
For enquiries, please call Ms. XX at 2788 XXXX or Ms. YY at 2788 YYYY.

# Appendix B2 Questionnaire (Chinese)

## 知識產權管理調查

**甲部 – 受訪者甄選(*請將問卷交給貴公司負責知識產權管理的人員作答*)**

1. 貴公司是否擁有最少一項知識產權? (包括自行研發、獲授權或購入的知識產權，如專利、外觀設計、商標或原創作品的版權等)
   a.□有 b.□沒有
   *如答"b"，貴公司無須填寫及交回本問卷，非常多謝 貴公司的支持及合作!*

2. 你參與公司內部那些有關知識產權管理的職務? (可選多於一項)
   a.□參與有關知識產權管理的決策 b.□執行公司內部有關知識產權的工作

**乙部 – 知識產權管理的實行程度**

請就貴公司在下列各項有關知識產權管理範疇上的實行程度，按以下量度準則，以圓圈"ⅰ"圈出適當的評分

| 現在沒有實行及沒有計劃實行 | 現在沒有實行，但已計劃實行 | 已實行了少部分 | 已實行了一半 | 已實行了大部分 | 已全面實行 |
|---|---|---|---|---|---|
| 0 | 1 | 2 | 3 | 4 | 5 |

| 3. 知識產權策略管理 | 實行程度 | | | | | |
|---|---|---|---|---|---|---|
| a. 我們基於公司的目標和方向制定知識產權策略 | 0 | 1 | 2 | 3 | 4 | 5 |
| b. 我們定立知識產權政策及規則 | 0 | 1 | 2 | 3 | 4 | 5 |
| c. 我們定立知識產權實施計劃及方案，並監管實施方案的成效 | 0 | 1 | 2 | 3 | 4 | 5 |
| d. 公司高級管理階層支持及參與執行知識產權策略、政策及規則 | 0 | 1 | 2 | 3 | 4 | 5 |
| e. 公司有關人員均支持及遵守公司定立的知識產權政策及規則 | 0 | 1 | 2 | 3 | 4 | 5 |
| f. 公司所有員工對公司的知識產權政策及規則都有足夠的認知 | 0 | 1 | 2 | 3 | 4 | 5 |
| g. 我們在僱員合約中清晰地聲明公司的知識產權政策及規則 | 0 | 1 | 2 | 3 | 4 | 5 |
| h. 我們定期向員工發出提醒去加強執行知識產權政策及規則 | 0 | 1 | 2 | 3 | 4 | 5 |
| i. 我們更新並向員工發放有關知識產權政策與法例的最新信息 | 0 | 1 | 2 | 3 | 4 | 5 |
| j. 我們有專責的員工/隊伍/部門負責管理知識產權 | 0 | 1 | 2 | 3 | 4 | 5 |
| k. 我們為有關知識產權管理的員工提供培訓 | 0 | 1 | 2 | 3 | 4 | 5 |
| l. 我們在知識產權法律問題上尋求法律/知識產權顧問的意見 | 0 | 1 | 2 | 3 | 4 | 5 |

| 4. 新科技/產品/服務的研究開發 | 實行程度 | | | | | |
|---|---|---|---|---|---|---|
| a. 我們對知識產權進行檢索及分析 | 0 | 1 | 2 | 3 | 4 | 5 |
| b. 我們訂閱/訂購市場上現有的知識產權資料庫 | 0 | 1 | 2 | 3 | 4 | 5 |
| c. 我們建立公司內部的知識產權資料庫 | 0 | 1 | 2 | 3 | 4 | 5 |
| d. 公司自行研究及開發新的科技/產品/服務 | 0 | 1 | 2 | 3 | 4 | 5 |
| e. 我們與科研機構合作(如大學)去發展新產品/科技/服務 | 0 | 1 | 2 | 3 | 4 | 5 |
| f. 公司高級管理階層對新發明有既定及嚴謹的挑選程序 | 0 | 1 | 2 | 3 | 4 | 5 |
| g. 我們謹慎進行設計的修改，以避免新產品出現侵權行為 | 0 | 1 | 2 | 3 | 4 | 5 |
| h. 我們對新概念/發明進行市場及技術可行性評估 | 0 | 1 | 2 | 3 | 4 | 5 |
| i. 我們對發明申請專利的可能性進行評估 | 0 | 1 | 2 | 3 | 4 | 5 |
| j. 我們發展及測試工程樣品 | 0 | 1 | 2 | 3 | 4 | 5 |

| 5. 知識產權組合管理 | 實行程度 | | | | | |
|---|---|---|---|---|---|---|
| a. 我們有足夠的經費及資源去支援公司的知識產權組合 | 0 | 1 | 2 | 3 | 4 | 5 |
| b. 我們對所擁有的知識產權有清晰的記錄 | 0 | 1 | 2 | 3 | 4 | 5 |
| c. 我們在香港或中國內地申請專利保護 | 0 | 1 | 2 | 3 | 4 | 5 |
| d. 我們在海外市場申請專利保護 | 0 | 1 | 2 | 3 | 4 | 5 |
| e. 我們申請外觀設計保護 | 0 | 1 | 2 | 3 | 4 | 5 |
| f. 我們進行有關專利權稅的審核 | 0 | 1 | 2 | 3 | 4 | 5 |
| g. 我們註冊商標/服務商標 | 0 | 1 | 2 | 3 | 4 | 5 |
| h. 我們對所擁有的知識產權進行估值 | 0 | 1 | 2 | 3 | 4 | 5 |
| i. 我們進行成本效益分析以便維持公司的知識產權 | 0 | 1 | 2 | 3 | 4 | 5 |
| j. 我們把公司的核心知識產權實施及應用於產品上 | 0 | 1 | 2 | 3 | 4 | 5 |
| k. 我們將公司非核心的知識產權授權予合作伙伴或採取放棄的決定 | 0 | 1 | 2 | 3 | 4 | 5 |
| l. 我們利用某些知識產權成立獨立的商業個體 | 0 | 1 | 2 | 3 | 4 | 5 |
| m. 我們對原創作稿件進行存檔及記錄 | 0 | 1 | 2 | 3 | 4 | 5 |
| n. 我們嚴格執行知識產權政策及規則去管理保密資料 | 0 | 1 | 2 | 3 | 4 | 5 |
| o. 我們管理及監控有關版權問題 | 0 | 1 | 2 | 3 | 4 | 5 |

| 6. 對外關係及市場建立 | 實行程度 | | | | | |
|---|---|---|---|---|---|---|
| a. 我們從合作伙伴獲得知識產權的授權 | 0 | 1 | 2 | 3 | 4 | 5 |
| b. 我們從其他機構/公司或個人購入知識產權的擁有權 | 0 | 1 | 2 | 3 | 4 | 5 |
| c. 我們與合作伙伴開展涉及知識產權的計劃前簽署保密協議 | 0 | 1 | 2 | 3 | 4 | 5 |
| d. 我們在與合作伙伴的協議書/合約上闡明知識產權的擁有權 | 0 | 1 | 2 | 3 | 4 | 5 |
| e. 我們與合作伙伴的商業合同中有條款保障公司的知識產權，以防範公司的知識產權受到侵犯 | 0 | 1 | 2 | 3 | 4 | 5 |
| f. 我們與有關商業/策略性伙伴合作為新的產品/科技/服務建立市場 | 0 | 1 | 2 | 3 | 4 | 5 |
| g. 我們建立及鞏固品牌在市場中的地位 | 0 | 1 | 2 | 3 | 4 | 5 |
| h. 我們在廣告及傳播媒體宣傳產品時，標明產品擁有專利、外觀設計或商標的知識產權 | 0 | 1 | 2 | 3 | 4 | 5 |
| i. 我們定期檢查公司有沒有侵犯別人的知識產權 | 0 | 1 | 2 | 3 | 4 | 5 |
| j. 我們持續監察外在的環境，確保公司的知識產權沒有遭受到任何侵權行為 | 0 | 1 | 2 | 3 | 4 | 5 |

**丙部 – 知識產權管理成效**

請以圓圈“**i**”圈出適當的評分，以顯示公司現時在知識產權管理上的表現

7. 知識產權資本化的成果

貴公司是否擁有下列知識產權或與知識產權相關的成果? 其中百分之幾能成功為公司帶來經濟效益?

| 知識產權或與知識產權相關的成果 | 是否擁有 | | 成功為公司帶來經濟效益的比例 (%) | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 否* | 是@ | 0 % | 20% | 40% | 60% | 80% | 100% |
| a. 已註冊的專利 | 0 | 1 | 0 | 1 | 2 | 3 | 4 | 5 |
| b. 已註冊的外觀設計 | 0 | 1 | 0 | 1 | 2 | 3 | 4 | 5 |
| c. 已註冊的商標/服務商標 | 0 | 1 | 0 | 1 | 2 | 3 | 4 | 5 |
| d. 已授權出去的知識產權 | 0 | 1 | 0 | 1 | 2 | 3 | 4 | 5 |
| e. 基於發明/專利分拆成立獨立的子公司 | 0 | 1 | 0 | 1 | 2 | 3 | 4 | 5 |
| f. 已獲他人授權的知識產權 | 0 | 1 | 0 | 1 | 2 | 3 | 4 | 5 |
| g. 已購入的知識產權 | 0 | 1 | 0 | 1 | 2 | 3 | 4 | 5 |
| h. 基於知識產權而建立的長期合作伙伴 | 0 | 1 | 0 | 1 | 2 | 3 | 4 | 5 |
| i. 基於對公司知識產權管理信任而建立的長期客戶 | 0 | 1 | 0 | 1 | 2 | 3 | 4 | 5 |

*註:* - 如答“否”,請跳至下一項*

*@ - 如答“是”,請回答該類成果之中百分之幾能成功為公司帶來經濟效益*

8. 與合作伙伴關係

| 你是否同意以下各項有關公司與合作伙伴關係方面的表現? | 非常不同意 | 不同意 | 一般 | 同意 | 非常同意 |
|---|---|---|---|---|---|
| a. 我們的合作伙伴沒有對公司的知識產權進行侵權行為 | 1 | 2 | 3 | 4 | 5 |
| b. 我們沒有對合作伙伴的知識產權進行侵權行為 | 1 | 2 | 3 | 4 | 5 |
| c. 我們將公司在知識產權事務上對合作伙伴所負的責任減至最低 | 1 | 2 | 3 | 4 | 5 |
| d. 我們基於對知識產權管理的相互信任與合作伙伴建立良好的長期合作關係 | 1 | 2 | 3 | 4 | 5 |
| e. 客戶基於對公司知識產權管理的信任與公司建立良好的長期業務關係 | 1 | 2 | 3 | 4 | 5 |
| f. 在有關知識產權的合作伙伴關係中，合作雙方都能獲益 | 1 | 2 | 3 | 4 | 5 |

**丁部 – 公司資料**

9. 公司的業務性質

a.□ 製造業 b.□ 出/入口 c.□ 批發 d.□ 零售
e.□ 建築 f.□ 餐廳及酒店 g.□ 物流運輸、倉務及傳訊
h.□ 金融、保險、地產及商業服務 i.□ 社區、公共及個人服務
j.□ 其他 (請註明): _____

如業務性質為 a-d(製造業、出/入口、批發及零售)，請說明產品類別：____
a.□食物及飲料 b.□紡織及製衣 c.□傢俱
d.□鞋類及皮類產品 e.□塑膠製品及零部件 f.□鐘錶及珠寶
g.□玩具及禮品 h.□印刷/出版及紙品 i.□金屬製品及零部件
j.□電子產品及零部件 k.□建築材料 l.□家庭電器
m.□機械及設備 n.□通信設備 o.□辦公室設備
p.□化學、藥物、燃油及化妝品 q.□雜貨及消費品
r.□一般日用品 s.□ 其他 (請註明): _____

10.公司在香港、中國內地及海外僱用的僱員人數(包括廠房員工)?
僱員總數:_____ (香港: _____ 中國內地: _____ 海外: _____)

11. 貴公司在香港成立了多久? *(大概年數)*_____年

12. 公司的投資國家 (可選多於一項)
a.□香港 b.□中國內地 c.□台灣
d.□日本 e.□美國
f.□其他(請註明):_____

13.請問閣下在貴公司的職級？_____

***問卷完，非常多謝貴公司的支持及合作!***

請把填妥的問卷傳真至 ABC
(傳真號碼：2788 XXXX 或 2788 YYYY)

查詢請致電 XX 小姐(電話：2788 XXXX)
或 YY 小姐(電話：2788 YYYY)

# Appendix C1 Measurement Items for AHP Study (English)

The Measurement Items of IP Management

**1 Management Support**

**1.1 Strategic Management Plan for IP Activities**

1.1.1 The organization formulates strategic direction on IP based on its mission & vision. The top management sets IP policies and practices and is committed and involved in the implementation of the strategic direction, policies and practices on IP.

1.1.2 The organization's employees at all levels are well-aware of the organization's IP policies and practices. The relevant staff is committed and abided to the IP policies and practices. The organization sets implementation plan for IP management activities and set action items with performance monitoring for its IP plan.

**1.2 Internal IP Management Function, Knowledge and Skill**

1.2.1 The organization updates and disseminates new changes in IP policies and laws/regulations to its staff. The organization reinforces the IP policies and practices through reminding its employees periodically.

1.2.2 The organization makes clear statements in employment contract on IP policies and practices.

1.2.3 The organization provides training to relevant staff on IP management.

1.2.4 The organization appoints dedicated staff/ team/ department for managing IP.

**1.3 IP Defense and Enforcement System**

1.3.1 The organization checks if it infringes on other's IP periodically.

1.3.2 The organization continuously monitors external environment to ensure no infringing acts against its IP.

**2 Innovation Development**

**2.1 Creativity Generation, Concept Selection and Prototyping**

2.1.1 The organization undertakes R&D initiatives on new technologies/ products/ services.

2.1.2 The organization takes precautions in modifying its design to avoid its new product infringing the IP rights of others.

2.1.3 The organization conducts market feasibility and technical assessment of new concepts/ inventions. The organization evaluates the patentability of its inventions.

2.1.4 The top/ senior management performs vetting procedures to select new inventions.

2.1.5 The organization develops and tests its engineering prototype.

**2.2 IP Intelligence and Advisory Support**

2.2.1 The organization performs searches and analysis on IP.

2.2.2 The organization develops internal database on IP. The organization subscribes to external database on IP (e.g. existing patent databases in the market).

2.2.3 The organization seeks advice on legal matters for its IP from legal advisor/ IP consultant.

2.2.4 The organization provides adequate budget and resources for supporting its IP portfolio.

## 3 Intellectual Property Capitalization

**3.1 Internal IP Security**

3.1.1 The organization strictly implements its policies and practices to govern confidential information.

3.1.2 The organization manages and controls the copyright issues.

3.1.3 The organization maintains documentations and records for all original works created. The organization maintains inventory list for all its IP.

**3.2 IP Application/Registration**

3.2.1 The organization applies for patent protection in the local market. The organization applies for patent protection in its overseas markets.

