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Examining how Firms Leverage IT to Achieve Firm Productivity: RBV and Dynamic Capabilities Perspectives

Gary PAN
Singapore Management University, garypan@smu.edu.sg

Shan Ling PAN
University of New South Wales

Chu Yeong LIM
Singapore Management University, cylim@smu.edu.sg

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Shan-Ling Pan
University of New South Wales

Gary Pan*
Singapore Management University
School of Accountancy

Chu Yeong Lim
Singapore Management University
School of Accountancy

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Introduction

Information technology (IT) enabled firm productivity refers to the influence of IT in facilitating firm performance at organization-wide levels, comprising both efficiency and competitive impacts (Melville et al., 2004). IT can enhance operational efficiency, and enable new products and services for organizations (Laudon, 2009). Stiroh (2002) suggests there is a strong association between investments in IT and firm productivity, at macroeconomic and microeconomic levels. Both Brynjolfsson (1996) and Anderson (2006) have also reported evidence of statistical correlations between IT and firm productivity. While these prior studies agreed with IT's impacts on firm productivity, others however, argued that investments in IT has not yielded significant productivity gains (Barua et al., 1995; Brynjolfsson & Hitt, 1995). This is concurred by Sambamurthy et al. (2003) who indicated that how and why IT investments affect firm performance continues to remain ambiguous. Essentially whether a firm is able to enhance its productivity depends on its available resources and capabilities, and how it mobilizes these resources and capabilities (Barney, 1991). This is because the mastery of mobilization may require a knowledge discovery process that involves 'learning and unlearning' the resources and capabilities, and the way they are synchronized (Sirmon et al., 2007). Capabilities may be enriched by learning new skills that extend the repertoire of current skills or by adding a complementary resource from the resource portfolio to the current bundle. An additional resource may also have existed in the resource portfolio for some time, or it may have been developed or acquired recently with the purpose of enriching a particular capability (Pan et al., 2012). An interesting question that remains unanswered in the IS literature is: by complementing IT assets with other resources, are firms better equipped with the capability to leverage their IT investments on improving performance (Maes et al., 2011; Tan, 2010)?

Accordingly, our research question is two-fold: (1) what information systems (IS) and other complimentary non-IS resources and capabilities are valuable in enabling firm productivity? (2) how do firms organize their IS and non-IS resources and leverage IT capabilities in enabling firm productivity? Our research outcome culminates in a framework that explicates the role of capabilities across IT adoption process, and builds up our conceptual understanding in this area. Drawing upon concepts from resource based view of firms (RBV) and dynamic capabilities, we utilize a case study of Batamindo Shipping & Warehouse Pte Ltd's (BSW) IT capability development process to analyze how firms may assemble, integrate and deploy their resources and capabilities to leverage IT for firm productivity. The outcome enables organizations to decide how much to invest in IT, how to leverage IT capabilities and whether complementary assets are needed. We inductively derived a process framework that identifies nine capabilities, and actionable prescriptions on how these capabilities may be developed to improve IT enabled firm productivity.

In this paper, we employed RBV as one of the theoretical lens for the following reasons: (1) it enables us to uncover those aspects of IS that are central resources in enhancing firm productivity, (2) it enables us to view IS within the context of other central resources needed to effectively uncover the complementarities needed for IS to pave the way toward enhancing

firm productivity and (3) it provides us a framework within which to examine the role of IS in coordinating the deployment of the entire bundle of resources in enabling firm productivity.

In addition, we employed dynamic capabilities as another theoretical lens to understand how firms may maintain competitiveness through enhancing, combining, protecting, and when necessary, reconfiguring the firms' resources and capabilities. Where RBV focuses on strategically exploiting existing capabilities and assets in stable market environments, dynamic capabilities refer to a firm's ability to respond and even create market change through integrating, reconfiguring, gaining and releasing resources in changing market situations (Eisenhardt & Martin, 2000). Such understanding is important as fast changing markets require the ability to reconfigure the firm's asset structure and to accomplish the necessary internal and external transformation (Amit & Schoemaker, 1993).

Our paper is organized as follows. We begin with a review of RBV and dynamic capabilities in IS literature. We then present our research methodology and case narrative. This is followed by case analysis and findings, implications, future research and conclusion.

Resource Based View in IS Research

The Resource Based View of firms describes a firm as a specific collection of resources and capabilities that can be deployed to achieve competitive advantage (Barney, 1991). Firm resources are defined as all assets (tangible or intangible) and capabilities belonging to or controlled by a firm that can be used to implement competitive strategies (Teece et al., 1997; Pan et al., 2006). A firm's combination of resources forms the basis of competitive heterogeneity (Helfat & Peteraf, 2003), where the scarcity of resources results in maximum rent generation (Grant, 1991). Firm-specific resources and capabilities must be protected and made difficult to transfer, imitate or replicate (Barney, 1991). By protecting their valuable resources against imitation or substitution, firms can sustain existing advantages. As resources drive and constrain the growth of the firm, these resources play a major role in the firm's process of capability development. It is therefore important for firms to acquire, accumulate and divest resources to put together an effective resource portfolio (Peteraf, 2005; Makadok, 2001) so that they are capable of reacting, adapting and responding to changes in volatile environments (Winter, 2003).

IS research using RBV has largely focused on classifying information-based resources along the attributes of resources --value, rarity, appropriability, imitability, substitutability, mobility --posited by RBV with a view towards understanding which IS resources are most likely to contribute to competitive advantage (Wade & Hulland, 2004; Mata et al., 1995). Wade and Hulland (2004) also propose that outside-in (external relationship management and market responsiveness) and spanning (IS-business partnerships and IS planning and change management) will have greater impact on short and long-term competitive position than will inside-out (IS infrastructure, IS technical skills, IS development, and cost effective IS operations). While the IS work using RBV has focused largely on identifying specific IS resources, there is recognition that the value of IS resources might have less to do with the particular IS resource per se, than with the IS resources' interaction, or bundling, with other non-IS resources (Ravichandran & Lertwongsatien, 2002, Wade & Hulland, 2004). A resource may influence other resources in one of the three ways: (1) compensatory -- a change in the level of one resource might offset the change in a level of another resource; (2) enhancing -- a change in the level of a resource may magnify the impact of another resource; (3) suppressing -- the presence of a particular resource might lessen the impact of another

resource (Wade & Hulland, 2004). Nevo & Wade (2010) suggest IT assets can play a strategic and synergistic role when they are combined with organizational resources to create IT enabled resources. Oh and Pinsonneault (2007) indicate that the resource-centered perspective has a strong predictive ability of IT impact on firm revenue and profitability. They also argue that investments in IT applications may directly and positively impact firm productivity. This leads to our first research question: *what IS resources (assets and capabilities) are valuable in enabling firm productivity?*

