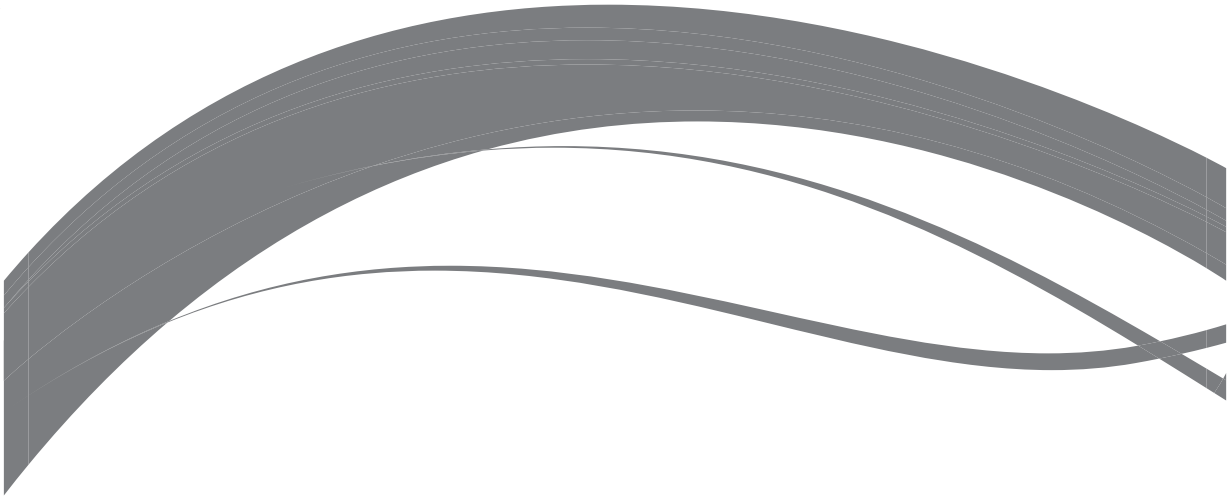

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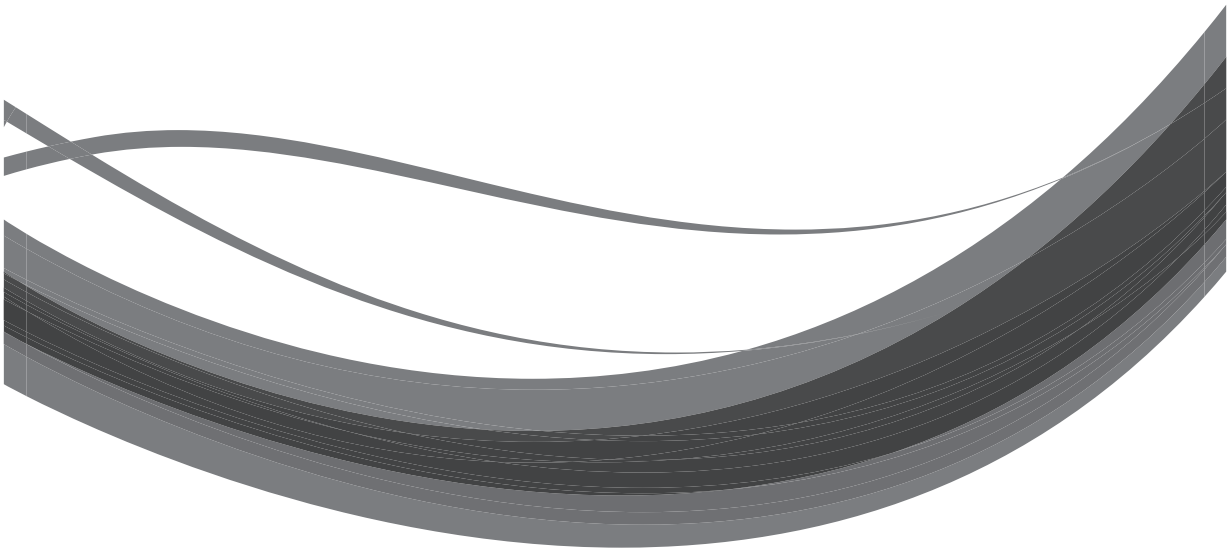

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FOREWORD

It gives me a great pleasure to launch this new journal,"International Journal of Business Development and Research" which has been created to provide academics and practitioners a platform and a journal for their exploration of new ideas, concepts, systems and practice in the areas of business innovation, applied technologies, and industrial & organizational managementright across the world. Nevertheless, we cannot be satisfied. The world is changing;there is a continuation of needs in exploring new ideas for reconsideration and evaluation and to attemptavailableinnovative ideas onmeasuring the outcomes for further deliberation as to prepare in the next evaluation.For this, we must hear from individuals who are dynamic in professional management, business development and in research. Theory and practice are interrelated, and we want to bridge the gaps.

The contributions in this journal came not only from Thailand but also from very renowned countries such as Taiwan, Finland, and Slovenia. In this initial volume, we have established a respectable reply from submissions around the world. After due process of double blind peer review, we have selected 5 research papers.

The inaugural issue has been very carefully put together covering a range of business development in the domain of success factors, strategic management of technology, knowledge based competitive advantage, innovations of regions networking, productization of university services, marketing management in tourism and public – private partnership in education sector, value-added productivity, productivity measurement and management, profitability, Business Intelligence (BI) systems, software project contingency model, project risk management, new product development, business ecosystem and business models of semiconductor industry, life cycle cost management, Total Quality Management (TQM), and critical success factor and soft factor.

We hope that the research featured here will set up new milestones. We have had an overwhelming response from some very eminent editors and researchers globally to support as editorial team. I look forward to make these endeavors very meaningful. A very warm thanks to readers, authors, editorial board members, let me use this opportunity to express my appreciation and indebtedness for your contribution to the journal. Your work, either by contributing articles, reviewing them or by working as a board member, has formed or framed the journal.

Editors

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Business Ecosystem Perspective to New Product Development

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Abstract

The purpose of this conceptual study is to synthesise a theoretical view for describing business ecosystems based on stakeholders' business models, to aid new product development ecosystems The research approach of this study is constructive. This study is founded on a thorough literature review clarifying how business ecosystems are covered in academic writings in conjunction with new product development. The literature findings are analysed and synthesised to obtain a theory-based view on business ecosystems.

This study indicates that a business ecosystem can be described via the business models of participating actors, and that business model elements can portray the structure of an ecosystem. Business actors are connected to each other and to ecosystem's customers via relationships characterised by offering and revenue. An ecosystem offering is the composition of the actors' offerings. The value creation structure of an ecosystem is described by linkages between actors. Based on the experiences of this study, describing semiconductor ecosystem via business model elements is a tangible way to perceive an ecosystem and the roles of different actors.

This study is purely conceptual and is based on the existing literature; hence some aspects are potentially ignored. Academics and company managers may benefit of utilising the results of this study in describing, and analysing different ecosystems,understanding which business actors are required, and what their role is in new product development.

Keywords: New product development, business ecosystem,semiconductor industry, business models.

1. Introduction

New product development (NPD) in today's business environment is challenged by short product-life cycles, technical complexity, market uncertainties and rising cost of development (e.g. Bhaskaranand Krishnan 2009, Cooper 2001)Accelerating NPD is one way navigate in a fast changing business environment, in the world of globalisation (e.g. Chen et al., 2012; Stanko et al., 2012)These challenges can also be addressed by sharing costs, sharing risks, and sharing profits by collaborating with others, or outsourcing (Bhaskaranand Krishnan 2009; Chesbrough 2003).Consequently, NPD research has been extended from a firm-specific focus to integration of other actors (Leonard-Barton 1992; Mishra and Shah 2009).

Increasingly, successful new product development calls for collective effort bya collaborative network (Bhaskaranand Krishnan 2009). The risks involved in product development can be alleviated through collaboration, while potentially improving customer satisfactionand taking advantages of market opportunities that would be overwhelming for single companies (Littler et al., 1995).Nevertheless, in order to collaboration to truly increase the efficiency and effectiveness of product development, knowledge transfer and communication must be seamless among the participating actors (e.g. Distanont et al., 2011).

Networked businessesbeing the current reality for companies in the global market makes analysing business ecosystems, from different perspectives, potentially beneficial (e.g. Zarvić et al., 2012). For instance, a business ecosystem engaged to a product development project can be composed of tens of organisations globally, while the success is dependent on the whole ecosystems performance (Iansiti andLevien 2004b). Ecosystem participants can be classified in different ways, each having their own role in the cooperation (e.g. Moore 1993). It is often the case that some central companies lead the new product development in their ecosystem and plan new business around their innovation, making the central companies more dependent on the projects as they invest the most resources (e.g. Iansiti and Levien 2004a).

Business ecosystem perspective is especiallyinteresting when, as a result of development, the product may change the nature of the business, either requiring new partners, or changing the business model of the current stakeholders (e.g. Petrie 2012). However, even though business model theory has been studied from different perspectives (e.g. Shafer et al., 2005; Afuah 2004; Osterwalder andPigneur2009), business model elements have not been utilised to describe an ecosystem.

This study aims to come up with a theoretical view over business ecosystems based on stakeholders' business models. This conceptual study is conducted by carefully analysing the existing literature on business ecosystems and business models. Also, new product development context is analysed from the perspective of ecosystem design.The research has been further divided into two distinct research questions:

RQ1 How doactors' business models describe a business ecosystem?

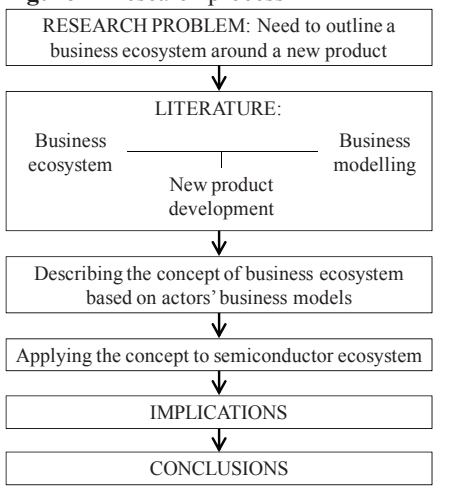
RQ2 Howdoes the created concept reflectsemiconductor business ecosystem?

The research questions are attempted to answer via conducting an extensive literature review. The theoretical background is reflected to practice with a semiconductor business ecosystem example that is also constructed based on the literature.

2. Research Process

Figure 1 illustrates the research process utilised in this study. The literature was reviewed carefully to clarify how business ecosystems are covered in academic writings in conjunction with a new product. The literature review was specifically focused to cover the topics of business ecosystem, new product development, and business model elements. The literature review concentrated particularly on the early phases of new product development. The literature findings were analysed and synthesised in order to obtain a theory-based view on business ecosystem, one that acknowledges business models of relevant actors. Hence, the research approach utilised in this article can be considered to be constructive (e.g. Oyegoke 2011).The conceptual theory-based view over a business ecosystem was used to provide a theory-based example by describing the semiconductor ecosystem via the relevant actor groups and business model elements. The findings of this study were carefully analysed in order to answer the research questions set for this study, together with considering relevant implications.

Figure 1 Research process



3. Literature review

The business ecosystem concept has been derived from biology and is commonly used to describe business networks (Moore 1993). The concept provides an analogy and a vivid view on the nature of business networks, regardless of the fact that biology and business do not share congruent scientific basis (Corallo2007). Both, business and biological ecosystems are characterised by a large number of loosely interconnected participants who depend on each other for their mutual effectiveness and survival (Iansiti and Levien 2004a).

Business ecosystem ispartially an overlapping concept withvalue networkand value chain (Hearn and Pace 2006). In a value chain, organisations are horizontally linked to each other and each providingproducts or services to the next operator (Porter 1985). A value chain can be considered as a group of sequential activities thatare connected through information and resource flows. The goal of a value chain is to provide value to the end customer.A value network, on the other hand, has the goal of providingvalue also for firms and societies participating in the network,not only for customers (Parolini 1999;

Bovet and Martha 2000). In value networks, resource and information flows can be simultaneous and multidirectional. Therefore, a value network canbe described as a web rather than a funnel-like value chain. In a network structure,actors are linked, vertically and/or horizontally, through value exchange activities.The ecosystem perspective emphasises network members' symbiotic, co-evolving relationships and dynamic nature of business networks (Hearn and Pace 2006). In a business ecosystem, companies' capabilities co-evolve around new innovations while cooperation and competitionadvance coming up with new offerings, satisfying customer needs and eventually discovering innovations (Moore 1993).

Ecosystems are characterised by the structure, relationships andconnections among members, and the differing roles played by their members (Iansiti and Levien 2004a). According Moore (1993) business ecosystem members can be classified as leaders, followers or business partners. The leader plays a role of central ecological contributor, and the role is valued by the rest. Followers appreciate the leader because of its grip on customers (Moore 1993). IansitiandLevien (2004a) identify four fundamentally distinct roles in a business ecosystem, including keystone, classic dominator, value dominator and niche player.

According Corallo (2007) actors in a co-evolutionary relationship activate selective pressure on others, consequently influencingeach other's evolution. Economic and social aspects are emphasised in a business ecosystem; its evolution is due to competitive and cooperative interactions among its members. The members take part in an ecosystem for their own benefit and share the total value that the ecosystem creates. Each organisation adds its distinct aspects of offering to the value generated by the ecosystem (Camarinha-Matos et al., 2009).

3.1. New product development ecosystem perspective

Ability to commercialise product innovations has long been an essential way for companies to grow in terms of market share, revenue and profit. Many firms have adopted a formal NPDprocess, such asthe idea-to-launch process,for developing andbringing new products to the market (Cooper 2001).NPD success is challenged by shortening product lifecycles, increasing technical complexity, market uncertainty and risingcost of development(Bhaskaranand Krishnan 2009, Cooper 2001).A common way to respondto this challenge is toaccelerateNPD as well as to share costs, risks and profits by collaboration and outsourcing (Chesbrough 2003, Bhaskaranand Krishnan 2009).NPD research has been extended from a firm-specific process to integration ofdifferent actors, such as suppliers, partners and lead users, to the process(Bhaskaranand Krishnan 2009).Still, NPD addresses market opportunity by products which best combine customer satisfaction, available technologies and firm profitability (Krishnan and Ulrich 2001).

In an ecosystem, NPD addressesbusiness opportunitiesthat require a diverse set of capabilities to meet customer needs that are beyond the capability of any single company(Carbone 2009).Ideally, business ecosystem members share resources, knowledge and technologies across the ecosystem providing basis for holistic value creation via the ecosystem (Hearn and Pace 2006). Comparedagainst an individual firm, an ecosystem has several potential advantages in new product development: it can invest more resources and tolerate higher risk through cost sharing; it may integrate broader set of diversified capabilities; and it maydevelop broader set of products.Productivity, i.e.networks ability to consistently lower costs and launch new products, is seen as one of the main indicators for ecosystems health (IansitiandLevien 2004b). In emerging ecosystems, central companies focus onworkingtogether with essentialstakeholders, such as lead customers, key suppliers and important channels,to(Moore 1993):

- Define new customer value propositionsbased on innovation,
- Determine how to deliver and implement the customer value propositions,
- Design business that serves the potential market

3.2. Business model elements and components

Business models have actively been discussed in the literature during last fifteen years. As a consequence, dozens of various business model concepts and frameworks exists, including up to fifty different business model components (Morris et al., 2005; Mäkinenand Seppänen 2007; Shafer et al., 2005).

Generally, a business model describes how a firm creates and captures value (Haaker et al., 2006).Afuah (2004) defines a business modelas a framework for money-making and explains business models as a strategic management approach. According toOsterwalderandPigneur (2009) a business model describes the rationale of how an organisation creates, delivers and captures value. Furthermore, Osterwalder and Pigneur(2009) viewbusiness modelsas a blueprint for strategy to be implemented through organisational structures, processes, and systems. Shafer et al. (2005) define business model as a representation of a firm's underlying core logic and strategic choices for creating and capturing value within a value network. Their study is an example of many attempts to define business models by integrating and synthesising earlier literature. According Suikkiet al. (2006) business model describes the offering, the value chain/ network, and revenue model of a firm. The framework by Suikkiet al., (2006) provides an example of using business models for research purpose in an industry setting.

Table 1 summarises the content and structure of the above discussed frameworks by dividing them into main elements and components.