3.2.2 The organization applies for design protection.

3.2.3 The organization registers for trademark/service mark.

**3.3 Internal IP Audit and Evaluation**

3.3.1 The organization performs IP royalty audit.

3.3.2 The organization evaluates the financial value of its IP.

3.3.3 The organization performs cost and benefit analysis for maintaining its IP.

**3.4 IP Licensing and Acquisition**

3.4.1 The organization licenses out the non-core IP.

3.4.2 The organization licenses in partners' IP.

3.4.3 The organization acquires IP ownership from others.

## 4 External Relationship Management

**4.1 IP Commercial Development and Marketing**

4.1.1 The organization uses its core IP in new products/ services.

4.1.2 The organization builds and reinforces its brand in the market.

4.1.3 The organization promotes its products with identification of its patent, design or trademark in all advertising and communication materials.

**4.2 External IP Security, Agreement and Partners Matching**

4.2.1 The organization clarifies IP rights ownership in written agreements before entering into a partnership.

4.2.2 The organization sign Non-disclosure Agreement (NDA) with partners before commencement of any projects involving IP.

4.2.3 The organization collaborates with relevant business/strategic partners on developing new markets for its new technologies/products/services.

4.2.4 The organization provides provisions in commercial contracts to ensure its IP rights are protected from infringement by the contractual party and others.

**4.3 Research Venture and IP Holding Business Startup/Spinout**

4.3.1 The organization collaborates with research institutes (e.g. Universities) to develop new technologies/ products/ services.

4.3.2 The organization use some forms of IP to start up separate business entities.

# Appendix C2 Measurement Items for AHP Study (Chinese)

知識產權管理測量項目

**1 管理支援**

**1.1 知識產權活動的策略性管理計劃**

1.1.1 公司基於其目標和方向制定知識產權策略。公司定立知識產權政策及規則。公司高級管理階層支持及參與執行知識產權策略、政策及規則。

1.1.2 公司所有員工對公司的知識產權政策及規則都有足夠的認知。公司有關人員均支持及遵守公司定立的知識產權政策及規則。公司定立知識產權實施計劃及方案，並監管實施方案的成效。

**1.2 內部知識產權管理功能、知識及技能**

1.2.5 公司更新並向員工發放有關知識產權政策與法例的最新信息。公司定期向員工發出提醒去加強執行知識產權政策及規則。

1.2.6 公司在僱員合約中清晰地聲明公司的知識產權政策及規則。

1.2.7 公司為有關知識產權管理的員工提供培訓。

1.2.8 公司有專責的員工/隊伍/部門負責管理知識產權。

**1.3 知識產權防禦及執行系統**

1.3.1 公司定期檢查自己有沒有侵犯別人的知識產權。

1.3.2 公司持續監察外在的環境，確保公司的知識產權沒有遭受到任何侵權行為。

**2 創新發展**

**2.1 創意產生、概念挑選及製作樣品**

2.1.1 公司自行研究及開發新的科技/產品/服務。

2.1.2 公司謹慎進行設計的修改，以避免新產品出現侵權行為。

2.1.3 公司對新概念/發明進行市場及技術可行性評估。公司對發明申請專利的可能性進行評估。

2.1.4 公司高級管理階層對新發明有既定及嚴謹的挑選程序。

2.1.5 公司發展及測試工程樣品。

**2.2 知識產權資訊及諮詢支援**

2.2.1 公司對知識產權進行檢索及分析。

2.2.2 公司建立其內部的知識產權資料庫。公司訂閱/訂購市場上現有的知識產權資料庫。

2.2.3 公司在知識產權法律問題上尋求法律/知識產權顧問的意見。

2.2.4 公司有足夠的經費及資源去支援公司的知識產權組合。

**3 知識產權資本化**

**3.1 內部知識產權安全**

3.1.1 公司嚴格執行知識產權政策及規則去管理保密資料。

3.1.2 公司管理及監控有關版權問題。

3.1.3 公司對原創作稿件進行存檔及記錄。公司對所擁有的知識產權有清晰的記錄。

**3.2 知識產權申請/註冊**

3.2.1 公司在本地市場申請專利保護。公司在海外市場申請專利保護。.

3.2.2 公司申請外觀設計保護。

3.2.3 公司註冊商標/服務商標。

**3.3 內部知識產權審查及評估**

3.3.1 公司進行有關專利權稅的審核。

3.3.2 公司對所擁有的知識產權進行估值。

3.3.3 公司進行成本效益分析以便維持公司的知識產權。

**3.4 知識產權授權及收購**

3.4.1 公司將其非核心的知識產權授權予合作伙伴。

3.4.2 公司從合作伙伴獲得知識產權的授權。

3.4.3 公司從其他機構/公司或個人購入知識產權的擁有權。

**4 外部關係管理**

**4.1 知識產權商業發展及推廣**

4.1.1 公司把其核心知識產權實施及應用於產品上。

4.1.2 公司建立及鞏固品牌在市場中的地位。

4.1.3 公司在廣告及傳播媒體宣傳產品時，標明產品擁有專利、外觀設計或商標的知識產權。

**4.2 外部知識產權安全、協議書及夥伴配對**

4.2.1 公司在與合作伙伴的協議書/合約上闡明知識產權的擁有權。

4.2.2 公司與合作伙伴開展涉及知識產權的計劃前簽署保密協議。

4.2.3 公司與有關商業/策略性伙伴合作為新的產品/科技/服務建立市場。

4.2.4 公司與合作伙伴的商業合同中有條款保障公司的知識產權，以防範公司的知識產權受到侵犯。

**4.3 從事研究的風險投資及持有知識產權的起步公司/分支機構**

4.3.1 公司與科研機構合作(如大學)去發展新產品/科技/服務。

4.3.2 公司利用某些知識產權成立獨立的商業個體。

## Appendix D Attribute Description of Rapid Audit System

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Attribute Description of Rapid Audit System
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Attribute Name: IP Management Excellence
Attribute Description: The present "IP Management Excellence" audit framework is developed by separating it into two sections; one section is to audit the "Systems and Practices" and the other is to audit the "Results".

---

Attribute Name: Section A: IP Management Implementation - Systems and Practices
Attribute Description: The "IP Management Implementation - Systems and Practices" is assessed based on the evaluation of four IP management enabling categories "Management Support", "Innovation Development", "Intellectual Property Capitalization" and "External Relationship Management".

---

Attribute Name: 1.0 Management Support: Does your organization focuses on leadership, strategy and core competencies in managing IP?
Attribute Description: Management support category focuses on leadership, strategy and core competencies for managing IP:

a) How the leaders embed IP management in visionary leadership and develop strategic management plan for IP activities.

b) How the organization ensures that core competence in IP knowledge and skill is adequate in all functions.

c) How the organization establishes IP defense and enforcement system.

---

Attribute Name: 1.1 Approach
Attribute Description: It measures the degree of approach used to address

leadership, strategy and core competencies for managing IP.

---

Attribute Name: 1.2 Deployment
Attribute Description: It measures the extent to which the approach has been implemented to leadership, strategy and core competencies for managing IP.

---

Attribute Name: 2.0 Innovation Development: Does your organization focuses on concept creation and product development that lead to IP generation?
Attribute Description: Innovation development category focuses on commitment for product development and commercialization that lead to IP generation:

a) How the organization initiates basic processes for concept creation and development that lead to IP generation.

b) How the organization avoids costs due to reinvention efforts and potential infringement litigations in early design cycle by using IP intelligence and advisory support.

---

Attribute Name: 2.1 Approach
Attribute Description: It measures the degree of approach used to address commitment for product development and commercialization that lead to IP generation.

---

Attribute Name: 2.2 Deployment
Attribute Description: It measures the extent to which the approach has been implemented to commitment for product development and commercialization that lead to IP generation.

---

Attribute Name: 3.0 Intellectual Property Capitalization: Does your organization focuses on identification, protection and controlling the exploitation of IP?

Attribute Description: Intellectual property capitalization category focuses on identification, protection and controlling the exploitation of IP:

a) How the organization formalizes internal security control measures for safeguarding the content of IP portfolios.

b) How the organization develops basic processes for identifying, protecting and controlling the organization's own IP.

c) How the organization reduces costs associated with the organization's IP portfolios by using internal audit and evaluation.

d) How the organization extracts value directly from IP as quickly and inexpensively as possible.

---

Attribute Name: 3.1 Approach
Attribute Description: It measures the degree of approach used to address identification, protection and controlling the exploitation of IP.

---

Attribute Name: 3.2 Deployment
Attribute Description: It measures the extent to which the approach has been implemented to identification, protection and controlling the exploitation of IP.

---

Attribute Name: 4.0 External Relationship Management: Does your organization focuses on market development, strategic alliances and buyer-seller relationship based on some forms of IP?
Attribute Description: External relationship management category focuses on market development, strategic alliances and buyer-seller relationship based on IP requirements:

a) How the organization embeds IP in technology, product and service.

b) How the organization becomes more sophisticated in managing external relationship with IP requirements.

c) How the organization stakes a claim on the future with encouragement

of research ventures and IP holding business startups or spinouts.

---

Attribute Name: 4.1 Approach
Attribute Description: It measures the degree of approach used to address market development, strategic alliances and buyer-seller relationship based on IP requirements.

---

Attribute Name: 4.2 Deployment
Attribute Description: It measures the extent to which the approach has been implemented to market development, strategic alliances and buyer-seller relationship based on IP requirements.

---

Attribute Name: Section B: IP Management Results
Attribute Description: The “IP Management Results” are assessed based on the evaluation of two IP management result categories “IP Outcomes” and “External Relationship Satisfaction”.

---

Attribute Name: 5.0 Intellectual Property Outcomes: What is the effectiveness of your organization to generate profits from IP?
Attribute Description: Intellectual property outcomes measure the effectiveness of your organization to generate profits from IP:

a) What is the effectiveness of your organization to generate profits from IP in the context of internal structure?

b) What is the effectiveness of your organization to generate profits from IP in the context of external environment?

---

Attribute Name: 5.1 Results
Attribute Description: It measures the effectiveness of your organization to generate profits from IP.

---

Attribute Name: 6.0 External Relationship Satisfaction: What is the

result of external relationship satisfaction based on trust in your organization's IP management?
Attribute Description: External relationship satisfaction measures the result of external relationship satisfaction based on trust in your organization's IP management.

---

Attribute Name: 6.1 Results
Attribute Description: It measures the result of external relationship satisfaction based on trust in your organization's IP management.

---

# Appendix E Assessment Results on All Attributes of Rapid Audit System for Company A

```
=========================================================
The Assessment Results on All Attributes for <Company A>
=========================================================

Alternative Name: Company A
Alternative Utility: 0.7983
Alternative Ranking: 1
_____________________________________________________________

 Attribute Name: IP Management Excellence
Obtained Result: Belief Degree   Grade Name
                    0.0000       Unaware
                    0.0000       Drifters
                    0.0591       Beginners
                    0.6171       Improvers
                    0.2881       Achievers
                    0.0358       Unassigned
Average Utility: 0.7983
_____________________________________________________________

 Attribute Name: Section A: IP Management Implementation - Systems and
Practices
Obtained Result: Belief Degree   Grade Name
                    0.0000       Unaware
                    0.0000       Drifters
                    0.0326       Beginners
                    0.5772       Improvers
                    0.3436       Achievers
                    0.0466       Unassigned
Average Utility: 0.8161
_____________________________________________________________

 Attribute Name: 1.0 Management Support: Does your organization focuses
on leadership, strategy and core competencies in managing IP?
Obtained Result: Belief Degree   Grade Name
                    0.0000       Unaware
                    0.0000       Drifters
                    0.0000       Beginners
```

```
                    0.5098       Improvers
                    0.4500       Achievers
                    0.0402       Unassigned
Average Utility: 0.8525
```

---

```
 Attribute Name: 1.1 Approach
Obtained Result: Belief Degree   Grade Name
                    0.0000       Unaware
                    0.0000       Drifters
                    0.0000       Beginners
                    0.5000       Improvers
                    0.4500       Achievers
                    0.0500       Unassigned
Average Utility: 0.8500
```

---

```
 Attribute Name: 1.2 Deployment
Obtained Result: Belief Degree   Grade Name
                    0.0000       Unaware
                    0.0000       Drifters
                    0.0000       Beginners
                    0.5000       Improvers
                    0.4500       Achievers
                    0.0500       Unassigned
Average Utility: 0.8500
```

---

```
 Attribute Name: 2.0 Innovation Development: Does your organization
focuses on concept creation and product development that lead to IP
generation?
Obtained Result: Belief Degree   Grade Name
                    0.0000       Unaware
                    0.0000       Drifters
                    0.0000       Beginners
                    0.6849       Improvers
                    0.2759       Achievers
                    0.0393       Unassigned
Average Utility: 0.8091
```

---

```
 Attribute Name: 2.1 Approach
Obtained Result: Belief Degree   Grade Name
                    0.0000       Unaware
```

| | |
|---|---|
| 0.0000 | Drifters |
| 0.0000 | Beginners |
| 0.6500 | Improvers |
| 0.3000 | Achievers |
| 0.0500 | Unassigned |

Average Utility: 0.8125

---

Attribute Name: 2.2 Deployment

Obtained Result:

| Belief Degree | Grade Name |
|---|---|
| 0.0000 | Unaware |
| 0.0000 | Drifters |
| 0.0000 | Beginners |
| 0.6500 | Improvers |
| 0.3000 | Achievers |
| 0.0500 | Unassigned |

Average Utility: 0.8125

---

Attribute Name: 3.0 Intellectual Property Capitalization: Does your organization focuses on identification, protection and controlling the exploitation of IP?