Dynamic Capabilities in IS Research

Early applications of RBV theory were criticized for having limited application to hyper-competitive environments where rapid and sudden changes are common (Teece et al., 1997). To address this issue, the theory of dynamic capability emerged to explain how firms react, adapt and respond to changes in volatile environments (Winter, 2003). Basically, the dynamic capabilities perspective suggests that new forms of competitive advantage are achieved by creating new resources to obtain congruence with the changing environment (Eisenhardt & Martin 2000). It also emphasizes the understanding of how organizations develop new resources and capabilities to support business strategy in rapidly changing environments (Montealegre, 2002). Organizational capabilities are characterized by Teece et al. (1997) as being dependent on three factors: (1) coordination/integration, learning and reconfiguration of organizational and managerial processes/routines; (2) firm-specific strategic position as defined by the firm's asset structure and resource configurations; and (3) firm history, which accounts for the path-dependent nature of capabilities. In general, capabilities and resources evolve over time as organizations learn and adapt to change. The evolution consists of three stages (Helfat & Peteraf, 2003) that begin with the founding stage, followed by the development stage before reaching the maturity stage, where capabilities become more embedded within organizational routines. Interestingly, the type of capabilities developed has been suggested to be dependent on the level of market dynamism within the external environment (Eisenhardt & Martin, 2000). For instance, capabilities developed in high-velocity markets, where uncertainty and unpredictability abound, are based on simple processes developed through rapid, iterative and experience-based learning. An organization's strategic approach is crucial to the development of capabilities that would best enhance the organization's competitive status (Raff, 2000). Therefore, studying organizational learning mechanisms that relate organizational knowledge to capability development is crucial for understanding how dynamic capabilities evolve in response to feedback and stimuli from the external environment (Zollo & Winter, 2002). The path-dependent nature of dynamic capabilities suggests repeated practice and incremental learning from small mistakes will finally lead to capabilities that are complex, difficult to imitate, and responsive to change (Eisenhardt & Martin, 2000).

In recent years, we have witnessed increasing research interest in dynamic capabilities in the IS area (Wheeler, 2002; Tan et al., 2004). For example, Rui et al. (2013) suggest that organizations with greater investment in IT capability tend to be more agile in response to environmental changes. Bharadwaj et al. (2007) argue the firm's IS capability and the complementary effects of the IS capability with interfunctional and interorganizational coordination mechanisms are significant predictors of firm's performance. Nazir and Pinsonneault (2012) assert that IS can enhance organizational agility by building digital options, helping firms to speed up decision making, facilitate communication, and respond quickly to changing conditions. Although existing IS research has examined the performance benefits of IT resources and capability (Stoel & Muhanna, 2009), there is still limited understanding of the links between the mobilization of IT resources/capability and firm

productivity. This leads to our second research question: *how do firms organize its IT and other non-IT resources and leverage IT capabilities in enabling firm productivity?*

To summarize, our review suggests that little is known about IS resource and capability development as part of a bundle of resources, nor the underlying mechanisms to be deployed in enabling firm productivity. By understanding the central role played by IS both as a resource and capability, firms can better position themselves to enhance productivity by utilising IT.

Research Methodology

We adopted a qualitative research approach with case study design (Pan & Tan, 2011). The selection of the cases was guided by the principle of theoretical replication (Yin, 2003). Our strategy was to study Batamindo Shipping & Warehousing Pte Ltd's IT capability development process to analyze how organizations may assemble, integrate and deploy their resources and capabilities to leverage IT for firm productivity. We selected and successfully obtained access to BSW's case site and carried out extensive primary and secondary data collection. The case study approach is particularly appropriate for an exploratory study since its strength also lies in its ability to explain the phenomenon based on the interpretation of data (Eisenhardt, 1989). Overall our goal was to expand and generalize theories and not statistical generalization (Yin, 2003).

Data Collection

Between January 2012 and August 2012 we collected the data. Semi-structured interviews and informal discussions were conducted with all those involved. These interviews were tape-recorded with interviewees' permission and transcribed immediately afterwards. Twenty interviews were conducted, each lasting an average of one and a half hours. The interviewees were selected from a wide variety of business functions across the organization. The interview topics and questions are summarized in Appendix A. These questions are open-ended and exploratory to allow opinions to be expressed. They allowed the researcher to interpret the interviewees' interpretation of events, as well as their beliefs. Triangulation of data was carried out for the findings wherever possible by searching for convergence among multiple and different sources of information to form themes or categories in our investigation (Creswell, 2000). This was achieved through secondary data including direct observations, as well as documents and artifacts, such as internal documentations and newspaper reports.

Interviewees were encouraged to speak freely about the processes that took place across the adoption phases of BSW's IS innovations, and how the firm leveraged IT to achieve productivity gains. Further, we interviewed an independent consultant who was the vendor of BSW to supplement the views collected from BSW's employees.

Overall, the data collection process drew on the participants' perceptions of key issues in the adoption of IT. These transcripts formed the main repository of data for subsequent analysis. Other documentary evidence used to supplement the evidence included follow-up email clarifications and verifications.

Data Analysis

We carried out data analysis by recursively iterating between the empirical data, the theoretical lens, and the RBV and dynamic capabilities in IS research literature. The iteration helped to shape our findings. We continued the iterative process until the state of theoretical

saturation was reached, that is, when it was possible to comprehensively explain the findings of the case study, and no additional data needed to be collected to improve the developed prototypes. Our analysis included reading all transcripts and documents, highlighting the descriptions and developing a list of themes that include: Skilled Expertise, Solution Compatibility with the Local Context, Technology Integration, Customer Demand, IT Outsourcing Management, IT-Induced Change Management and Performance Monitoring.

To establish the reliability of the coding, each coder was asked to quote a particular segment of the relevant texts. Coding was conducted independently and without consultation and guidance. We examined the portions of the codings where both coders agreed and measured the inter-coder reliability. Our coefficient score suggests substantial agreement between the two coders, and the result also demonstrates that the categories were clearly defined and could be located in the text with little ambiguity. As the reliability coefficient was high, each coder was subsequently asked to code separate portions of the texts. We sorted relevant interview comments and secondary reports according to the various categories and developed a list of themes within each category (Harris, 2001). The list contained the location of each comment on the transcript, the transcript number, the interview date, any links to other comments, reports, and sources of news coverage. In order to reduce researcher bias, a senior colleague was asked to take part in early analysis of some of the data. The colleague was uninvolved in the fieldwork and was, therefore, unfamiliar with the case. The role of this colleague was to bring a different and possibly more objective eye to the evidence and detect any bias in data analysis.

Case Study: Batamindo Shipping & Warehousing Pte Ltd

This section presents the case description of Batamindo Shipping & Warehouse Pte Ltd and highlights the processes of the firm's venture into IT to achieve firm productivity. The case is structured chronologically into three periods, followed by the epilogue and challenges. Figure 1 shows the key milestones in BSW's evolution of IT adoption.

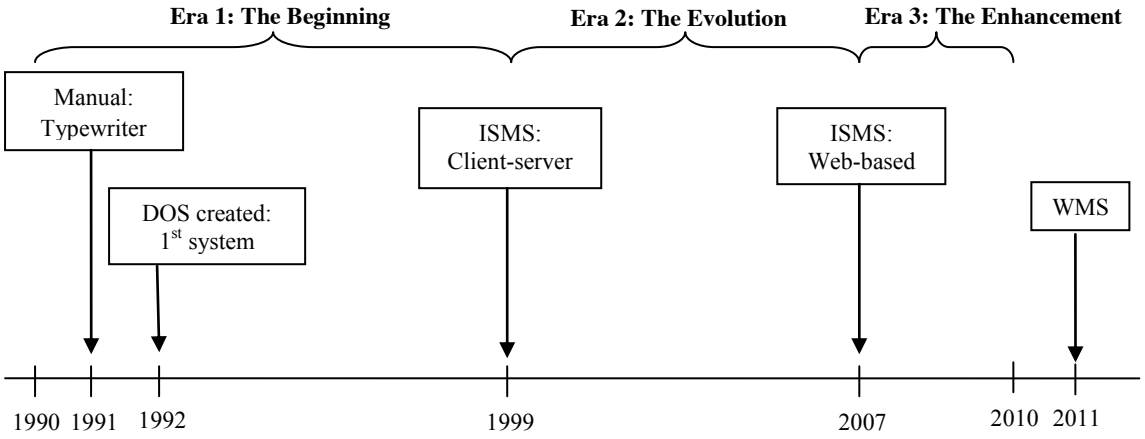

Figure 1: The Evolution of Batamindo's Inhouse IT Systems

Batamindo Shipping & Warehouse Pte Ltd is a regional logistics provider of logistics support to manufacturers and traders in Batam, Indonesia. It offers door-to-door shipping and transport services for raw material and finished goods between Singapore and the Batamindo Industrial Park of Indonesia (refer to Figure 2). Since its inception in 1990, BSW has

extended its service from core shipping and transport services to warehousing, project cargo, and international freight forwarding.