Table 1 Business model elements and components in the literature

Author	Main elements	Components
Afuah(2004)	Positions	Customer value; market segments; revenue sources; price; relative position (vis-à-vis competitive forces)
	Industry factors	Competitive and macro forces; co-operative forces; industry value drivers
	Activities	Decisions of: Which activities to perform and which not; how to perform activities; when to perform activities?
	Resources	Resources (or assets: tangible, intangible and human); competences (or capabilities)
	Costs	Cost drivers of: industry; resource; activity; position
Osterwalder andPigneur(2009);*Osterwalder*(2004)	Offer	Value proposition
	Customers	Customer segments; channels; customer relationships
	Infrastructure	Key resources; key activities; key partnerships
	Financial viability	Cost structure; revenue streams
Shafer et al., (2005)	Strategic choices	Customer; value proposition; capabilities/competences, revenue/pricing, competitors; output (offering); strategy; branding; differentiation; mission

Author	Main elements	Components
	Create value	Resources/assets; processes/activities
	Value network	Suppliers; customer information; customer relationship; information flows; product/service flows
	Capture value	Cost; financial aspects; profit
Suikkiet al., (2006)	Offering	Composition; customer; sales approach
	Value creation system	Structure; players; size
	Revenue model	Basic logic; cost and pricing structure; market; share of value

MäkinenandSeppänen (2007) conclude that business model literature is diverse and lacks unified taxonomy and conceptual groundings.Besides differences in naming and hierarchical classification, there isdeviation in the actualcontent of business model descriptions. Within firms, the business model concept is linked to, and positioned between, strategy level and operations in which activities and processes are carried out (e.g. Osterwalder 2004). It is also argued whether a business modelincludes competitive strategy,value capture aspects of strategy,or whether it is a blueprint of strategy (Afuah 2004, Chesbrough and Rosenbloom 2002, Osterwalder and Pigneur 2009).Furthermore, authors, such as Osterwalder and Pigneur (2009) and Suikkiet al., (2006) exclude strategy completely from a business model.Relations toexternal environment, and actors outside a firm,are diversely described and included in business models. Besides customers, perceptions on which actors should be included in a business model vary by default. Relation to external environment is overextended in Afuah's (2004) business model framework compared to others. Especially, the main element of industry factors and its components are not included in other business model frameworks.

3.3. Business model elements describingan ecosystem

In simple terms,a business model describes how a firm creates and captures value(Shafer et al., 2005, Osterwalder and Pigneur 2009).Although business model frameworks vary, there are some commonalities. Table 2 describes the business model elements and components synthesised from the literature.

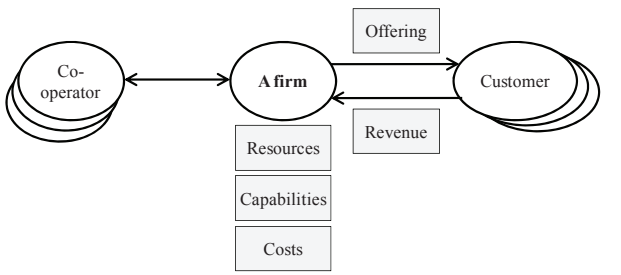
Table 2 Business model elements and components for describing a business ecosystem

Elements	Components
Business actors	A firm, customer, co-operator
Value creation structure	Chain or network
Offering	Offering
Capabilities	Capabilities, activities, processes
Resources	Resources
Revenue	Revenue logic, share of value
Cost	Cost of: resources, capabilities, upstream (co-operators)

Typically, business model frameworks include direct connections from the focal firm to itscustomers and tothe *actors* with whom it creates value, namely co-operators. The connections between all the actors define whether the *value creation structure* is a chain or a network. Value creation is built into all business models, but the emphasis is typically on different aspects, such as resources, activities, value network, and those participating in a value network.All the studied frameworks identify customer anda firm's *offering* that proposes value to a customer.An offering is understood as a source of *revenue*that includes everything a firm offers to its customers, from raw materials and components to products, services, tools and technologies. *Costs* area very basic element of all business models, and they are seen to result from other business model elements. For example,different activities, such as using and maintaining *capabilities* and *resources*, making acquisitions from the value network, and delivering an offering, create costs for a firm.

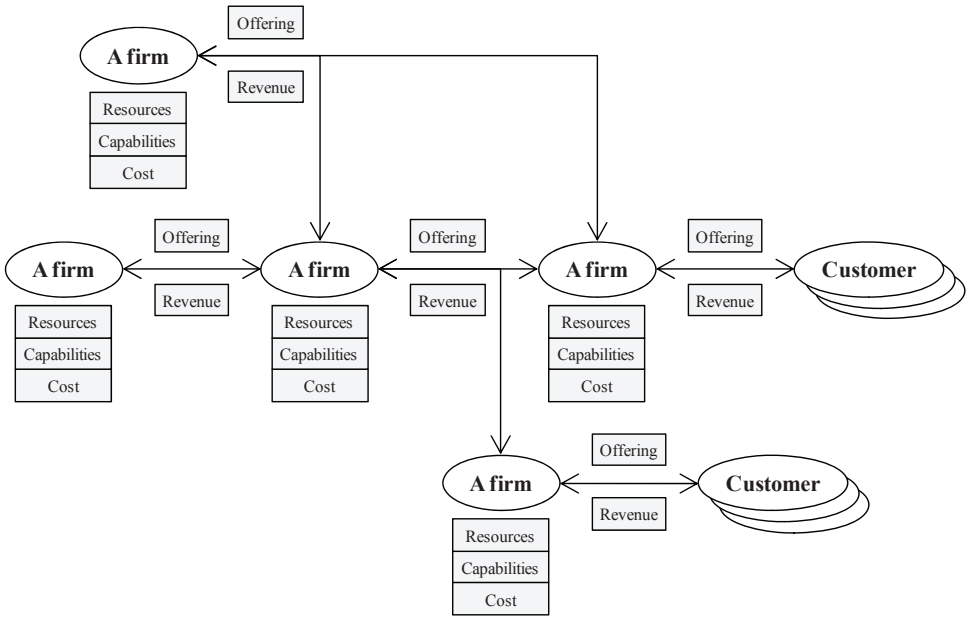
The main actors in business model frameworks are a firm and customers. In addition, different co-operators, i.e. suppliers, partners and value network players are mentioned in the literature (Figure 2).

Figure 2 Business model elements and the main actors



A business model framework provides means to describe a firm and the relationships between the firm and its customers. Describing the business models of all actors in an ecosystem would provide an interlinking view on an ecosystem. The actors would be more or less interconnected to each other through customerships.Figure 3 introduces a theoretical view on a business ecosystem.

Figure 3 A theory-based view on business ecosystem based on business models of actors

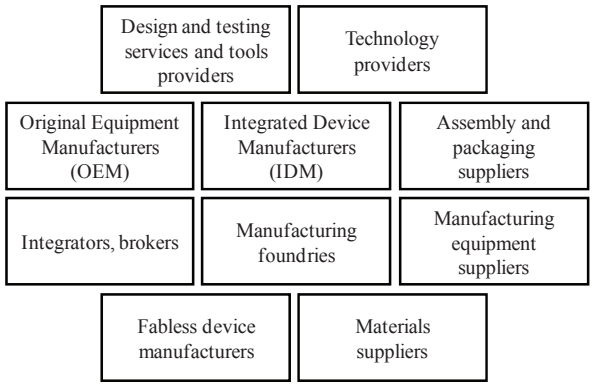


In simple terms, a business ecosystem is a loose network of interdependent business actors (e.g.IansitiandLevien 2004a). From a theoretical perspective, actors' business models describe business ecosystem in several ways:Business actors are connected to each other and the customers of the ecosystem, through relationships which are characterised by*offering* and *revenue*. An actor's offering describes the value that the actor creates and proposes together with its co-operators, while revenueis the value that the actor captures from the customers.An *ecosystem offering* is the composition of the actors' offerings. Connections between actors describethe *value creationstructure*of an ecosystem. An ecosystem can be a chain, a network, or more likely a mix of these two. The position and the necessity of each actor for an ecosystem can change over time. The position and the necessity are determined by the actor's resources, capabilities, offering and financial performance. The revenue gained by an actor must cover the costs of actor's resources, capabilities and upstream actors' revenue, in order to survive in a long run. Every business model elementhas its rolein describing a business ecosystem.

3.4. Semiconductor ecosystem

Semiconductor industry has grown since inventing a transistor and an integrated circuit, in some 60 years, into a 300 billionUSD annual business (SIA 2012). The industry serves other major industries such as consumer electronics, information and telecommunications, transportation, medical, automation, and energy, by providing fundamental enabling technologies (e.g. Albright 2002; Sturgeon and Kawakami, 2011).
The value chain of semiconductor industry is constantly evolving and the roles of the business actors in the ecosystem are changing (e.g. Li et al., 2011). Originally, so called integrated device manufacturers (IDM) dominated the industry due their strengths in technology development for manufacturing processes, devices and applications. Over the years specialisation took place as the size of required investments, capacity needs and diversity in applications and technological complexity increased (Ernst 2005). Today, semiconductor industry is relatively capital intensive, in which capacity utilisation significantly influences the effectiveness and profitability (Chien and Lin 2012).
Semiconductor ecosystem can be fundamentally characterised as a design and manufacturing ecosystem. (e.g. Li et al., 2011; Ernst 2005). Figure 4 illustrates the main ecosystem actors that can be identified based on the literature.

Figure 4 Main actors of semiconductor industry



In the ecosystem the original equipment manufacturers (OEM) are closest to end users and applications served by retailers, service providers and public sector (Liu et al., 2007; Luo, 2007; Mathews, 2002; Brandt and Thun, 2011; Sun et al., 2010; Sturgeon and Kawakami 2011). Integrated device manufacturers (IDM) are companies that design, manufacture, and sell semiconductor devices (Yu and Po, 2012; Chen and Xue, 2010; Wenand Yang, 2010; Vind and Fold, 2007).Fabless device manufacturers (FDM) specialise in the design and sale of semiconductor devices while outsourcing the fabrication (Ku et al., 2007; Kumar, 2011; Sturgeon and Kawakami, 2011; Yeung, 2007). Manufacturing foundries (FAB) purely concentrate on fabricating semiconductors by providing manufacturing capacity to other actors (Ku et al., 2007; Chien and Kuo, 2011; Li et al., 2011). Intellectual property (IP) providers purely provide IP and IP libraries to make money from patents and related fees (Rong et al., 2010; Chu and Chen 2011; Brown and Linden 2009).Design services and tools providers either concentrate on providing tools or design support services (Ku et al., 2007; Chu and Cheng, 2005; Yu and Po, 2012; Li, 2009; Chou et al., 2011). IP integrators and brokers purely act as intermediaries between actors by mapping and commercialising intellectual property (Li, 2009; Yuncui and Gang, 2011). Material suppliers, manufacturing equipment suppliers and assembly & packaging suppliers have a limited role in serving the ecosystem members running manufacturing foundries (Brown and Linden 2009). Nevertheless the business actor roles, in the semiconductor industry, are widely discussed in the literature,

and they are not always pure, but different combinations exist (e.g. Sturgeon and Kawakami 2011; Kumar 2011).

3.5. Semiconductor ecosystem and business models

The semiconductor industry is discussed broadly in the literature as is the case with business models. However, the previous literature has not comprehensively viewed the roles of semiconductor industry actors through different business model elements.
Table 3illustrates a semiconductor industry ecosystem through business model elements of offering, capabilities and resources. Revenue and cost elements are not covered as they do not specifically describe the ecosystem structure or functions.

Table 3 Semiconductor ecosystem description by actor's business models

Author		Main elements	Components	
Original equipment manufacturer (OEM)	Products to consumers and industrial customers (Sturgeon and Kawakami 2011)	Understanding customer and end-user needs, market knowledge, solution development, product design and development expertise (Brandt and Thun 2011)	R&D for product development, brand, marketing and market development, distribution and sales networks (Brown and Linden 2009, Brandt and Thun 2011)	Apple, HP, Dell, Sony (Brandt and Thun 2011, Sturgeon and Kawakami 2011)
Integrated device manufacturer (IDM)	Semiconductor devices to OEMs (Chu and Chen 2011, Tuomi 2009)	Vertically broad set of capabilities:Device technology, manufacturing process technology, engineering and design expertise (Chu and Chen 2011, Kumar 2011)	R&D for device and manufacturing process technologies, manufacturing equipment and facilities (Chu and Chen 2011, Kumar 2011)	Intel, Samsung, IBM (Li et al., 2011, Tuomi 2009, Kumar 2011)
Fabless device manufacturer (FDM)	Semiconductor devices to OEMs (Kumar 2011, Li et al., 2011)	Engineering and design expertise, device and device technology development (Kumar 2011)	R&D for device and device technology development (Kumar 2011)	Qualcomm, NVIDIA, Broadcom (Li et al., 2011)
Manufacturing foundry (FAB)	Manufacturing capacity to FDM and IDM (Li et al., 2011)	Manufacturing process technology, technology development (Li et al., 2011, Brown and Linden 2009)	R&D for process development, manufacturing equipment and facilities, enormous amount of capital resources (Li et al., 2011, Chu and Chen 2011)	TSMC, UMC, GlobalFoundries (Li et al., 2011)
IP (technology) provider	License IP, designs elements and technology to IDM and FDM devices, and	Design expertise and specialist knowledge technology	Portfolio of IP and patents, R&D for product and device technology	ARM, Rambus, MIPS (Brown and Linden 2009, Chu and Chen 2011)

Author		Main elements	Components	
	OEM products (Chu and Chen 2011, Brown and Linden 2009)	development for devices and OEM products (Tuomi 2009)	development (Tuomi 2009)	
Design and testing services and tools providers	Design support services and engineering tools for all the above actors (Brown and Linden 2009, Chu and Chen 2011, Kumar 2011)	Engineering and design methods for products, devices and manufacturing process development (Kumar 2011)	R&D for engineering tools and methods; engineering services capacity	Cadense Design Systems, Synopsys, Faraday Technology (Brown and Linden 2009)
IP integrator and broker	IP integration, brokering and commercialisation services to FDM, IDM, OEM, FAB, IP providers (Tuomi 2009)	Engineering and IP acquisition for devices and OEM products	Engineering services capacity, IP market platform	Design & Reuse, IPextreme (Tuomi 2009)

In semiconductor ecosystem OEMs can be seen as the top of the food chain.The entire ecosystems contact interface to end-users and access to markets is managed via OEMs.On the other hand, OEMs are dependent on the ecosystem actors' capability to innovate and supply cost effective technology solutions.In practice, the semiconductor industry serves several types of OEMs which act in different end-user market segments and industries that utilise semiconductors. Therefore, the industry is not dependent on only one OEM group.
Integrated device manufactures (IDMs) can dominateand occupy most of the value network, yet only few of them truly have this capability with leading-edge technologies.Should an IDM dominate, meaningful ecosystem may not emerge around it as the majority of value capture and creation would be based on its own business model. In practice, increasingcomplexity of technologies has forced IDMs to act more as keystones, thus enabling emergence of niche players.
Also manufacturing foundries can act as keystones from the perspectiveof the entire ecosystem, in the same manner as IDMs. Foundries have enabledthe emergence of fabless device manufacturers (FDMs), which both foster the existence of niche players while competing against IDMs in serving the OEMs.
Niche actors, such as technology and IP providers, integrators and services providers can be regarded to locate at the bottom of the ecosystem, serving the other players, even OEMs directly. Even if the role of these actors is typically minor, some specialised materials and IP suppliers may be able to gain a value dominator position, potentially endangering the healthiness of the entire ecosystem.
Actors in a semiconductor ecosystem can benefit of strong keystone players,such as IDMs and FABs, when the entire ecosystem thrives in competition and gains more profit and revenue. Such ecosystem can create and capture more value than individual actors and produce a wider variety of offering and servea higher number of OEMs. This type of ecosystem can serve end user applications in variety of market segments and industries.

4. Conclusions

New product development in the current business environment is often beneficial to be conducted in collaboration with others in order to share risks, and to increase the efficiency and effectiveness of the required activities. In many cases, an entire business ecosystem of relevant stakeholders is required to carry out the NPD activities. This conceptual study utilises business model elements to describe such an ecosystem based

on findings from the existing literature. The theoretical background is attempted to reflect to practice via a literature based example of semiconductor business ecosystem.

According to the findings of this study, the main business model elements that can describe a business ecosystem include; business actors, value creation structure, offering, capabilities, resources, revenue, and cost.Compared to other concepts, such as value network and value chain, the proposed model aims to include the entire business model, rather than single perspectives. A business model framework provides means to describe a firm and the relationships between the firm and its customers. From a theoretical perspective, *actors*' business models describe a business ecosystem in many ways: Actors are connected to each other and the customers of the ecosystem, through relationships which are characterised by *offering* and *revenue*. An actor's offering describes the *value* that the actor creates and proposes together with its co-operators, while revenue is the value that the actor captures from the customers. An *ecosystem offering* is the composition of the actors' offerings. Connections between actors describe the *value creation structure* of an ecosystem.

According to the literature, semiconductor ecosystem can be interpreted to include the following main actors; original equipment manufacturers, integrated device manufacturers, fabless device manufacturers, manufacturing foundries, intellectual property providers, design & testing service and tools providers, and intellectual property integrators and brokers. In this study the roles of these actors are described via the business model elements of offering, capabilities and resources. Some companies that belong to the identified categories are also named to provide more tangibility on the discussed issues. Based on the experiences of this study, describing the semiconductor ecosystem via business model elements is a tangible way to perceive an ecosystem and the roles of different actors.

As an implication of this conceptual study, academics interested in business ecosystems can consider utilising business model elements to describe different ecosystems when seeking ways to provide the ease of comprehension, and analysing the roles of different actors. In addition, this study may provide new viewpoints tothe new product development research. Elements typical to business model literature have been utilised in an original way to describe business ecosystems. One of the major contributions of this article include, a company being able to utilise the model when organising collaborative new product development and choosing which ecosystem/s to join.The presented conceptual model may enable focal companies in perceiving which actors are required in ecosystems relevant for new product development, and what is the role of those companies. In principle, a focal company can be located anywhere in a business ecosystem. Better understanding an ecosystem may benefit managers by enabling better preparation for risks and to understand business opportunities enabled by a product more swiftly. A business ecosystem description may also enable understanding potential success with different business models.