Obtained Result:

| Belief Degree | Grade Name |
|---|---|
| 0.0000 | Unaware |
| 0.0000 | Drifters |
| 0.0000 | Beginners |
| 0.5192 | Improvers |
| 0.4000 | Achievers |
| 0.0808 | Unassigned |

Average Utility: 0.8298

---

Attribute Name: 3.1 Approach

Obtained Result:

| Belief Degree | Grade Name |
|---|---|
| 0.0000 | Unaware |
| 0.0000 | Drifters |
| 0.0000 | Beginners |
| 0.5000 | Improvers |
| 0.4000 | Achievers |
| 0.1000 | Unassigned |

Average Utility: 0.8250

---

Attribute Name: 3.2 Deployment

Obtained Result: Belief Degree Grade Name
0.0000 Unaware
0.0000 Drifters
0.0000 Beginners
0.5000 Improvers
0.4000 Achievers
0.1000 Unassigned
Average Utility: 0.8250

---

Attribute Name: 4.0 External Relationship Management: Does your organization focuses on market development, strategic alliances and buyer-seller relationship based on some forms of IP?
Obtained Result: Belief Degree Grade Name
0.0000 Unaware
0.0000 Drifters
0.2475 Beginners
0.4202 Improvers
0.2475 Achievers
0.0848 Unassigned
Average Utility: 0.7288

---

Attribute Name: 4.1 Approach
Obtained Result: Belief Degree Grade Name
0.0000 Unaware
0.0000 Drifters
0.2500 Beginners
0.4000 Improvers
0.2500 Achievers
0.1000 Unassigned
Average Utility: 0.7250

---

Attribute Name: 4.2 Deployment
Obtained Result: Belief Degree Grade Name
0.0000 Unaware
0.0000 Drifters
0.2500 Beginners
0.4000 Improvers
0.2500 Achievers
0.1000 Unassigned
Average Utility: 0.7250

---

Attribute Name: Section B: IP Management Results

| Obtained Result: Belief Degree | Grade Name |
|---|---|
| 0.0000 | Unaware |
| 0.0000 | Drifters |
| 0.1065 | Beginners |
| 0.5872 | Improvers |
| 0.2647 | Achievers |
| 0.0416 | Unassigned |

Average Utility: 0.7792

---

Attribute Name: 5.0 Intellectual Property Outcomes: What is the effectiveness of your organization to generate profits from IP?

| Obtained Result: Belief Degree | Grade Name |
|---|---|
| 0.0000 | Unaware |
| 0.0000 | Drifters |
| 0.0000 | Beginners |
| 0.6500 | Improvers |
| 0.3000 | Achievers |
| 0.0500 | Unassigned |

Average Utility: 0.8125

---

Attribute Name: 5.1 Results

| Obtained Result: Belief Degree | Grade Name |
|---|---|
| 0.0000 | Unaware |
| 0.0000 | Drifters |
| 0.0000 | Beginners |
| 0.6500 | Improvers |
| 0.3000 | Achievers |
| 0.0500 | Unassigned |

Average Utility: 0.8125

---

Attribute Name: 6.0 External Relationship Satisfaction: What is the result of external relationship satisfaction based on trust in your organization's IP management?

| Obtained Result: Belief Degree | Grade Name |
|---|---|
| 0.0000 | Unaware |
| 0.0000 | Drifters |
| 0.2500 | Beginners |
| 0.4500 | Improvers |
| 0.2500 | Achievers |

```
                    0.0500       Unassigned
Average Utility: 0.7375
```

---

```
 Attribute Name: 6.1 Results
Obtained Result: Belief Degree   Grade Name
                    0.0000       Unaware
                    0.0000       Drifters
                    0.2500       Beginners
                    0.4500       Improvers
                    0.2500       Achievers
                    0.0500       Unassigned
Average Utility: 0.7375
```

---

# Appendix F IP Management Excellence Assessment Report for Company A

## A. Introduction

Intellectual property (IP) management becomes increasingly important due to the rapid globalization of the world economy. IP Management Excellence facilitates an organization to generate new invention, transfer its technology, gain market shares, and enhance investor's confidence.

The rapid IP Management Excellence Assessment gives an overview on the IP management activities of an organization. The assessment results show a preliminary picture on the strength and weaknesses of IP management in different areas and hence the weakness areas identified can be further improved.

## B. IP Management Assessment Model

This IP Management Assessment Model gives a general assessment on Company A's IP Management issues. It is divided into two parts, Section A and Section B.

Section A – IP Management Implementation:
Section A emphasizes on the IP Management Implementation, which assesses the general adoption and implementation of Company A's IP Management. It includes 4 enabling categories:

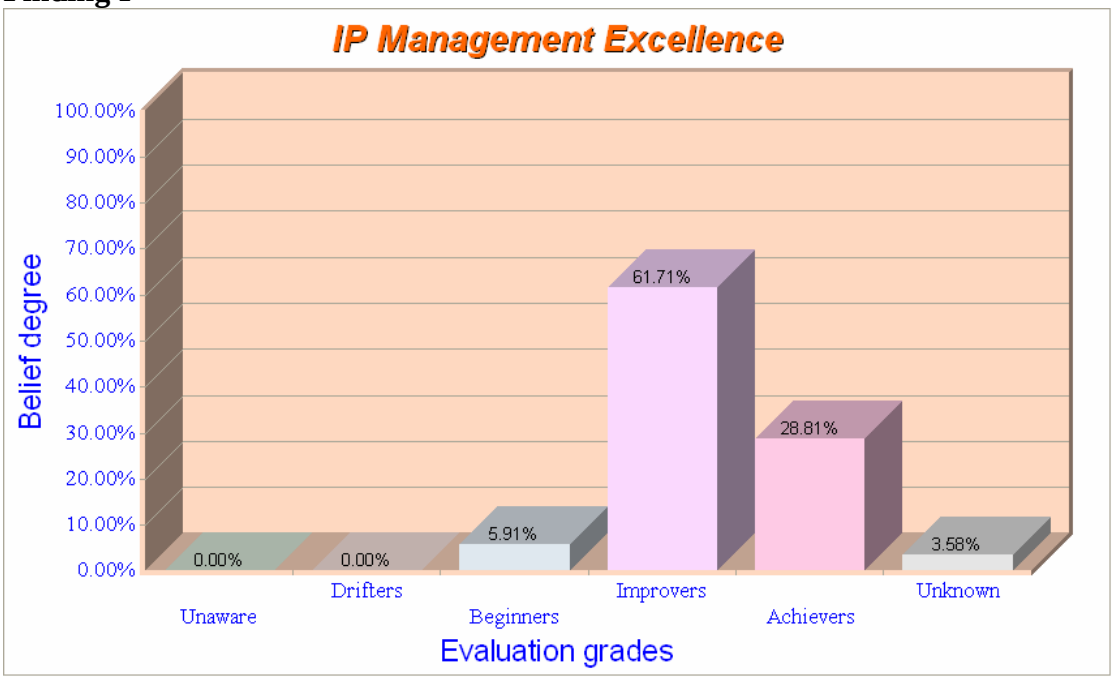
1 –Management Support
2 - Innovation Development
3 - Intellectual Property Capitalization
4 - External Relationship Management

Section B – IP Management Results:
Section B emphasizes on the IP Management Results, which measure the utilization of IP portfolios in generating company's profits and reputation. It includes 2 result categories:

1 - IP Outcome
2 - External Relationship Satisfaction

## C. Findings and Results

**Finding I**



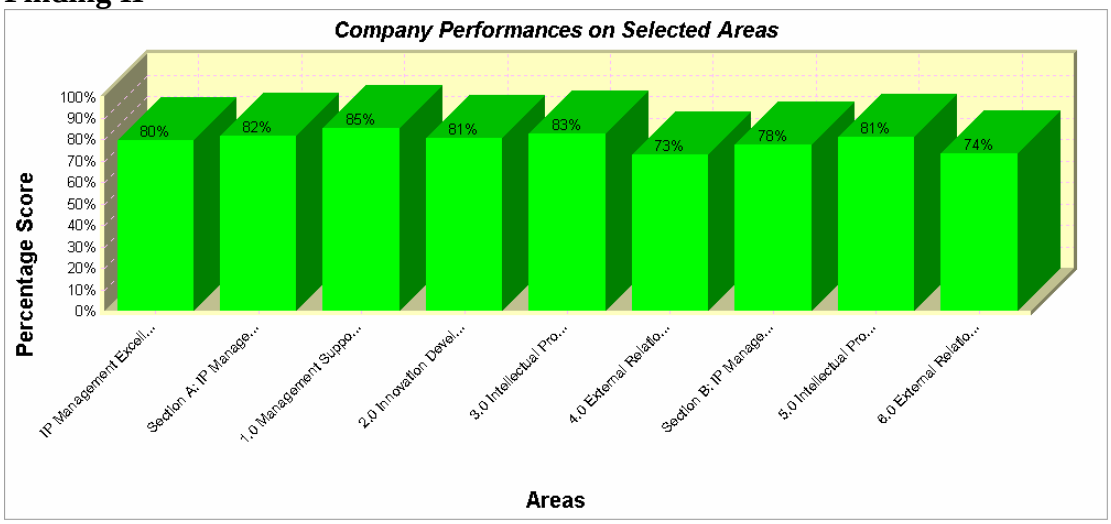

Graph 1: Evaluation Grades on IP Management Excellence

| | |
|---|---|
| Unaware | 0.00% |
| Drifters | 0.00% |
| Beginners | 5.91% |
| Improvers | 61.71% |
| Achievers | 28.81% |
| Unknown | 3.58% |

This graph shows the evaluation grades on Company A's IP Management Excellence. To a large extent (61.74% believe degree), Company A performs as an 'Improver'. According to the characteristics of the five evaluation grades found in IP Management Excellence Model, 'Improvers' are those who have implemented IP management and have positive progress; they can manage IP management in an effective way.

The finding also shows that Company A is making effort to upgrade its IP Management status towards 'Achievers'.

**Finding II**




Graph 2: Overall and Individual Performance on Section A and Section B

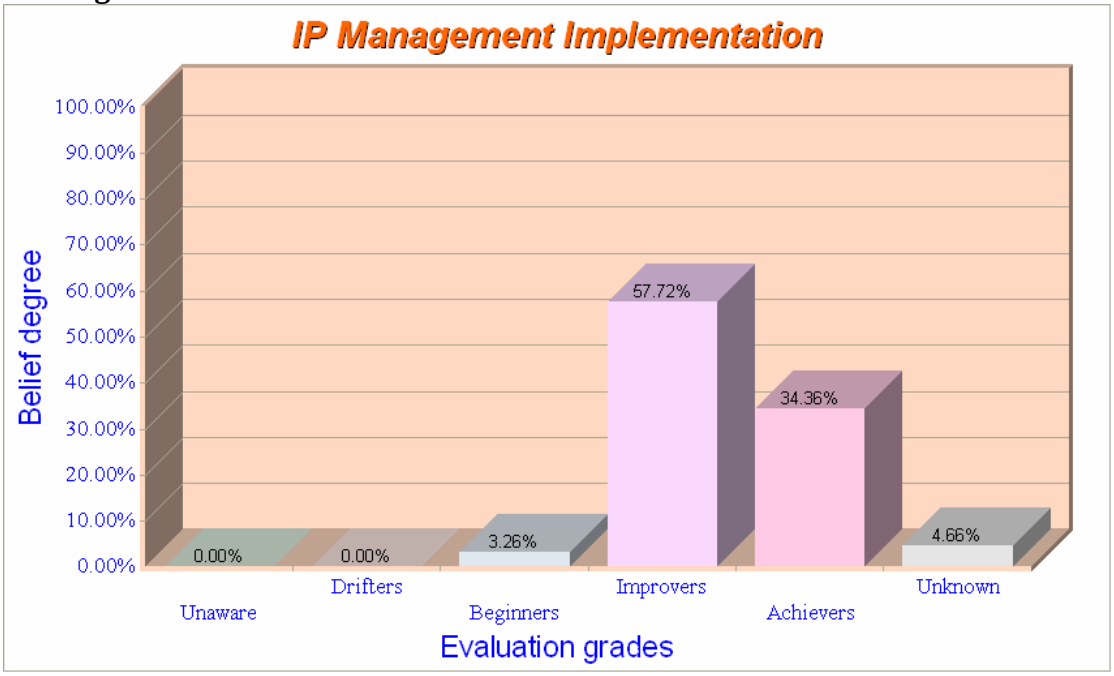
| | | |
|---|---|---|
| **Overall Performance - IP Management Excellence :** | **80%** | |
| **Section A – IP Management Implementation:** | **82%** | |
| 1.0 Management Support | | 85% |
| 2.0 Innovation Development | | 81% |
| 3.0 Intellectual Property Capitalization | | 83% |
| 4.0 External Relationship Management | | 73% |
| **Section B – IP Management Results:** | **78%** | |
| 5.0 IP Outcomes | | 81% |
| 6.0 External Relationship Satisfaction | | 74% |

This graph shows both overall performance (IP Management Excellence) and individual performance on each category in Section A (IP Management Implementation) and Section B (IP Management Results).

For the IP Management Implementation, Company A demonstrates a better performance in Management Support (85%), Innovation Development (81%) and Intellectual Property Capitalization (83%) with percentage scores above the overall performance (80%); however, improvement in External Relationship Management (73%) is needed.

For IP Management Results, Company A demonstrates a better performance in IP Outcomes (81%) with percentage scores above the overall performance (80%); however, improvement in External Relationship Satisfaction (74%) is needed.

**Finding III**

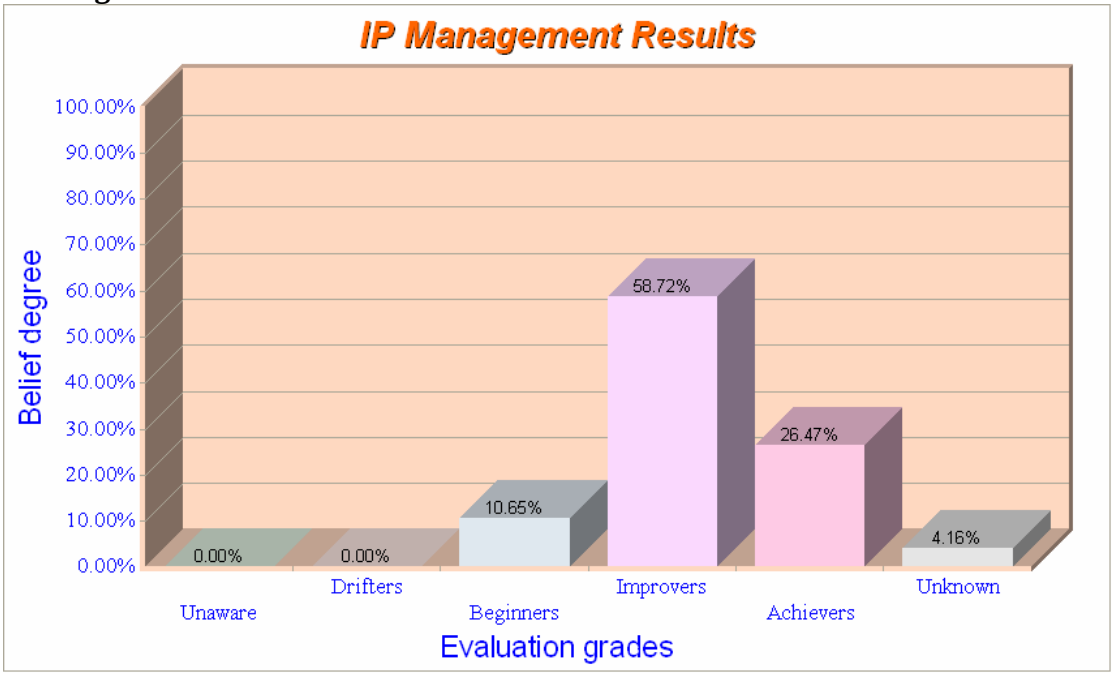



Graph 3: Evaluation Grades on IP Management Implementation

| | |
|---|---|
| Unaware | 0.00% |
| Drifters | 0.00% |
| Beginners | 3.26% |
| Improvers | 57.72% |
| Achievers | 34.36% |
| Unknown | 4.66% |

This graph shows the evaluation grades on IP Management Implementation. Company A tends to present as an 'Improver' with 57.72% belief degree in the assessment, while there is also 34.36% belief degree with evidence support that Company A is preformed as an 'Achiever' in IP Management Implementation. Thus, there is potential for Company A to advance their IP Management Implementation level from 'Improvers' to 'Achievers'.