Unlike typical freight forwarder, BSW is uniquely positioned between a shipper and freight forwarder, with core business in the former. As a shipper, it focuses on the movement between Batam and Singapore, thus it has to maintain its own vessels, plan voyages and maintain containers either self-owned or owned by its customers.

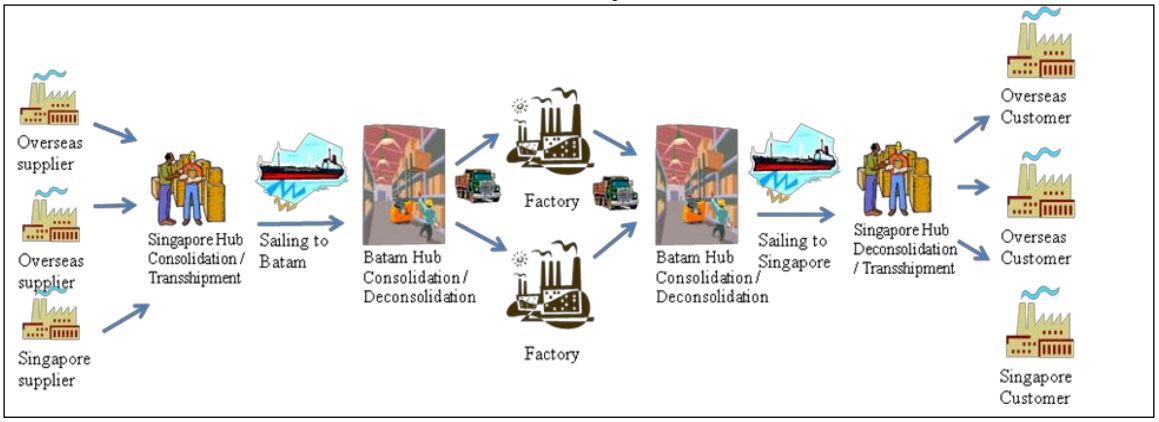

Figure 2: BSW's Door-to-door Services for Customers that used Batam as a Hinterland to Singapore

As a freight forwarder, BSW bases its operations in the Port of Singapore Authority (PSA), allowing it to make quicker trans-shipment services for both inbound and outbound sea cargo via Singapore to international destinations. By having Connecting Carriers Agreement with a number of shipping lines, BSW is able to provide one single Bill-of-Lading (BL) and offer its customers a higher level of convenience at lower cost. The logistics industry is competitive, especially for freight forwarding segment, which involves customers with high bargaining power.

BSW is the leading player in Batamindo Industrial Park, with staff strength of about 80 in Singapore headquarters and Batam. It handles the highest volume of containers in the industrial park, holding connecting carrier agreements with a number of international shipping lines, such as Maersk Lines. In its core shipping and transport business between Singapore and Batam, it liaises with a number of parties in the supply chain. These parties include shipping lines, customs, freight agents, truckers, customers, yard operators and warehouses, some of which are under the direct control of BSW while others are subcontractors or agents. BSW has implemented an Integrated Shipping Management System (ISMS) to facilitate information flow, documentation, and change responsiveness. BSW's adoption of IT in the past two decades has driven its success as a first mover in the logistics industry. For example, during the operation phase, BSW would regularly monitor its business performance to detect any need for IT improvements. This is to improve the visibility of its business performance. One way is through the measurement of key performance indicators (KPI):

> "Among the country GMs, one KPI is to ensure that 95% of the data is written to the network by the time the goods are sent." – General Manager

Visibility can be viewed as the extent to which partner firms' information/knowledge related to supply chain cooperation is visible to the focal firm through inter-organizational IS. Visibility involves two types – visibility at rest (inventory), and visibility in-transit (cargo on

the move). The former is achieved through systems such as the Warehouse Management System (WMS), whereas the latter is more difficult for smaller organizations. One suggestion for firm collaboration is via web technology:

> "Web-based technology is prevalent. The originator/freight forwarder of the shipment can collaborate with players along the supply chain to update the system information at certain point of time via portal." – General Manager

Era 1: The Beginning - Data Capture with DOS (1990 – 1999)

In 1990, BSW used typewriters to prepare manifest, bill-of-lading and invoices. As the volume of transactions was manageable, using typewriters was viable. In 1991, BSW started its thrice weekly schedule for its feeder services with barge Batamindo I. In the same year, it became the first operator for the Batam sector to operate at the PSA Marina Wharves, making it a close connection node for main line carriers to feeder their containers between Singapore and Batam. As the volume increased, typewriters became a constraint in an industry where productivity was crucial. For BSW, the efficiency of its operations was critical to meeting customer service demands. Furthermore, using typewriters greatly hindered efficiency in documentation as same data had to be reproduced for various purposes, from booking to invoicing. Hence BSW envisioned a system that could improve operational productivity.

> "Basically they needed same information. So we suggested why don't we create one system to link order booking to invoicing?" – Finance and Administration Manager

In 1992, BSW ventured into leveraging IT with a simple DOS system developed by a vendor using Dbase. This DOS system, termed "Data Capture", was implemented as BSW's first centralized digital data repository. It had the functions of storing data and creating quotations, booking, bill-of-lading and manifest, hence supporting BSW employees in their business operations.

The benefits of Data Capture became apparent as the system was embedded into BSW's internal process. Apparently, Data Capture served as single source of data for multiple data uses and generated significant time savings. Through data capture, the Sales & Marketing department could create quotations. The operations Department would process order booking and the Finance Department would generate invoice.

However, a limitation is due to workflow dependency, BSW's employees still had to write their input on paper first before entering the data in Data Capture:

> "When we record the booking, we have to first fill in some necessary information before we could enter in the system." – Finance and Administration Manager

Overall, Data Capture still generated significant time saving and minimized data entry error. In June 1992, BSW moved to a daily schedule for its feeder services, and was considered more competitive compared to its competitors.

Era 2: The Evolution – Proprietary In-house IT System (1999 – 2007)

As BSW progressed, its business needs surpassed the capabilities of Data Capture. Consequently, BSW's efforts in working around the system limitation no longer sufficed. For instance, the system lacked a search functionality to track container location, which still had to be manually traced using a T-card. Employees wrote delivery container information such as date, BL number on the colour coded T-cards and used them to count and track the location of various types and sizes of containers. They had to bear with the inconvenience of maintaining the data on the T-card and transferring to the system for other purposes such as billing etc.

