

1. Introduction

1.1. Research Background

1.1.1. Growth of IT Investment

Owing to the popularization of IT education, government support of the high-tech industry and enthusiastic public investment in IT hardware and software, Taiwan has taken its place at the table of global IT production. According to the 2005 Global Competitiveness Report by the World Economic Forum (WEF), out of 102 global economies, Taiwan ranked fifth, behind Finland, the U.S.A., Sweden, and Denmark, on the Growth Competitiveness Index (GCI), the WEF's key indicator of medium to long-term economic growth expectancy. The remarkable results of this report illustrate Taiwan's technology potential by the fact that the island has developed such a great level of competitiveness in the global market.

Although the article "IT Doesn't Matter!" published in *Harvard Business Review* in 2003, caused some extensive discussions, a lot of relevant research has pointed out that IT investment has a close relationship with competitiveness. From the research of Organization for Economic Co-operation and Development (OECD), McKinsey, Gartner, IDC, Forrester, et al, showed that countries' ICT (Information & Communication Technology) and network investments would affect their economic growth and productivity.

According to the "2005 Global IT Spending Developments and Trends" and "Analysis of IT Investment of Taiwan's Industries", reports released by MIC¹, firms' IT investments in Taiwan appear to have the same growth trend as the whole world.

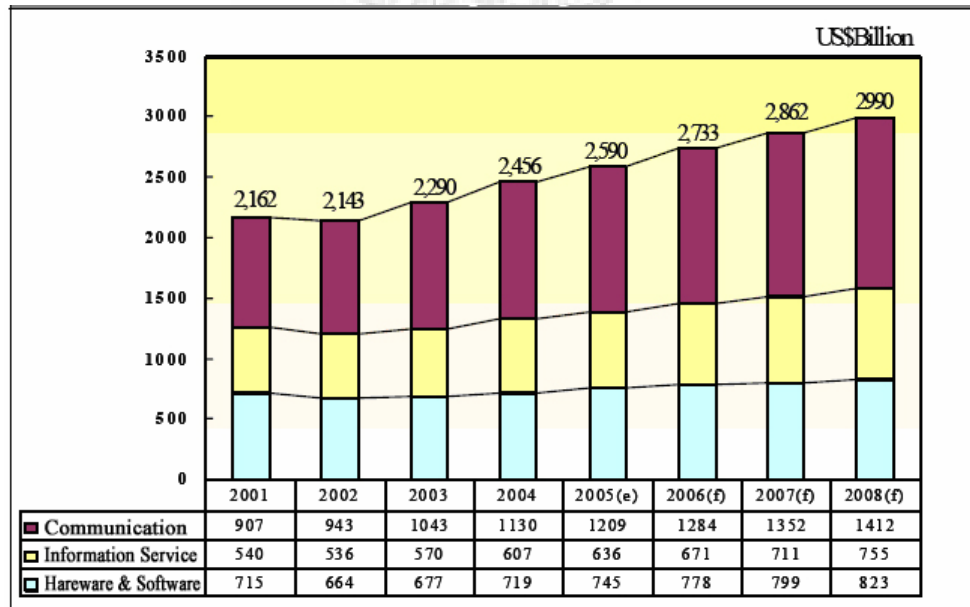


Fig. 1.1: Global enterprise IT Spending amount from 2001 to 2008

Source: MIC III Taiwan, January 2005

¹ MIC: Market Intelligence Center

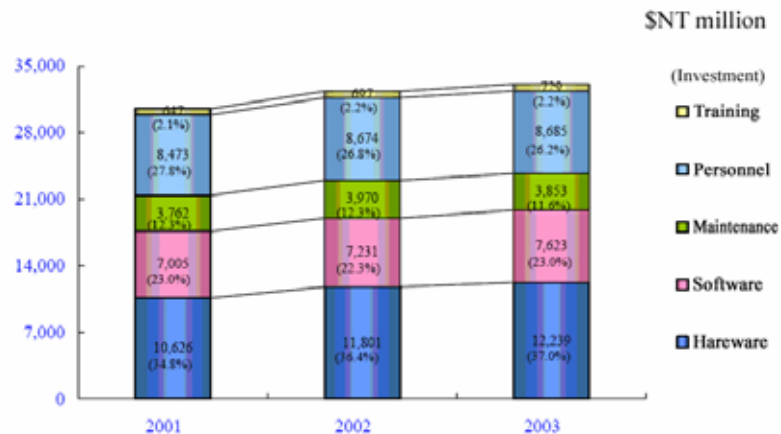


Fig. 1.2: IT investment of firms in Taiwan from 2001 to 2003

Source: MIC III Taiwan, January 2003

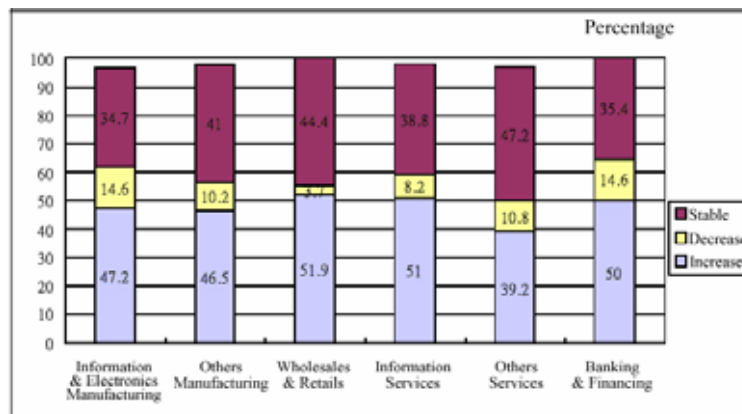


Fig. 1.3: IT spending of firms in Taiwan from 2003 to 2004(Industry level)

Source: MIC III Taiwan, March 2005

As a result, IT development and investment have already become an important factor for global economic growth. Every enterprise invests a large amount of manpower and resources to develop and apply IT to meet various demands.

1.1.2. Importance of Intellectual Capital (IC)

The use of IT is widespread, but not all IT investment can immediately bring a benefit to enterprises. Furthermore, where and how to make IT investments has already become the serious topics for businesses, academia, and governments.

In order to keep the competitive advantage and improve efficiency and capability, enterprises invest not only in traditional labor and assets but also in intangible techniques, processes, and organizational structures. The quality and the quantity of intangible capital of a firm have turned into the key factors in creating greater value and benefit. Furthermore, more and more of the tangible capital of Taiwan's industry is moving toward China. How to keep the critical intangible assets will be crucial to the next generation's competitiveness and business strategy in Taiwan.