**Finding IV**




Graph 4: Evaluation Grades on IP Management Results

| | |
|---|---|
| Unaware | 0.00% |
| Drifters | 0.00% |
| Beginners | 10.65% |
| Improvers | 58.72% |
| Achievers | 26.47% |
| Unknown | 4.16% |

This graph shows the evaluation grades on IP Management Results. It shows that Company A tends to present as an 'Improver' with 58.72% belief degree in the assessment, while there is also 10.65% and 26.47% belief degrees with evidence support that Company A is preformed as a 'Beginner' and 'Achiever', respectively, in IP Management Results. The IP Management Results present an opportunity for Company A to plan its improvement strategies.

## D. Recommendations

The rapid assessment shows that Company A performs mainly as an ‘Improver’ in IP Management Excellence. Although Company A has increasing awareness on IP Management, inconsistent and limited extents of IP management activities have been implemented and there still exists room for improvement and further development.

IP Management Implementation

For the IP Management Implementation, the assessment shows that the major problem of IP management in Company A is found in the enabling category on External Relationship Management.

Thus, it is essential to focus on market development, strategic alliances and buyer-seller relationship based on IP requirements. It is recommended to:

a) embed IP in technology, product and service;
b) become more sophisticated in managing external relationship with IP requirements; and
c) stake a claim on the future with encouragement of research ventures and IP holding business startups or spinouts.

IP Management Results

For the IP Management Results, the assessment shows that the major problem of IP management in Company A is found in the result category on External Relationship Satisfaction. Thus, it is recommended to measure the result of external relationship satisfaction based on trust in the organization's IP management.

# Appendix G Assessment Results on All Attributes of Rapid Audit System for Company B

```
=========================================================
 The Assessment Results on All Attributes for <Company B>
=========================================================

Alternative Name: Company B
Alternative Utility: 0.5583
Alternative Ranking: 2
_____________________________________________________________

 Attribute Name: IP Management Excellence
Obtained Result: Belief Degree   Grade Name
                    0.0000       Unaware
                    0.1480       Drifters
                    0.4804       Beginners
                    0.2650       Improvers
                    0.0580       Achievers
                    0.0485       Unassigned
Average Utility: 0.5583
_____________________________________________________________

 Attribute Name: Section A: IP Management Implementation - Systems and
Practices
Obtained Result: Belief Degree   Grade Name
                    0.0000       Unaware
                    0.0751       Drifters
                    0.4259       Beginners
                    0.2940       Improvers
                    0.1337       Achievers
                    0.0712       Unassigned
Average Utility: 0.6216
_____________________________________________________________

 Attribute Name: 1.0 Management Support: Does your organization focuses
on leadership, strategy and core competencies in managing IP?
Obtained Result: Belief Degree   Grade Name
                    0.0000       Unaware
                    0.0000       Drifters
                    0.5192       Beginners
```

```
                    0.4000       Improvers
                    0.0000       Achievers
                    0.0808       Unassigned
Average Utility: 0.6000
```

---

```
 Attribute Name: 1.1 Approach
Obtained Result: Belief Degree   Grade Name
                    0.0000       Unaware
                    0.0000       Drifters
                    0.5000       Beginners
                    0.4000       Improvers
                    0.0000       Achievers
                    0.1000       Unassigned
Average Utility: 0.6000
```

---

```
 Attribute Name: 1.2 Deployment
Obtained Result: Belief Degree   Grade Name
                    0.0000       Unaware
                    0.0000       Drifters
                    0.5000       Beginners
                    0.4000       Improvers
                    0.0000       Achievers
                    0.1000       Unassigned
Average Utility: 0.6000
```

---

```
 Attribute Name: 2.0 Innovation Development: Does your organization
focuses on concept creation and product development that lead to IP
generation?
Obtained Result: Belief Degree   Grade Name
                    0.0000       Unaware
                    0.0000       Drifters
                    0.1935       Beginners
                    0.3024       Improvers
                    0.4194       Achievers
                    0.0847       Unassigned
Average Utility: 0.7853
```

---

```
 Attribute Name: 2.1 Approach
Obtained Result: Belief Degree   Grade Name
                    0.0000       Unaware
```

```
                    0.0000       Drifters
                    0.2000       Beginners
                    0.3000       Improvers
                    0.4000       Achievers
                    0.1000       Unassigned
Average Utility: 0.7750
```

---

```
 Attribute Name: 2.2 Deployment
Obtained Result: Belief Degree   Grade Name
                    0.0000       Unaware
                    0.0000       Drifters
                    0.2000       Beginners
                    0.3000       Improvers
                    0.4000       Achievers
                    0.1000       Unassigned
Average Utility: 0.7750
```

---

```
 Attribute Name: 3.0 Intellectual Property Capitalization: Does your
organization focuses on identification, protection and controlling the
exploitation of IP?
Obtained Result: Belief Degree   Grade Name
                    0.0000       Unaware
                    0.2953       Drifters
                    0.5315       Beginners
                    0.0906       Improvers
                    0.0000       Achievers
                    0.0827       Unassigned
Average Utility: 0.4488
```

---

```
 Attribute Name: 3.1 Approach
Obtained Result: Belief Degree   Grade Name
                    0.0000       Unaware
                    0.3000       Drifters
                    0.5000       Beginners
                    0.1000       Improvers
                    0.0000       Achievers
                    0.1000       Unassigned
Average Utility: 0.4500
```

---

```
 Attribute Name: 3.2 Deployment
```

```
Obtained Result: Belief Degree   Grade Name
                    0.0000       Unaware
                    0.3000       Drifters
                    0.5000       Beginners
                    0.1000       Improvers
                    0.0000       Achievers
                    0.1000       Unassigned
Average Utility: 0.4500
```

---

```
 Attribute Name: 4.0 External Relationship Management: Does your
organization focuses on market development, strategic alliances and
buyer-seller relationship based on some forms of IP?
Obtained Result: Belief Degree   Grade Name
                    0.0000       Unaware
                    0.0000       Drifters
                    0.3024       Beginners
                    0.4194       Improvers
                    0.1935       Achievers
                    0.0847       Unassigned
Average Utility: 0.7016
```

---

```
 Attribute Name: 4.1 Approach
Obtained Result: Belief Degree   Grade Name
                    0.0000       Unaware
                    0.0000       Drifters
                    0.3000       Beginners
                    0.4000       Improvers
                    0.2000       Achievers
                    0.1000       Unassigned
Average Utility: 0.7000
```

---

```
 Attribute Name: 4.2 Deployment
Obtained Result: Belief Degree   Grade Name
                    0.0000       Unaware
                    0.0000       Drifters
                    0.3000       Beginners
                    0.4000       Improvers
                    0.2000       Achievers
                    0.1000       Unassigned
Average Utility: 0.7000
```

---

Attribute Name: Section B: IP Management Results

| Obtained Result: Belief Degree | Grade Name |
|---|---|
| 0.0000 | Unaware |
| 0.2417 | Drifters |
| 0.4742 | Beginners |
| 0.2417 | Improvers |
| 0.0000 | Achievers |
| 0.0424 | Unassigned |

Average Utility: 0.5000

---

Attribute Name: 5.0 Intellectual Property Outcomes: What is the effectiveness of your organization to generate profits from IP?

| Obtained Result: Belief Degree | Grade Name |
|---|---|
| 0.0000 | Unaware |
| 0.3000 | Drifters |
| 0.4500 | Beginners |
| 0.2000 | Improvers |
| 0.0000 | Achievers |
| 0.0500 | Unassigned |

Average Utility: 0.4750

---

Attribute Name: 5.1 Results

| Obtained Result: Belief Degree | Grade Name |
|---|---|
| 0.0000 | Unaware |
| 0.3000 | Drifters |
| 0.4500 | Beginners |
| 0.2000 | Improvers |
| 0.0000 | Achievers |
| 0.0500 | Unassigned |

Average Utility: 0.4750

---

Attribute Name: 6.0 External Relationship Satisfaction: What is the result of external relationship satisfaction based on trust in your organization's IP management?

| Obtained Result: Belief Degree | Grade Name |
|---|---|
| 0.0000 | Unaware |
| 0.2000 | Drifters |
| 0.4500 | Beginners |
| 0.3000 | Improvers |

```
                    0.0000       Achievers
                    0.0500       Unassigned
Average Utility: 0.5250
```

---

```
 Attribute Name: 6.1 Results
Obtained Result: Belief Degree   Grade Name
                    0.0000       Unaware
                    0.2000       Drifters
                    0.4500       Beginners
                    0.3000       Improvers
                    0.0000       Achievers
                    0.0500       Unassigned
Average Utility: 0.5250
```

---

# Appendix H IP Management Excellence Assessment Report for Company B

## A. Introduction

Intellectual property (IP) management becomes increasingly important due to the rapid globalization of the world economy. IP Management Excellence facilitates an organization to generate new invention, transfer its technology, gain market shares, and enhance investor's confidence.

The rapid IP Management Excellence Assessment gives an overview on the IP management activities of an organization. The assessment results show a preliminary picture on the strength and weaknesses of IP management in different areas and hence the weakness areas identified can be further improved.

## B. IP Management Assessment Model

This IP Management Assessment Model gives a general assessment on Company B's IP Management issues. It is divided into two parts, Section A and Section B.

Section A – IP Management Implementation:
Section A emphasizes on the IP Management Implementation, which assesses the general adoption and implementation of Company B's IP Management. It includes 4 enabling categories:

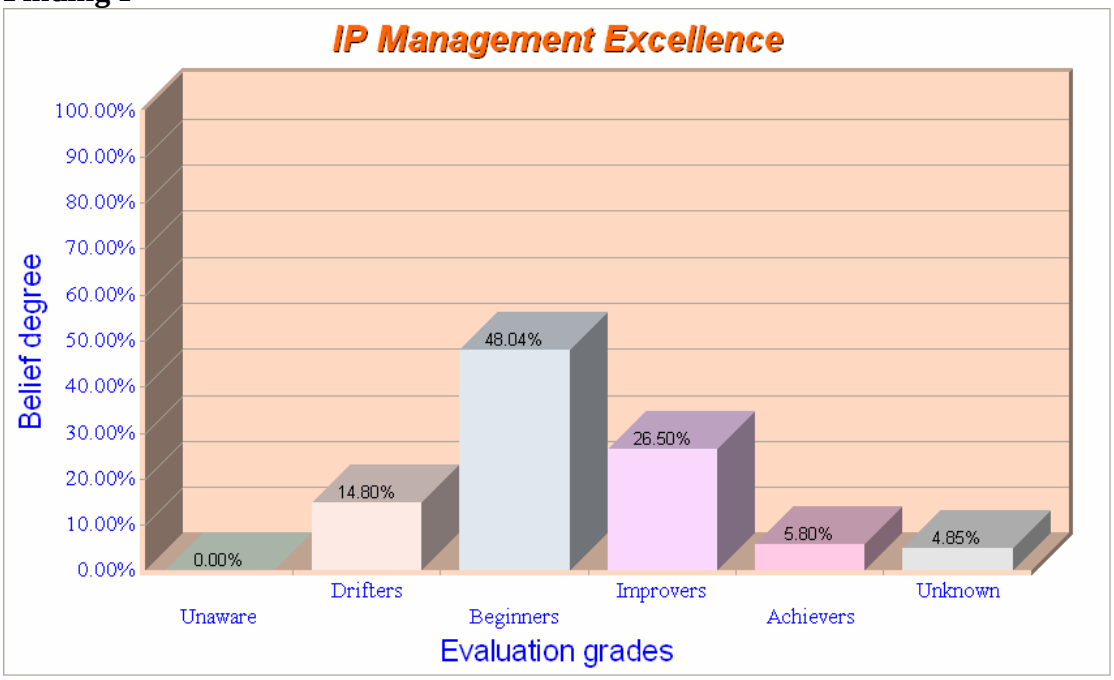
1 –Management Support
2 - Innovation Development
3 - Intellectual Property Capitalization
4 - External Relationship Management

Section B – IP Management Results:
Section B emphasizes on the IP Management Results, which measure the utilization of IP portfolios in generating company's profits and reputation. It includes 2 result categories:

1 - IP Outcome
2 - External Relationship Satisfaction

## C. Findings and Results

**Finding I**



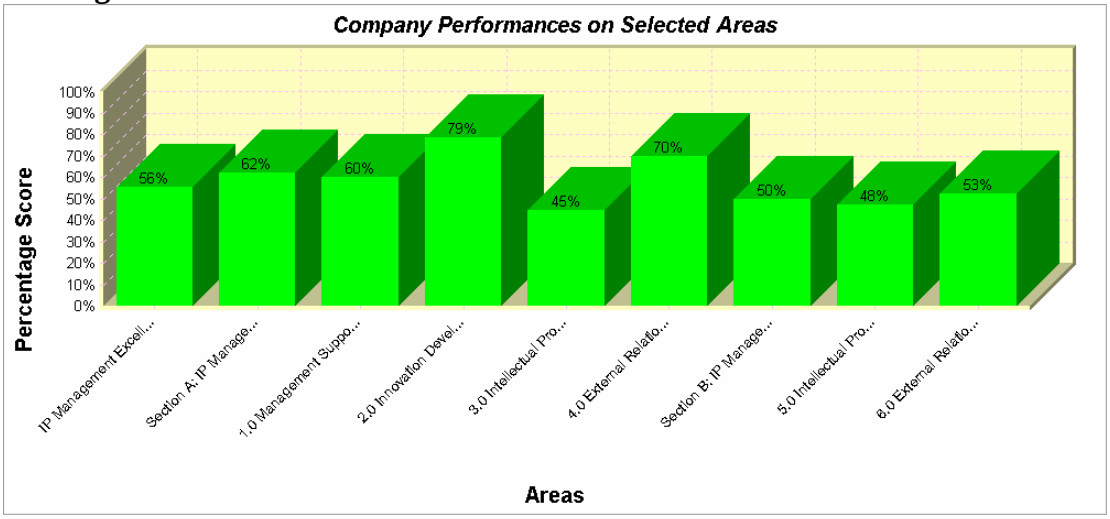

Graph 1: Evaluation Grades on IP Management Excellence

| | |
|---|---|
| Unaware | 0.00% |
| Drifters | 14.80% |
| Beginners | 48.04% |
| Improvers | 26.50% |
| Achievers | 5.80% |
| Unknown | 4.85% |

This graph shows the evaluation grades on Company B's IP Management Excellence. To a large extent (48.04% belief degree), Company B performs as a 'Beginner'. According to the characteristics of the five evaluation grades found in IP Management Excellence Model, 'Beginners' are those who have understanding of the importance of IP management and its positive relation with IP management performance. They are still in early stage of implementation; clear guidance for improvement in IP management is required.

The finding also shows that Company B is making effort to upgrade its IP Management status towards 'Improvers' and 'Achievers'.