In terms of reporting, only BL, manifest and invoices were printed. Other documents were handwritten. Quotation was done manually using word processors; hence information had to be retyped. Eventually, Data Capture was unable to cope with the increased volume of operations, and was subjected to frequent system overload.

The existing system and process soon turned into a constraint on BSW's operational efficiency. Hence, the General Manager decided to transit to a new system in 1999. This transition marked the evolution of BSW's in-house IT system, to the Integrated Shipping Management System (ISMS).

BSW set up a project team led by the Finance and Administration manager, who was well-equipped with business knowledge. As BSW did not have an IT function, it sourced an external vendor who possessed prior experience in developing IT systems for other logistics providers to tailor the system to meet BSW's business needs.

The business requirements from each BSW's department led to customized modules in the new system. These included the Customer Module, Quotation Module, Rates Module, Booking Module, Billing Module, Voyage Module, Container Module, and Report Module, underpinned by Oracle database. In 1999, BSW successfully launched its proprietary in-house Integrated Shipping Management System.

After the replacement of Data Capture with ISMS, BSW's employees experienced improvements in its business operations. The new system workflow was streamlined to start work at customer profile and quotation creation instead of booking in the previous system. BSW's employees were able to print out quotations directly from the system. This eliminated duplication of work. The ISMS database also removed the need for T cards as information on container movements were stored in its database.

With ISMS, validation checks were incorporated. A customer's booking could now be checked against the quotation for validity. Prior to the implementation of ISMS, employees were unable to verify the validity of the customer and the quotation, and they had to process the bookings based on their memory and the relationship they had with the customer. For instance, when a particular customer called to make a booking, only pre-approved customers would be able to make bookings:

> "If it is not a valid quotation, even when you tried to save in the system, the system would not allow it. So ISMS helped us to check if this is our valid customer and not a blacklisted customer or [customer with] expired quotation." – Operations Manager

With ISMS, employees could also download data to process statistical reports that enhance business decision making. In 2003, BSW started a shipping agency for the Maersk Line in Batam, which strengthened its position in the shipping dustry. In 2004, BSW handed over the maintenance of ISMS from its current vendor to another independent consultant.

Era 3: The Enhancement (2007 – 2010)

The initial version of the ISMS was client-server based. Over the years due to BSW's growing capacity, ISMS could not handle huge volume of concurrent processing work by multiple users. Technically, the ISMS lacked scalability and was not designed for information search. According to BSW's independent consultant:

> "What happened was that when BSW's employees needed a record, they had to wait for more than a minute just to search for an old booking." – BSW's Independent Consultant

BSW hoped that conversion from client-server to the web version would improve coordination among its Singapore and Batam counterparts.

While enhancing the ISMS, BSW reiterated its need for a customized solution that was aligned with its market position. When asked to purchase a standard freight forwarding solution, the General Manager was adamant against it:

> "If he were to adopt the freight forwarding solution, and expand it to the rest, it would not work very well for him because his main bulk of business was actually more towards shipper." – BSW's Independent Consultant

In order to learn BSW's business processes, the independent consultant team worked closely with BSW to review and streamline its existing business processes:

> "I had a chance to see how they worked at the Operations Department, how they performed billing, and how they performed at the Marketing side, so that we could speak the same lingo. For example, what is 'consol invoice'? It's important because customers did not like to receive bits and pieces of invoices. They preferred to receive a consolidated one." – BSW's Independent Consultant

After that, the independent consultant team discussed the proposed process changes with the BSW's project team, which also supported the changes strongly:

> "They (project team) were very involved in the streamlining of the processes. What we did was we actually compared what were in the old processes, and then we went through every process in detail." – BSW's Independent Consultant

After the teams went through the as-is and to-be processes, the consultant created prototypes to ascertain BSW's functional requirements before signing off the project. Throughout the system development process, BSW and its independent consultant maintained a sound working relationship:

> "We adopted a flexible approach: as we encountered problems, we consulted them and at the same time, the project team would suggest ways to change. So I would say it was a good working relationship." – BSW's Independent Consultant

The enhanced ISMS was successfully implemented in 2007.

The enhanced ISMS vastly improved the way BSW's employees performed their work. Besides allowing users to work from home, BSW's Batam counterparts could access the ISMS independently rather than having to always contact the Singapore employees for clarification.

Unlike the client-server era, when different file formats were used by Singapore and Batam employees, the enhancement of ISMS would allow both parties to use the same excel file to communicate the delivery information, hence reducing data duplication and mistakes. The ISMS was easy to use. The system was designed after close walkthrough of the workflow.

With the new system, employees performed their tasks more efficiently. For example, employees had to maintain the Rates Management Module (RMM) cost by keying each rate for each container. With the system upgrade, employees could upload the information by batch.

Also, the reporting functions of ISMS provided comprehensive information for management's strategic planning:

> "We had a weekly variance report which looked at how our loading had increased or decreased over one month period. We could also query by daily loading and by customer over the time period you specified." – Sales & Marketing Manager

The customized features of both freight forwarding and shipping management systems, along with the web-enabled feature that allowed for external connectivity in ISMS helped BSW secure its niche position in the logistics industry. Further plans that aimed to enhance ISMS with new management reporting features, and to integrate with external systems, such as PortNet, were also carried out.

As part of continuous business improvement, BSW and its vendor also explored ways to exploit the ISMS, so that BSW could open up certain modules for its Batam counterpart. An example on synthesis of information to improve business process is given below:

> "I think at the end of the day what customers want is information availability, reliability and integrity. And we have to work together with the vendors to achieve this." – General Manager

Epilogue (2010 and beyond)

BSW targeted to implement WMS by July 2011 to strengthen its warehouse management and inventory management operations. Prior to WMS, excel spreadsheets were used in the internal warehouse management operation. For example, employees would track their storage in excel spreadsheets.

Information could be transferred between the enhanced WMS and the existing ISMS. The WMS and existing ISMS support both manufacturing at Batam and the regional HQ in Singapore:

> "We needed to control goods received in warehouse. Basically we had the same information for one pallet we received and shipped to Batam, so there was no need to key in again when they received the cargo. This actually saved time on data input"- Finance and Administration Manager

BSW consulted its vendor on the compatibility of solutions with her business context. For instance, the vendor advised against investing in a global positioning system (GPS) for container tracking, as it was not cost-effective to BSW. BSW's customers might not be so concerned with container tracking because the distance between Batam and Singapore is only about 4 hours sailing time. BSW's customers were more concerned with service levels and notifications of changes to daily schedule:

> "We worked with our customers to offer an end-to-end solution in and out of Batam. Operationally, we emphasized on our service level and delivery timings to customers." – General Manager

Challenges Faced

BSW faced several difficulties during the system transitions. For example, budget consideration necessitated trade-offs in deciding system requirements:

> "Due to budget constraint, Shaun (ex-GM of Batamindo) would always say, 'Good to have, nice to have and must have…which one do you want to choose?'" – Operations Manager

Another challenge was the ability of the vendor and the system it developed in meeting BSW's business requirements. The Finance and Administration Manager said that since standard WMS functions were not suitable for BSW's business needs, they chose the only vendor (out of a total of three vendors) who was willing to customize the system.