Recently, an intangible asset, called Intellectual Capital (IC), has become known as a method to assess an enterprise's value. It is different from the traditional method which reveals a business's value through the balance sheet. According to a report from Deloitte Consulting (DC), American firms' ratio of market value and book value was almost 1:1 before 1990. However, because of the rise of network and software companies in 2000, the ratio increased to 4:1. Even the proportions of Microsoft and Trend Micro are up to 30:1, showing that 70 percentage of a firm's value can not be reflected by tangible assets.

On the other hand, the traditional balance sheet could not demonstrate the real value of businesses anyway, and the research in IC showed that a new assessment was needed. In addition, the key factor that allows businesses to survive has been shifted to the ability to manage intangible assets. Enterprises will regard IC as the main development strategy and will effectively manage and create IC for a competitive advantage in the future.

1.1.3. Development of IC Research

In 1969, an economic researcher, Galbraith, used intellectual capital to explain the difference between the market value and the book value of an enterprise. In a knowledge-based economy, more and more researchers are paying attention to the subject of IC, and agree that IC is the key competitive advantage for enterprises.

Since industrial technology innovation is one of the important factors in upgrading industrial structure, the government has continually promoted industrial research. Therefore, the DoIT² began setting aside budgets to commission CNCCU³ and MIC to found the Taiwan Intellectual Capital Research Center (TICRC)⁴ in 2003. The TICRC's most important task would be promoting industrial IC research and development, and assisting the progress of intellectual capital in Taiwan.

Popularization of the concept of IC is helpful to the management, strategy, and competitiveness of enterprises. However, most industries in Taiwan still do not have a clear concept of IC at the present, and they do not have an effective support system to reflect the achievement of intangible assets.

In other words, an enterprise is unable to understand the benefit of investment in time due to the lack of integrated information about IC. Investors are also unable to obtain the whole value of enterprise through the disclosure of financial statements. As a result, they will only focus on the short-term profit and lose the goal of long-term benefit. All of these problems are still the issues of IC research at the present.