**Finding II**




Graph 2: Overall and Individual Performance on Section A and Section B

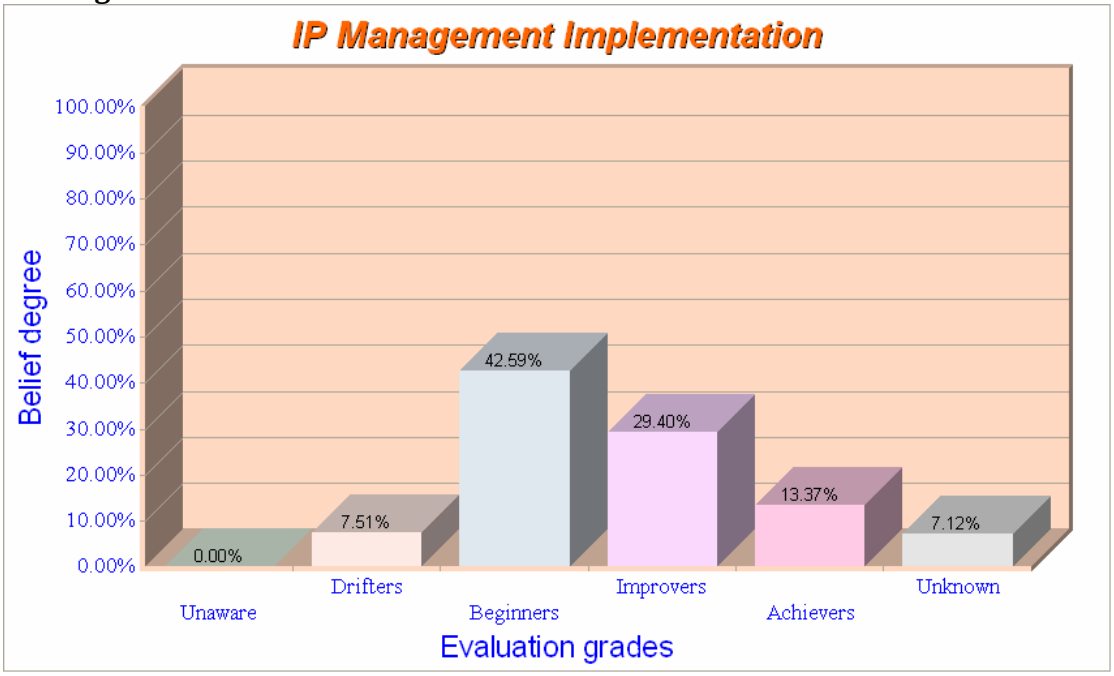
| | | |
|---|---|---|
| **Overall Performance - IP Management Excellence :** | **56%** | |
| **Section A – IP Management Implementation:** | **62%** | |
| 1.0 Management Support | | 60% |
| 2.0 Innovation Development | | 79% |
| 3.0 Intellectual Property Capitalization | | 45% |
| 4.0 External Relationship Management | | 70% |
| **Section B – IP Management Results:** | **50%** | |
| 5.0 IP Outcomes | | 48% |
| 6.0 External Relationship Satisfaction | | 53% |

This graph shows both overall performance (IP Management Excellence) and individual performance on each category in Section A (IP Management Implementation) and Section B (IP Management Results).

For the IP Management Implementation, Company B demonstrates a better performance in Management Support (60%), Innovation Development (79%) and External Relationship Management (70%) with percentage scores above the overall performance (56%); however, improvement in Intellectual Property Capitalization (45%) is needed.

For IP Management Results, Company B demonstrates a weaker performance in IP Outcomes (48%) and External Relationship Satisfaction (53%), with percentage scores below the overall performance (56%).

**Finding III**

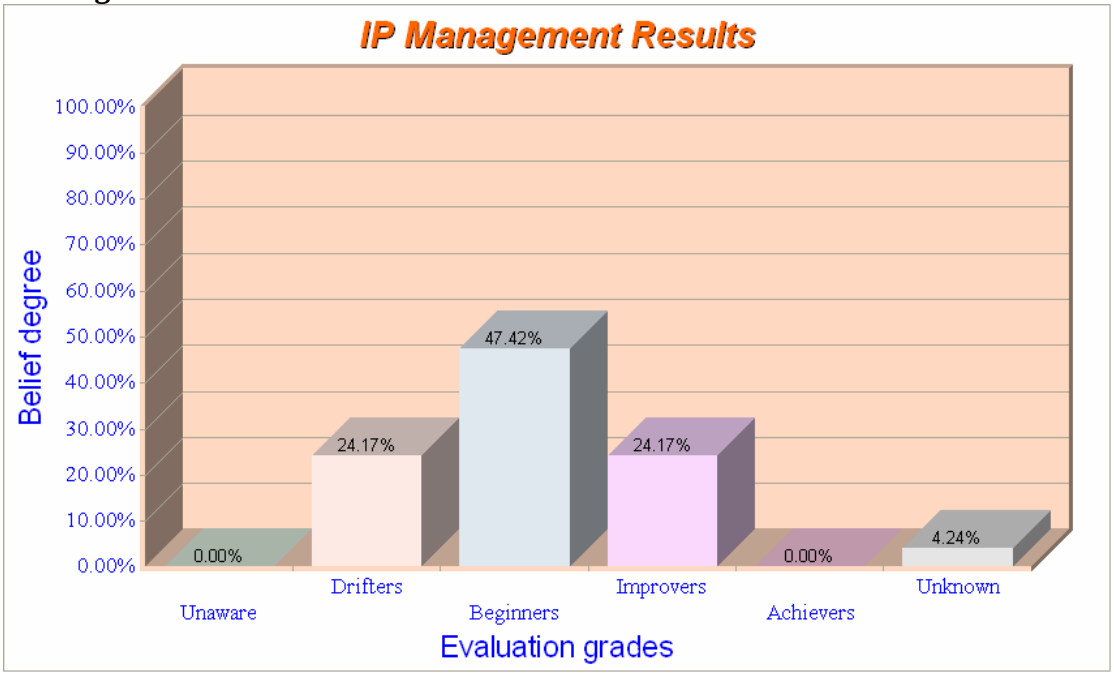



Graph 3: Evaluation Grades on IP Management Implementation

| | |
|---|---|
| Unaware | 0.00% |
| Drifters | 7.51% |
| Beginners | 42.59% |
| Improvers | 29.40% |
| Achievers | 13.37% |
| Unknown | 7.12% |

This graph shows the evaluation grades on IP Management Implementation. Company B tends to present as a 'Beginner' with 42.59% belief degree in the assessment, while there is also 29.40% and 13.37% belief degrees with evidence support that Company B is preformed as an 'Improver' and 'Achiever', respectively, in IP Management Implementation. Thus, there is potential for Company B to advance their IP Management Implementation level from 'Beginners' to at least 'Improvers'.

**Finding IV**




Graph 4: Evaluation Grades on IP Management Results

| | |
|---|---|
| Unaware | 0.00% |
| Drifters | 24.17% |
| Beginners | 47.42% |
| Improvers | 24.17% |
| Achievers | 0.00% |
| Unknown | 4.24% |

This graph shows the evaluation grades on IP Management Results. It shows that Company B tends to present as a 'Beginner' with 47.42% belief degree in the assessment, while there is also 24.17% and 24.17% belief degrees with evidence support that Company B is preformed as a 'Drifter' and 'Improver', respectively, in IP Management Results. The IP Management Results present an opportunity for Company B to plan its improvement strategies.

## D. Recommendations

The rapid assessment shows that Company B performs mainly as a ‘Beginner’ in IP Management Excellence. Although Company B has increasing awareness on IP Management, inconsistent and limited extents of IP management activities have been implemented and there still exists room for improvement and further development.

IP Management Implementation

For the IP Management Implementation, the assessment shows that the major problem of IP management in Company B is found in the enabling category on Intellectual Property Capitalization.

Thus, it is essential to focus on identification, protection and controlling the exploitation of IP. It is recommended to:

a) formalize internal security control measures for safeguarding the content of IP portfolios;
b) develop basic processes for identifying, protecting and controlling the organization's own IP;
c) reduce costs associated with the organization's IP portfolios by using internal audit and evaluation; and
d) extract value directly from IP as quickly and inexpensively as possible.

IP Management Results

For the IP Management Results, the assessment shows that the major problems of IP management in Company B are found in the result categories on IP Outcomes and External Relationship Satisfaction. Thus, it is recommended to measure the effectiveness of the organization to generate profits from IP; and the result of external relationship satisfaction based on trust in the organization's IP management.

# Appendix I Assessment Results on All Attributes of Rapid Audit System for Company C

```
=========================================================
The Assessment Results on All Attributes for <Company C>
=========================================================

Alternative Name: Company C
Alternative Utility: 0.3123
Alternative Ranking: 3
_________________________________________________________

 Attribute Name: IP Management Excellence
Obtained Result: Belief Degree   Grade Name
                   0.0908       Unaware
                   0.5693       Drifters
                   0.2859       Beginners
                   0.0000       Improvers
                   0.0000       Achievers
                   0.0540       Unassigned
Average Utility: 0.3123
_________________________________________________________

 Attribute Name: Section A: IP Management Implementation - Systems and
Practices
Obtained Result: Belief Degree   Grade Name
                   0.0938       Unaware
                   0.5937       Drifters
                   0.2652       Beginners
                   0.0000       Improvers
                   0.0000       Achievers
                   0.0472       Unassigned
Average Utility: 0.3047
_________________________________________________________

 Attribute Name: 1.0 Management Support: Does your organization focuses
on leadership, strategy and core competencies in managing IP?
Obtained Result: Belief Degree   Grade Name
                   0.0000       Unaware
                   0.7396       Drifters
                   0.2217       Beginners
                   0.0000       Improvers
```

```
                    0.0000       Achievers
                    0.0387       Unassigned
Average Utility: 0.3151
```

---

```
 Attribute Name: 1.1 Approach
Obtained Result: Belief Degree   Grade Name
                    0.0000       Unaware
                    0.7000       Drifters
                    0.2500       Beginners
                    0.0000       Improvers
                    0.0000       Achievers
                    0.0500       Unassigned
Average Utility: 0.3250
```

---

```
 Attribute Name: 1.2 Deployment
Obtained Result: Belief Degree   Grade Name
                    0.0000       Unaware
                    0.7000       Drifters
                    0.2500       Beginners
                    0.0000       Improvers
                    0.0000       Achievers
                    0.0500       Unassigned
Average Utility: 0.3250
```

---

```
 Attribute Name: 2.0 Innovation Development: Does your organization
focuses on concept creation and product development that lead to IP
generation?
Obtained Result: Belief Degree   Grade Name
                    0.0000       Unaware
                    0.5192       Drifters
                    0.4000       Beginners
                    0.0000       Improvers
                    0.0000       Achievers
                    0.0808       Unassigned
Average Utility: 0.3702
```

---

```
 Attribute Name: 2.1 Approach
Obtained Result: Belief Degree   Grade Name
                    0.0000       Unaware
                    0.5000       Drifters
```

```
                    0.4000       Beginners
                    0.0000       Improvers
                    0.0000       Achievers
                    0.1000       Unassigned
Average Utility: 0.3750
```

---

```
 Attribute Name: 2.2 Deployment
Obtained Result: Belief Degree   Grade Name
                    0.0000       Unaware
                    0.5000       Drifters
                    0.4000       Beginners
                    0.0000       Improvers
                    0.0000       Achievers
                    0.1000       Unassigned
Average Utility: 0.3750
```

---

```
 Attribute Name: 3.0 Intellectual Property Capitalization: Does your
organization focuses on identification, protection and controlling the
exploitation of IP?
Obtained Result: Belief Degree   Grade Name
                    0.2423       Unaware
                    0.4732       Drifters
                    0.2423       Beginners
                    0.0000       Improvers
                    0.0000       Achievers
                    0.0423       Unassigned
Average Utility: 0.2606
```

---

```
 Attribute Name: 3.1 Approach
Obtained Result: Belief Degree   Grade Name
                    0.2500       Unaware
                    0.4500       Drifters
                    0.2500       Beginners
                    0.0000       Improvers
                    0.0000       Achievers
                    0.0500       Unassigned
Average Utility: 0.2625
```

---

```
 Attribute Name: 3.2 Deployment
Obtained Result: Belief Degree   Grade Name
```

```
                    0.2500       Unaware
                    0.4500       Drifters
                    0.2500       Beginners
                    0.0000       Improvers
                    0.0000       Achievers
                    0.0500       Unassigned
Average Utility: 0.2625
```

---

```
 Attribute Name: 4.0 External Relationship Management: Does your
organization focuses on market development, strategic alliances and
buyer-seller relationship based on some forms of IP?
Obtained Result: Belief Degree   Grade Name
                    0.2475       Unaware
                    0.4202       Drifters
                    0.2475       Beginners
                    0.0000       Improvers
                    0.0000       Achievers
                    0.0848       Unassigned
Average Utility: 0.2712
```

---

```
 Attribute Name: 4.1 Approach
Obtained Result: Belief Degree   Grade Name
                    0.2500       Unaware
                    0.4000       Drifters
                    0.2500       Beginners
                    0.0000       Improvers
                    0.0000       Achievers
                    0.1000       Unassigned
Average Utility: 0.2750
```

---

```
 Attribute Name: 4.2 Deployment
Obtained Result: Belief Degree   Grade Name
                    0.2500       Unaware
                    0.4000       Drifters
                    0.2500       Beginners
                    0.0000       Improvers
                    0.0000       Achievers
                    0.1000       Unassigned
Average Utility: 0.2750
```

---

Attribute Name: Section B: IP Management Results
Obtained Result: Belief Degree Grade Name
0.1104 Unaware
0.4779 Drifters
0.3273 Beginners
0.0000 Improvers
0.0000 Achievers
0.0843 Unassigned
Average Utility: 0.3253

---

Attribute Name: 5.0 Intellectual Property Outcomes: What is the effectiveness of your organization to generate profits from IP?
Obtained Result: Belief Degree Grade Name
0.0000 Unaware
0.5000 Drifters
0.4000 Beginners
0.0000 Improvers
0.0000 Achievers
0.1000 Unassigned
Average Utility: 0.3750

---

Attribute Name: 5.1 Results
Obtained Result: Belief Degree Grade Name
0.0000 Unaware
0.5000 Drifters
0.4000 Beginners
0.0000 Improvers
0.0000 Achievers
0.1000 Unassigned
Average Utility: 0.3750

---

Attribute Name: 6.0 External Relationship Satisfaction: What is the result of external relationship satisfaction based on trust in your organization's IP management?
Obtained Result: Belief Degree Grade Name
0.2500 Unaware
0.4000 Drifters
0.2500 Beginners
0.0000 Improvers
0.0000 Achievers
0.1000 Unassigned

Average Utility: 0.2750

---

Attribute Name: 6.1 Results

| Obtained Result: Belief Degree | Grade Name |
|---|---|
| 0.2500 | Unaware |
| 0.4000 | Drifters |
| 0.2500 | Beginners |
| 0.0000 | Improvers |
| 0.0000 | Achievers |
| 0.1000 | Unassigned |

Average Utility: 0.2750

---

# Appendix J IP Management Excellence Assessment Report for Company C

## A. Introduction

Intellectual property (IP) management becomes increasingly important due to the rapid globalization of the world economy. IP Management Excellence facilitates an organization to generate new invention, transfer its technology, gain market shares, and enhance investor's confidence.