In addition there was user resistance. Some BSW employees criticized the new system for its inability to perform certain functions, while others resisted change and preferred the old way of doing things. The development team's implementation strategy was to mandate the implementation, and phase out the old system after one month's parallel run of both systems:

> "Sometimes we had to force it down their throats. After a while, when they became used to it, they would love the new system." – Operations Manager

Process Framework: Driving Productivity through IT Capabilities Development

We inductively derived the process framework of a three-phased approach to IT-enabled productivity (see Figure 3). Our framework comprises two dimensions. The first dimension is the IS adoption lifecycle, a temporal view that is time-sliced into three phases of decision, implementation, and operation. The second dimension is a spatial view that views IT at three levels of performance, namely IT Unit, Internal Business, and External Business. This provides a comprehensive view of stakeholder groups affected by the adopted IT systems.

Within each phase, we seek to answer one key question. Figure 3 shows the three key questions in the respective 3 phases:

(1) Decision: "How to ensure that IT investment will add value to the firm's productivity?" Decision phase involves the identification of potential productivity value that can be derived from IT (Smith & McKeen, 2003). It consists of activities that "examine all the dimensions and implications (i.e., benefits, risks, challenges, costs)" of a particular IS investment decision, such as buying and implementing a software, before the IS function commits the time, money, and resources to the investment (Verville et al., 2007; Markus & Tanis, 2000; Ahituv et al., 2002). Three capabilities, namely *Grounding*, *Visioning*, and *Sensitizing*, seek to address this question.

(2) Implementation: "How to ensure that IT investment will be successfully converted to productivity-enabling assets?" Implementation phase involves the effective conversion of the IS investment to productivity-enabling assets (Smith & McKeen, 2003). It consists of activities such as project team configuration, project management, software development and configuration, testing and deployment of system (Kwon & Zmud, 1987; Markus & Tanis, 2000; Bajwa et al., 2004). Here, the *Symbiotic Pivoting*, *Moderating*, and *Co-adapting* capabilities seek to address this question.

(3) Operation: "How to ensure that IT will continually deliver productivity benefits to the firm?" Operation phase, commonly known as post-implementation phase, is where actual realization of IT productivity value occurs (Smith & McKeen, 2003). It consists of activities that stabilize the system for routine operations, such as corrective actions, and those that provide ongoing maintenance, user support, and upgrades to the system (Kwon & Zmud, 1987; Markus & Tanis, 2000; Bajwa et al., 2004). The *Meliorating*, *Structured Improvising*, and *Catalyzed Synergizing* capabilities would seek to address this question.

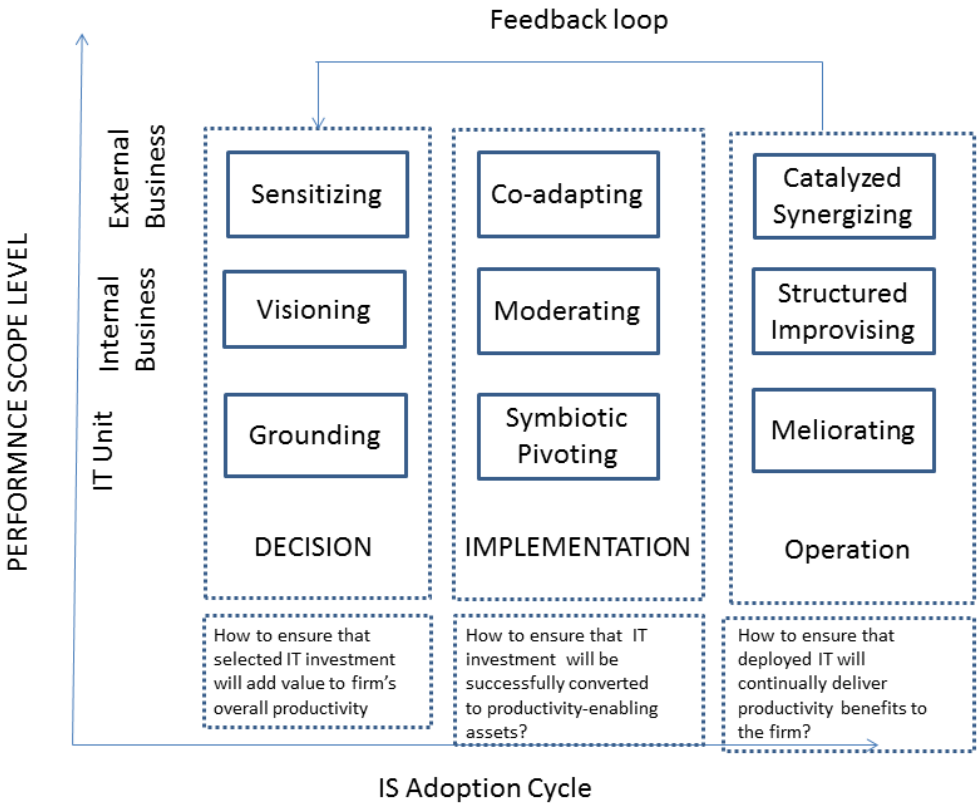

Figure 3: A Process Framework of IT-enabled Productivity

We explain the inductively derived theoretical framework in the next section.

Decision Phase

The decision phase marks the start of the firm's foray into IT, and is centered on the identification of potential productivity value-adding IT opportunities (Smith & McKeen, 2003). The key question is "How to ensure that IT investment will add value to the productivity?" The Decision phase comprises "Grounding", "Visioning" and "Sensitizing" capabilities at the IT unit, Internal and External business levels respectively. Both business and technical knowledge at the Grounding and Visioning phases of the IS adoption cycle ensure that the firm is supplied with the right IT skills and business knowledge during decision making. The Visioning capability integrates isolated domain knowledge in the Grounding capability and supports IT investment decisions. The Sensitizing capability monitors technologies for their impact on inter-firm interactions (e.g. firm-partner and firm-customer). While the Visioning capability looks at how IT improves intra-firm performance, the Sensitizing capability encompasses an outside-in approach.

IT Unit Level: Grounding

Domain Insights Pertinent to Business

Grounding capability is the ability of the firm to possess domain insights pertinent to its business. During decision phase, the Grounding capability enables the firm to identify IT investments that it may leverage for productivity. *Technical domain* and *Business domain insights* form this capability (Pan, et al., 2007). Technical domain insights refer to technical knowledge related to underlying technologies, technical platforms, and standards that are

being adopted within the firm. Business domain insights, on the hand, refer to organizational knowledge on the firm's business (e.g., business position and operation).

BSW's project was led by the Finance and Administration Manager, who had the business domain knowledge and good understanding of BSW's position as both a shipper and freight forwarder in the market. BSW also engaged an external vendor who has technical domain insights, with the experience in developing IT systems for other logistics providers to tailor the system to suit BSW's business needs. Having technical domain insights is important, especially when the IT solutions in the business context are complex. Collectively, both domains ensure that the firm possessed important IT skills and business knowledge during decision making (Nelson, 1991). The Grounding capability serves as the knowledge platform consisting two disparate knowledge domains. This can be viewed a support capability that would bundle with the Visioning and Sensitizing capabilities in order to enable the firm to make judicious IT investment decisions.

