TOWARD MANAGEMENT INNOVATION FOR IT-ENABLED OPERATIONAL AGILITY: A DEPENDENCIES PERSPECTIVE

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Abstract

Firms make large investments in enterprise IT systems expecting positive impacts to their supply chain operations. Yet, though systems facilitate the responsibilities of multiple stakeholders, their success is not determined merely by its adoption. This study shows how management innovation is developed to affect operational agility of a firm. The model suggests that operational agility in supply chain requires constructing dependency structures and implementing coordinating mechanisms, to develop management innovation processes. In addition, the study prescribes a set of actionable guidelines to help managers classify and manage innovative firm management practices.

Keywords: Operational Agility, Management Innovation, Interdependencies

1 INTRODUCTION

Operational agility, the ability to execute the identification and implementation of business opportunities quickly, accurately, and cost-efficiently, is an important determinant of firm success (Sambamurthy et al. 2003). It is a capability that when leveraged, allows the firm to sense environmental changes and respond effectively (Overby et al. 2006). IT plays an important enabling role for operational agility in firms and in their supply chains (Overby et al. 2006). Practitioners are increasingly aware of the need for IT programs to support rapid responses to immediate business issues. The annual Operational Agility Forum, which was convened in 2009 by senior business and IT professionals, focuses on exploring new ways of empowering business operations to delivering operational agility with the IT function. Accordingly, many scholars have contributed to the knowledge of IT-enabled operational agility in supply chains (Agarwal et al. 2007; Huang et al. 2012; Lui et al. 2007).

In practice, though often carefully rationalized in advance, firms fail to realize all expected benefits immediately post IT-implementation, such that expectations of IT systems are often disassociated from their continuance (Bhattacherjee 2001; Nevo et al. 2007). Organizations could take years to realize the full potential of contemporary software applications, hence firms face the ever increasing pressure to justify IT investments (Wei et al. 2007). This for instance, severely undermines the realization of benefits in supply chain enabling commercial packages, such as advanced planning systems (APS) (e.g. Lee et al. 2002), scheduling and controlling systems (Shobrys et al. 2002). Hence, scholars suggest that packaged systems must be accompanied by new practices as benefits of new practices are partially offset by the learning curves associated with them (Hendricks et al. 2007; Strong et al. 2010). This, the generation and implementation of a management practice, process, structure, or technique at the operational level, is sometimes referred to as management innovation (Birkinshaw et al. 2008). Management innovation represents insights on what managers do and how they do it to achieve competitive advantage for their firms (Vaccaro et al. 2010).

Despite knowledge of management innovation development to achieve IT-enabled operational agility, few suggest how. The study of management innovation development is a gap that still eludes researchers (Birkinshaw et al. 2008). Although management scholars view innovation as the most important determinant of firm performance, the focus of the scholars is mainly on innovation as an outcome (Crossan et al. 2010). We conducted two case studies of IT systems use to enable supply chains in firms from India and Australia to apply our model. From our analysis of the empirical data, we derive a model to illustrate how firms achieve supply chain operational agility through management innovation. Operational agility is achieved through developing coordination loops across planning, production and order fulfilment.

2 LITERATURE

A literature review was conducted, involving the examination of two bodies of literature: (1) supply chain and operational agility and (2) management innovation and dependencies in firms.

2.1 Supply Chain and Operational Agility

Developing an agile supply chain–a dynamic network of organizations and linkages in the different processes (Christopher 1998; Stadtler 2004) –is a critical determinant for firms' success in responding to customer demands and producing product and service value for consumers (Agarwal et al. 2007; Huang et al. 2012; Lui et al. 2007). This requires integrating organizational units and coordinating materials, information and financial flows to improve competitiveness. Conceptually, this is similar to achieving operational agility, the ability to execute the identification and implementation of business

opportunities quickly, accurately, and cost-efficiently (Sambamurthy et al. 2003). Extant literature has suggested that IT systems play an important enabling role for operational agility in firms and for their supply chains (Overby et al. 2006). IT supports operational agility capabilities and allows the firm to sense environmental changes and respond effectively (Overby et al. 2006).

Despite this, studies indicate that humans, and not tools, play an essential role in defining the planning process and planning model. Scholars argue that the knowledge about hierarchical planning, goods, structures and algorithms is still insufficiently developed to allow for easy implementation using IT tools (Zoryk-Schalla et al. 2004). The bulk of supply chain management (SCM) related literature focuses less on the nature of goods supplied and organizations' operating mantra and more on planning systems and supply chain processes improvement. For instance, Stadtler (2004) looked at main shortcomings of software for advanced planning in the supply chain; Meyr et al.(2002) looked at software modules covering the supply chain; Lodree Jr.'s (2007) paper investigates a supply chain system solution to backlogged items, lost sales, and contractual disagreements. These studies make important contributions on how the supply chain process is optimised using SCM systems. We are in view of a more holistic take. Prior literature suggests that when different cohorts use systems differently and cohorts themselves work in tandem for the systems to realise operational goals, sources of innovation at a management level must exist. Case-in-point: while operational cohorts create records and financial reports, managers authorise payment and thereafter coordinate marketing strategies (Parr et al. 2003; Wu et al. 2007).