The limitations of this study include the research being purely conceptual and being based on the existing literature. Another limitation includes this article merely focusing on business actors, potentially ignoring any actors or bodies who do not have business models, hence not seeking for profit. This type of actors/bodies may impose important issues such as environmental standards, green-related regulations and laws. Even though the literature reviews were conducted in a very comprehensive manner to cover all relevant viewpoints, there is always the possibility that some aspects are ignored. It is noteworthy that it can be difficult to draw exact boundaries to an ecosystem and figure out all the actors who belong to it, leaving some room for interpretation.At best,any model can only be an illustration of a given moment, making the time aspect a challenge.The future research could include testing the constructed theory-based view on business ecosystem based on actors' business models by analysing real-life ecosystems in practice.

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Coping with Challengesfor Successful BI Implementation

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Abstract
Nowadays, business enterprises are facing unprecedented competitive pressures; they need timely and effective business information not only to succeed but also to survive. Business intelligence (BI) systems can improve decision qualities andspeed response to customers' needs. It seems the promising solution for companies to gain competitiveness.Managers are interested and eager to implement the systems. However; many cases end up encountering implementation BI system difficulties such as cost overruns, project delays, and unmet user's needs. As well as other software projects, implementing BI has many risk factors to cause failure. Thererfore, managers need to be aware of the risk factors to avoid loss of valuable time , and resources of the companies. Therefore, we conducted this research and tried to help enterprises successfully in light of implemented BI systems to prevent failure and gain competitive advantages.
The objectives of this research are to identify risk factors of BI implementation, further to prioritize them so that enterprises can manage them well with limited resources;eventually to reduce BI project failures.In this study we conducted a questionnaire survey by distributing questionnaires to top ranking companies in retail and services industries of Taiwan which have expanded their operations in huge domestic market in China. Hypotheses were made according to the modified Software Project Contingency Model. The findings identified the key risk factors of the model that affected sample enterprises. The recommendations and solutions of BI implementation are also proposed.

Key words: Business Intelligence (BI) systems, Software Project Contingency Model, Project risk management

1. Introduction

Today, more than ever, it is vital for organizations to monitor their competitors, fast changing business environments and the direction of the market. This increase focus on competition has given rise to the practice of business intelligence (BI), the process of collecting, analyzing, and assimilating information about industry developments or market trends to enhance a company's competitive advantages [1][2]. In most industrial countries, business intelligence has stirred much interest for years. A growing number of organizations implements formal BI activities[3]. In Taiwan, enterprises started to notice the value of BI in recent years. China has transformed from "world factory" into "world market". As a springboard to the huge Chinese market after ECFA signed, retail and services industries in Taiwan have expanded and rapidly developed by the way of chain store or franchising in China. BI serves as nerve system in the organization and has been found central in improving the quantitative and qualitative value of the knowledge available to decision makers. Enterprise executives understand that timely and accurate knowledge can improve business performance. To be more competitive, BI seems to be the right solutions for them.
Although BI systems can provide insight with enterprises operations, they are painstakingly difficult to implement [4]. Resistance of the IS staff, expense, inadequate incentive, lack of training and inadequate time to complete projects have

caused the program failure. IT remains a sad statistic that too many software development projects end in failure.Even currently, project failures and organization adoption of enterprise resource planning systems facing difficulties are very common. Management of software projects becomes a critical problem. Software risk measurement and management have become hot research issues among the scholars and enterprises remaining current throughout the eighties.

To mitigate risks and decrease failure of BI implementation, in this study we collect the most important SCIarticles related to BI topics and interviewed with the executives of the enterprises to analyze the risk factors while establishing BI systems.These risk factors will cause unsatisfactory outcomes of the project development. They need to be explored, identified, and prioritized so that enterprises can manage them well with limited resources.

The objectives of this research are to identify and prioritize software project risk factors of BI implementation, and eventually to reduce failure of BI project implementation. We conducted questionnaire survey and distributed to the members ofTaiwan Chain Stores and Franchise Association (TCFA). They are top ranking and privileged companies in retail and services industries in Taiwan. Their opinions and views would be well represented for the industries. Software Project Contingency Model is developed as research questions for empirical test. We found that Risk factor skills mix, Risk factor software system design, Risk factor user involvement and training, Risk management and IT surveillance all affect Fit requirement of BI system quality. However, Fit does not necessarily affect contribution of BI implementation.

2.Literature review

2.1.BI definition

In this research, "Business Intelligence" (BI) represents a term for information systems which support decision makers in providing business analysis on the basis of internal and external data. According to Antti Lönnqvist and Virpi Pirttimäki (2006), the term BI can be used to refer to any or all of the following explanation: (1) Relevant information and knowledge describing the business environment, the organization itself, and its situation in relation to its markets, customers, competitors, and economic issues. (2) An organized and systematic process by which organizations acquire, analyze, and disseminate information from both internal and external information sources significant for their business activities and for decision making.

2.2.Contingency theory

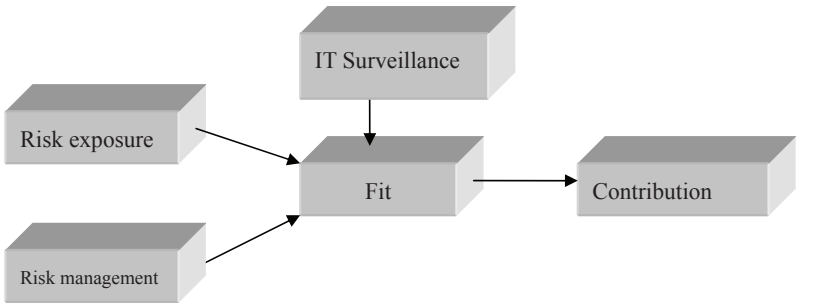
The IS research has adopted the contingency approach to software project risk management. Contingency theory has strong influence on these research perspectives. Organizational contingency theorists suggest that successful organizations establish a fit between project management and personal, project, organizational and information factors to clarify the uncertain factors and measurement in order to improve project process and performance. The fundamental concept of the information process viewpoint is that, "if the task is fully understood prior to its performance, most of the activities can be preplanned and managed." Therefore, the uncertain factors and risk will decrease and the project performance will be improved.

Adapting Venkatraman's[5] definition of Fit as profile deviation to the context of software development projects, this approach implies that if an ideal pattern for risk management profile is specified for a particular level of risk exposure, a software project's degree of adherence to such a multidimensional profile will be positively related to Performance if it has a high level of risk exposure-project management practices Fit. It means that if risk exposure can be well managed with risk management accordingly to meet Fit requirement, the project performance will be good, which means the enterprise will benefit the contribution.

2.3.Software project contingency model of risk management

The Software Project Contingency Model was based on theoretical and empirical IS researches conducted by a number of researchers[6]. The model posits five major dimensions or categories of information system to evaluate the software system development - risk exposure, risk management, Fit, IT surveillance and contribution. The research model is illustrated as following:

Software Project Contingency Model (SPCM)



2.4.Risk exposure

Risk exposuredefined here includes three constructs as skills mix, software system design, user involvement and training. **Risk management**means to manage risk exposure. Information technology (**IT) surveillance**refers to monitor the process of system implementation. **Fit**refers to the required risk management level of each risk factor to be managed by risk management adequately. **Contribution** is to analyze the actual BI outcomes of those enterprises that implement BI systems.

Many IS specialists reviewing the software project development apply the software contingency model to identify the project uncertainty and project development risk factors. Therefore, how to identify risk factors is the key issue of software project development.

Based on the literature, the probability of an unsatisfactory outcome is defined as "risk",risk exposure as the probability multiplied by potential loss of the undesirable outcomes. We explore the risk assessmentby identifying and assessing situational characteristics that are likely to influence the software development outcomes. These characteristics are generally labeled as risk factors. According to previous research, we categorize the risk factors of IT implementation as skills mix, software system design and user involvement and training. Skills mix includes items such as recruiting and retaining BI professionals, appropriate experience of user representatives, appropriate staffing and personnel performance, equipped with application knowledge, lack of analysts with business and technology knowledge, andfailure to mix internal and external expertise effectively. The potential items which may affect software system design include software system design that is not easy to use, the system design is not helpful with industry, lack of integration among enterprise-wide systems, developing the wrong functions and wrong user interface and insufficient staffing in IT department. The items of user involvement and training include lack of user commitment and ineffective communications with users, insufficient training of end-users, users don't have experiences of using similar systems and that users don't understand the value and benefits of BI. These risk factors will cause unsatisfactory outcomes of the project development. Hence, we need to explore the risk factors, identify them, and prioritize them so that enterprises can manage them well with limited resources.

2.4.1.Risk management
The current research conceptualizes the construct of software project risk management profile as a multidimensional construct. According to the scholar Dr. Law, software project risk management is unlike the latent and aggregate models, where a multidimensional construct can be summarized as a single overall representation of all dimensions for profile construct. There is not a single theoretical overall construct that can summarize and represent all dimensions. Therefore, to deal with software risk management of each risk factor, it is difficult to apply just one theoretical concept to deal with all risk factors. It is like a person who can be identified as high or low in general mental ability and job satisfaction; however, one cannot say that person is in high or low in personality in all constructs.According to previous research, we synthesize the items of software project risk management as lack of agreement on project goals; lack of senior management involvement; lack of top management commitment to the project and Improper composition of project team members.

2.4.2.IT surveillance
After the project risk exposure assessment and risk management to deal with each risk factor, we propose fit requirements to deal with risk factors. Then, we need to think of how to achieve the above-mentioned target. Therefore, we need a moderator of IT surveillance to supervise the software project development if it is on the track as our request. IT surveillance is defined as a term to test the software functionality as our expecting standard. We then determine the required functions and risk management to deal with those risk factors and match the fit requirements of risk management. Moreover, we also apply IT surveillance from software project management IT perspectives to survey the accuracy of function performance, IT engineer's programming capability, user's know-how, coordination ability, time schedulesif asrequired. By doing this, it can createfavorable resultsfor software project development.According to previous research, we synthesize the items of IT Surveillance as technology newness; technology complexity; instability of current technology;attempting to link legacy systems; difficult to integrate with other application systems and reducing planned models or functions.

2.4.3.Fit
This construct reflects the extent to which a project risk management profiles to deal with each risk indicator to match each risk indicator of risk exposure. Therefore, we are carefully to adopt a contingency approach to studying a risk phenomenon and define the conceptualization of fit. From the literature, fit is defined as a profile to examine the risk factor and risk management level to fit the good performance of project development outcome. Italso implies an idea or pattern of risk management related to project development performance. Moreover, there are some requirements to identify risk management of those risk factors to certain level that is based on the expected outcome of the project development performance. According to previous research, the items of Fit are synthesized as sufficient resources; extent of changes; managing change properly; redesign business process; support cross-organization design; set up formal communication channel and budget planning.

2.4.4.Contribution
This construct refers to efficiency and effectiveness the systems generate at top ranking enterprises after implementation. Moreover, we also take into account two key dimensions as BI systems are implemented and the result of its contribution for enterprises. The contributions of BI system implementation for enterprises are how well the developed system that contributed to their companies after the systems are implemented. Based on previous research and Business Intelligence gurus, we synthesized and listed the following contributions including improve the accuracy and timeliness of information; reduce operation cost, improve operation efficiency; enhance the capability of fast response; integrate the enterprise-wide systems; real-time monitor business operations; improve the quality of management strategies; help overall strategic operations of the enterprise; help globalization of the enterprise and enhance flexibility of organization.

3. Research method
We applied in-depth interview, questionnaire survey in this study. There are three phases during the research. Phase I study is to collect information based on SCI literature plus in-depth interviews with administrators from various enterprises of retail and services industries in Taiwan and experts in BI field. Phase II study isto develop a structured questionnaire based on collectedinformation and comments from Phase I study.A questionnaire survey was distributed to the executivesin target organizations. In order to reduce the probability of misinterpretation, during Phase III studyDelphi approach was applied to further revise and validate the extended framework that was synthesized from Phase I and Phase II studies. Regression analysis was used to analyze their relationships and verify hypotheses that were proposed in this research.

3.1.Research design
Based on risk factors of IT system implementation, the questionnaire is composed of five constructs: Fit, risk exposure (risk factors including skills mix, software system design and user involvementand training), project risk management, IT surveillance and contributions.
The first part of the survey questionnaire is composed of demographic characteristics of the subject, such as age, gender, education, and work experience, job title. The second part recorded the subject's perception of each variable in the research model. Each participant was asked to indicate the degree of agreement with each item. A Likert scale from 1-5 is employed as the method of the survey with 1 being strongly negative, 3 being neutral, and 5 being strongly positive. After the initial questionnaire was generated, iterative personal interviews were conducted with the domain experts who are enterprise executives and well-known BI researchers. The experts were invited to verify the completeness, operation, and appropriateness of the instrument in order to improve the content validity.

3.2.Data Collection
The samples of the study are mainly from the members of Taiwan Chain Stores and Franchise Association (TCFA). They are top ranking and privileged companies in retail and services industries in Taiwan. Their opinions and views would be well represented for the industries. 48% of them have 1000 employees or above. The respondents of the questionnaire include high executives (38%), managers (35%) and owners (7%). The composition of the respondents is about 39 % from IT department, about 31% from administrative and operation department and 30% from other departments.
The questionnaires were distributed to the representatives of the enterprises of TCFA attended the Annual Conference. We collected the completed questionnaires at the end of the conference. Most of participants submitted them. In regard to validity, they were requested if they had problems completing the questionnaire, they could bring it back to the company and ask for IT manager or project manager to complete it then mail it back. Some of members were communicated by e-mail. All the respondents were assured that their response would be kept confidential.120 questionnaires were distributed in total. Finally 80 questionnaires were collected. Follow-up calls were made if the questionnaire was incomplete. Effective questionnaires totaled about 66%.

3.3.Hypotheses
According to the Software Project Contingency Model (SPCM) shown above, we proposed the following hypotheses:
H1Risk factor skills mix affects Fit requirement of BI system quality.
H2Risk factor software system design affects Fit requirement of BI system quality.
H3Risk factor user involvement and training affects Fit requirement of BI systemquality.

H4Risk management affects Fit requirement of BI system quality.
H5IT surveillance affects Fit requirement of BI system quality.
H6Fit affects contributions of BI implementation.

3.4.Data Analysis and results

3.4.1.Pearson coefficient correlation analysis

Pearson Test

		Fit	RiskSkillMix	RiskSoftwareSD	RiskUserIT	RiskMgt	IT Surveillance
Pearson Correlation	Fit	1.000	.603	.699	.535	.680	.516
	RiskSkillMix	.603	1.000	.615	.630	.701	.587
	RiskSoftwareSD	.699	.615	1.000	.563	.776	.636
	RiskUserIT	.535	.630	.563	1.000	.543	.618
	RiskMgt	.680	.701	.776	.543	1.000	.606
	ITSurveillance	.516	.587	.636	.618	.606	1.000

Pearson's coefficientcorrelation shown in above tableindicated low and high existent correlations among variables for the measurement of the Software Project Contingency Model (SPCM).
From the results of Pearson test, Software system design (0.699) is the highest correlated to the dependent variable Fit. Second highest variable to affect Fit is project risk management (0.68). The third variable to affect Fit is skills mix (0.603). User involvement and training (0.535) is the fourth correlated to Fit. IT surveillance (0.516) is the lowest correlated with Fit. In conclusion, the five independent variables skills mix (SM), software system design (SSD), user involvement and training (UIT), project risk management (PRM) and IT surveillance (ITS) are all significantly correlated to dependent variableFit.

3.4.2. Regression analysis

ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	902.856	5	180.571	18.966	.000(a)
	Residual	704.532	74	9.521		
	Total	1607.388	79			

According to the ANOVA test, the F test value is 18.966. The p value (0.000) is less than 0.05 ($p < 0.05$) which means the variables are significantly related. And the model is acceptable.

Coefficients (a)

Model		Unstandardized Coefficients		Stnd Coefficients	t	Sig.	Correlations			Colinearity Statistics	
		B	Std. Error	Beta	Zero-order	Partial	Part	Tolerance	VIF	B	Std. Error
1	(Constant)	2.905	2.060		1.410	.163					
	RiskSkillMix	.177	.147	.145	1.207	.231	.603	.139	.093	.413	2.423
	RiskSoftwareSD	.473	.166	.372	2.843	.006	.699	.314	.219	.347	2.885
	RiskUserIT	.154	.140	.120	1.099	.275	.535	.127	.085	.499	2.004
	RiskMgt	.212	.121	.240	1.747	.085	.680	.199	.134	.313	3.191
	ITSurveillance	-.037	.167	-.024	-.219	.827	.516	-.025	-.017	.476	2.101

According to the table of Coefficients, we found that Beta value of four independent variables software skills mix(0.145), software system design(0.372), user involvement and training(0.120), project risk management(0.240) that are significant related to Fit. However, IT surveillance (-0.24) is insignificantly related to Fit. VIF value of all those variables is less than 10 (VIF<10) which means there is no colinearity.

Summary of Model

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
	R Square Change	F Change	df1	df2	Sig. F Change	R Square Change	F Change	df1	df2
1	.749(a)	.562	.532	3.08556	.562	18.966	5	74	.000

The R square is 0.749. The adjusted R square is 0.532 which means the explanation power of this model is 53.2 % capability. The p value (0.000) is less than < 0.05, which means there are significant relations among those variables.
From the table of ANOVA, the value of F test is 0.603. The p value (0.440) is larger than 0.05 ($p > 0.05$), which means there are insignificant relations among those variables.