Internal Business Level: Visioning

Strategic Alignment of IT with Business

Visioning capability is defined as the ability to ensure strategic alignment of the firm's IT motivations with its central business focus. It is well-known that IT has the potential to alter the internal business processes of the firm directly (e.g. automated accounting systems, human payroll systems etc.) for productivity intentions (Swanson, 1994). This capability includes identification of business focus, and formulation of actionable IT plans. The term "actionable" means that the firm needs to visualize compatibility of the IT investment with the local context during decision making. Compatibility refers to the investment being both technically compatible with existing systems – hardware and software (Bradford & Florin, 2003), *and* having a good fit with the firm's business (Bush et al., 2009).

To ensure such strategic alignment, this capability builds on the Grounding capability, in that the isolated domain insights at the IT unit level are integrated and applied at this scope level, thereby providing actual strategic support in the planning and decision-making of what constitutes a suitable productivity-enabling IT investment for the firm.

Insights gleaned from the case data show that operational efficiency forms the core focus for logistics firms in general. Although meeting customer requirements and achieving customer satisfaction is the ultimate goal, business process efficiency is the core means by which customer satisfaction is achieved. BSW has identified business process efficiency as its business focus, to achieve customer satisfaction. Hence as such, BSW's IT strategy has always focused on internal process efficiencies such as Data Capture, ISMS, and WMS. For example, during era 1 decision phase, BSW visualized and formulated the Data Capture system to overcome the operational inefficiency of using typewriters. During the era 3 enhancement decision phase, BSW considered that its client-server ISMS lacked the search function for large volumes, and converted to the web version. When a solution does not serve the central needs of the business, it is of limited use to the adopting firm. The Visioning capability enables the firm to align its IT mission, objectives, and plans with those of the business (Reich & Benbasat, 2000). In so doing, a clear role of IT can be demarcated within the adopting firm's internal business operating environment. The negative consequences of not having either elements of this capability, such as investing in a solution that serves

limited or no usefulness to the adopting firm, and thus adds not much or no productivity-enabling value, may result in lost opportunities or wasted resources (Bush et al., 2009).

External Business Level: Sensitizing

Renewed Sense and Interpretation of Trends to External Stimuli

Sensitizing capability is defined as the ability of the firm to have renewed sense and interpretation of external trends to have an informed response to external stimuli. External stimuli refer to changes in the external environment, such as changes in regulations, laws, consumer demands, and technological advancements, which may prompt the firm to react accordingly (Overby, 2006).

Two concepts are manifested here, based on our findings. Firstly, we posit the monitoring of external technology-related trends closely, so that the firm has sufficient awareness of the trends that are related to technology standards, platforms, tools, and solutions that are emerging in its industry, and which could facilitate interaction with its business partners and customers. In so doing, the firm renews its sense of the dynamic changes occurring in its external environment. Further, as changes must not only be sensed, but also interpreted across time in order for the firm to invoke the necessary response (Crossan, 1998), we contend that this ability to interpret is intrinsically supported by the Grounding capability developed at the IT unit level, whereby the collective business and technical domain insights contribute to the firm's ability to interpret and evaluate the impact of the trends to the firm.

With this (1) renewed sense and interpretation, we posit that the firm will be better enabled to (2) execute an informed response to external stimuli, in terms of deciding whether or not to react to the external trends, and the corresponding steps or action to do so. In effect, the firm will be better informed to explore IT to enhance its interaction with business partners and customers in the ecosystem.

As with the extant literature, our case data reiterated the distinctive characteristic of the logistics industry as one that needs strong supply chain capabilities, such as technology integration and network connectivity (Bhatt & Stump, 2001). Inter-firm *technology integration* reflects "the level of technology alignment with channel partners" (Wu, Yeniyurt, Kim, & Cavusgil, 2006), which is important as a step towards activity integration, which is the "extent to which a firm coordinates its strategic channel activities such as planning and forecasting with its supply chain partners" (Wu, Yeniyurt, Kim, & Cavusgil, 2006).

The underlying reason why technological integration warrants such great attention is because its absence or lack thereof, affects firms' ability to achieve network connectivity within the supply chain network. *Network connectivity* refers to the "extent to which an organization's units and their respective databases are made accessible internally and externally via electronic linkages" (Bhatt & Stump, 2001). This ultimately affects the level of visibility that could be afforded to partners and customers, which in turn impacts coordination, efficiency and overall performance of the myriad supply chain activities.

There was evidence of case data that suggested the presence of Sensitizing capability. For instance, in the late 1990s, BSW was aware of the proliferation of the Internet, and how it could facilitate visibility and coordination with its Batam counterpart (renewed sense and interpretation). As a result, it decided to leverage the web platform to enhance its client-

server ISMS, thereby facilitating network connectivity between itself and the Batam partner (informed response to external stimuli).

Implementation

In this phase, the investment gets converted from "dollars to assets" (Markus & Tanis, 2000). IT project implementation success is viewed as the key metric in this phase. Our framework seeks to answer the question of "How to ensure that IT investment will be successfully converted to productivity-enabling assets?" At the Implementation phase, the Symbiotic Pivoting capability pulls together diverse resources such as internal project team and external vendors in IT implementation. Moderating change at the technical and non-technical levels (such as work culture) serves to *prepare* the firm for the new IT and enhance IT conversion success. "Co-Adapting" capability helps to connect with partners and customers to facilitate information flow.

IT Unit Level: Symbiotic Pivoting

Synchronized Complementary Resources for IT Conversion

The Symbiotic Pivoting capability is defined as the ability of the firm to manage the IT project with synchronized leverage on complementary resources for IT conversion success. The coordination and leverage of necessary resources and expertise is instrumental in managing the project at the IT level. As resources can be diverse and range from several sources, such as internal project team, external vendors, our research data show that the Symbiotic Pivoting capability played a requisite role in IT implementation.

The essential intrinsic element is the synchronization of the firm's complementary resources, whether internal or external, followed by leveraging on these synchronized resources for project progression. Hence, the firm must not only identify relevant project resources that complement each other, but also coordinate (synchronize) and then use these resources as a pivot (leverage) for mutual progression in the IT conversion process. Our empirical evidence resonate with the IS literature indicating a symbiosis relationship between the IT unit and the resources involved in the IT conversion process.

As we observe BSW's IT implementation trajectory from the Evolution through the Enhancement eras, BSW has consistently elucidated this ability to coordinate its internal project team and external vendor team (complementary resources), bridging the knowledge gaps between its internal and external IT resources for mutual progression (synchronized leverage) in the IT conversions (Carlile, 2002). The outcome was greater control infused into the conversion process, which was facilitated by the vendor's good understanding of BSW's processes, a proposed streamlined process flow which benefited BSW, and the development of the system with ambiguities on business or technical requirements greatly minimized at the technical implementation level (Levina & Ross, 2003). A significant implication of this finding lies in its reverberation with research that shows strategic alignment of systems that needs to be tackled both prior and during implementation in order for alignment to happen (Ravishankar et al., 2011). Overall, at the IT unit level, the Symbiotic Pivoting capability targets issues that affect project success associated with the actual system development, usually corroborated with the widely popularized concept of triple constraint, which is defined as the deliverance of a project on time, within budget, and meeting the clients' requirements (Jang & Lee, 1998).

Internal Business Level: Moderating

Ensuring Organization Readiness towards IT-induced Change

During implementation phase, it is important that the adopting firm is geared with internal organization readiness towards IT-induced change. We term the ability to achieve this as the Moderating capability, and contend that it complements the Symbiotic Pivoting capability explicated at the IT unit level previously. Based on our study, implementation success at the IT level alone is clearly insufficient for overall conversion success; our findings highlight the need to also ensure that the adopting firm is ready to not only accept, but also embrace the technical and non-technical changes that are induced by the newly adopted IT systems.