² DoIT: Department of Industrial Technology, Ministry of Economic Affairs, R.O.C.

³ CNCCU: National Chengchi University's College of Commerce

⁴ TICRC: Taiwan Intellectual Capital Research Center

1.1.4. Development of High-Tech Industry

For a long time, the high-tech industry has been a leader in driving the growth of the economy and the development of technology in Taiwan. According to the “*CommonWealth Magazine* Top 1000,” the top ten companies almost all belong to the high-tech industry. According to the definition of the OECD, the high-tech manufacturing industry is one of the knowledge-type industries, like the information industry. The companies of the high-tech industry are focused on the development of technology and knowledge, and the market value of the companies has exceeded the range that traditional accounting methods can express. Therefore, a new assessment indicator should be able to measure the intangible assets as opposed to the traditional method of mainly measuring tangible assets. It is crucial to create and construct a model of IC assessment at this time.

According to the report by MIC, in 2005, many IT products in Taiwan’s information industry still held the top one or two worldwide market share, such as motherboards, notebook PC’s, LCD’s, optical disk drives, and digital still cameras. The production value of the information hardware industry in Taiwan maintains steady growth, so it is obvious that the high-tech industry is still a dominant industry with high competitiveness at present.



Fig. 1.4: 1997~2005 Production value of information hardware industry in Taiwan

Source: MIC III Taiwan, November 2005

1.2. Research Motivation

1.2.1. IT Productivity Paradox

By redesigning the way existing business processes were performed and using IT to enable new ones, some organizations were able to achieve significant improvements in key business drivers, such as cost, quality, service levels, or lead times. However, these successes did not seem to make an impact on productivity

figures. A famous quip that “You can see the computer age everywhere but in the productivity statistics” provoked a great deal of debate. If IT investments do not yield any clear advantages, why do so many organizations continue to invest heavily in IT? The suggestion that IT does not bring benefits to organizations seems to go against intuition and common sense.

The question of IT productivity paradox for managers is not whether IT pays off in general but what IT applications should be deployed in their respective organizations. The difference between IT success or failure may be the ability to evaluate the benefits and strategic potential versus the cost and risks of proposed IT investments, and having the right management processes in place to plan and execute IT projects.

1.2.2. Measurement of Intangible Assets

Due to intensified global competition, enterprises need to enhance strategic management to retain or strengthen competitiveness. Intangible assets have become one of the key components in an organization. Although the growth of IT investment increases continually, it is hard to measure the benefits of IT investment in an enterprise. IT skills usually result from complex and cumulative processes. In other words, a single investment in IT will generate not only tangible assets but also intangible assets which bring a continuous advantage. Much of the work in internal IT assessment is focused on financial resources and staffing, but little research concentrates on intangible resources.

Most researchers do not separate the IT from IC and study the special role of IT in the enterprises. However, IT is the critical factor of success in business process, innovation, human resources, and customer relations. If we don't have IT, the firm will lose a great number of competitiveness and quantity of IC. After the popularization of the IC concept during recent years, more and more companies have already realized the importance of IC and promoted the IC investment inside the firms. Nevertheless, they still have to afford the decrease of the short-term book value or unable to display the benefit of IC investment immediately. The balance sheet does not disclose the content of IC, and the investor could not get the complete information of a firm's potential value. Not only the administration but also the general investor requires the information of IC to make an appropriate decision.

1.2.3. An Assessment Tool for Practitioners

Facing international competition and the strategy of merging, it is very important to assess the investment and measure the intangible value in the enterprise, especially in high-tech industry. According to “2004 Taiwan IT Top 100” of *CommonWealth*

Magazine, 70% of the companies on the billboard in 2004 were not even listed in 2001. Under this environment, how to maintain the competitiveness, hold the leader position, and handle the inside value will be of greater and greater concern.

1.3. Research Issues

It is an enterprise's primary goal to integrate IT into critical business processes effectively, but the value and influence of a firm's performance is very difficult to show in financial statements and quantify using regular assessment methods. IT managers and executives are still concerned about the problem of IT assessment, because there is no simple and suitable method to measure the benefit of IT investment at the present. Therefore, this research develops an approach which considers both tangible and intangible benefits, in order to understand insights and provide practitioners with an assessment tool.