4. Research findings and discussion

Among 80 valid questionnaires, the empirical results tell us that the most challenging problems the enterprises encountered during BI implementation are that users don't have experiences in using similar systems, technology newness, insufficient experiences of consultants and that users don't understand the value and benefits of BI. The detailed information is as following:

Mean of Fit

Fit	Survey questions	Mean
1	Sufficient resources	3.50
2	Managing change properly	2.50
3	Ability to redesign business process	2.00
4	Ability to support cross-organization design	2.00
5	Build up formal communication channel	2.50
6	Budget	3.00

What Fit requirements an organization needs to meet when it implemented BI systems are listed as the order of their importance: sufficient resources, underfunding of development, failure to redesign business process, and failure to manage change properly.

Mean of Risk factor Skills Mix

Skills mix (Risk factor)	Survey questions	Mean
1	Failure to recruit and retain BI professional	3.50
2	User representatives lack appropriate experience	3.50
3	Inappropriate staffing	2.50
4	Lack of analysts with business and technology knowledge	3.00
5	Failure to mix internal and external expertise effectively	2.50

In the facet of Skills mix, the following challenges the enterprises faced according to the statistic analysis. They are failure to recruit and retain BI professionals, user representatives' lack of appropriate experience and lack of analysts with business and technological knowledge.

Mean of Project risk management

Project risk management	Survey questions	Mean
1	Lack of agreement on project goals	3.00
2	Lack of top management commitment to project	2.50
3	Improper composition of project team members	2.50
4	Lagging of project	2.00
5	Changing scope/objectives	3.00
6	Insufficient experiences of consultants	4.00

In the construct of Project risk management, when implementing BI systems, the enterprises encountered problems such as insufficient experiences of consultants, lack of agreement on project goals and changing scope/objectives.

Mean of Risk factor Software System Design

Software S.D. (risk factor)	Survey questions	Mean
1	Software system design not easy to use	2.50
2	System design is not helpful with industry	2.50
3	Lack of integration among enterprise-wide systems	1.50
4	Developing the wrong functions and wrong user interface	1.50
5	Insufficient staffing in IT department	3.00

In the facet of Software system design, the statistic result reveals that the organizationsface the following challenges. They are insufficient staffing in IT department;hard-to-use software system design and the system design that is unhelpful to industry.

Mean of Risk factor User Involvement and Training

User I.T (Risk factor)	Survey questions	Mean
1	Ineffective communication among users	3.00
2	Failure to get user support	3.00
3	Insufficient training of end-user	3.00
4	Users don't have experiences in using similar systems	4.50
5	Users don't understand the value and benefits of BI	3.50

In the construct of User involvement and training, the statistical results show that the enterprises faced the following problems when they implemented BI systems. Users don't have experiences in using similar systems; users don't understand the value and benefits of BI; ineffective communication among users; failure to get user support and insufficient training of end-users.

Mean of IT Surveillance

IT surveillance	Survey questions	Mean
1	Technology newness	4.50
2	Instability of current technology	3.00
3	Attempting to link legacy systems	2.50
4	Difficulty of integration with other application systems	2.50
5	Reducing planned models or functions	2.00

In the IT surveillance construct, the results of statistical analysis reveal that the enterprises had the following problems during BI implementation - technology newness, instability of current technology, attempting to link legacy systems, and difficulty of integration with other application systems.

Mean of Contributions

Contribution	Survey questions	Mean
1	Improve the accuracy and timeliness of information	5.00
2	Reduce operating costs, improve operational efficiency	5.00
3	Enhance the capability of fast response	5.00
4	Integrate the enterprise-wide systems	4.50
5	Real- time monitor business operations	5.00
6	Improve the quality of management strategies	4.00
7	Help for the overall strategic operations of the enterprise	4.50
8	Enhance customer satisfaction	4.00
9	Help globalization of the enterprise	3.50
10	Enhance flexibility of organization	3.50

From the statistical results of the survey, we found that the contribution of BI implementation to the enterprises surveyed are as follows: improve the accuracy and timeliness of information, reduction of operating costs, improve operational efficiency, enhance the capability of fast response,real- time monitoring of business operations, integrating the enterprise-wide systems and help for the overall strategic operations of the enterprise.

The result of regression coefficient analysis shows that risk factor skills mix (SM) significantly affects Fit requirement of BI system quality. Applying TAM model to design good BI systems satisfies the user's demands that the system be easy of use, useful, and a pleasure of use. Therefore, the result verified that a good system design is very important for users. Hence, from the research finding, skills mix is a critical issue for implementation to affect of BI system quality.

Italso indicates that risk factor software system design (SSD) significantly affects Fit requirement of BI system quality.Facing the trend of globalization, high competition, and fast response to markets, applying BI innovative technology becomes a need for an organization to survive and a demand for business operation. How to integrate customer relationship management (CRM) providing better services, supply chain management (SCM) among suppliers, fast processing orders, transaction of currency from fiscal market and enterprise resource planning (ERP) is essential. BI provides the solution for enterprises and becomes a required IT weapon among global competition threat. Therefore, that several of enterprises which need to process with various channels and different system integration to create a BI IT system becomes a critical challenge. Therefore, good system design is a must to achieve good system quality. From this research finding, we found that it is a very important issue for enterprises to handle the complexity of IT systems and to integrate with various subsystems. Thus, we conclude that software system design affects the system quality.

Based on the empirical result, user involvement and training (UIT) affects Fit requirement of BI system quality.The rationale is that new BI system has very many barriers and problems such as expertise's software design, user's know-how, cost estimation and budget planning, top or senior strong commitment to the project, communication, and coordination. Those problems not only cause early adopter exhaustion but also BI system design and implementation failures. From the failure experience of BI innovation, the early adopters apply new innovations such as system compatibility among enterprises; solve complex issues of programming, know-how, integrated system spec., system trainability and easy observation in order to prevent BI system failures. Therefore, how to enhance smooth coordination and deal with various perspectives of confronting problems becomes a critical issue to assure the system implementation success. Commonly,software system design did not meet the user's demands and expectations. This is mainly due to coordination, user involvement and training problems. Thus, the research finding verified that it is a must to integrate users' participation, support and training with professional programming skills.

The statistical results reveal that project risk management (PRM) affects Fit requirement of BI system quality significantly.The current research conceptualizes the construct of software project risk management profile is as a multidimensional construct. According to the scholar Dr. Law, software project risk management is unlike the latent and aggregate models, in which a multidimensional construct can be summarized as a single overall representation of all dimensions for profile construct. From the literature review, we identified three key components of project management practices along with the construct of risk management profile that can be assessed. They are formal planning, internal integration and users' participation. The three components reflect the project risk management approaches that capture the key issue of various approaches, which are suggested by various scholars and the literature review. Furthermore, formal planning is defined as the reliance on plans, schedules and budgets to ensure efficient and timely execution of a project. Formal planning is also related to the arm's length strategy to guide cost estimation, budget, user's coordination, experts of software programming, the elite of project leader, and know-how of project operation. Therefore, the research finding shows that project management is a very important issue to manage risk exposure in order to avoid software development failure.

The empirical result indicates that IT surveillance (ITS) affect Fit requirement of BI system quality.When BI systems are at the design and implementation stage, enterprises need to deal with risk exposure and quality requirement issues. They need a tool to monitor the system design and implement in order to reach the goal of quality. From the literature review, IT surveillance is defined as a term to test the software functionality as expecting standard, amount and efficient operation. The required amount of functions and risk management are used to deal with those risk factors to examine if they match fit requirements. Moreover, IT surveillance is also applied to survey the accuracy of function performance, IT engineer's program capability, user's know-how, coordination ability, time schedule etc. as required to create favorable results for software project development. However, the empirical result indicates that IT surveillance is the least correlated among the independent variables. The rationale is that risk management already handles risk exposure. Therefore, risk management has replaced the importance of IT surveillance.

According to the statistic result, it reveals that Fit affects contribution insignificantly. This is a quite interesting and important finding. First, we get back to the Software Project Contingency Model to explain it. Fit in SPCM model is a facet to manage risk factors with risk management accordingly while enterprises design and implement BI system. Contribution of BI only happens if the enterprise successfully implements and executes the system. The reason that the empirical results do not support the hypothesis here can be that the respondents think implementation does not have a direct relationship with contribution. They think when an enterprise implements BI systems; it does not mean that performance and contribution produced by this system will absolutely achieve positive results. To take an example of golf to explain this, just as when a golfer owns the best quality golf clubs (Fit), it does not mean that he definitely can score a hole-in-one (contribution). The contribution of best quality golf clubs is to help him score a hole-in-one as long as he practices with them. Similarly, if an enterprise has implemented good quality of BI system, it does not mean that it can have the greatest performance or expected the contributions of BI implementation mentioned above. After BI systems implemented, an enterprise needs to adjust and practice the system as a daily operation, then, it will have a better chance of obtaining the expected contributions of BI. It is more interesting that the software vendors always persuade their customers of how great their software system is. But if a company implements BI systems without keeping modifications and executions daily, the contributions of BI system for this enterprise will not be positive for sure.

5. Conclusion

We applied in-depth interview, questionnaire survey in this study.Regression analysis was used to analyze their relationships and verify hypotheses which were proposed in this research.

Software Project Contingency Model (SPCM) is developed and 6 hypotheses are proposed as our research questions. The empirical results are concluded that Risk factor skills mix, Risk factor software system design, Risk factor user involvement and training, Risk management and IT surveillance affects Fit requirement of BI system quality are all significant. Only Fit affects contribution of BI implementation is insignificant.

The contribution of this research is that many researches regarding BI are found to be related to the technical dimension, little is on management perspectives. In addition, empirical studies on BI implementation are scarce since implementing BI systems for enterprises are still at an early stage in Taiwan. This is an exploratory research of BI implementation, which focuses on retail and service industries. The reason we chose the industries is that they play more important role in the economy and also in the trend of customer delight, their service quality affects our daily life. The findings of this research will provide more enterprises, which plan to implement BI systems with awareness of risk factors to avoid failure. Moreover, from the survey result, we are in light of the contribution to those enterprises that already adopted BI system to diffuse and assimilate at their daily operations to enhance competitive advantage.

6. Managerial implication

According to the research findings, we propose that enterprises apply Contingency Perspective on Software Project Risk Management during BI design and deployment. The solutions for implementing BI systems[7]are provided as follows:

- Start with executive support
- Evaluate current processes
- Inventory and rationalize current information gathering systems
- Bringing IT managers on board by emphasizing new BI technology and the need to harness such systems
- Seek BI vendors who can prove the breadth and integration their platforms
- Seek BI vendors who present a clear vision of how to integrate its products
- Review company-wide information needs and decision-making facilitation requirements from the bottom up
- Designate a specialist to handle regulatory compliance/corporate governance issues

Kliem [8] figures that the relevant work of risk management is best performed as early as possible in the life cycle. The fundamental concept of the information process viewpoint is that, “if the task is fully understood prior to its performance, most of the activities can be preplanned and managed.” Therefore, the uncertain factors and risks will be decreased and the project performance will be improved.Prioritizing the risk factors and managing the risk factors accordingly is supposed to be the most effective way of project risk management. In the research, we have identified the risk items and listed them in ranking order for references of enterprises.Being aware of that, we propose that the organizationswhich plan to implement the systemscarefully evaluate the potential risk factors in advance and make a risk factor checklist based on their conditions.(3) The following step is risk control which involves risk management planning, risk resolution, and risk monitoring. Risk management planning helps prepare to address each risk item, including the coordination of the individual risk-item plans with each other and with the overall project plan. Risk monitoring involves tracking the project’s progress toward resolving its risk items and taking corrective action where appropriate.

Further research

One of the weaknesses of this study is the small sample size, which may have already affected external validity. Thus, I recommend repeating the study with a larger sample size for further research. Today, more than ever, it is vital for organizations to monitor their competitors, fast changing business environments and the direction of the market. This increase focus on competition has given rise to the practice of business intelligence (BI), the process of collecting, analyzing, and assimilating information about industry developments or market trends to enhance a company’s competitive advantages.

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Critical Success Factors of TQM in Thailand: A Literature Review and TQM Implementation Approach

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Abstract
This study has the goal to identify the critical success factors of TQM in Thailand. The study applies content analysis to derive 23 TQM critical success factors from Thailand Quality Award winners. The triangulation is used to validate the findings and verify that most of the factors are similar to those of international studies. The study proposed the Critical Success Factor (CSF) model that represents the relationship between CSFs and the success of TQM implementation in organizations. The proposed model which divides CSFs into soft factors and hard factors show the different set of CSFs in each success phase of TQM; the adoption phase and the performance excellence phase. In the adoption phase, the most influential soft CSFs is leadership related factors and the most influential hard CSFs is fact-based management factor. For the performance excellence phase, workforce related factors are the most important soft CSFs which help organization to maintain its processes and promote continuous improvement throughout the organization.

Keywords: TQM, TQA, critical success factor, soft factor, Thailand

1. Introduction

In intense competition, companies must seek for sustainable competitive advantage to survive. Since operational efficiency is one of the cost controlling tools, quality control becomes fundamentally important in most organizations. Research regarding the effect of quality management (QM) on organizational performance becomes widespread. Research on quality management has evolved from quality inspection, quality control quality assurance, to total quality management (TQM). Most studies suggest positive relationship between TQM and quality performance. Since Malcolm Baldrige National Quality Award (MBNQA) had publicized in 1987, the management concept of TQM becomes extensively known in all industries. More than 70 countries, including Thailand, adopt their national quality awards based on concept of MBNQA. Thailand Productivity Institute (TPI) started giving Thailand Quality Award (TQA) in 2002. As well, Thai government has supported TQA by registering TQA as a

target in the national development plan number nine in 2000 (OTQA, 2012). Nevertheless, the qualified recipients are limited and so is the research in Thailand.

In Thailand, quality management is being adopted as a management tool. The study of Krasachol et al. (1998) showed that the adopters of quality management in Thailand are mainly foreign-owned companies within the electronics sector. Rohitratana and Boonitt (2001) study ISO 9000 implementation in Thailand. The result showed that the obstacles to ISO 9000 implementation in Thailand are the lack of knowledgeable specialist in the ISO 9000 series, lack of understanding of the details of quality standards from the enterprises' point of view, and employees' lack of cooperation. To date, there is still no clear critical success factor in TQM in Thailand. For example, Reis and Pati (2007) found that leadership is a main driver of successful TQM implementation in Thailand while Laohavichien (2011) found that leadership is the main driver to the quality management practice in Thailand.

The goal of the study is to identify critical success factors of TQM in Thailand. In order to meet the goal, the research questions are identified as follows:

RQ1. What are critical success factors of TQM implementation in Thailand?

RQ2. Are critical success factors of TQM in Thailand different from those of other studies?

RQ3. How critical success factors of TQM in Thailand affect the success in the phase of TQM adoption and performance excellence?

The research attempts to develop the TQM critical success factor framework. The framework includes the concept of soft factor and hard factor. The soft factor is human oriented factor while the hard factor is non-human oriented factor. The purposed framework will be used as the groundwork of further studies in the relationship between soft factor and hard factor.

2. Research process

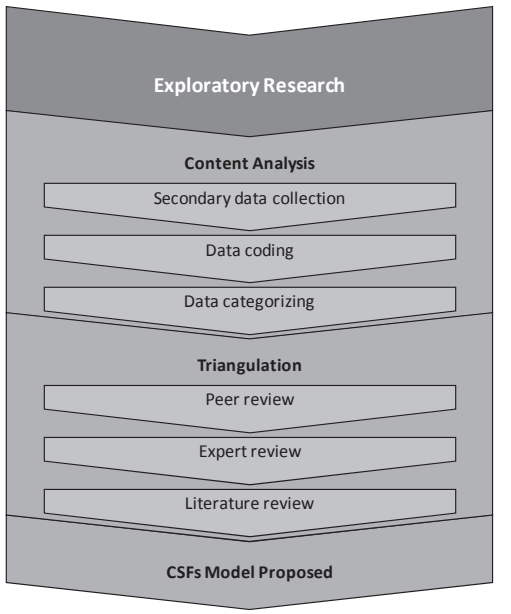
The research process is in Figure1. This study has an objective of studying the critical success factors (CSFs) of TQM in Thailand. In addition, the CSFS found in the research are compared with those in literature reviews studied overseas in various concepts. The CSF model of the successful adoption stage in TQM and that of the performance excellence stage will be presented.

This study uses the concept of exploratory research to derive CSFs of TQM in Thailand. The reason is that the studies on CSFs of TQM in Thailand are limited and all studies are based on CSFs derived from international publications. Thus, qualitative content analysis, which is one of the exploratory research methodologies based on ground theory, is chosen. Since TQA represents TQM-base practices in Thailand, the group of TQA winners is selected as a target group. In other ward, the study focuses on analyzing the critical success factors of the TQA winners. The secondary data from executive interviews of TQA-awarded companies is used as the major source of information. The data is collected from online database of Thai newspapers. The period of interest is from 2002, the year the first award granted, to 2011. In total, there are 315 news articles related to TQA winners. However, only 29 news are selected because they include the interviews of the leaders or top executives of TQA winners whose interviews describe the success they have done in implementing TQA.

The data is then coded according to the methodology suggested by Foss & Waters (2003). In order to increase research reliability and reduce human bias, the coding process is done by using Qualitative Data Analysis (QDA) program.