Hence, the two elements that incorporate this capability are (1) Technical change readiness – which refers to the firm's ability to manage IT-induced technical change, such as infrastructural change, and (2) Non-technical change readiness – which refers to the firm's ability to manage IT-induced non-technical change, such as work culture changes. Collectively, the two elements serve to moderate the strength of IT conversion success at the internal business level as it *prepares* the firm for the impending IT.

The need for IT-induced change management was readily apparent. On one hand, organizational cultural readiness (Non-technical change readiness) was a typical ongoing challenge for the adopting firm, as user resistance to the new system was common. This was evident in BSW, whereby voices of resistance were echoed but voices of constructive feedback were hard to solicit. User resistance could be due to the heterogeneity in technology background and learning curves among employees. However, such issues were often overcome by proper training during and after system testing, espouse and encouragement, or in the case of BSW, a top-down mandate to cut-off the old system after a one-month parallel run. By instituting formal and informal controls to cultivate culture readiness to the new IS innovation, the firm is better poised to avoid project failures, such as expectation failure, whereby user expectations are not matched by the IT systems, and interaction failure, whereby users hold negative attitudes toward the implemented IT (Aloini, Dulmin, & Mininno, 2007). On the other hand, infrastructural change poses a more significant IT-induced change which the logistics firm needs to have sufficient preparation for. An infrastructural change could arise from changes in technical platform that underlies the firm's IT architecture (Willcocks & Feeny, 2006). At the aggregate level, we find that organizational readiness towards IT-induced change needs to be tackled carefully, as IT implementation is often besieged with multi-functional change management issues of both technical and non-technical nature, all of which could affect the trajectory of IT implementation success (Smith & McKeen, 2003).

External Business Level: Co-adapting

External Connectivity via Information Flexibility

Co-adapting capability is defined as the ability of the adopting firm to maximize external connectivity potential via information flexibility during implementation, and forms the core focus at the external business scope level. Flexibility refers to the capability to adapt the IS to

new competitive environments (Golden & Powell, 2000), and the Co-adapting capability will aid the firm in overcoming temporal and spatial limitations.

Based on our findings, it is important that firms are able to connect with its partners and customers so as to facilitate information flow. We deduce that the ability to co-adapt involves firstly the need to (1) identify and explore opportunities for information flexibility – "anytime, anywhere access to and dissemination of information and knowledge" (Vannoy & Salam, 2010). This means that the solutions should as much as possible be able to scale its information reach to partners and customers when needed.

In the case of BSW, it identified the web interface as the way to achieve information flexibility in the Enhancement era so as to connect with its Batam counterpart more efficiently. Furthermore, in its implementation of WMS, it has considered electronic interfaces that could bridge communication between its ISMS and WMS so that it could improve overall interaction with its partners and customers.

Subsequently, the firm should (2) incorporate the viable technical means to pursue the identified opportunity for information flexibility. Eventually this adds value to the productivity-enabling asset conversion process, as it helps to maximize external connectivity, thereby enhancing firm-partner and firm-customer interactivity. These prescribed steps implicitly assume that the firm is supported by expertise grafted from the Grounding and Symbiotic Pivoting capabilities.

For instance, firms need to have the technical and domain insights to know what are the available technology interfaces, standards and protocols relevant to its industry (e.g. EDI, cloud computing) in order to identify opportunities. Next, the firm needs to have the knowledge lens through which it could evaluate the technical viability of the implementation to its context. In outsourcing pervasive firms, such as BSW, it leveraged the expertise of its vendor as the pivot from which to progress the implementation.

Operation

In this phase, the investment has been implemented and "actual realization" of productivity occurs (Smith & McKeen, 2003). Assimilation of IT into the firm's environment will continue iteratively, until saturation, when the deployed IT has either been fully utilized for productivity gains or it is no longer sufficient to satisfy the firm's evolving business needs. At this point, the firm might go back to the start of the IS adoption lifecycle, to consider new IT investment. This corresponds to the feedback loop in the process framework (Figure 3). In the Operation phase, firms build up the technical and business domain insights at the "Meliorating" phase. The "Structured Improvising" phase at the internal business level makes routine the changes in the daily operations and detects triggers for further improvements. When IT gets assimilated within the internal business, productivity benefits can be achieved. The "Catalyzed Synergizing" capability at the external business level maximizes firm performance in its interactions with external partners and customers. Firms need to monitor customer satisfaction in terms of visibility, *actively* seek opportunities to connect to new partners and customers by *synergizing* existing systems, and improve the way data are exchanged with partners or customers. Overall, the theoretical framework is able to analyze how a firm leverages its capabilities to harness IT for productivity gains.

IT Unit Level: Meliorating

Absorptive Capacity to Strengthen Versatility of IT

Our model defines the Meliorating capability as the ability of the firm to engage in absorptive capacity pursuit to strengthen the versatility of IT as the underlying platform through which productivity benefits can be delivered. Insights gleaned from our empirical data suggest that two main steps manifest in this capability, (1) Information and knowledge absorption for business support, and (2) Knowledge synthesis for extending IT locus of impact.

Consistent with the IS literature, IT has proven to be a significant lever for process efficiency in logistics firms, by facilitating the handling of huge volumes of transactions via computerization. IT also facilitates intra-firm cross-functional communication, thereby expediting business operations. Indeed, as seen in BSW, its process efficiency across departments was greatly improved each time it deployed a new iteration of IT system. These instances of IT-enabled improvements suggest that firms need to have (1) absorbed information and knowledge, such as useful data related to customer, partner and business operations, followed by (2) synthesis of these information and knowledge gathered, aided by analysis skills (e.g. business process re-engineering), in order to discover new insights on how IT could extend its locus of impact at the business levels. Hence firms could work together with vendor, like in the case of BSW. This is also the phase whereby firms build up the technical and business domain insights to strengthen its Grounding capability.

Internal Business Level: Structured Improvising

Regulated IT Process Improvements

In the operation phase, the deployed IT needs to be routinized into the daily operations of the firm so that the purported productivity value can be realized. At the internal business level, we observed that besides routinizing the deployed IT, there is a need for regular monitoring and improvement of IT to ensure that it will continually deliver productivity benefits at the firm level. As such, the penultimate capability explicated by our model is that of Structured Improvising, referred to as the ability to ensure regulated process improvements with IT as the central fulcrum. Based on insights gathered from our study, we surmise that firms need to undertake three recursive steps to achieve this.

Firstly, upon implementation success, the firm needs to (1) routinize the deployed IT with organizational business processes and work practices. We note that if the firm has sufficiently ensured organization readiness in previous phase (moderating capability), then during this phase user resistance could be better moderated, as explained previously. When the IT gets assimilated with the internal business environment, eventually productivity benefits start to become apparent, as in BSW where multi-user concurrent query was no longer saddled by system overload and hanging during the web-based ISMS era.

After which, there is a need to (2) detect trigger for improvement. This is to ensure that the deployed IT continues to generate productivity benefits to the firm, since business needs are ever-evolving (Motjolopane & Brown, 2004). An examination of BSW's systems evolution stages revealed that BSW did this by monitoring performance. For instance, over the years the client-server ISMS became unsuitable to cater to BSW's growing capacity. BSW noted

that it took more than a minute just to search for an old record, an overly long waiting time which it could not afford, and hence signaled as a trigger for improvement.