1.4. Research Objective

The aim of this research is to propose a more suitable approach to measure the value of IT in an enterprise. We define and construct a set of IT performance indicators based on a capital-oriented view, including tangible and intangible assets. Using case studies, we test our approach empirically. Another goal of this research is to study the process of IT capital formulation and its application in high-tech industries.

1.5. Research Limitations

This research proposes a new view of IT assessment. More case studies are needed to empirically test our model for further research. A broader sample of firms is also needed to verify the effectiveness of our IT capital performance indicators. Third, for further research, it is a challenge to demonstrate the usefulness of an improved approach to IT assessment in other industries.

1.6. Research Flow

The flow of this research is as follows:

- (1). Define the subject, objective, and scope of research.
- (2). Review the literature of information technology assessment, tangible and intangible assets measurement, and intellectual capital research.
- (3). Define the research structure of IT capital.
- (4). Develop a set of dimensions and indicators of IT Capital performance.
- (5). Case interviews and studies.
- (6). Examine the set of performance indicators.

- (7).Take a questionnaire approach to gather the scores from the IT managers of the cases.
- (8).Results analysis and explanation of the answers of the questionnaire.
- (9). Research implications and conclusion.

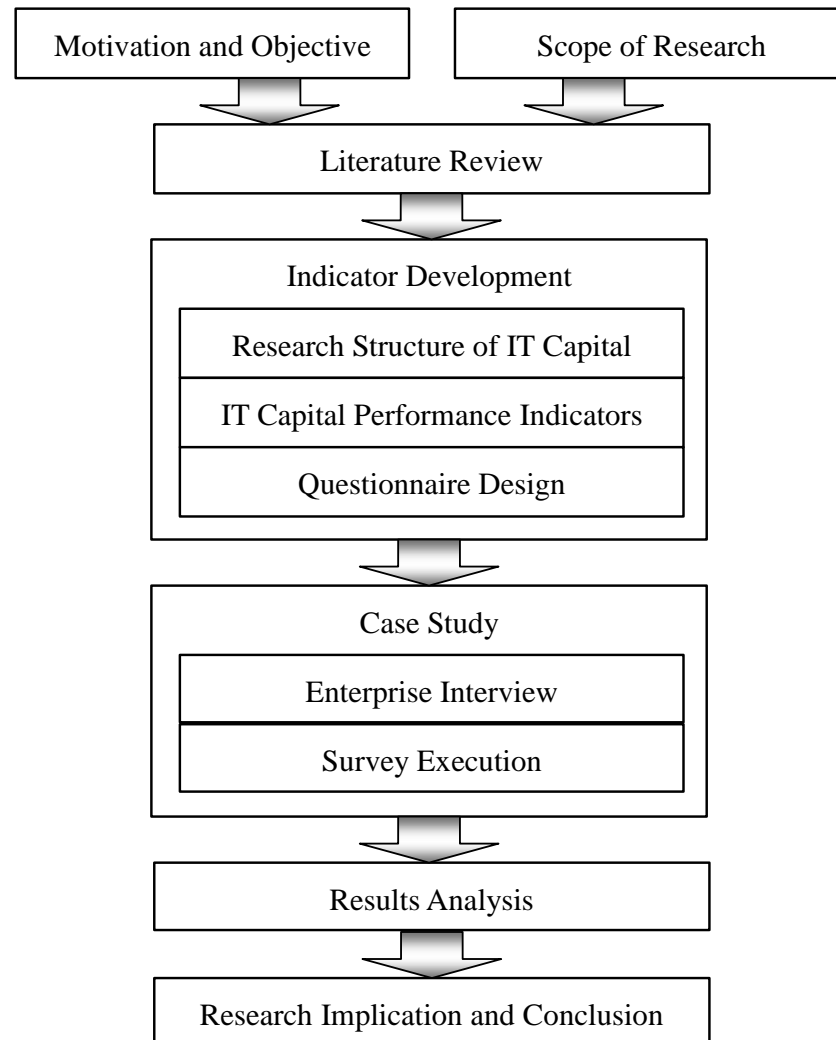


Fig. 1.5: Research flow

Source: This research