The validity is verified by triangulation process. First, a peer review by PhD in Management is carried on in order to confirm the derived CSFs. Next, an expert review is conducted by experts, who were selected from TQA assessors and TQA winners' executives or staffs who responsible to TQA implementation in their organizations. In this process, the CSFs were rated in order to determine which factors are important in TQA adoption process and which factors are crucial for QM to the extent that they drive the organization to its excellence and achieve TQA award. The rated score is divided into three levels, namely not important (1), important (3), or very great important (9) (Warwood & Roberts, 2004). Finally, the findings are compared with literature review in order to confirm the derived CSFs and develop the model of quality management CSFs Thailand.

Figure 1 Research Process



3. Literature Review

3.1. Total Quality Management (TQM)

After the end of World War II, quality management is developed continuously and can be divided into four stages which are quality inspection, quality control, quality assurance and Total Quality Management (TQM) (Dale and Plunkett, 1990). The concept of TQM began in 1950's but received more interests from scholars and organizations in 1980's. The objective of TQM in the early years is to create management system, as well as organizational culture in order to acquire customer satisfaction and maintain continuous improvement (Flynn et al., 1995). The majority of the studies claim that TQM improves quality of products and services, as well as the performance of organizations. Aldred (1998), for instance, also found that TQM improves financial performance and stock price. However, the major obstacles for TQM implementers lie in the ambiguity of TQM. The concepts of TQM are also expressed differently among scholars and practitioners. Nevertheless, most studies acknowledge that Malcolm Baldrige National Quality Award (MBNQA) is a well defined TQM model (Black & Porter, 1996; Rao et al., 1999; Flynn & Saladin, 2001).

3.2. Malcolm Baldrige National Quality Award (MBNQA)

Malcolm Baldrige National Quality Award was developed in year 1987 based on TQM concept. The difference between MBNQA and TQM concept is the shift of organizational focus from the quality of production to strategic management which affects the overall competitive advantage of

organizations (NIST, 2011). MBNQA proposes seven criteria which are (1) leadership, (2) strategic planning, (3) customer focus, (4) analysis measurement and knowledge management, (5) workforce focus, (6) operation focus, and (7) result. MBNQA also promotes 11 core values. The core values indicate the organisational characteristics that present excellence in performance. They are (1) visionary leadership, (2) customer-driven excellence, (3) organizational and personal learning, (4) valuing workforce members and partners, (5) agility, (6) focus on the future, (7) managing for innovation, (8) management by fact, (9) societal responsibility, (10) focus on results and creating value, (11) and systems perspective (NIST, 2011).

Over the past two decades, MBNQA has popularized the TQM concept in great extent. MBNQA criteria is also improved and becomes more integrated. The major improvements are the changes in business environment, the more focus on strategic management, the creation of both customer engagement and employee engagement, the corporate governance and ethics, the corporate social responsibility, and the sustainability of an organization. In total, there are 70 countries using MBNQA as a foundation to their national quality award (OTQA, 2012). In Thailand, MBNQA is adapted and applied as a national quality award called Thailand Quality Award (TQA) which has similar components as those of MBNQA.

3.3. Critical Success Factors (CSFs)

The continuity of the research on CSFs of quality management is prominent as shown in figure 2. In 1990s, most studies focused on the quality of products which affects directly to customer satisfaction. The CSFs of TQM were studied mostly for quality performance such as productivity, conformance to specification, on-time delivery, rework product, scrap, defect rate of final assembly, returned product, cost of warranty claims, product and process innovation, customer complaint, and customer satisfactions. There are several renowned scholars who have worked on this quality performance aspect such as Saraph et al. (1989), Fynn et al. (1995), Ahire et al. (1996), and Dow et al. (1999).

Table 2 CSFs from literature review

MBNQA Categories	Related Factors	1	2	3	4	5	6	7	8	9	10
Leadership	Leadership Top management Commitment Share vision	x	x	x	x	x	x		x	x	x
Strategic planning	Strategic planning Resource management The right time		x					x			
Customer focus	Customer focus Customer satisfaction Product / service design External interface management	x		x	x	x	x	x	x	x	x
Analysis Measurement and Knowledge management	Information, measurement and analysis Benchmarking Knowledge Computer-based technologies Technology utilization	x		x		x	x	x	x		x
Workforce focus	Workforce management Employee involvement Human resource development Education and training Teamwork Empowerment Worker manager interactions Employee satisfaction Compensation Diversity Demographics	x	x	x	x	x	x	x	x	x	x
Operations focus	Process management Process improvement Design quality management Continuous improvement Tools and techniques Supplier management Inventory management	x	x	x	x	x	x	x	x	x	x
	Culture Adopting the philosophy Open organization Value and ethics Trust								x		x
	Communication Communication of improvement information		x								x

1) Saraph et al. (1989) 2) Porter and Parker (1993) 3) Flynn et al. (1994)
4) Anderson et al. (1995) 5) Powell (1995) 6) Ahire et al. (1996)
7) Black and Porter (1996) 8) Adam et al. (1997) 9) Grandzol and Gershon (1997)
10) Dow et al. (1999)

Table 1 (Cont.) CSFs from literature review

MBNQA Categories	Related Factors	11	12	13	14	15	16	17	18	19	20
Leadership	Leadership Top management Commitment Share vision	x	x	x	x	x		x	x		x
Strategic planning	Strategic planning Resource management The right time	x	x		x					x	x
Customer focus	Customer focus Customer satisfaction Product / service design External interface management	x	x	x		x		x	x		x
Analysis Measurement and Knowledge management	Information, measurement and analysis Benchmarking Knowledge Computer-based technologies Technology utilization	x	x	x	x		x		x	x	x
Workforce focus	Workforce management Employee involvement Human resource development Education and training Teamwork Empowerment Worker manager interactions Employee satisfaction Compensation Diversity Demographics	x	x	x	x	x	x	x	x	x	x
Operations focus	Process management Process improvement Design quality management Continuous improvement Tools and techniques Supplier management Inventory management	x	x	x	x	x	x		x	x	x
	Culture Adopting the philosophy Open organization Value and ethics Trust	x			x			x			
	Communication Communication of improvement information										

11) Rao et al. (1999)
12) Samson and Terziovski (1999)
13) Curkovic et al. (2000)
14) Yusof and Aspinwall (2000)
15) Agus and Sagir (2001)
16) Ho et al. (2001)
17) Lau and Idris (2001)
18) Motwani (2001)
19) Power and Sohal (2001)
20) Rahman (2001)

Table 1 (Cont.) CSFs from literature review

MBNQA Categories	Related Factors	21	22	23	24	25	26	27	28	29	30
Leadership	Leadership Top management Commitment Share vision	x	x	x	x	x	x	x	x	x	x
Strategic planning	Strategic planning Resource management The right time		x			x					x
Customer focus	Customer focus Customer satisfaction Product / service design External interface management	x	x	x	x	x	x	x	x	x	x
Analysis Measurement and Knowledge management	Information, measurement and analysis Benchmarking Knowledge Computer-based technologies Technology utilization	x	x	x		x	x	x		x	x
Workforce focus	Workforce management Employee involvement Human resource development Education and training Teamwork Empowerment Worker manager interactions Employee satisfaction Compensation Diversity Demographics	x	x	x	x	x	x	x	x	x	x
Operations focus	Process management Process improvement Design quality management Continuous improvement Tools and techniques Supplier management Inventory management	x	x	x	x	x	x	x	x	x	x
	Culture Adopting the philosophy Open organization Value and ethics Trust	x		x							
	Communication Communication of improvement information										

21) Curry and Kadasah (2002)
22) Lee et al. (2003)
23) Wali et al. (2003)
24) Laohavichien (2004)
25) Warwood and Roberts (2004)
26) Kaynak and Hartly (2005)
27) Rahman and Bullock (2005)
28) Tari (2005)
29) Parast et al. (2006)
30) Prajogo and Sohal (2006)

Table 1 (Cont.) CSFs from literature review

MBNQA Categories	Related Factors	31	32	33	34	35	36	37	38	39	40
Leadership	Leadership Top management Commitment Share vision	x	x	x	x	x	x	x	x	x	x
Strategic planning	Strategic planning Resource management The right time	x		x		x	x	x			
Customer focus	Customer focus Customer satisfaction Product / service design External interface management	x	x	x	x	x	x	x	x	x	x
Analysis Measurement and Knowledge management	Information, measurement and analysis Benchmarking Knowledge Computer-based technologies Technology utilization	x	x	x	x	x	x	x		x	x
Workforce focus	Workforce management Employee involvement Human resource development Education and training Teamwork Empowerment Worker manager interactions Employee satisfaction Compensation Diversity Demographics	x	x	x	x	x	x	x	x	x	x
Operations focus	Process management Process improvement Design quality management Continuous improvement Tools and techniques Supplier management Inventory management	x	x	x	x	x	x	x	x	x	x
	Culture Adopting the philosophy Open organization Value and ethics			x		x	x		x		
	Trust										
	Communication Communication of improvement information		x							x	

31) Sila (2007)
32) Awan et al. (2008)
33) Salaheldin (2009)
34) Fotopoulos and Psomas (2010)
35) Hoang et al. (2010)
36) Jha and Kumar (2010)
37) Zakuan et al. (2010)
38) Arumugam (2011)
39) Kumar (2011)
40) Valmohammadi (2011)

In 2000s, the TQM studies expand to organizational performance. The studies focus on the effects of TQM to quality performance, organizational effectiveness, and business results such as market and financial results. The scholars who have worked on this aspect are such as Kaynak (2003), Prajogo and Sohal (2004), Kaynak & Hartly (2005), Sila (2007), Fotopoulos & Psomas (2009), Zakuan (2010), and Valmohammadi (2011).
Besides the attempts to study CSFs across countries, Youssef & Zari (1995) discovered that there are certain common CSFs but differ in terms of the level of importance from region to region. According to Sila (2003), the 76 studies conducted in 19 countries reveal 18 common CSFs. Most of them are fit with MBNQA framework. Moreover, three CSFs namely top management commitment, customer focus and information and analysis, are found in all countries.

3.3.1. People-oriented CSFs
Since the 1990's, people-oriented concept has received more recognition in TQM studies. The concept plays an important role in the studies of the relationship among TQM, quality performance, and organizational performance. Additionally, in 1993, Porter & Parker have found that each CSF differs in its significance and can be arranged in hierarchy. Afterward, the concept of CSFs is gearing toward classifying CSFs into categories.as shown in figure 3.
Kochan et al. (1995) have determined Hard TQM as technical tools, and defined Soft TQM as changes in human practice. Despite the difference in definition, Abdullah et al. (2008) have defined soft factors as "behavioural aspects of management or human aspects", which consist of top management related factors, workforce related factors, and collaboration factors. Top management related factors are such leadership and management commitment. Workforce related factors are such as employee involvement, employee empowerment, and employee training and development. Collaboration factors are such as teamwork and communication. Among the soft factors, the study reports that management commitment, customer focus, and employee involvement have highest influential effects on organizational performance. Lau & Idris (2001) have defined soft factor as top management leadership, culture, trust, teamwork, employee involvement, employment continuity, education and training, and customer satisfaction/involvement. Their research shows that the soft factors affect quality performance and market performance. Furthermore, the study from Rahman and Bullock (2005) indicates that Soft TQM had indirect effect on organization performance through Hard TQM. In contrast, Fotopoulos & Psomas (2009) argued that Soft TQM affects organization performance rather than Hard TQM.
Thiagarajan & Zairi (1997) focus on CSFs that affects TQM implementation. They have categorized TQM into hard quality factors and soft quality factors. Similar to the study of Kochan et al. (1995), hard quality factor are system, tools, technique which affects effectiveness of organizations performance. For instance, the factors are quality management system, statistical process control (SPC), management by fact, self assessment, supplier management, customer management, and benchmarking. Soft quality factors, by contrast, are intangible and difficult to define. The factors involve leadership and employee involvement. The example of soft quality factors are senior executive commitment, workforce commitment empowerment, training and education, recognition system, communication, and teamwork. In addition, Das et al. (2000) also have comparative view on hard and soft factors. While quality practices are similar to hard factors, high involvement work practices represent soft quality factors.
Flynn et al. (1995) have divided CSFs into core quality factors and infrastructure quality factors. The core quality factors are related to hard TQM and hard quality factors by which they are defined as product design process, process flow management, statistical control and feedback. On the other hand, the infrastructure quality factors are similar to soft TQM and soft quality factors since they include top management support, customer relationship, workforce management, work attitudes, and supplier management. Ho et al. (2001) have studied the relationship between supportive and core TQM practice. Their study finds that core TQM practices affect the quality performance through supportive TQM practices. The study of Laohavichien (2004) followed the concepts of Flynn et al. (1995) and Ho et al. (2001). It reveals that infrastructure quality factors have indirect effect on quality performance through core quality factors. The research results are also similar to the findings reported by Rahman and Bullock.

Table 2 CSFs Categories

CSFs Category		Scholar
Hard TQM:	Soft TQM:	Kochan et al. (1995) Rahman and Bullock (2005) Abdullah et al. (2008) Fotopoulos & Psomas (2009)
Hard quality factors:	Soft quality factors:	Thiagarajan and Zairi (1997)
Quality practices	High involvement work practices	Das et al. (2000)
Core quality factor:	Infrastructure quality factor:	Flynn et al. (1995) Laohavichien (2004)
Core TQM factor	Supportive TQM factor	Ho et al. (2001)

3.3.2. CSFs studies in Thailand
Currently, the presence of many multinational companies in Thailand increases Thai awareness of CSF in quality management. There is a research in Thailand concentrated on some practices necessary in quality management implementation. For example, Laohavichien (2011) focus on leadership and quality management in Thailand. There are limited TQM CSFs studies in Thailand. Within the handful of the studies, most factors are either drawn from international literature, such as the work of Laohavichien (2004, 2009) and Das et al. (2008), or use the criteria of Thailand Quality Award (TQA) as the study of Siriprapawan & Walsh (2007).

4. Results and discussions
According to the content analysis, peer reviews, and expert reviews, there are 23 factors that affect the success of TQM implementation. These factors also cover all six categories of processes in the MBNQA criteria. Comparing with the literature reviews, only 21 factors are related to the previous studies. Out of the 21 factors, 13 factors are consistent with the previous studies of TQM implementation, three factors are MBNQA core values, and five factors are consistent with both the literature and MBNQA core value. There are two factors have not been mentioned in any previous research which are integrated management and employee determination as shown in figure 4.

The expert views show that each CSF has different impact on TQM in adoption phase and performance excellence phase as showed in Figure 5 and Figure 6 respectively. These finding also supports the study of Porter & Parker (1993) that CSFs can be arranged in hierarchy.

In the adoption phase, there are eight critical success factors rated by the majority of experts as very great important. These factors are (1) visionary leadership, (2) top executive role model, (3) attitude, (4) clear direction / target, (5) communication, (6) sense of belonging, (7) cooperation between management and staff, and (8) fact-based management. The rest of the factors except benchmarking are supporting factors, as they are viewed as important factors that support the success of TQM.

In order to succeed in the performance excellence phase, the results show that organizations need nine additional critical success factors. These factors are (1) long term result oriented, (2) employee determination, (3) employee involvement, (4) workforce focus, (5) workforce development, (6) knowledge management, (7) benchmarking, (8) process improvement, and (9) integrated management. The rest of the factors are supporting factors as they are rated as important for supporting the success of TQM.

