An Investigation to the Impacts of Information Systems Flexibility on Information Systems Strategy Implementation

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Abstract. The utilization of information technology has altered the basic nature of industry. Information technology also changed its traditional role from back office to a strategic role. The strategic use of information technology has been realized as a fundamental issue for business. The fast information technology development and its adoption in the business organization in recent years, for examples, the use of blockchain, or Internet of Things in business has brought an information systems strategic change in the organizations. This paper explores the impacts of information systems flexibility on information systems strategy implementation in a Chinese multinational State-owned Enterprise. The research design for the study follows a rigorous grounded theory approach, which consisted of 41 semi-structured interviews in 7 different company branches in China. Based on the study, we propose five main categories of information systems flexibility impacts on the information systems strategy implementation. Our study contributes to the new information technology adoption literature and provides implications for information technology adoption in practice.

Keywords: Information systems flexibility · Information systems strategy · Strategy implementation

1 Introduction

Under a more dynamic and changing marketplace environment, companies are facing increased complexity and economic uncertainty (Ness 2005). Information technology (IT) has taken a prominent role in the organizations, to achieve not only operational efficiencies but also competitive advantages in the dynamic and changing environment. Many studies have paid attention to the role of IT in sustaining competitive advantages of companies (Kim et al. 2011; Joshi et al. 2011). Moreover, examining IT capabilities as dynamic capabilities is emphasized in prior research (Mikalef and Pateli 2016; Chung et al. 2003). However, the investigation to the role of IT in maintaining competitive advantages mainly focuses on if IT has a positive or negative role on competitive advantages formulation. Few studies paid attention to how IT influences competitive advantages of companies, especially, how IT impacts the strategy implementation. This paper explores the role of IT in strategy implementation rather than strategy formulation in a changing environment.

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2 Literature Review

2.1 Information Systems Strategy

Information systems strategy is inconsistently defined and has heterogeneous interpretations in literature (Teubner 2013; Chen et al. 2010). In a broader understanding, information systems strategy is concerned with long-term strategic thinking and planning which aim to achieve effective management and best impact from all forms of information such as information systems, information technology or telecommunications (Ward and Peppard 2005). Some researchers argue the information systems strategy is considered with a close integration with business strategy (Ward and Peppard 2005). For instance, Chaffey and Wood (2005: 275) stated that information systems strategy is "the formulation of approaches and planning needed to deploy information systems resources to support organisational strategy". Furthermore, they pointed out one of the purposes of planning an information systems strategy is to combine the business aims of the organisation with an understanding of information and systems applications to determine the computer systems which should be implemented in the organisation (Chaffey and Wood 2005). Ward and Peppard (2005) claimed through highly aligning with the business strategy, information systems strategy is better placed to develop organisational advantages compared to competitors. On the other hand, Chen et al. (2010) stated IS strategy should be examined independently from business strategy since it is argued business and IS strategies can support and lead each other mutually. They defined IS strategy as "an organizational perspective on the investment in, deployment, use, and management of information systems." In addition, some researchers equates IS strategy with existing IS application portfolios (Chan et al. 1997). For example, Lederer and Sethi (1988) argued information systems strategy considers the objectives of the computing process and the applications the organisation should implement (Lederer and Sethi 1988).

Normally, information systems environment includes the business application environment, desktop environment, server environment, network environment, telecommunications environment and data centre environment (Cassidy 2006). To investigate the IS environment implies a need to understand the business strategy. It means to determine the opportunities, threats and to recognise the strengths and weakness of the business, and therefore determine the business requirements for information systems and information systems operations (Ward and Peppard 2005). Based on the information systems environment, the current information systems situation is analysed through identifying the trends of the information systems industry and competitors (Cassidy 2006). Finally, in the last phase, the direction phase, information systems visions, mission, goals and strategies are developed (Cassidy 2006).

It is argued research on IS strategy content is limited while considerable research focuses on IS strategy process issues (Teubner 2013; Sabherwal and Chan 2001). To exploring the reason to this, Teubner (2013) stated it might be expected that IS strategy itself as the outcome of strategic information systems planning, which should also be an issue of academic investigation. Especially, the evolution of IS planning is summarised (Teubner 2013; Ward and Peppard 2002), which shows the emerging of business-IT alignment concept. In the 1960s, IS/IT is in the data processing era, the aim

of IS planning was to develop efficient systems to automate standardized data processing. During this time, IS planning was independent from business planning, without any direct relationship with strategic business planning (Teubner 2013). During 1970s, it became known as the era of management information systems (Ward and Peppard 2002). IS deployment grew significantly, especially in the domain of management. New methods for IS planning were developed and applied to assist IS provide extensive management information (Teubner 2013). During 1980s, companies began to realize the strategic value of IT, which is defined as strategic information systems era. During this time IS planning started to focus on the competitive advantage (Teubner 2013). In the 1990s, it entered the "strategic alignment" ear, IS planning aimed at a mutual aligning of business and IS strategy (Teubner 2013). The concept of business-IT alignment starts to be developed from 1980–1990, which is discussed in the next section.