The rapid IP Management Excellence Assessment gives an overview on the IP management activities of an organization. The assessment results show a preliminary picture on the strength and weaknesses of IP management in different areas and hence the weakness areas identified can be further improved.

## B. IP Management Assessment Model

This IP Management Assessment Model gives a general assessment on Company C's IP Management issues. It is divided into two parts, Section A and Section B.

Section A – IP Management Implementation:
Section A emphasizes on the IP Management Implementation, which assesses the general adoption and implementation of Company C's IP Management. It includes 4 enabling categories:

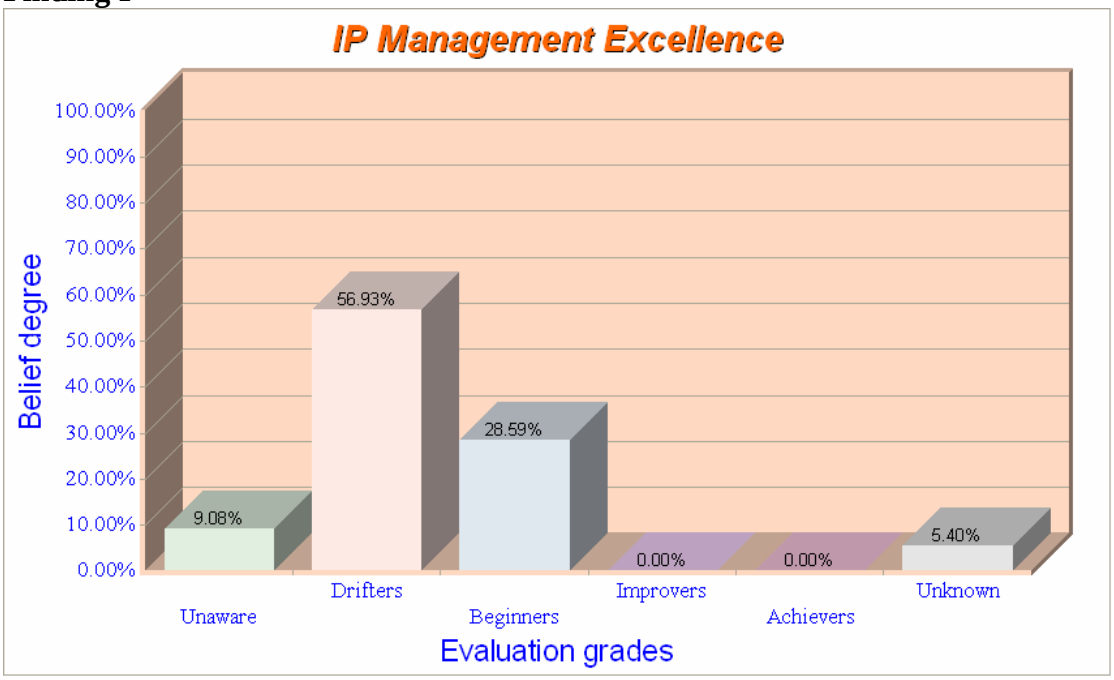
1 –Management Support
2 - Innovation Development
3 - Intellectual Property Capitalization
4 - External Relationship Management

Section B – IP Management Results:
Section B emphasizes on the IP Management Results, which measure the utilization of IP portfolios in generating company's profits and reputation. It includes 2 result categories:

1 - IP Outcome
2 - External Relationship Satisfaction

## C. Findings and Results

**Finding I**



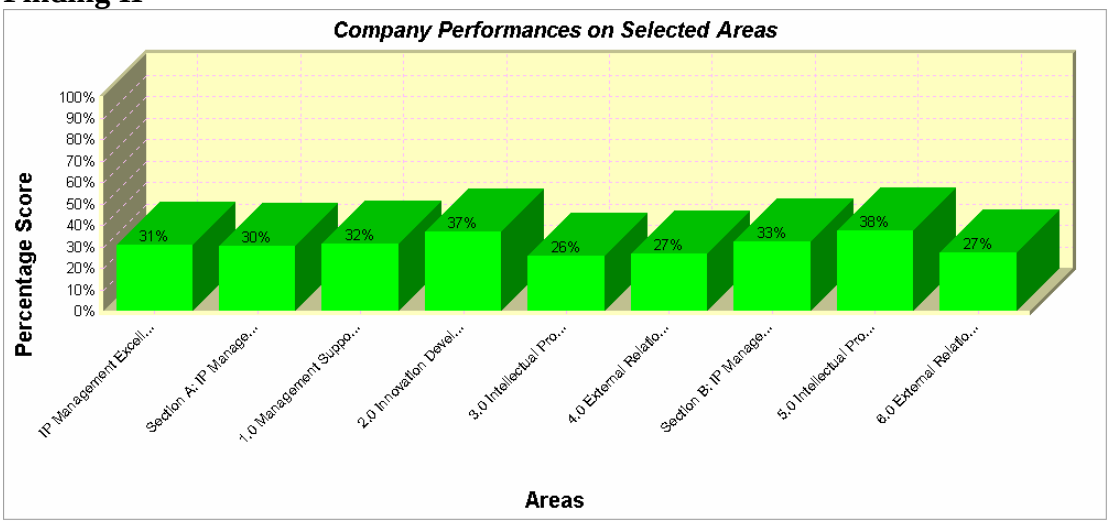

Graph 1: Evaluation Grades on IP Management Excellence

| | |
|---|---|
| Unaware | 9.08% |
| Drifters | 56.93% |
| Beginners | 28.59% |
| Improvers | 0.00% |
| Achievers | 0.00% |
| Unknown | 5.40% |

This graph shows the evaluation grades on Company C's IP Management Excellence. To a large extent (56.93% belief degree), Company C performs as a 'Drifter'. According to the characteristics of the five evaluation grades found in IP Management Excellence Model, 'Drifters' are those who have some understanding of the importance of IP management. However, they don't commit resources and efforts to develop and implement IP management.

The finding also shows that Company C is making effort to upgrade its IP Management status towards 'Beginners'.

**Finding II**




Graph 2: Overall and Individual Performance on Section A and Section B

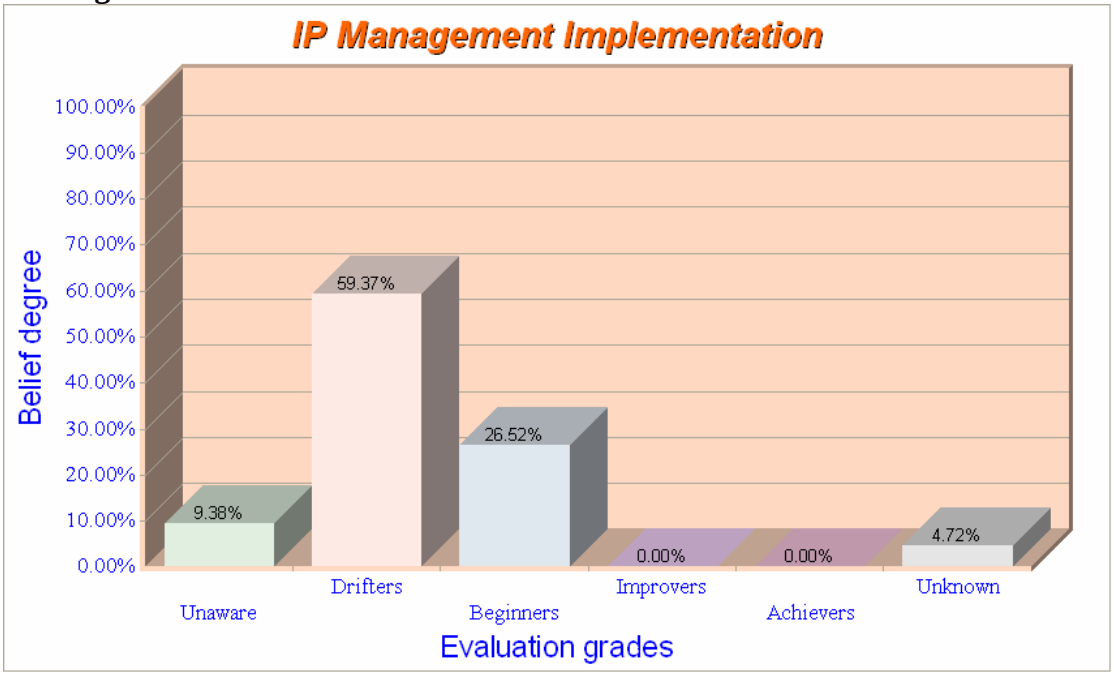
| | | |
|---|---|---|
| **Overall Performance - IP Management Excellence :** | **31%** | |
| **Section A – IP Management Implementation:** | **30%** | |
| 1.0 Management Support | | 32% |
| 2.0 Innovation Development | | 37% |
| 3.0 Intellectual Property Capitalization | | 26% |
| 4.0 External Relationship Management | | 27% |
| **Section B – IP Management Results:** | **33%** | |
| 5.0 IP Outcomes | | 38% |
| 6.0 External Relationship Satisfaction | | 27% |

This graph shows both overall performance (IP Management Excellence) and individual performance on each category in Section A (IP Management Implementation) and Section B (IP Management Result).

For the IP Management Implementation, Company C demonstrates a better performance in Management Support (32%) and Innovation Development (37%) with percentage scores above the overall performance (31%); however, improvement in Intellectual Property Capitalization (26%) and External Relationship Management (27%) are needed.

For IP Management Results, Company C demonstrates a better performance in IP Outcomes (38%) with percentage scores above the overall performance (31%); however, improvement in External Relationship Satisfaction (27%) is needed.

**Finding III**

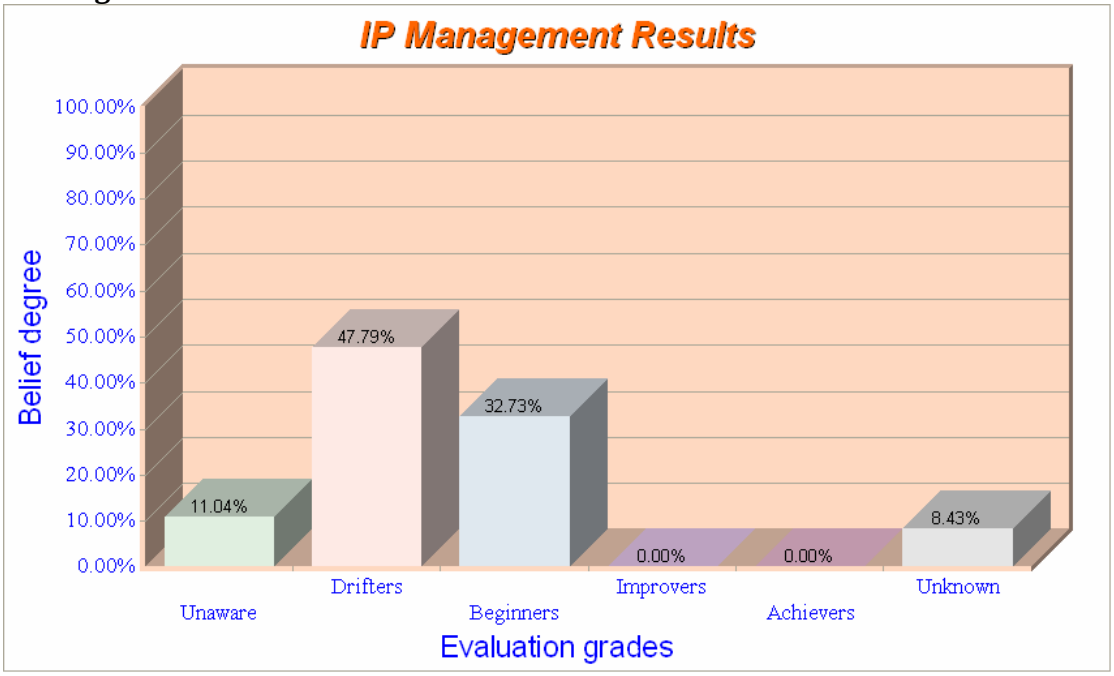



Graph 3: Evaluation Grades on IP Management Implementation

| | |
|---|---|
| Unaware | 9.38% |
| Drifters | 59.37% |
| Beginners | 26.52% |
| Improvers | 0.00% |
| Achievers | 0.00% |
| Unknown | 4.72% |

This graph shows the evaluation grades on IP Management Implementation. Company C tends to present as a 'Drifter' with 59.37% belief degree in the assessment, while there is also 9.38% and 26.52% belief degrees with evidence support that Company C is preformed as 'Unaware' and 'Beginner', respectively, in IP Management Implementation. Thus, there is potential for Company C to advance their IP Management Implementation level from 'Drifters' to at least 'Beginners'.

**Finding IV**




Graph 4: Evaluation Grades on IP Management Results

| | |
|---|---|
| Unaware | 11.04% |
| Drifters | 47.79% |
| Beginners | 32.73% |
| Improvers | 0.00% |
| Achievers | 0.00% |
| Unknown | 8.43% |

This graph shows the evaluation grades on IP Management Results. It shows that Company C tends to present as a 'Drifter' with 47.79% belief degree in the assessment, while there is also 11.04% and 32.737% belief degrees with evidence support that Company C is preformed as 'Unaware' and 'Beginner', respectively, in IP Management Results. The IP Management Results present an opportunity for Company C to plan its improvement strategies.

## D. Recommendations

The rapid assessment shows that Company C performs mainly as a ‘Drifter’ and ‘Beginner’ in IP Management Excellence. Although Company C has increasing awareness on IP Management, inconsistent and limited extents of IP management activities have been implemented and there still exists room for improvement and further development.

IP Management Implementation

For the IP Management Implementation, the assessment shows that the major problem of IP management in Company C is found in the enabling categories on Intellectual Property Capitalization and External Relationship Management.

Thus, it is essential to focus on identification, protection and controlling the exploitation of IP; and on market development, strategic alliances and buyer-seller relationship based on IP requirements. It is recommended to:

a) formalize internal security control measures for safeguarding the content of IP portfolios;
b) develop basic processes for identifying, protecting and controlling the organization's own IP;
c) reduce costs associated with the organization's IP portfolios by using internal audit and evaluation;
d) extract value directly from IP as quickly and inexpensively as possible.
e) embed IP in technology, product and service;
f) become more sophisticated in managing external relationship with IP requirements; and
g) stake a claim on the future with encouragement of research ventures and IP holding business startups or spinouts.

IP Management Results

For the IP Management Results, the assessment shows that the major problem of IP management in Company C is found in the result category on External Relationship Satisfaction. Thus, it is recommended to measure the result of external relationship satisfaction based on trust in the organization's IP management.