Table 3 23 Critical Success Factors derived from content analysis

Factor derived from content analysis	**Related Factors from literature reviews**	
Visionary Leadership	Visionary Leadership	Anderson et al. (1995), MBNQA core value
Top executive role model	Top management commitment / Management commitment	Kumar et al. (2011), Hoang et al. (2010), Jha & Kumar (2010), Curry & Kadasah (2002), Motwani (2001), Agus & Sagir (2001), Curkovic et al. (2000), Rao et al. (1999), Ahire et al. (1996), Powell (1995)
	Senior executive involvement	Adam et al. (1997)
	Quality practices of top management	Fotopoulos & Psomas (2010),
Fact-based management	Management by fact	MBNQA core value
Sense of belonging	Empowerment / Employee empowerment	Hoang et al. (2010), Jha & Kumar (2010), Wali et al. (2003), Rahman (2001), Motwani (2001), Curkovic et al. (2000), Ahire et al. (1996), Powell (1995)
Trust	Trust	Lau & Idris (2001)
Long term result oriented	Focus on the future	MBNQA core value
Attitude	work attitudes	Flynn et al. (1995)
Communication	Communication	Porter & Parker (1993)
	Effective communication	Kumar et al. (2011)
	Communication across the organization	Wali et al. (2003)
Integrated management	-	-
Clear direction / target	Effective policy and goal deployment	Thiagarajan & Zairi (1997)
Customer focus	Customer focus	Arumugam (2011), Valmohammadi (2011), Hoang et al. (2010), Fotopoulos & Psomas (2010), Sila (2007), Prajogo & Sohal (2006), Rahman & Bullock (2005), Laohavichien (2004), Wali et al. (2003), Curry & Kadasah (2002), Agus & Sagir (2001), Dow et al. (1999), Samson & Terziovski (1999), Grandzol & Gershon (1997), Ahire et al.(1996)
	Customer-driven excellence	MBNQA core value

Table 3 (cont.) 23 Critical Success Factors derived from content analysis

Factor derived from content analysis	Related Factors from literature reviews	
Workforce focus	Workforce focus	Agus & Sagir (2001)
	Human resource management	Sila (2007), Lee et al (2003)
	People management	Prajogo & Sohal (2006), Samson & Terziovski (1999)
	Workforce management	Laohavichien (2004), Flynn et al. (1994)
	Employee fulfilment	Grandzol & Gershon (1997), Anderson et al. (1995)
		Valmohammadi (2011)
	Employee management and involvement	MBNQA core value
	Valuing workforce members and partners	
Cooperation between management and staff	Worker manager interactions	Wali et al. (2003)
	Organizational cooperation	Laohavichien (2004)
	Internal and external cooperation	Grandzol & Gershon (1997), Anderson et al. (1995)
Self assessment	Self assessment	Thiagarajan & Zairi (1997)
Organizational culture	Work culture	Wali et al. (2003)
	Culture	Lau & Idris (2001)
	Work environment and culture	Yusof & Aspinwall (2000)
	Service culture	Hoang et al. (2010)
	Quality citizenship	Rao et al. (1999)
	Quality culture / Corporate quality culture	Arumugam (2011), Jha & Kumar (2010), Curry & Kadasah (2002), Black &Porter (1996)
Employee involvement	Employee involvement	Valmohammadi (2011), Hoang et al. (2010), Fotopoulos & Psomas (2010), Warwood & Antonny (2004), Curry & Kadasah (2002), Lau & Idris (2001), Rahman (2001), Rao et al. (1999), Adam et al. (1997), Ahire et al. (1996), Porter & Parker (1993)
Workforce development	Human resource development	Zakuan et al. (2010), Parast et al. (2006), Yusof & Aspinwall (2000), Adam et al. (1997)
	Education and training	Hoang et al. (2010), Jha & Kumar (2010), Warwood & Antonny (2004), Curry & Kadasah (2002), Lau & Idris (2001), Yusof & Aspinwall (2000), Porter & Parker (1993)
	Employee training / training	Kumar et al. (2011), Arumugam (2011), Kaynak & Hartly (2005), Laohavichien (2004), Rahman (2001), Motwani (2001), Agus & Sagir (2001), Rao et al. (1999), Ahire et al. (1996), Powell (1995), Saraph et al. (1989)
	Personnel training	Rahman & Bullock (2005), Dow et al. (1999)
	Learning	Grandzol & Gershon (1997), Anderson et al. (1995)
	Organizational and personal learning	MBNQA core value

Table 3 (cont.) 23 Critical Success Factors derived from content analysis

Factor derived from content analysis	Related Factors from literature reviews	
Process improvement	Process improvement	Wali et al. (2003), Powell (1995)
	Continuous improvement	Kumar et al. (2011), Rahman & Bullock (2005), Power & Sohal (2001), Curkovic et al. (2000), Yusof & Aspinwall (2000), Grandzol & Gershon (1997), Anderson et al. (1995),
Employee determination	-	-
Standardized work system	Process management	Arumugam (2011), Valmohammadi (2011), Hoang et al. (2010), Jha & Kumar (2010), Sila (2007), Prajogo & Sohal (2006), Kaynak & Hartly (2005), Laohavichien (2004), Lee et al. (2003), Motwani (2001), Samson & Terziovski (1999), Grandzol & Gershon (1997), Anderson et al. (1995), Flynn et al. (1994), Porter & Parker (1993), Saraph et al. (1989)
		Yusof & Aspinwall (2000), Porter & Parker (1993)
		MBNQA core value
	Systems and processes	
	Systems perspective	
Adaptability	Agility	MBNQA core value
Knowledge management	Knowledge	Adam et al. (1997)
Benchmarking	Benchmarking	Curry & Kadasah (2002), Motwani (2001), Curkovic et al. (2000), Rao et al. (1999), Dow et al. (1999), Ahire et al. (1996), Powell (1995)
	Application of best practice	Warwood & Antonny (2004)

Table 4 TQM Critical Success Factors (Adoption/implementation phase)

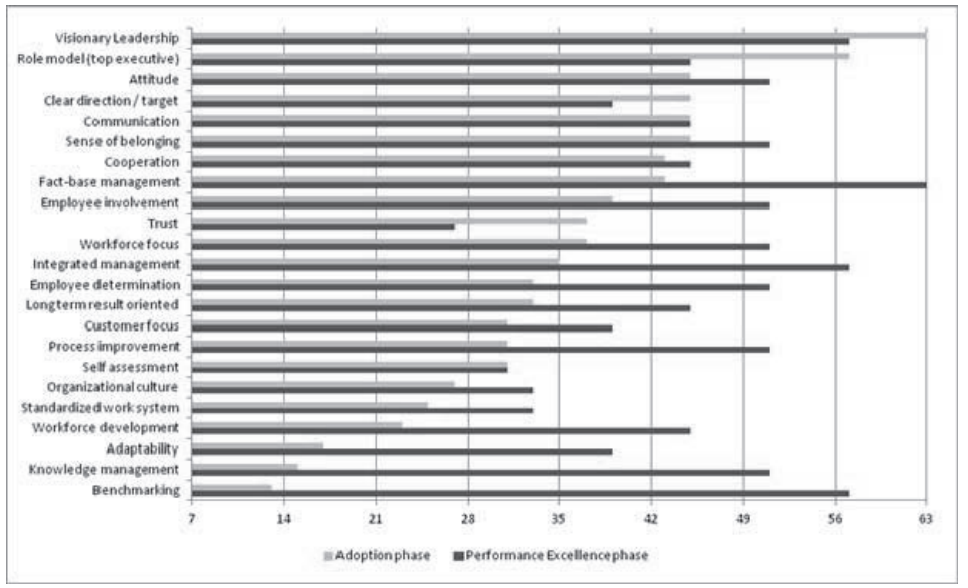
Factors	Somewhat Important [1]	Important [3]	Very great important [9]	Total Weighting
Visionary Leadership	-	-	7	63
Top executive role model	-	1	6	57
Attitude	-	3	4	45
Clear direction / target	-	3	4	45
Communication	-	3	4	45
Sense of belonging	-	3	4	45
Cooperation between management and staff	1	2	4	43
Fact-base management	1	2	4	43
Employee involvement	-	4	3	39
Trust	1	3	3	37
Workforce focus	1	3	3	37
Integrated management	2	2	3	35
Employee determination	-	5	2	33
Long term result oriented	3	1	3	33
Customer focus	1	4	2	31
Process improvement	1	4	2	31
Self assessment	1	4	2	31
Organizational culture	-	6	1	27
Standardized work system	1	5	1	25
Workforce development	2	4	1	23
Adaptability	2	5	-	17
Knowledge management	3	4	-	15
Benchmarking	4	3	-	13

Table 5 TQM Critical Success Factors (Performance excellence/award achieved phase)

Factors	Somewhat Important [1]	Important [3]	Very great important [9]	Total Weighting
Fact base management	-	-	7	63
Benchmarking	-	1	6	57
Integrated management	-	1	6	57
Visionary Leadership	-	1	6	57
Attitude	-	2	5	51
Employee determination	-	2	5	51
Employee involvement	-	2	5	51
Knowledge management	-	2	5	51
Process improvement	-	2	5	51
Sense of belonging	-	2	5	51
Workforce focus	-	2	5	51
Communication	-	3	4	45
Cooperation between management and staff	-	3	4	45
Long term result oriented	-	3	4	45
Top executive role model	-	3	4	45
Workforce development	-	3	4	45
Adaptability	-	4	3	39
Clear direction / target	-	4	3	39
Customer focus	-	4	3	39
Organizational culture	-	5	2	33
Standardized work system	-	5	2	33
Self assessment	1	4	2	31
Trust	-	6	1	27

The comparison of CSFs in the adoption phase and the performance excellence phase is demonstrated in Figure 7. In the adoption phase, leadership related factors such as visionary leadership, role model; clear direction / target are highly significant. Most critical success factors are soft factors except fact-base management which is hard factor. On the other hand, leadership related factors are also significant in performance excellence phase but in lesser extent. In this phase, hard factors such as benchmarking, process improvement, knowledge management, and integrated management become more important.

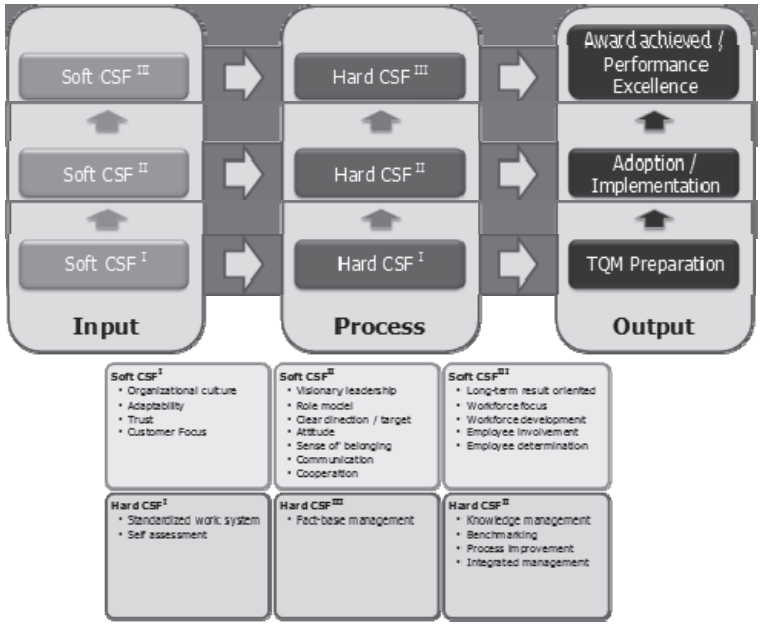
Figure 2 The comparison of CSFs in the adoption/implementation phase and performance excellence/award achieved phase



From the study, the CSF model is developed as shown in Figure 8. The proposed model describes the relationships between two types of CSFs and two stages of TQM implementation. The model supports the findings in the studies of Kochan et al. (1995), Rahman and Bullock (2005), Abdullah et al. (2008), and Fotopoulos & Psomas (2009) that the CSFs can be categorized into soft factors and hard factors. The soft factors represent the inputs of executives, workforces, and their collaboration that create the changes in organizations. The organizational changes especially in organizational processes represented as the hard factors in the model. In other word, soft factors have indirect impact on the success of TQM through hard factors (Ho et al., 2001; Laohavichien, 2004; Rahman and Bullock, 2005). For the output, it depends on the stages of implementation. In the adoption phase, the output is that the organizations can adopt TQM effectively. In the performance excellence phase, the output is that the organization performance reaches excellence level.

According to the proposed model, an organization need to prepare for implementing TQM by nurturing organizational culture which is prompt for changes, and promotes employees confidence on organization direction. The organization must standardize its work systems throughout all units. Next, to succeed in adopting TQM effectively, top executives roles are to adopt TQM by setting direction and goal, creating understanding and collaboration among employees. The standardized work system must be improved through fact-based management which each decision making is based on information support. Finally, to develop TQM system to achieve performance excellence, an organization need to develop TQM practices by focusing on workforce and developing employee capability which promote employee determination and devotion. Moreover, an organization needs to improve its organizational effectiveness by integrate all processes together, continuously improve practices in the organization by knowledge management and benchmarking with best practices.

Figure 3 Proposed CSF model



5. Conclusions and Recommendations

There are 23 TQM critical success factors derived from TQA winners in Thailand, as shown in Figure 4. Most of the factors are consistent with those from international studies. The study proposed the CSF model that represents the relationship between CSFs and the success of TQM system in organizations. The proposed CSF model shows the different set of CSFs in the TQM adoption phase and the performance excellence phase. The contribution of this research is through the presence of TQM critical success factors in Thailand and also, the CSF model for adoption phase and performance influential phase. Thus, executives in an organization need to prioritize their actions. First, an organization should evaluate the readiness of organization system and culture. Second, all processes need to be set and improved in fact-based manners. Finally, the leader should encourage and support the operation and internal processes by focusing on the soft factors as well as the workforce. By following this scheme, the organizations would receive the benefits of integrated processes which are well deployed and will be improved

continuously by their workforces. The performance of an organization can be increased and eventually become excellence through knowledge management, benchmarking with best practices, and improve continuously. However, there are some limitations since the research is a part of exploratory research. Therefore, future research is required to confirm the findings and ensure both the reliability and the validity of the CSFs in Thailand as well as the proposed CSF model.

In addition, the implications of this study are that Thai culture may not represent a different context for TQM critical success factors. This suggests to international managers that many of the TQM factors are useful in both developing countries and developed countries.

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Life-cycleBehavior: Implications and Managerial Practices

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Abstract
The study examines the life cycle cost fromthe two systems. The objective is to gain better understanding of and knowledge into the life cycle costing behavior from the perspective of a buyer. It is discovered that between 42-49 % of the total costs of the two systems under study over actually took place when a purchasing decision was made. In addition, almost 100% of the life cycle cost of the systems under study was committed when a selection is made. This implies that, after the acquisition, the cost management capability is greatly diminished. This finding is essentially consistent with the original viewpoint of system acquisition which is from the design. Finally, the life-cycle cost has become an integral part of the ongoing public-private partnership initiative since it ensures that the public interest is protected.

Keywords: life cycle cost management, acquisition, and procurement

1. Introduction

The life-cycle costing methodology (Fabrycky and Blanchard, 1998; Canada *et al*., 1996; and Blanchard 2008) has been primarily applied for an acquisition-related process; i.e., design and procurement. The methodology focuses on a customer-to-customer chain. This chain underlines the fact that a life cycle of a system to be designed or procured has to begin with customer needs and to end with retirement and disposal (Bullinger *et al*., 1994; and Olubodun *et al*., 2010). To help understand the importance of the life cycle costing consideration, it is necessary to explain the life cycle concept of the system. The life-cycle phases of the system under design can be described as follows (Blanchard, 1998). The system begins with customer needs. These needs are derived from the future trends and/or current deficiency (Ulrich and Eppinger, 2003; and Korpi and Ala-Risku, 2008). For examples, when a general population is aging, a less weighted system should be considered. When a future trend indicates more urban population, a use of information and communication technology should be considered to provide more convenience. Even in the public sector, an e-Revenue system helps people pay their income taxes online. Some of the current deficient systems have led to a need to develop a car which is more fuel efficient and is able to accommodate multiple sources of energy. A design of a new aircraft which is more fuel efficient, faster, and less noise is based on both airlines and passengers' needs. Quality Function Deployment is wildly used to gather and organize need information from customers as it also incorporates the information from competing systems in a marketplace (Ulrich and Eppinger, 2003).

Then, the system will be designed, developed, tested, produced, utilized/maintained, and retired/disposed. Designing and developing a system requires in-depth understanding on several issues. They include an establishment of key baselines on how a system is expected to operate (also known as operational requirements such as

system utilization and parameters— size, speed, accuracy, etc.), maintenance and support requirements such as logistics and roles of suppliers to support system use, a determination of primary functions of a system, and planning for test and evaluation. A ticket machine in a mass transit has several functions, including taking cash, accepting credit cards, printing out receipt, issuing tickets, providing information, recording transactions, etc.

Generally, there are three major activities embedded in design and development (Benson, 1998). The first one is called conceptual design (identification of operation requirements— mission profile, effectiveness requirement, deployment and distribution, expected useful life, operating conditions, and so on; and maintenance/support policy). The second activity is known as preliminary design (operational flow and maintenance flow diagrams). Finally, the last activity is described as detailed design (design for reliability, maintainability, supportability, human factors, economic feasibility, and environmental friendliness). Audit, evaluation, selection, and contract constitute a key task in managing supplier risk management and is considered to be critical during the preliminary and detailed designs[1].

Afterwards, the next phase is described as testing. Testing usually includes prototyping, preparation of test site, data collection, and design revision. After having successfully tested the design of the system, the next step of the life cycle phase is production/construction. Then, the system will be used or utilized by the intended user. In this phase, there are also other activities involved such as maintenance and support to ensure user satisfaction and requirements (including warranty). When the system reaches its useful life, the system will proceed to its last phase of its life cycle. This last phase is called retirement and disposal. Retirement and disposal are critical as it is part of regulatory requirements aiming to address health and safety of the general public (Yuracko and Morris, 2001)

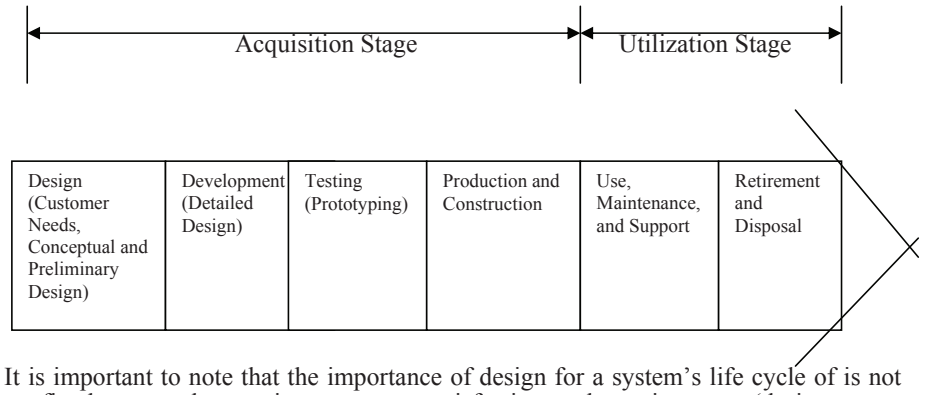
The life-cycle practices and management have been widely adapted, applied, and implemented in many industries such as aerospace and defense, automotive, electronic, etc[2]. Other complex systems, including airports and mass transits have applied this life-cycle management for design and development. On the other hand, due to the fact that the term acquisition deals with both design and purchase, a purchasing decision of a complex system has gradually recognized the need to blend a life-cycle management's viewpoint. In fact, DOD 5000.01 and 5000.02 stress the integration of life-cycle cost and management into a purchasing decision at the U.S. Department of Defense[3]. Figure 1 demonstrates all phases in the system's life cycle.