2.2 IT Flexibility

IT flexibility is defined as "the extent to which key IT resources can scale and adapt for different purpose" (Tallon and Pinsonneault 2011; Byrd and Turner 2000). It is argued in the literatures one dimension of IT flexibility is modularity, which means the ability to reconfigure the technology components easily (Duncan 1995; Chung 2003). Prior research has confirmed the positive correlation between IT flexibility and information systems strategy implementation (Ness 2005; Tallon 2003; Chung 2003). Furthermore, it is also argued that increased IT flexibility can enable the strategic alignment and a dynamic state of strategic alignment (Ness 2005; Tallon 2003). IT strategy needs to be tightly aligned with organizational strategy in order to facilitate the organizational responses to dynamic environments, which require the IT flexibility (Chung 2003).

3 Methodology

3.1 Combination of Grounded Theory and Case Study

A combination of case study and grounded theory strategies is used in the research. Allan (2003) argued that there are certain tensions between use of case study and grounded theory. To be specific, Allan (2003) stated that, according to Yin (1994: 13), the case study approach "benefits from the prior development of theoretical propositions to guide data collection and analysis"; however, Glaser and Strauss argued that grounded theory should start without preconceived ideas or hypothesis. To avoid this potential conflict, Saunders et al. (2003: 99) argued that, as one of the advantages of employing multi-methods in the research, different methods can be used to fulfil different requirements in the study. This point is able to address Allan's concerns. In this study, case study is used as a support tool to provide a social context for the adoption of grounded theory. Grounded theory is the main strategy used in the data collection and data analysis processes in the study. Furthermore, every research method or strategy has its own weaknesses and strengths that influence the research to some extent. To adopt a combination of different methods may reduce these effects so as to lead to

better conclusions (Saunders et al. 2003: 99). Grounded theory aims to investigate the actualities in the real world and build theory from discovering the concepts grounded in the data. The adoption of grounded theory needs context, and case study provides the context for using grounded theory.

3.2 Case Study Illustration

This study selected Chinese State-Owned Enterprises as the case study site, which is composed of seven enterprises which are alumina and primary aluminium producers and one research institute when it was established in 2001. As it is claimed on the official website, the aluminium business is still the core business in the corporation. This study focused on the headquarters in Beijing which is mainly responsible of management and original seven manufacturing branches since the research institute has no producing function. These seven branches are geographically dispersed in six provinces including Shanxi, Shandong, Henan, Guizhou, Guangxi and Qinghai in China.

3.3 Data Collection and Data Analysis

Data collection adopted semi-structured interviews as the tool. In this project, a total number of 41 interviews were conducted following the theoretical sampling strategy. The data collection and data analysis were conducted concurrently. Participants were approached individually in groups of three or four, based on the need for theory formulation reflected by the data analysis. After each set of interviews, the interview data were immediately transcribed and a brief analysis was conducted. The analysis results were used to revise the interview script and to guide the further sampling. The data collection was stopped when it is perceived that the theoretical saturation has achieved.

Coding is used for the data analysis with grounded theory approach. There are three types of coding adopted in data analysis with Strauss and Corbin (1998) approach, including open coding, axial coding and selective coding. There are four supporting tools used to support the data analysis practice, including data analysis software (Nvivo10), code definition table, quotation list, and concept map.

4 Findings

4.1 Business Strategy Change

The case SOE includes headquarters in Beijing, and seven other main manufacturing branches located in different cities in China. Business strategy has changed since 2002, when the corporation became the listed companies it has remained as, up to the present. There are two main obvious changes of business strategy. Firstly, the business in the corporation has experienced a product diversification process, from the single product aluminium to multi-products, including different types of aluminium, the product Gallium, and so on.

> "In 2010 we had an important restructuring adjustment. The corporation proposed a new strategy." "It indicated that we have a single business sector previously, which means we just have one business. Now we are involved in ten business sectors. The business scope has changed." (No40 Manager IT H)
> "Now we are trying to achieve product diversification and sustainable development. Our strategy is to develop diversified products on the base of mines. Previously we only had alumina. Now, as well as alumina, aluminium hydroxide, we have Metal gallium… We are developing diversification." (N13 Manager Function)

To summarise the quotations above, the corporation now has many more business sectors than previously and a long term sustainable development plan.