# Appendix K Attribute Description of Comprehensive Audit System

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Attribute Description of Comprehensive Audit System
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Attribute Name: IP Management Implementation - Systems and Practices
Attribute Description: The “IP Management Implementation - Systems and Practices” is assessed based on the evaluation of four IP management enabling categories “Management Support”, “Innovation Development”, “Intellectual Property Capitalization” and “External Relationship Management”.

---

Attribute Name: 1.0 Management Support: Does your organization focuses on leadership, strategy and core competencies in managing IP?
Attribute Description: Management support category focuses on leadership, strategy and core competencies for managing IP.

---

Attribute Name: 1.1 Strategic Management Plan for IP Activities
Attribute Description: How the leaders embed IP management in visionary leadership and develop strategic management plan for IP activities.

---

Attribute Name: 1.1.1 Vision, Strategy and Policy Setting
Attribute Description: How the organization develops vision, strategy and policy on IP and communicates top management's commitment in the implementation of the strategic direction, policies and practices on IP to employees, customers, suppliers, partners and other external parties.

---

Attribute Name: 1.1.2 Total Commitment to Action
Attribute Description: How the organization motivates the participation of employees at all levels on IP management, developing action plans aligned to IP strategies and setting action items with performance monitoring for IP action plans.

---

Attribute Name: 1.2 Internal IP Management Function, Knowledge and Skill
Attribute Description: How the organization ensures that core competence in IP knowledge and skill is adequate in all functions.

---

Attribute Name: 1.2.1 IP Manual
Attribute Description: How the organization provides staff with training manual in IP management and exploitation. Content of manuals and/or reference booklets should increase the staff member's ability to create, protect and leverage IP of the organization.

---

Attribute Name: 1.2.2 Employee Contract
Attribute Description: How the organization makes clear statements in internal official documents, such as employment contract, regarding the confidentiality requirement, ownership of IP, and incentive for invention.

---

Attribute Name: 1.2.3 IP Training
Attribute Description: How the organization identifies what related departments require the IP knowledge and skills and put the training system in place to develop what the organization needs in the related departments.

---

Attribute Name: 1.2.4 Internal IP Manager
Attribute Description: How the organization appoints suitable staff or collective team/department with dedicated responsibilities for IP portfolio management and extraction of value from IP.

---

Attribute Name: 1.3 IP Defense and Enforcement System
Attribute Description: How the organization establishes IP defense and enforcement system.

---

Attribute Name: 1.3.1 IP Defense
Attribute Description: How the organization seeks legal support with appropriate involvement of marketing, engineering and administration departments when dealing with issues or activities of IP infringement, in particular in the actions for defending against an aggressive accuser.

---

Attribute Name: 1.3.2 IP Enforcement
Attribute Description: How the organization seeks legal support with appropriate involvement of marketing, engineering and administration departments when dealing with issues or activities of IP infringement, in particular in the actions for pursuing an infringer.

---

Attribute Name: 2.0 Innovation Development: Does your organization focuses on concept creation and product development that lead to IP generation?
Attribute Description: Innovation development category focuses on commitment for product development and commercialization that lead to IP generation.

---

Attribute Name: 2.1 Creativity Generation, Concept Selection and Prototyping
Attribute Description: How the organization initiates basic processes for product creation and development that lead to IP generation.

---

Attribute Name: 2.1.1 Concept Creation
Attribute Description: How the organization generates new ideas that can create new products/processes with increased IP value, through activities such as brainstorming, creative thinking methodologies and research & development initiatives.

---

Attribute Name: 2.1.2 Design Around
Attribute Description: How the organization develops a solution for bringing a new product/process to market/for industrial application by

getting around IP rights owned by other organizations in order to avoid infringement.

---

Attribute Name: 2.1.3 Concept Evaluation
Attribute Description: How the organization generates workable new design/concept through practices such as technology concept analysis through internal business proposal; market needs assessment through customer-oriented studies; and business model investigation.

---

Attribute Name: 2.1.4 Concept Vetting Procedure
Attribute Description: How the organization performs vetting procedure of the concepts or inventions in review meetings and provides to management all necessary information required to make informed decisions as to proceed with trade secrets, patent protection, publishing as "Prior Arts", or other types of IP registration etc.

---

Attribute Name: 2.1.5 Prototype Testing and Development
Attribute Description: How the organization turns a new concept/invention into a product/process through the many different stages in product/process testing, engineering prototyping and pilot-production prototyping.

---

Attribute Name: 2.2 IP Intelligence and Advisory Support
Attribute Description: How the organization avoids costs due to reinvention efforts and potential infringement litigations in early design cycle by using IP intelligence and advisory support.

---

Attribute Name: 2.2.1 IP Search
Attribute Description: How the organization makes use of IP information as an important source of technological intelligence for invention assessment, infringement clearance search, monitoring of latest technological development, etc.

---

Attribute Name: 2.2.2 IP Information Database
Attribute Description: How the organization develops or utilizes internal or external IP knowledgebase as a form of information tool to reveal insights into IP rights, in particular, patent technology and gain strategic advantage in technology and competitive intelligence.

---

Attribute Name: 2.2.3 External IP Consultant

Attribute Description: How the organization seeks advice from professional IP consultant for those matters which are out of its employees' capability to handle such as the patentability of the invention, acquiring IP rights from other parties, etc.

---

Attribute Name: 2.2.4 IP Budget
Attribute Description: How the organization allocates resources for paying the cost incurred in the creation, evaluation, protection and maintenance of its IP and determines commercial viability of the IP.

---

Attribute Name: 3.0 Intellectual Property Capitalization: Does your organization focuses on identification, protection and controlling the exploitation of IP?
Attribute Description: Intellectual property capitalization category focuses on identification, protection and controlling the exploitation of IP.

---

Attribute Name: 3.1 Internal IP Security
Attribute Description: How the organization formalizes internal security control measures for safeguarding the content of IP portfolios.

---

Attribute Name: 3.1.1 Confidential Information

Attribute Description: How the organization controls the access and prevents premature disclosure of the confidential information through the

use of confidentiality agreements and making clear statements in internal official documents regarding the confidentiality requirement.

---

Attribute Name: 3.1.2 Copyright Protection
Attribute Description: How the organization protects the original literary, artistic, musical and other works which are resulted from creative skill and/or significant labor and/or investment by recording in any form of the works that has been created and taking steps to prove that materials belonged to the organization.

---

Attribute Name: 3.1.3 Internal Design Documentation
Attribute Description: How the organization or business unit documents and communicates in either hard or digital forms internally developed technology within an organization with the use of invention disclosure form or design document as a means to recover unrealized potential technological innovation and original designs developed by employees and to avoid the loss of knowledge due to staff turnover.

---

Attribute Name: 3.2 IP Application/Registration
Attribute Description: How the organization develops basic processes for identifying, protecting and controlling the organization's own IP.

---

Attribute Name: 3.2.1 Patent Application
Attribute Description: How the organization protects an invention or utility model by applying for patent application; giving the owner exclusive rights to produce, use or sell the protected innovation.

---

Attribute Name: 3.2.2 Design Application
Attribute Description: How the organization protects distinctive appearance of products by applying for design application; giving the owner exclusive rights to produce, import or sell the protected design.

---

Attribute Name: 3.2.3 Trademark or Service Mark Registration
Attribute Description: How the organization protects valuable symbols, logos or words by applying trademark or service mark that can help identifying its products or services and prevents others from infringing.

---

Attribute Name: 3.3 Internal IP Audit and Evaluation
Attribute Description: How the organization reduces costs associated with the organization's IP portfolios by using internal audit and evaluation.

---

Attribute Name: 3.3.1 IP Audit
Attribute Description: How the organization performs IP audit to review its policies and procedures concerning IP with an aim to identify potential areas of deficiency for consideration and correction.

---

Attribute Name: 3.3.2 IP Valuation
Attribute Description: How the organization uses proper tools, procedures and methods to determine the financial value of IP and then to evaluate what is considered to be the organization's greatest value of its IP for various reasons including IP licensing, IP litigation, sale of IP, acquisitions/mergers, cost/benefit analysis for R&D and accounting purpose.

---

Attribute Name: 3.3.3 IP Cost/Benefit Analysis
Attribute Description: How the organization evaluates what is considered to be the organization's greatest value of IP and assess commercial viability of IP.

---

Attribute Name: 3.4 IP Licensing and Acquisition
Attribute Description: How the organization extracts value directly from IP as quickly and inexpensively as possible.

---

Attribute Name: 3.4.1 IP Out-licensing

Attribute Description: How the organization identifies and pursues licensing opportunities such as licensing out your own IP portfolio in non-competing ways that can create new products, services or market in order to capture revenue, market share and competitive edge.

---

Attribute Name: 3.4.2 IP In-licensing
Attribute Description: How the organization identifies and pursues licensing opportunities such as licensing in your partner's IP portfolio that can create new products, services or market in order to capture revenue, market share and competitive edge.

---

Attribute Name: 3.4.3 IP Ownership Acquisition
Attribute Description: How the organization balances the benefit and risk of using internal resources to develop or acquiring/transferring IP ownership from/to the relevant party and then makes appropriate decision so as to conform to the organizations' IP exploitation policy.

---

Attribute Name: 4.0 External Relationship Management: Does your organization focuses on market development, strategic alliances and buyer-seller relationship based on some forms of IP?
Attribute Description: External relationship management category focuses on market development, strategic alliances and buyer-seller relationship based on IP requirements.

---

Attribute Name: 4.1 IP Commercial Development and Marketing
Attribute Description: How the organization embeds IP in technology, product and service.

---

Attribute Name: 4.1.1 IP Commercialization Conversion
Attribute Description: How the organization accomplishes all the technical steps, up to full-scale production, establishing sales and distribution and achieving business growth through incorporation of IP in new products.

---

Attribute Name: 4.1.2 Brand Positioning
Attribute Description: How the organization capitalizes on a name or logo that defines and conveys its message to its target market segment and to spend money, time and effort to position its brand in market.

---

Attribute Name: 4.1.3 Advertising Channel
Attribute Description: How the organization projects the image of the product with IP right(s) to all contact points of the market, i.e. promoting the product with patent, registered design and/or trademark in all advertising and communication materials.

---

Attribute Name: 4.2 External IP Security, Agreement and Partners Matching
Attribute Description: How the organization becomes more sophisticated in managing external relationship with IP requirements.

---

Attribute Name: 4.2.1 IP Right Ownership
Attribute Description: How the organization addresses specific issue of IP rights and clarifies the ownership of IP and other relevant rights in written agreements with involved parties.

---

Attribute Name: 4.2.2 Non-disclosure Agreement
Attribute Description: How the organization ensures the recipient to keep information of the owner confidential by means of non-disclosure agreement (NDA) signed by parties involved.

---

Attribute Name: 4.2.3 Business / Technology Collaboration
Attribute Description: How the organization collaborates with the business partners to implement a new project. How the organization matches the owner of IP rights with the exploiter of technology for mutual advantages of both parties. With collaboration, the partners are able to come together to pursue a business opportunity, which they would not have

been able to pursue independently.

---

Attribute Name: 4.3 Research Venture and IP Holding Business Startup/Spinout
Attribute Description: How the organization stakes a claim on the future with encouragement of research ventures and IP holding business startups or spinouts.

---

Attribute Name: 4.3.1 Research Collaboration
Attribute Description: How the organization establishes a cooperative research and development relationship with research institutes such as universities in order to develop novel products/processes.

---

Attribute Name: 4.3.2 Startup/Spinout
Attribute Description: How the organization starts up an IP holding company by developing a business plan, financial model, investor/venture capital relationship and customer base for the successful commercialization of identified IP.

---

# Appendix L Assessment Results on All Attributes of Comprehensive Audit System for Company B

```
=====================================================================
The Assessment Results on All Attributes of Comprehensive Audit System
for <Company B>
=====================================================================


Alternative Name: Company B
Alternative Utility: 0.6143

_____________________________________________________________________

 Attribute Name: IP Management Implementation - Systems and Practices
Obtained Result: Belief Degree   Grade Name
                  0.0244         Unaware
                  0.1004         Drifters
                  0.4181         Beginners
                  0.3079         Improvers
                  0.1492         Achievers
                  0.0000         Unassigned
Average Utility: 0.6143

_____________________________________________________________________

 Attribute Name: 1.0 Management Support: Does your organization focuses
on leadership, strategy and core competencies in managing IP?
Obtained Result: Belief Degree   Grade Name
                   0.0000        Unaware
                   0.1507        Drifters
                   0.5423        Beginners
                   0.3070        Improvers
                   0.0000        Achievers
                   0.0000        Unassigned
Average Utility: 0.5391

_____________________________________________________________________

 Attribute Name: 1.1 Strategic Management Plan for IP Activities
Obtained Result: Belief Degree   Grade Name
                   0.0000        Unaware
```

```
                    0.5000       Drifters
                    0.5000       Beginners
                    0.0000       Improvers
                    0.0000       Achievers
                    0.0000       Unassigned
Average Utility: 0.3750
```

---

```
 Attribute Name: 1.1.1 Vision, Strategy and Policy Setting
Obtained Result: Belief Degree   Grade Name
                    0.0000       Unaware
                    0.0000       Drifters
                    1.0000       Beginners
                    0.0000       Improvers
                    0.0000       Achievers
                    0.0000       Unassigned
Average Utility: 0.5000
```

---

```
 Attribute Name: 1.1.2 Total Commitment to Action
Obtained Result: Belief Degree   Grade Name
                    0.0000       Unaware
                    1.0000       Drifters
                    0.0000       Beginners
                    0.0000       Improvers
                    0.0000       Achievers
                    0.0000       Unassigned
Average Utility: 0.2500
```

---

```
 Attribute Name: 1.2 Internal IP Management Function, Knowledge and Skill
Obtained Result: Belief Degree   Grade Name
                    0.0000       Unaware
                    0.0000       Drifters
                    0.8043       Beginners
                    0.1957       Improvers
                    0.0000       Achievers
                    0.0000       Unassigned
Average Utility: 0.5489
```

---

```
 Attribute Name: 1.2.1 IP Manual
Obtained Result: Belief Degree   Grade Name
                    0.0000       Unaware
```

```
                    0.0000       Drifters
                    1.0000       Beginners
                    0.0000       Improvers
                    0.0000       Achievers
                    0.0000       Unassigned
Average Utility: 0.5000
```

---

```
 Attribute Name: 1.2.2 Employee Contract
Obtained Result: Belief Degree   Grade Name
                    0.0000       Unaware
                    0.0000       Drifters
                    0.0000       Beginners
                    1.0000       Improvers
                    0.0000       Achievers
                    0.0000       Unassigned
Average Utility: 0.7500
```

---

```
 Attribute Name: 1.2.3 IP Training
Obtained Result: Belief Degree   Grade Name
                    0.0000       Unaware
                    0.0000       Drifters
                    1.0000       Beginners
                    0.0000       Improvers
                    0.0000       Achievers
                    0.0000       Unassigned
Average Utility: 0.5000
```

---

```
 Attribute Name: 1.2.4 Internal IP Manager
Obtained Result: Belief Degree   Grade Name
                    0.0000       Unaware
                    0.0000       Drifters
                    1.0000       Beginners
                    0.0000       Improvers
                    0.0000       Achievers
                    0.0000       Unassigned
Average Utility: 0.5000
```