[1] See Capability Maturity Model for Business Development (2004), published by Business Development Institute International (www.bd-institute.org)

[2]See Acqusition Logistics Guide (1997), published by Defense Systems Management College, Fort Belvoir, Virginia, USA.

[3] See the U.S. Department of Defense Instructions 5000.01 (Year 2007), and 5000.02 (Year 2008) on Defense Acuisition System, and Military Handbook or MIL-HDBK 502 (Year 2005) for Acquisition Logistics, Department of Defense, USA

Figure 1 Life Cycle Phases of the System from the Designer/Producer's Point of View (Adapted from Blanchard, 2008)



It is important to note that the importance of design for a system's life cycle of is not confined to merely meeting customer satisfaction and requirements (during use— functionality, maintenance and support, etc.). Fabrycky and Blanchard (1998), and Blanchard (2008) argued that this design concept couldgreatly influence the life cycle cost of a given system. In other words, poorly designed system can negatively impact the financial well being of an organization as well as its customers (Matipa *et al*., 2009; and Fasil and Osada, 2011). Therefore, decision evaluation and selection analysis need to explicitly consider the life-cycle cost. Such scenarios resulted from poor design include the following.

- Supplier incapable of fulfilling product requirements
- Cost relating to supplier switches
- Product recall, repair and replacement
- Urgent technical assistance and handling after useful life
- New search for raw materials suppliers
- Unplanned production
- Cost overrun from product warranty
- Logistic delay for consumers during maintenance
- Large inventory asset in comparison with sale revenue
- Poor on-time delivery due to packaging size
- Long waiting time due to a lack of available space during maintenance and repair
- Long downtime due to a lack of spares for maintenance and repair

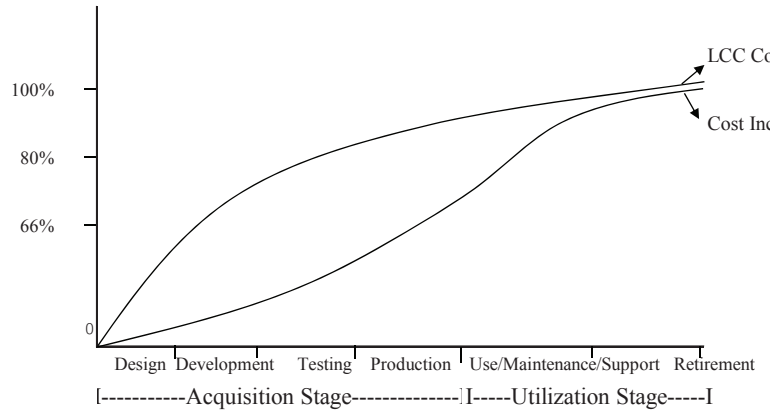
According to Blanchard (2008), a decision made today in regard to system acquisition (i.e., design or procurement) will have a great deal of future impact due to cost commitment (although there is no actual cost incurred when a decision is made). This is for both private and public sectors (Anussornnitisarn*et al*., 2010). For examples, a selection of the roof materials for an airport terminal will affect operating and upkeep costs during use. A decision to purchase a machine without any regard to operational compatibility will influence on training, operating, maintenance, spare, and other related costs.

Given the financial impacts, many firms which undertake investment and/or upgrade decisions have advocated more applications of the following terms— commonality, interchange-ability, and interoperability. These terms are based on the need to focus more on life-cycle cost management (Blanchard, 2008; and Kashirsagar *et al*., 2010). The low-cost airlines attribute their success to buy only one type of an aircraft. This decision has resulted in less operating, training, maintenance, and repair costs. In addition, aircraft productivity and asset utilization have improved due to better time management (e.g., lower turnaround time, lower maintenance downtime, etc.). Streamlining operations is benefited from integrating commonality, interchange-ability, and interoperability (Robinson, 1996; and Czop, and Leszczynska, 2011).

Fabrycky and Blanchard (1991) concluded that, an organization that is responsible approximately 80% of the life cycle cost of the system is committed when the design is completed. In other words, when involving with design, development, and production/construction of a system for consumer use, the future cost have already been determined. Interestingly, the actual cost of design activities is estimated to be around 10% of the system's life cycle cost. The key lessons from this conclusion can be described as follows.

Apparently, the greatest impact on a system's life cycle cost occurs at its early stage. This is due to the fact that the future price of raw materials depends on a selection during a design. Production and manufacturing is made in accordance to design specification. Staff training for inspection and other related operations relies on a final design. The after-sale-service plan is based on the maintenance/support policy determined during a design. The flexibility of and system utilization for an operator depends on a system's design. The hazardous concern and safety consideration during the retirement/disposal phase is resulted from the materials selected during the design. Figure 2 demonstrates the cost behavior of the life cycle cost committed and the actual life cycle cost incurred.

Figure 2 Life Cost Behavior for Committed and Actual Cost Incurred (Fabrycky and Blanchard, 1991)



2.Problem statement and research objective

Fabrycky and Blanchard (1998), and Blanchard (2008) advocated the greatest potential area for cost saving and prevention is at the early state of a system's life cycle. This is because any changes in system design (packaging, characteristics, size, useful life, maintenance support activity, disposal methods, etc.) at the production and operation phases are much more costly and less timely. Cost competitiveness for a firm indicates the need to prevent future unnecessary costs (e.g., recall, rework, return, replacement, warranty, etc.). In addition, the opportunity loss; e.g., longer time to market when comparing with competitors, is of serious concerns.

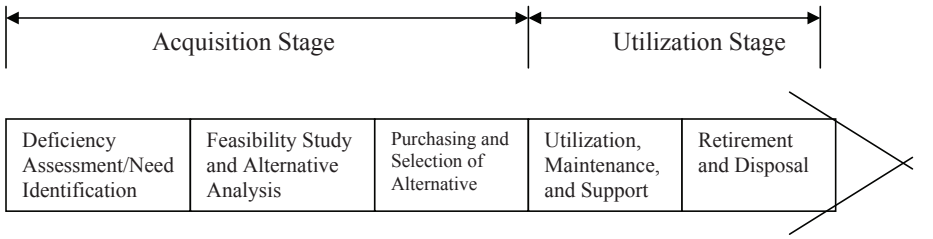
For this study, the focus shifts into a buyer's perspective. In other words, the research aims to learn more in regard to a behavior of the life cycle cost committed from the perspective of the buyer (instead of the designer/producer as described by Fabrycky and Blanchard, 1991). The underlying question is whether the above premise advocated by Fabrycky and Blanchard (1991), and Blanchard (2008) is still applicable from the viewpoint of a buyer. The research objective is to test the applicability of the life-cycle cost for both acquisition circumstances; i.e., design and procurement.

3. Methodology and results

The life cycle cost concept has been practiced since 1980s (Blanchard 2008). Despite its popularity, for this study, it is important to note that the phases in the system's life cycle have to be revised. From the buyer's perspective, there are five primary phases in the system life cycle[4]. They are current deficiency assessment/need identification, feasibility study and alternative analysis, purchasing/selection, utilization/maintenance/support, and retirement/disposal.

The deficiency assessment/need identification phase includes an examination and verification of needs, and determination of operational requirements. The feasibility study and alternative analysis phase includes data collection according to operational requirements, an economic evaluation of alternatives, after-sale service options on installation, maintenance, and support, and etc. The purchasing/selection phase includes a selection of the best possible alternative which is expected to advance organizational missions, policies, and objectives. The utilization/maintenance/support category includes labor for operator and technicians, spare parts, replaced materials, transportation and handling, inventory, inspection, documentation, and so on. Finally, the retirement/disposal phase includes transportation, movement, handling, and so on. Figure 3 demonstrates the primary phases in the system's life cycle from the buyer's point of view.

Figure 3 Life Cycle Phases of the System from the Buyer's Point of View



In this research, the procurement of two systems by a public agency was under study. Since the agency that provided data on the system life cycle cost requested that its name and systems remain anonymous. As a result, the two systems will be referred to as System A and B respectively. These two procurements were made several years ago. The useful life of each system was anticipated to be about 5 years. In this study, all the values of the cost will be converted to the same time horizon, at the present. The discount rate for the monetary conversion is the Minimum Lending Rate at the time of the purchase. This conversion is necessary since, in some cost categories, the expenditure had occurred at the different periods during the 5-year time horizon.

The cost, included in the acquisition stage, is purchasing cost of system. On the other hand, the cost associated with the utilization stage includes operating cost, spare/repair parts, support and maintenance cost, and utilities. Many costs, occurred at the utilization stage, were dependent on the system's acquisition. It was unnecessary to prepare facilities for system use, to obtain supporting and handling equipment for system operation, and preparation, and to facilitate and conduct training for system operator and its maintenance personnel. The primary reason for these costs to take place was to support the utilization of the system.

It is important to note that the data on retirement and disposal cost is not available for this study. Since both Systems A and B contain no chemical and hazardous materials, the cost at this phase probably has no impact on the research conclusion.

[4] The Seven Steps to Performance-based Service Acquisition by Interagency- industry Partnership in Performance (www.acqnet.gov/Library/OFPP/BestPractices/pbsc)

Table 1 illustrates the life cycle cost associated with both Systems A and B.

Table 1 System Life Cycle Cost for A and B

Description	Present Value of System A, Baht	Present Value of System B, Baht
1. Purchasing (Acquisition Stage)	**398,309,420**	**103,004,084**
• System	346,605,338	103,004,083
• System modification	46,250,234	-
• Technical data	5,453,848	-
2. Operation (Utilization Stage)	**2,133,443**	**1,854,751**
3. Maintenance (Utilization Stage)	**641,906**	**644,386**
• System	439,890	441,590
• Facilities	202,016	202,796
4. Support in terms of preparation of facilities for system use (Utilization Stage)	**165,895,924**	**72,243,300**
• Land	10,000,000	-
• Building	135,019,820	-
• Accommodation	20,876,104	-
5. Supporting/handling equipment (Utilization Stage)	**252,848,431**	**31,808,070**
6. Training (Utilization Stage)	**16,475,506**	**1,135,661**
• Operator	4,270,837	811,187
• Maintenance personnel	12,204,669	324,474
7. Spare and repair parts (Utilization Stage)	**102,759,677**	-
8. Utilities (Utilization Stage)	**2,188,153**	**2,196,107**

Table 2 demonstrates the summary of the life cycle cost of both System A and B.

Table 2 Life Cycle Cost Summaries for Systems A and B

Description	**System A**	**System B**
1. Cost Associated with the Acquisition Stage	398,309,420	103,004,084
2. Cost Associated with the Utilization Stage	542,943,040	109,882,275
3. Total Life Cycle Cost	941,252,460	212,886,359
4. % of Acquisition Stage	42.32	48.38
5. % of Utilization Stage	57.68	51.62

Figure 4 displays the cost curve representing the behavior of the actual life cycle cost for both Systems A and B

Figure 4 Cost Behavior of Actual Life Cycle Cost for System A and B

Description	**System A**	**System B**
1. Cost Associated with the Acquisition Stage	398,309,420	103,004,084
2. Cost Associated with the Utilization Stage	542,943,040	109,882,275
3. Total Life Cycle Cost	941,252,460	212,886,359
4. % of Acquisition Stage	42.32	48.38
5. % of Utilization Stage	57.68	51.62

4. Discussion and implications

There are several insights about the life-cycle cost from these two cases. First of all, at the utilization stage of the system, all important costs associated with this category were resulted from the purchasing decision. In other words, the system's procurement is critical as life-cycle costs were committed after this decision. Secondly, the general findings are consistent with the premise suggested by Fabrycky and Blanchard (1991). From the buyer's point of view, the analysis prior to the selection has to be deliberate since almost or all life cycle cost associated with the system to be purchased will be committed at this phase. In other words, key questions such system requirements, repair and maintenance, etc. should be raised at this stage.

For examples, some of these questions are:(1) how long a system is expected to be under operation, (2) what its operating conditions will be, and (3) how often it is expected to require inspection and repair. In addition, the consideration into its commonality and interoperability with existing systems should be addressed and known early to help maintain and minimize operating costs. Moreover, an assessment of maintenance capability or prospect of sharing maintenance personnel, ability to interchange parts, or share database and facility, cooperate on using similar supporting and handling equipment during system operation must be part of the system evaluation and analysis. Otherwise, as suggested by the research finding, the organizations will eventually have to pay for the life cycle cost that is associated with the system.

From the two case demonstrations, the life-cycle cost stresses the importance of forward-looking and places less emphasis on the initial least cost. It appears that the life-cycle cost is compatible to the do-it-right-the-first-time theme in which all future costs should be estimated and illustrated. The life-cycle cost also highlights the need to have a standard unit cost to ensure that cost estimates are accurate and acceptable (Sciulli, 2009). Given its applications for several public-private partnerships projects for both economic (e.g., highways, subways, etc.) and social (e.g., schools and hospitals) infrastructures, the life-cycle cost is sometimes referred to as the whole-of-life costs. In fact, according to Sciulli (2009), the life cycle cost estimation is required by many countries as a prerequisite for public interest test prior to an investment decision in the partnership projects. In other words, the use of life-cycle cost ensures that the public interest is protected.

Finally, it appears that a behavior of the life cycle cost committed from the perspective of the buyerand the designer reflects strong similarities. Regardless of the viewpoint, the knowledge of life-cycle cost is needed to ensure customer requirements, budgetary preparation, and effective cost comparison. The use of life cycle cost in emerging practices from the public sector in several countries confirms its continuous importance (Greasley *et al*., 2008).

5.Conclusion

The study examines the life cycle cost from the two systems. The objective is to gain better understanding of the life cycle costing behavior from the perspective of a buyer. It is discovered that between 42-49 % of the total costs of the two systems under study over actually took place when a purchasing decision was made. In addition, almost 100% of the life cycle cost of the systems under study was committed when a selection is made. Apparently, after the acquisition, the flexibility in regard to cost management is greatly diminished. This finding is essentially consistent with the acquisition logistics concept which advocates the consideration into life-cycle cost when making a selection decision. Moreover, the life-cycle cost has become an integral part of the ongoing public-private partnership initiative since it ensures that the public interest is protected.

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Value-added Concept, Productivity, and Profitability: Applications and Insights

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Abstract
The primary purposes of the study are to apply the value-added concept, especially relating to performance measurement, and to analyze the specific circumstances in which they should be appropriate. This concept has been more important due to the rapid changes in a company's operations such as shifting from a 'push' to 'pull' approach, use of information and communication technology, emerging importance of human capital, and more intense business competition. The research methodology involves, company selection, data collection (from Stock Exchange of Thailand), regression and statistical analyses, the discussion of the findings with the company executive, and the conclusion. The company under study is a large sugar refinery plant located in the Northeast region of Thailand. This selection is based on the strong growth of Thailand' sugar industry which has to deal with emerging competition from neighboring countries such as Vietnam and Indonesia. The study concludes the following. It is now inevitable that measuring a company's performance involves the value-added concept. The concept of value-added productivity measurement may not be helpful under some of the aforementioned circumstance: (1) regulated and controlled markets, (2) a company operating in a supply chain in which it has several business partners or spin-off firms using (or purchasing) its products for other production and operations.

Keywords: value-added productivity, productivity measurement and management, and profitability

1. Introduction

The term value added reflects the ability for a firm to generate the value that meets customer requirements and needs (Lindholm and Levainen, 2006). Perceived value shows that customers are satisfied with the products and services received, given the amount of money paid. The management process consists of performance measurement, analysis, and improvement (Fasil and Osada, 2011). Because of the importance of intangible assets (e.g., knowledge, human capital, etc.), measuring the value added has been widely practiced and is used to reflect an output of an organization (Marr and Schiuma, 2001; and Manasserian, 2005). This is the case for most small and medium enterprises that have prioritized the innovation and creativity for their operations, including new product development and process improvement. In addition, due to the constant changes in a company's operations such as shifting from a 'push' to 'pull' approach, use of information and communication technology, emerging importance of human capital, and more intense business competition; measuring a company's value added appears inevitable as it indicates its innovativeness and long-term competitiveness (Cheng *et al*., 2010; and Dobni, 2011).

The value added can be measured in several ways[1]. From the engineering viewpoint, it indicates how well a firm is able to transform the raw materials into the products that are needed by customers. As a result, the value added represents by the value of outputs (e.g., expected sale price multiplied by number of products) subtracted by the combination of purchased value of raw materials, services needed for production (e.g., external inspections or certifications), and utilities (e.g., electricity and water). This difference represents the value added in which typical companies aim to increase continuously. Based on this definition, the ability to learn and understand customer needs and blend them into new product development is essential. The ability to minimize the use of utilities for production and operations is also critical. Understanding the markets so that a firm is able to acquire needed raw materials at the right cost is important. Moreover, the value added has been applied by integrating the data derived from the accounting system. It is widely believed that the value added, from the business and economic perspectives, indicates how well the wealth has been created (Ropret *et al*., 2012). There are many terms used to associate with this concept such as Economic Value Added[2].