Eventually, upon detecting the trigger, firms should (3) improvise for business process improvement. This is to maximize IT exploitation, denoted as the "use and development of things already known through refinement and extension of existing competencies, technologies, and knowledge" (March, 1991). For instance, a participant's firm underwent three iterations of system developments over time to arrive at a system that is increasingly aligned with its business needs. In fact, the case of BSW is similar. We notice that each time BSW detected a trigger, it tried to improvise and improve its business performance by working around the existing IT. However when its workarounds no longer sufficed, it then transited to new system, leading the firm back to the decision phase whereby a new IT investment is considered. Hence we note that intrinsically, this is the phase whereby conceptualization of IT investments can start to occur when assimilation reaches saturation point.

External Business Level: Catalyzed Synergizing

Dynamic Service Enhancements Expedited by IT

Here, we focus on the external business level during operation phase. Maximizing the performance of the firm in its interactions with external partners and especially customers is important in the firm's day-to-day operations, and from our study IT is a potential catalyst for continually delivering productivity benefits in this respect. Insights derived from our research suggest IT can expedite the process of enhancing the firm's services, and can be achieved by active synergy of the firm's existing deployed IT. Consequently, we term this ability to ensure dynamic service enhancements expedited by IT as Catalyzed Synergizing capability.

Our data shows that the ability to provide visibility is seen as an important capability in logistics industry. Visibility can be viewed as "the extent to which partner firms' information/knowledge related to supply chain cooperation is visible to the focal firm through inter-organizational IS" (Kim, Ryoo, & Jung, 2011). Visibility-in-transit is challenged by lack of control of location status tracking, especially for smaller organizations.

Yet, visibility remains a strong customer demand in logistics sector. Further, the logistics industry is competitive in nature, thus firms have to consistently "prove their worth" in order to win customers' loyalty to their services. This is especially a concern for freight forwarding segment involving mainly visibility-in-transit, in which the bargaining power of customers is considerably high, as switching costs are not as high as those in the warehousing & inventory management segment involving mainly visibility-at-rest. As such, there is a need for firms to continually increase its integration with partners and customers so as to enhance its service reach (Malhotra, Gosain, & Sawy, 2007).

Our findings suggest implications, such as the need for logistics firms to monitor customer satisfaction in terms of visibility, *actively* seek opportunities to connect to new partners and customers by *synergizing* existing systems, improve the way data is exchanged with partners or customers, so that the firm can reach out to its partners and customers further. Indeed, as evidenced in the case, BSW was actively discussing opportunities to interface its internal web-based ISMS with the external PortNet system.

In essence, in the operation phase, firms should focus on active capitalization of IT as the catalyst from which to improve and enhance its service reach to more customers and partners, via creating synergies between existing intra- and inter-firm systems to better firm productivity at the overall external business level.

Implication and Conclusion

Overall, we inductively derived a process framework that provides spatial and temporal perspectives for organizations to manage their IT adoption so as to achieve firm productivity. We identified nine core areas that the adopting organization should focus along dimensions of performance scope levels and IS adoption lifecycle. Overall, our study makes two major contributions to existing IS literature. First, this research offers an empirical study that explains how firms leverage IS to achieve firm productivity – a topic that is little known in existing IS literature (Maes, Haes, & Grembergen, 2011). Second, our study offers an empirically grounded IT-enabled firm productivity process framework. In so doing, our framework can serve as underpinnings for future advancement of theoretical knowledge in this area.

Beyond its theoretical implications, findings from this study also illuminate notable practical significance. First, this study provides important insights to policy planners and IT managers on the impact of IT on firm productivity, which enables them to make better decisions on how much to invest in IT and whether the acquisition of complementary assets is necessary to make their IT investments work. Second, our framework serves as guidance for IT managers in both public and private organizations. Managers can use our findings as a reference to developing and leveraging their resources and capabilities to achieve firm productivity.

Overall, our research has not only contributed to academics, but also yielded significance in practice. It is hoped that managers who utilize our process framework find it useful to harness their diverse resources and capabilities to successively exploit IT to its fullest potential for firm productivity amidst the dynamic competitive environments today.

The limitation of this research is that although a single case research method provides a typical and sound approach in qualitative research (Lee & Baskerville, 2003), there exists the problem of generalizability or external validity (Walsham, 2006). While we acknowledge statistical generalization is impossible from a single case, we posit that our study is still generalizable beyond its singular context since our process framework is grounded in empirical evidences derived not only from the case interviews, but also corroborated with established extant literature. For future research, more work can be directed at statistical validations of the propositions within our framework. Further studies can also investigate the extensibility and robustness of our framework to specific firm-level contexts through more empirical studies in different industries.

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Appendix A – List of Interview Topics and Questions

To plan IT strategy well, IT staff must have industrial insights and technical knowledge in system interoperability.

1. Does the IT department understand how logistics industry operates?
2. Does the IT department understand how systems interoperate with systems outside the organization?
3. Does the IT department have the technical knowledge to assess IT technologies that facilitate interoperability?
4. Does the IT department influence IT decisions?

The organization has IT roadmap to enhance business process efficiency.

5. Does the organization have a roadmap on how to improve internal operation using IT?
6. Does the organization place sufficient focus on enhancing internal business processes?
7. Does the organization use innovative ideas to improve internal operation?
8. Do the employees contribute to IT roadmap?
9. Has the IT Roadmap been communicated well to stakeholders?

The organization scans and adopts IT technologies that impact industry

10. Does the organization actively review industry trends in using IT?
11. Does the organization actively monitor new IT technologies adopted in industry?
12. Does the organization actively consider adoption of IT technologies adopted in industry?
13. Does the organization actively seek new IT technologies that can improve visibility for customers?
14. Does the organization actively seek new IT technologies that can integrate better with business partners?

IT Project Team has good technical knowledge during IT implementation to enhance operational efficiency

15. Does the IT team have in-depth technical knowledge?
16. Does the IT department give sufficient focus on operational efficiency?
17. Does the IT team have technical background to evaluate vendors' solutions?

The organization ensures organization Infrastructure is ready when implementing a new system

18. Does the IT department ensure the infrastructure can support the IT roadmap?
19. Does the IT department assess existing infrastructure before deploying a new system?
20. Is the organization able to overcome staff resistance to system change?

Our organization leverages on interoperability technology when implementing IT systems that reach out to customers or partners

21. Is the solution scalable to connect to other systems in the future?
22. Is the solution flexible to be integrated with business partners?
23. Is the solution flexible to be integrated with existing or potential customers?

IT staff has skills to provide operational insights via data analysis

24. Does the IT department collect useful data related to operation?
25. Does the IT department analyse operational data to understand process performance?
26. Does the IT department share operational data with other departments?

Our organization continues to improve operational efficiency by process enhancement and staff training on using IT systems

27. Do the internal processes continue to improve via the use of IT?
28. Do the staffs use IT effectively because they are comfortable with IT?
29. Do the staffs have sufficient training to use IT systems effectively?

Our organization continues to enhance our reach to more customers and partners with more integration

30. Does the organization seek opportunities to connect new partners to existing system?
31. Does the organization seek opportunities to connect its customers via the existing system?
32. Does the IT department continue to improve the way it exchange data with partners or customers?
33. Is the organization ahead of its competitors in using IT to reach out to customers and partners?