Secondly, a centralized control was undertaken when the corporation started to be listed companies while changing to strategic control along with the development.

> "When ERP was built there was only aluminium business and at that time the management idea was centralized control." "The idea was raised in 2002. At that time, the corporation needed restructuring in order to be listed on the stock market. The first goal for restructuring is to withdraw the branches and institute unified management." (N40 Manager IT H)

Moreover, the contents of business strategy were mentioned in interviews: for instance, a functional manager stated:

> "When branches started to implement ERP systems, it was based on management ideas, and management requirements to set the configurations of ERP. It refers to our strategy requirements, and strategy requirements in headquarters, such as financial centralized management, centralized management of funds, investment centralized management and centralized management of purchasing and sales." (N28 Manager Function)

As reflected in the quotation, there are five main requirements for centralized control in business strategy, including "financial centralized management", "centralized management of funds", "investment centralized management" and "centralized management of purchasing and sales". For these five perspectives of the centralized management, the manager in the headquarters argued that "we do not mention them anymore" (N40 Manager IT). Furthermore, the roles branches play in the SOE group under centralized management are similar to manufacturing plants:

> "We are actually a factory. It means headquarters consider the strategy. We are just a cost centre for them or a production plant." (N14 Manager Function)

To summarise, under the centralized management, finance, funds, investment, purchasing and sales were all managed and controlled at headquarters, while branches were just in charge of production. However, along with market-oriented reforms and market development, the SOE group is growing, and the business strategy has changed from centralized management to "strategic control" (N40 Manager IT H), as one of the interviewees stated:

> "The SOE group is developing. However, there was only several hundred staff at headquarters. It is impossible for them to manage so many staff in branches. You must allow branches to adapt to the markets themselves. So we use strategic control now. There is a huge change in management ideas." (N40 Manager IT H)

As shown in the quotation, headquarters use strategic control to manage the branches now, which means "the headquarters manage the branches at a strategic level without

considering the business operations specifically", "headquarters formulate the strategic objectives and performance assessment objectives" (N40 Manager IT H), and all the branches "self-manage the business" (N41 Manager IT H). The business strategy has changed in this large SOE group with the development of enterprises and markets. It is realised that centralised management is not suitable to manage different branches located in various cities in large area of China. Strategic control is used instead in order to activate the enthusiasm of the branches.

4.2 IS Strategy Change

Correspondingly, there was an IS strategy change along with the business strategy change at headquarters. Previously, the IS strategy was produced there, which provides an overall IS management thinking, while branches implemented the IS strategy with a few developments for some special IS projects, based on individual requirements, as IT staff stated:

> "We all comply with the strategy command in headquarters. We must not deviate from it since there is a master plan. It means our plan is an implementation under on overall plan in headquarters." (N8 Manager IT)
> "The IS strategy for the SOE group are made in IT department in Beijing. We made IS strategy in Henan. Subject to standards in Beijing, called 'five unified plan', we made ours in Henan, considering our characteristics". (N7 Manager IT)

To explain the process to put the IS plan into action in the branches, he stated further:

> "Our plan is made according to the standards in Beijing, including 'unified planning and construction, unified investment, unified management and maintenance'. Based on this five point unified plan, we refer to our Henan branch. For instance, we are considering IS built in mining part, including exploration, mining, and digital mine. Or including all the other branches, we are considering communications, such kinds of things, for further implementation. Project implementation is our further consideration. This kind of implementation refers to a cost, if above one million or two millions, we should report to headquarters for approval. If the project needs a large investment, it is organized in Beijing." (N7 Manager IT)

As reflected in the quotations above, the IS strategy is made at headquarters. In branches, the "IS strategy in Henan" is actually given some considerations on IS projects based on business requirements, showing a lack of an overall planning referring to business strategy. As another IT manager stated:

> "IS strategy is not involved in our job. The reason for saying this is the IS strategy is generated at headquarters." (N11 Manager IT)

To summarise, headquarters are responsible for generating an IS strategy while branches are implementing IS strategy in enterprises. However, it is not realised that there was an IS strategy change in 2010. As mentioned, a new business strategy was proposed in 2010. In the same year, IT department in headquarters made the new IS strategy to support the business strategy.