Recently, the value added has been widely applied for productivity measurement and management (Hoehn, 2003; and Laitinen, 2009). In other words, many manufacturing firms have divided the value added with labor and machinery and have referred them to as value-added labor and machinery productivity respectively. Specifically, value-added labor productivity reflects how well a person (or one hour or one Baht used by labor) is able to generate value added (which is measured in terms of Baht). The information from this indicator shows whether a firm is able to utilize its workforce in several areas such as production and other operational processes (e.g., customer relations, new production development, inspection, etc.). Simply put, the substitute of value added for a company's outputs has been promoted.

Despite the emerging trend in adapting value-added productivity for measuring the productiveness of an organization, the specific circumstance in which it can be effectively utilized and adapted has been raised over the years. Therefore, the research focuses on the following question. When should the value- added productivity measurement be applied? What conditions are suitable for its applications? Moreover, the research highlights the importance of the value added within the management process and its emerging need to promote innovation and creativity within an organization. The remaining sections will be as follows. The next section describes the research objectives. Then, the discussion on the research methodology will be made. Afterwards, the results and their interpretations will be summarized. Finally, the conclusion will be provided.

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[2] Kasikorn Research Centre (2006) Thai Service Sector: Adjustment and Liberalization, Available at www.kasikornresearch.com/kr/eng/econ_analysis.jsp, as of April 4th, 2007

2. Objectives

The understanding on when the value added productivity measurement is not clearly defined despite its business acceptance and continuous promotion by the public sector (Manasserian, 2005; and Gomes et al., 2011). This lack of knowledge represents a challenge in blending value-added productivity into operational management by top management. In general, value-added productivity measurement has been widely utilized in the competitive markets over the past decades. On the other hand, for those conducting the businesses in a less-open market (e.g., regulated or semi-controlled markets), the problem remains whether the value added productivity measurement should be used.

Given the circumstance aforementioned, the overall objectives of this research are to apply the value added (especially value added productivity measurement) and to analyze the specific conditions in which the measurement information can be analyzed. This analysis focuses on the usefulness of the value added concept and value added productivity information for the executives and what conditions it should be further applied.

For the company under study, it is the large sugar refinery plant which is located in the northeast region of Thailand. This company is currently trading in the Stock Exchange of Thailand. It is part of the large conglomerate which has expanded its business areas covering agriculture, foods, and energy areas. For Thailand's agricultural sector, the cane and sugar industry is one of the largest in terms of size and export value. Due to the growing competition from neighboring countries such as India, Vietnam, and Indonesia, there is an urgent need to ensure that the industry remains competitive for the foreseeable future.

Improving crop planning, farming and harvesting, and productivity of the refinery side have been underlined as the foundation for sustaining cost competitiveness. Because of the recognition on the ability to extend production of sugarcane to include several products (e.g., molasses and monosodium glutamate or food additive) and the need to maintain the high level of productivity, the sugar refinery is selected for this study.

3. Literature Review

Productivity is regarded as one of the key performance areas (Wiboonchutikula, 2001). Being productive positively contributes to profitability and long-term competitiveness of a firm Thailand[3]. To ensure individual firms' productiveness, Federation of Thai Industries or FTI has actively promoted the use of the cluster concept to improve a firm's productivity and competiveness level[4]. This concept aims to strengthen supply chains or supplier networks within all key manufacturing areas such as auto parts and automotive, cement, food processing, electrical and electronics, textile, and petrochemical[5]. In addition to effective supply chains, FTI has promoted the use of information technology and adapted to benchmarking and other international standards for quality management such as ISO 9001. Recently, the term value added productivity has been brought up to FTI members due the upcoming Association of Southeast Asian Nations or ASEAN Economic Community in which a single market will be emerged in 2015. Important industries such as agriculture, foods, electronics, and automotives have to improve value added and the productivity level at the same time.

From the description referred by Asian Productivity Organization, the value added productivity measurement basically involves the use of a firm's outputs to measure the wealth created by an organization through its production or service operations. Then, the output value is to be

[3] In accordance to the document used during Training for Productivity Improvement for Thai SMEs 2008 during 15-18 December 2008 by Federation of Thai Industries

[4] See www.fti.or.th/2008/thai/ftitechnicalsubdetail.aspx?id=262 as of December 2010 and www.nesdb.go.th/Portals/0/tasks/dev_ability/report/data47.pdf as of January 2011

[5] See www.fti.or.th/2008/thai/ftitechnicalsub.aspx?sub_id=49 as of December 2010

subtracted by the inputs such as brought- in materials (e.g., raw materials) and external services needed for the completion of the output such as certification and calibration. See Table 1 for various value-added definitions.

Table 1 Definitions of the Term Value Added(Source: Asian Productivity Organization)

Source	Formula
Bank of Japan	Value added = Ordinary income + Personal costs + Financial costs + Rent + Taxes and Public imposts + Depreciation costs
Mitsubishi Research Institute Japan	Value added = Personal costs + Rent + Depreciation costs + Financing cost + Taxes and public imports
Small and Medium Enterprise	Value added = Production value – (Direct material costs + Cost of parts purchased + Payments to subcontractors + Indirect material costs)

Traditionally, there are two approaches in quantifying the value added. The first approach is to deduct specific costs from the total operations while the second one is to aggregate/ add the key items. According to, Shimizu *et al*. (1991) and Leung and Wong (1993), pointed that the primary objective of value added was measured the effectiveness of production activities and dealt with fairness in distribution economic gains brought about by the gains in efficiency. It is now an integral part of a company since the value added can blend the data from current accounting practices (Elbanna and Naguib, 2009). In other words, the value added focuses on how well a firm is able to add positive value its outputs, it is often for many to use this term as a substitute for an output. In addition, Bao and Bao (1998), suggested the general equation of value added thatwould detect abnormal economic earning of organizations. It is as follows.

$$ValueAdded = Sales - CostofGoodsSold - Depreciation \ldots\ldots (1)$$

Becoming productive is essential for an organization's profitability (Hoehn, 2003). The reason is that the profitability indicates the relationships between an organization's revenue and cost (i.e., revenue divided by cost). If a rate of revenue increase is higher than that of cost, a company is said to be profitable.

4. Research Methodology

There are several steps taken to complete the study. The first step deals with the selection of a company to be examined (for the circumstances in which value-added productivity is suitable). The second step is to collect the data, given the agreement on the definition of the term value added. The next step is to apply statistical techniques in order to gain better understanding on the roles and impacts of value added on the company's performance. Within these analyses, several techniques are to applied; namely Pearson Correlation, Factor Analysis, and Multiple Regression. The interpretation of the findings is part of this step. Then, the interview is to be conducted with the company's executive. This interview is important since sharing the findings and the result interpretations with the executives should lead to more insights into how productivity information is viewed. In addition, the usefulness of value added productivity information can be extensive discussed. The last step is the conclusion.

5. Results

The company under study has successfully operated in the sugar industry and has enjoyed the business growth over the past decade. The data is collected though the company's financial reports released by the Stock Exchange of Thailand. See Appendix A. Also see Table 2 which shows the value-added results and the profit information from Year 2005 (representing the first year of the company's entry into the Stock Exchange of Thailand) until 2011.

Table 2 Illustrations of Value Added and Profits from the Company under Study

Indicators (Million Baht)	Years						
	2005	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
Value Added	1,006	1,173	1,523	2,306	2,400	2,437	4,134
% Change	-	*16.61*	*29.85*	*51.37*	*4.08*	*1.53*	*69.67*
Profit	495.11	678.95	835.86	859.53	900.70	76.81	2032.20
% Change	-	*37.13*	*23.11*	*2.83*	*4.79*	*-91.47*	*2545.71*

Then, it is to explore how value-added related information can be applied by the company's management team. As a result, an attempt is to be made for examining the interrelationships between productivity and profitability. Indicators to be used in this examination are based on several studies and are similar to the framework suggested by Asian Productivity Organization and Thailand Productivity Institute. See Table 3.

Table 3 Key Variables for Examining the Interrelationships between Productivity and Profitability

Variables	Formulation
x_1; Labor Productivity	= Value Added/ Number of Employees
x_2; Wage Level	= Personal Cost/ Number of Employees
x_3; Labor Share	= Personal Cost/ Value Added
x_4; Total Capital Productivity	= Value Added/ Average Total Capital
x_5; Capital Intensity	= Average Total Capital/ Number of Employees
x_6; Value Added Ratio	= Value Added/ Sale
x_7; Capital Utilization Ratio	= Sale/ Average Total Capital
x_8; Capital Shares	= Profit/ Value Added
y; Profitability	= Profit/ Average Total Capital

The data collected from the company's annual reports and the information released by the Stock Exchange of Thailand can be illustrated as follows. The primary aim for applying the regression analysis is to examine the possible impacts from achieving high value-added productivity on the company's financial performance. See Table 4.

Table 4 Information from Key Indicators (Variables)

Variables	Years						
	2005	2006	2007	2008	2009	2010	2011
x_1; Labor Productivity	0.390	0.407	0.449	0.662	0.562	0.730	1.231
x_2; Wage Level	0.40	0.29	0.43	0.49	0.43	0.47	0.67
x_3; Labor Share	103.1	71.99	96.51	64.53	76.34	64.88	54.25
x_4; Total Capital Productivity	12.14	12.05	12.32	14.94	12.78	11.18	16.73
x_5; Capital Intensity	3.22	3.37	3.65	4.43	4.40	6.53	7.35
x_6; Value Added Ratio	19.30	19.28	17.99	21.41	20.87	20.39	25.39
x_7; Capital Utilization Ratio	62.90	62.53	68.49	69.78	61.25	54.85	65.91
x_8; Capital Share	49.22	57.88	54.87	37.28	37.53	3.15	49.16
y; Profitability	5.97	6.98	6.76	5.57	4.80	0.35	8.23

The next step involves the use of Pearson Correlation Test. This test is used to assess the linear relationships between the two variables. The purpose is to learn how individual variables relate to the profitability and how they interact among themselves. If the relationship between two variables is linear, the correlation should approach the value of one or 1.0. Two variables with the non-zero value are described as having the correlations. The Pearson Correlation Coefficient used in this study is set at 0.70 due to the limited data. In other words, if the Pearson Correlation Coefficient between the two variables is less than 0.70, the two variables have a low level of the co-relationship. If the Pearson Correlation Coefficient between two variables is greater than or is equal to the value of 0.70, these variables have a linear relationship. See Table 5. Note that the results only show the absolute value.

Table 5 Results from the Pearson Correlations

	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	y
y	0.11	0.13	0.12	0.58	[0.24]	0.23	***0.76***	***0.94***	1.00

From Table 5, the results clearly demonstrate the relationship between X_7 and Y, and X_8 and Y. In other words, the Capital Utilization and Capital Share appear to have the linear relationships with the profitability level of the company under study. The next step is to develop a regression to determine which variable influences the profitability level more. This step is critical as the study needs to extend information from value added productivity measurement into the analysis stage. In this case, it appears that Capital Share significantly impacts the profitability level. Again, the value added is embedded in both the Capital Share and Profitability. It shows that the value added plays an important role in ensuring business success. See Table 6.

Table 6 Results of Regression Analysis

Parameter	Regression Model		p-value	Adj-R^2
y =	$-0.0456 + 0.0495x_7 + 0.130x_8$		0.001***	98.40%
	Predictor	**Coefficient**	**p-value**	**VIF**
	Constant	-0.0456	0.112	-
	Capital utilization ratio (x_7)	0.0495	0.279	2.034
	Capital's share (x_8)	0.130	0.001***	2.178

Note: 1) *** significance at the 0.001 level

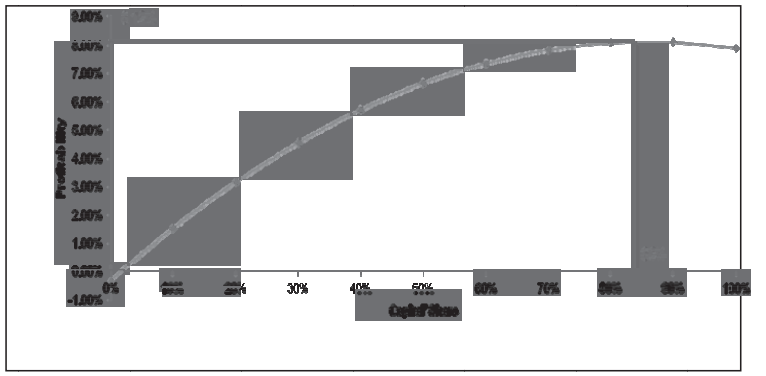
The above results show that blending the value added concept with productivity and financial performance of an organization is possible. In addition, the information from having blended the value added (including value added productivity) points to useful insights into how the company's performance should be managed. Interestingly, during the discussion, the company's executive suggested afurther demonstration on extending information analysis. As a result, the Quadratic Regression Model is applied. Note that, when adding 1% of capital's share, the profitability level is expected to be increased by 0.13%. Again, this demonstration is to highlight whether the value added concept, especially value-added productivity, can strengthen information analysis. In this case, it appears that it generates personal interests from the company's executive. The quadratic equation model shows the maximum profitability is at 8.12% when the capital share's value is at 86%. See Table 7. Also see Figure 1.

Table 12 Demonstration of the Quadratic Equation Model

Parameter	Relationships	p-value	Adj-R^2
y =	$-0.0030 + 0.1968x_8 - 0.114x_8^2$	0.009**	85.70%

Note: 1) ** significance at the 0.01 level

Figure 1: Demonstration of the Interrelationships between Capital Share (x_8) and Profitability (Y)



6. Discussion

The interview session is conducted with the company's major board member (note that the company started off as a family business). From this interview session, many lessons have been pointed out and learned, especially with respect to the use of value-added measurement.Essentially, the concept of value-added productivity is needed for all companies operating in the competitive and open markets. It is also agreed that, regardless of the products or and services, the concept value-added has become prevalent among the companies today. It indicates how well a firm is able to keep up with customer requirements and expectation which explicitly imply intensive use of human capital and other technology for constant changes and improvement in its products, services, and work processes. In addition, by combining the value added with productivity (i.e., substituting the outputs with the value added while dividing it with key input factors), it can help underline the importance of both terms to business operations, especially from the financial standpoint. Simply put, measuring value-added productivity provides useful feedback and information, and should be encouraged more in the future. Despite a strong endorsement by the company's executive, there are more insights into and careful consideration during the deployment of the value-added productivity in a firm.

The key lessons learned from having conducted this study together with the company's executive areas follows. When operating in a regulated or controlled market, the significance of measuring value-added productivity has become less. The reason is that, from the company viewpoint, the sugar is subjected to price control jointly managed by the farmer groups (associations and cooperatives), sugar producers, and Office of the Cane and Sugar Board (under Ministry of Industry). As a result, cost control and management (a.k.a. cost reduction) plays more critical roles than an attempt to add value to the sugar products. In addition, it is the nature of the sugar industry that the attempt to add more value to by-products from the sugar production has been made over the years, including molasses (for beverages and alcohols), ethanol for fuel, bagasse for bio fuel and electricity generation, Monosodium glutamate or MSG for common food additive, and inulin for dietary fibers. Therefore, measuring the value-added productivity in one factory which is part of the agriculture-foods-nutrition chain may not yield useful information. For the company under study, it has extended its business scope through spin-offs, and joint ventures with local and international firms. They have formed inter-dependent supply chains in which an output from one company becomes an input for another such as by-products from sugar refinery for the MSG production. In conclusion, the specific conditions to be considered before use for value-added productivity measurement are stated, based on one case study. More studies and comparisons with other industries need to be conducted in order to provide a future guideline for use.

7. Conclusion

Due to the rapid changes in a company's operations and production systems, applications of information and communication technology, and the importance of human capital, measuring value added has been continuously emphasized. The research methodology involves many steps such as company selection, data collection, regression and statistical analyses, discussion of the findings with the company's executive, and the conclusion. The company under study is a large sugar refinery plant located in the Northeast region of Thailand, is based on the strong growth of Thailand' sugar industry which has to deal with emerging competition from neighboring countries such as Vietnam and Indonesia. The interview sessions are conducted with the company's major board member. The study concludes together with this executive the following. The concept of the value-added (especially value-added productivity) is generally important for all firms and can provide useful information for a company management. The reason is that the value added has significant relationship with the profitability level.However, it is important to note that the value-added concept may not be helpful in all circumstance. The concept may not be applied under some specific scenarios: (1) regulated and controlled markets, (2) a company operating in a supply chain in which it has several business partners or spin-off firms using (or purchasing) its products for other production and operations.

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Appendix A: Partial Illustration of the Computational Data for the Company under Study

	2005	2006	2007	Unit
Sales	5,213	6,086	8,468	M Baht
Cost of Goods Sold	4,046	4,681	6,629	M Baht
Depreciation	162	232	317	M Baht
Net Profit	459.11	678.95	835.86	M Baht
Annual Expense	4,897.66	5,441.66	7,428.15	M Baht
Raw Materials Cost	3,396.50	4116.15	4,972.60	M Baht
Labor Cost	488	544	636	M Baht
Selling and Administrative Expense	549.79	301.00	834.64	M Baht
Average Number of Employees	2,577	2,885	3,391	Persons
Average Total Capital	8,288.58	9,732.82	12,365.22	M Baht
Average Tangible Fixed Asset	5,586	6,494	8,351	M Baht

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