---

```
 Attribute Name: 1.3 IP Defense and Enforcement System
Obtained Result: Belief Degree   Grade Name
                    0.0000       Unaware
```

```
                    0.0000       Drifters
                    0.0000       Beginners
                    1.0000       Improvers
                    0.0000       Achievers
                    0.0000       Unassigned
Average Utility: 0.7500
```

---

```
 Attribute Name: 1.3.1 IP Defense
Obtained Result: Belief Degree   Grade Name
                    0.0000       Unaware
                    0.0000       Drifters
                    0.0000       Beginners
                    1.0000       Improvers
                    0.0000       Achievers
                    0.0000       Unassigned
Average Utility: 0.7500
```

---

```
 Attribute Name: 1.3.2 IP Enforcement
Obtained Result: Belief Degree   Grade Name
                    0.0000       Unaware
                    0.0000       Drifters
                    0.0000       Beginners
                    1.0000       Improvers
                    0.0000       Achievers
                    0.0000       Unassigned
Average Utility: 0.7500
```

---

```
 Attribute Name: 2.0 Innovation Development: Does your organization
focuses on concept creation and product development that lead to IP
generation?
Obtained Result: Belief Degree   Grade Name
                    0.0000       Unaware
                    0.0000       Drifters
                    0.1806       Beginners
                    0.4010       Improvers
                    0.4184       Achievers
                    0.0000       Unassigned
Average Utility: 0.8095
```

---

```
 Attribute Name: 2.1 Creativity Generation, Concept Selection and
```

```
Prototyping
Obtained Result: Belief Degree   Grade Name
                    0.0000       Unaware
                    0.0000       Drifters
                    0.1720       Beginners
                    0.1720       Improvers
                    0.6559       Achievers
                    0.0000       Unassigned
Average Utility: 0.8710
```

---

```
 Attribute Name: 2.1.1 Concept Creation
Obtained Result: Belief Degree   Grade Name
                    0.0000       Unaware
                    0.0000       Drifters
                    0.0000       Beginners
                    0.0000       Improvers
                    1.0000       Achievers
                    0.0000       Unassigned
Average Utility: 1.0000
```

---

```
 Attribute Name: 2.1.2 Design Around
Obtained Result: Belief Degree   Grade Name
                    0.0000       Unaware
                    0.0000       Drifters
                    0.0000       Beginners
                    0.0000       Improvers
                    1.0000       Achievers
                    0.0000       Unassigned
Average Utility: 1.0000
```

---

```
 Attribute Name: 2.1.3 Concept Evaluation
Obtained Result: Belief Degree   Grade Name
                    0.0000       Unaware
                    0.0000       Drifters
                    0.0000       Beginners
                    1.0000       Improvers
                    0.0000       Achievers
                    0.0000       Unassigned
Average Utility: 0.7500
```

---

```
 Attribute Name: 2.1.4 Concept Vetting Procedure
Obtained Result: Belief Degree   Grade Name
                    0.0000       Unaware
                    0.0000       Drifters
                    1.0000       Beginners
                    0.0000       Improvers
                    0.0000       Achievers
                    0.0000       Unassigned
Average Utility: 0.5000
```

---

```
 Attribute Name: 2.1.5 Prototype Testing and Development
Obtained Result: Belief Degree   Grade Name
                    0.0000       Unaware
                    0.0000       Drifters
                    0.0000       Beginners
                    0.0000       Improvers
                    1.0000       Achievers
                    0.0000       Unassigned
Average Utility: 1.0000
```

---

```
 Attribute Name: 2.2 IP Intelligence and Advisory Support
Obtained Result: Belief Degree   Grade Name
                    0.0000       Unaware
                    0.0000       Drifters
                    0.1957       Beginners
                    0.8043       Improvers
                    0.0000       Achievers
                    0.0000       Unassigned
Average Utility: 0.7011
```

---

```
 Attribute Name: 2.2.1 IP Search
Obtained Result: Belief Degree   Grade Name
                    0.0000       Unaware
                    0.0000       Drifters
                    0.0000       Beginners
                    1.0000       Improvers
                    0.0000       Achievers
                    0.0000       Unassigned
Average Utility: 0.7500
```

---

Attribute Name: 2.2.2 IP Information Database
Obtained Result: Belief Degree Grade Name
0.0000 Unaware
0.0000 Drifters
0.0000 Beginners
1.0000 Improvers
0.0000 Achievers
0.0000 Unassigned
Average Utility: 0.7500

---

Attribute Name: 2.2.3 External IP Consultant
Obtained Result: Belief Degree Grade Name
0.0000 Unaware
0.0000 Drifters
0.0000 Beginners
1.0000 Improvers
0.0000 Achievers
0.0000 Unassigned
Average Utility: 0.7500

---

Attribute Name: 2.2.4 IP Budget
Obtained Result: Belief Degree Grade Name
0.0000 Unaware
0.0000 Drifters
1.0000 Beginners
0.0000 Improvers
0.0000 Achievers
0.0000 Unassigned
Average Utility: 0.5000

---

Attribute Name: 3.0 Intellectual Property Capitalization: Does your organization focuses on identification, protection and controlling the exploitation of IP?
Obtained Result: Belief Degree Grade Name
0.0972 Unaware
0.2375 Drifters
0.4782 Beginners
0.1871 Improvers
0.0000 Achievers
0.0000 Unassigned
Average Utility: 0.4388

---

```
 Attribute Name: 3.1 Internal IP Security
Obtained Result: Belief Degree   Grade Name
                    0.0000       Unaware
                    0.0000       Drifters
                    1.0000       Beginners
                    0.0000       Improvers
                    0.0000       Achievers
                    0.0000       Unassigned
Average Utility: 0.5000
```

---

```
 Attribute Name: 3.1.1 Confidential Information
Obtained Result: Belief Degree   Grade Name
                    0.0000       Unaware
                    0.0000       Drifters
                    1.0000       Beginners
                    0.0000       Improvers
                    0.0000       Achievers
                    0.0000       Unassigned
Average Utility: 0.5000
```

---

```
 Attribute Name: 3.1.2 Copyright Protection
Obtained Result: Belief Degree   Grade Name
                    0.0000       Unaware
                    0.0000       Drifters
                    1.0000       Beginners
                    0.0000       Improvers
                    0.0000       Achievers
                    0.0000       Unassigned
Average Utility: 0.5000
```

---

```
 Attribute Name: 3.1.3 Internal Design Documentation
Obtained Result: Belief Degree   Grade Name
                    0.0000       Unaware
                    0.0000       Drifters
                    1.0000       Beginners
                    0.0000       Improvers
                    0.0000       Achievers
                    0.0000       Unassigned
Average Utility: 0.5000
```

---

```
 Attribute Name: 3.2 IP Application/Registration
Obtained Result: Belief Degree   Grade Name
                    0.0000       Unaware
                    0.3333       Drifters
                    0.3333       Beginners
                    0.3333       Improvers
                    0.0000       Achievers
                    0.0000       Unassigned
Average Utility: 0.5000
```

---

```
 Attribute Name: 3.2.1 Patent Application
Obtained Result: Belief Degree   Grade Name
                    0.0000       Unaware
                    0.0000       Drifters
                    0.0000       Beginners
                    1.0000       Improvers
                    0.0000       Achievers
                    0.0000       Unassigned
Average Utility: 0.7500
```

---

```
 Attribute Name: 3.2.2 Design Application
Obtained Result: Belief Degree   Grade Name
                    0.0000       Unaware
                    1.0000       Drifters
                    0.0000       Beginners
                    0.0000       Improvers
                    0.0000       Achievers
                    0.0000       Unassigned
Average Utility: 0.2500
```

---

```
 Attribute Name: 3.2.3 Trademark or Service Mark Registration
Obtained Result: Belief Degree   Grade Name
                    0.0000       Unaware
                    0.0000       Drifters
                    1.0000       Beginners
                    0.0000       Improvers
                    0.0000       Achievers
                    0.0000       Unassigned
Average Utility: 0.5000
```

---

```
 Attribute Name: 3.3 Internal IP Audit and Evaluation
Obtained Result: Belief Degree   Grade Name
                   0.0000       Unaware
                   0.3333       Drifters
                   0.3333       Beginners
                   0.3333       Improvers
                   0.0000       Achievers
                   0.0000       Unassigned
Average Utility: 0.5000
```

---

```
 Attribute Name: 3.3.1 IP Audit
Obtained Result: Belief Degree   Grade Name
                   0.0000       Unaware
                   0.0000       Drifters
                   1.0000       Beginners
                   0.0000       Improvers
                   0.0000       Achievers
                   0.0000       Unassigned
Average Utility: 0.5000
```

---

```
 Attribute Name: 3.3.2 IP Valuation
Obtained Result: Belief Degree   Grade Name
                   0.0000       Unaware
                   1.0000       Drifters
                   0.0000       Beginners
                   0.0000       Improvers
                   0.0000       Achievers
                   0.0000       Unassigned
Average Utility: 0.2500
```

---

```
 Attribute Name: 3.3.3 IP Cost/Benefit Analysis
Obtained Result: Belief Degree   Grade Name
                   0.0000       Unaware
                   0.0000       Drifters
                   0.0000       Beginners
                   1.0000       Improvers
                   0.0000       Achievers
                   0.0000       Unassigned
Average Utility: 0.7500
```

---

```
 Attribute Name: 3.4 IP Licensing and Acquisition
Obtained Result: Belief Degree   Grade Name
                   0.7143       Unaware
                   0.2857       Drifters
                   0.0000       Beginners
                   0.0000       Improvers
                   0.0000       Achievers
                   0.0000       Unassigned
Average Utility: 0.0714
```

---

```
 Attribute Name: 3.4.1 IP Out-licensing
Obtained Result: Belief Degree   Grade Name
                   0.0000       Unaware
                   1.0000       Drifters
                   0.0000       Beginners
                   0.0000       Improvers
                   0.0000       Achievers
                   0.0000       Unassigned
Average Utility: 0.2500
```

---

```
 Attribute Name: 3.4.2 IP In-licensing
Obtained Result: Belief Degree   Grade Name
                   1.0000       Unaware
                   0.0000       Drifters
                   0.0000       Beginners
                   0.0000       Improvers
                   0.0000       Achievers
                   0.0000       Unassigned
Average Utility: 0.0000
```

---

```
 Attribute Name: 3.4.3 IP Ownership Acquisition
Obtained Result: Belief Degree   Grade Name
                   1.0000       Unaware
                   0.0000       Drifters
                   0.0000       Beginners
                   0.0000       Improvers
                   0.0000       Achievers
                   0.0000       Unassigned
Average Utility: 0.0000
```

---

Attribute Name: 4.0 External Relationship Management: Does your organization focuses on market development, strategic alliances and buyer-seller relationship based on some forms of IP?

| Obtained Result: Belief Degree | Grade Name |
|---|---|
| 0.0000 | Unaware |
| 0.0000 | Drifters |
| 0.3604 | Beginners |
| 0.3351 | Improvers |
| 0.3045 | Achievers |
| 0.0000 | Unassigned |

Average Utility: 0.7360

---

Attribute Name: 4.1 IP Commercial Development and Marketing

| Obtained Result: Belief Degree | Grade Name |
|---|---|
| 0.0000 | Unaware |
| 0.0000 | Drifters |
| 0.3333 | Beginners |
| 0.3333 | Improvers |
| 0.3333 | Achievers |
| 0.0000 | Unassigned |

Average Utility: 0.7500

---

Attribute Name: 4.1.1 IP Commercialization Conversion

| Obtained Result: Belief Degree | Grade Name |
|---|---|
| 0.0000 | Unaware |
| 0.0000 | Drifters |
| 0.0000 | Beginners |
| 0.0000 | Improvers |
| 1.0000 | Achievers |
| 0.0000 | Unassigned |

Average Utility: 1.0000

---

Attribute Name: 4.1.2 Brand Positioning

| Obtained Result: Belief Degree | Grade Name |
|---|---|
| 0.0000 | Unaware |
| 0.0000 | Drifters |
| 0.0000 | Beginners |
| 1.0000 | Improvers |
| 0.0000 | Achievers |

```
                    0.0000       Unassigned
Average Utility: 0.7500
```

---

```
 Attribute Name: 4.1.3 Advertising Channel
Obtained Result: Belief Degree   Grade Name
                    0.0000       Unaware
                    0.0000       Drifters
                    1.0000       Beginners
                    0.0000       Improvers
                    0.0000       Achievers
                    0.0000       Unassigned
Average Utility: 0.5000
```

---

```
 Attribute Name: 4.2 External IP Security, Agreement and Partners
Matching
Obtained Result: Belief Degree   Grade Name
                   0.0000        Unaware
                   0.0000        Drifters
                   0.3077        Beginners
                   0.5385        Improvers
                   0.1538        Achievers
                   0.0000        Unassigned
Average Utility: 0.7115
```

---

```
 Attribute Name: 4.2.1 IP Right Ownership
Obtained Result: Belief Degree   Grade Name
                    0.0000       Unaware
                    0.0000       Drifters
                    0.0000       Beginners
                    1.0000       Improvers
                    0.0000       Achievers
                    0.0000       Unassigned
Average Utility: 0.7500
```

---

```
 Attribute Name: 4.2.2 Non-disclosure Agreement
Obtained Result: Belief Degree   Grade Name
                    0.0000       Unaware
                    0.0000       Drifters
                    1.0000       Beginners
                    0.0000       Improvers
```

```
                    0.0000       Achievers
                    0.0000       Unassigned
Average Utility: 0.5000
```

---

```
 Attribute Name: 4.2.3 Business / Technology Collaboration
Obtained Result: Belief Degree   Grade Name
                    0.0000       Unaware
                    0.0000       Drifters
                    0.0000       Beginners
                    0.5000       Improvers
                    0.5000       Achievers
                    0.0000       Unassigned
Average Utility: 0.8750
```

---

```
 Attribute Name: 4.3 Research Venture and IP Holding Business
Startup/Spinout
Obtained Result: Belief Degree   Grade Name
                    0.0000       Unaware
                    0.0000       Drifters
                    0.5000       Beginners
                    0.0000       Improvers
                    0.5000       Achievers
                    0.0000       Unassigned
Average Utility: 0.7500
```

---

```
 Attribute Name: 4.3.1 Research Collaboration
Obtained Result: Belief Degree   Grade Name
                    0.0000       Unaware
                    0.0000       Drifters
                    0.0000       Beginners
                    0.0000       Improvers
                    1.0000       Achievers
                    0.0000       Unassigned
Average Utility: 1.0000
```

---

```
 Attribute Name: 4.3.2 Startup/Spinout
Obtained Result: Belief Degree   Grade Name
                    0.0000       Unaware
                    0.0000       Drifters
                    1.0000       Beginners
```

```
                    0.0000       Improvers
                    0.0000       Achievers
                    0.0000       Unassigned
Average Utility: 0.5000
```

---