> "It was in 2010 when we made the plan because in China there is planning every five years. We made further development plans for the next five years. So the current strategy is consistent with the strategy. The IS strategy is consistent with the business one." (N40 Manager IT H)

As reflected in the quotation, new IS strategy was produced in the same year of the new business strategy, 2010. IT managers argue that the current IS strategy "is consistent with the business one". To be specific, the process of new IS strategy formulation refers to the business and management development objectives in the corporation.

> "Firstly, you need to understand the corporation itself, its development direction, which means the main business. [To understand] whether the future development emphasizes the main business or if there are any strategic adjustments, such as new business being involved. According to this development direction… the IT department created an IS development plan based on the requirements." (N40 Manager IT H)

As shown in the quotation, the new IS strategy is made according to the new business development direction. In addition, since the business strategy has changed to strategic control, which means the branches need to manage the business themselves, the branches also need to consider the IS development plan themselves, as headquarters do not generate IS plans for them in this situation.

> "The current operation mode in the corporation is self-management, which means that whatever the business branches want to do, they take responsibility themselves. What they are going to do for IS development, actually we did not participate at all, we did not manage or plan……We were in charge of the budget in branches. In terms of what they are going to build, we are not helping". (N41 Manager IT H)

As reflected from the quotations above, headquarters no longer participate in decision-making on the IS development plan in headquarters. Branches need to consider the IS construction and development plan themselves. However, headquarters take responsibility of the IS development budget. It is perceived that it will influence the strategic and creative thinking of IS development in branches if there is a lack of good communication between headquarters and branches.

4.3 Misalignment of Systems Operations and Business Processes

It is found that the functions and operations of current systems do not match with the business functions and processes from three perspectives. Firstly, ERP operations do not match with the business processes in reality. For instance, one of the interviewees stated:

> "I think ERP is under the ideal processes… but different from reality. In real operations, it is not possible to be ideal." "In ERP, when you receive the products, you settle the account in the same month. But we can't make it like this now. We need a period for quality acceptance check… as delays in the pricing system means they don't reflect the real price". (N4 Manager Function)

As reflected here, the business processes in reality are not the same as the ones set in the IS. There are some business processes which are not considered with the systems. Furthermore, for some business functions or business requirements, there is a lack of function in IS to support or fulfil the requirements.

> "I think there are differences between the IS and their requirements." "For example, I think for many people, when they need systems support, maybe there it is not available. For instance, previously I learnt contract approval… They need IS applications to facilitate the fast delivery and joint check and approval. These were not available and they have to do it by hand." (N11 Manager IT)

As reflected in the quotations, some business work is still finished by hand. The existing IS applications did not support all the business work. It is also worth noting those misalignments between business processes and systems processes caused by organizational change.

> "The production situation changes very quickly. This system is relatively fixed. It is not able to change whenever you change. It is very difficult to make changes on systems" "For instance, last year, at the beginning, there were two alumina producing plants, and then these two were merged together. After merging, the costing in the systems should have been modified. It was very difficult when we made changes. (N20 Manager Function)
> "For instance, the financial system has recently been abandoned… because the financial system is SAP, as decided by headquarters. After implementation, no changes were made to it, such as… data measures and the control department; it has disappeared. The electrolysis plant disappeared and production management units disappeared. But in SAP, these cost centres are still there. Although these departments do not exist in reality, the costings still need to be issued here, even after merger. Now the system has peeled off, and operates with great difficulty… If the information does not change along with the management, information is dead." (N11 Manager IT)

As reflected in the quotations, when there are organizational changes, IS applications are not able to change in time, therefore the operation processes in systems do not match with the real business process. As a result, the IS use brings troubles to business work.

4.4 Frequent Reforms and Low IS/IT Flexibility

As mentioned in previous sections, enterprises are not in a good business situation now, therefore there are frequent reforms made in order to reduce the cost and increase efficiency.

> "Because now the situations of enterprise are not well, it's always in reforms. Maybe there were reforms last year and then other reforms this year. This is not suitable." (N20 Manager Function)

As reflected in the quotation, when there are frequent reforms, the IS applications are not suitable to the business structure or processes well. The low IS/IT flexibility has been discussed in the previous section.

5 Discussions

In this research, the deferred IS application change when business strategy and organizational change cause the strategic implementation problems both in structural and operational levels. When there are business strategy and organizational changes, the management activities and business processes are different. IS applications are not flexible to change along to fulfil the new requirements, which turns to be information systems strategy implementation barriers in both structural and operational levels. In structural level, a low IT flexibility leads to insufficient IS support to management when business strategy and management hierarchies change in headquarters and branches.

In operational level, low IT flexibility results in misaligns of business processes and systems operations when there is organizational changing. IT flexibility is important factor that influences the IS strategy implementation in the organizations.

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