2.2 Management Innovation and Dependencies

Management Innovation at an operational level is the generation and implementation of a management practice, process, structure, or technique that is without known precedent and is intended to further organizational goals (Birkinshaw et al. 2008). Management innovation is important when firms latch onto a single new practice or new technology and expect it to solve their problems; they are inevitably disappointed (despite the advertised benefits). Commercial software are accompanied by vendor hype and stories of implementation failure, hence many studies suggest that software must be accompanied by new practices as benefits of new practices are partially offset by the learning curves associated with them (Strong et al. 2010) and organizational lag (Damanpour et al. 1984). For this, the process of management innovation needs to be developed (Birkinshaw et al. 2008). Briefly, the term 'process' covers the underlying logic that explains a causal relationship and concepts of organizational actions, such as rates of communications and decision making techniques, in an organizational entity's existence over time (Van De Ven et al. 1995).

Incidentally, Nah et al. (2003) and Shang and Seddon (2002) illustrates the value and appropriateness of managers' inputs for software implementation and adoption success. Organizations look to managers for strong leadership to champion IT use and to drive organizational change (Bassellier et al. 2003; Kotter et al. 2008) in two ways. Firstly, leadership in innovation is linked with organizational and contextual factors through managers that play direct and indirect roles in coordinating innovation processes and relationships (Crossan et al. 2010). Secondly, managers implement deductive innovation structures through their decisions and actions to deliver innovation (Regener 2003). These are reflected in the two constructs below, such that management innovation requires constructing interdependent networks and implementing coordinating mechanisms in firms.

2.2.1 Interdependent Networks

Studying the effect of interdependent networks in firms remains a central concept (Lenox et al. 2007; Munksgaard 2010; Sirmon et al. 2009; Tomkins 2001), such that it allows understanding both intra and inter firm decisions on performance (Caglio et al. 2012). Interdependence refers to the extent to which departments and/or workers depend upon each other for resources to accomplish their tasks (Gerdin 2005; Macintosh et al. 1987). Increasing interdependencies between departments and workers

poses significant challenges as it creates additional information requirements to facilitate workflow coordination and creates higher levels of uncertainty in decision-making contexts between departments (Gerdin 2005). Hence, high or low levels of interdependence poses acute challenges when deciding the appropriate configurations of firm activities, given their current environment, to achieve competitive advantage (Siggelkow et al. 2003; Teece 2009). Those challenges aroused by high or low levels of interdependence will stimulate more appropriate management practice, leading to management innovation (Teece 2009).

Low levels of interdependence typically imply that tasks performed between departments and/or workers are fairly repetitive and familiar, which means that the number of exceptions that can occur during task execution are relatively few. In lower levels of interdependence, relative certainty about objectives also implies highly standardized processes where the decision-making process is straightforward, and the outcome fairly well predicted (Gerdin 2005). On the other hand, **High** levels of interdependence typically imply tasks are likely to create an increasing level of uncertainty in the decision-making context. In higher levels of interdependence, products or project tend to be highly customized and the absence of standardization at high levels of interdependence makes it difficult to anticipate which problems will be encountered during task execution (Gerdin 2005).

2.2.2 Coordinating Mechanisms

Different work structures demand different coordination methods in terms of rules and operating procedures, adaptive planning and scheduling, and mutual adjustments at the very least (Munksgaard 2010). The adjustments on work structure will require more appropriate management practice as coordination methods change (Gerdin 2005). Hence, scholars have purported that workflows range from autonomy (for lowest form of pooling interdependency), and linkage of organizational departments in serial fashion (for sequential interdependence) to project and mutual adjustment among the specialized departments (highest form of reciprocal interdependence) (Gerdin 2005; Macintosh et al. 1987; Thompson 1967). As interdependence varies, information needed must be current, timely, and pertain to unpredictable events. For instance, as tasks become increasing interdependent (such as data mining and coordination), the exchange of current information in a timely fashion is necessary to ensure that activities are on schedule and conversely that resources are employed for analytical and strategic uses. The strategic role of IT systems as coordinating mechanisms of interdependent relationships in a firm is widely recognised (Kumar et al. 1996). The premise is that uncertainty and organisational conflicts, typically over resources and decision-making, can pose a threat to cooperative processes. And the use of IT may potentially reduce the risk of loss of resource control (Kumar et al. 1996). When relationships between units are highly interdependent, the need for structure is easily satisfied by the simplest coordination mechanisms and IT. A less structured relationship requires more complex and ambiguous coordination mechanisms, and is not likely to fully contain the contingencies in the relationship.

3 RESEARCH METHOD

The study follows a case study design (Pan et al. 2011) where we focus on a particular phenomenon of IT systems use by managers to support the supply chain. This design emphasizes a systematic way of looking at the events, collecting data, analysing information, and reporting the results. The case approach is appropriate as we seek in-depth answers to an exploratory and investigative set of ‘how’ questions such as: How does management innovation develop and how does it support IT-enabled operational agility? We focus on reflections of the manner or the actual activities completed when a manager interacts with the supply chain systems. We analyse the breadth and depth of how managers interact with IT systems. We analyse the development of cognitive states when a manager interacts with the IT systems, from tentative and transactional to more fluent and matured, hence the depth and the proficiency that a manager demonstrates on the system at that level at a point in time.

3.1 Case Descriptions

The first case study describes Aus-P, a major milk and dairy products supplier in Australia. The case reveals how Aus-P manages its expectations of the IT systems in facilitating their supply chain, with due consideration for the nature of its Fast-Moving Consumer Goods (FMCG) and its operating mantra. The second case study focuses on four of the largest firms operating in one regional location in India. The case reveals how firms operate to provide agri-service, fuel, utilities and medical products for the provincial state.

The selection criterion for the case firms and interviewees are (1) the use of enterprise IT systems is predominant in the firm, and for a variety of work processes, (2) all interviewees hold managerial positions in their organisations for at least a year (this ensures all interviewees had one to two years of experience with the ES in their organisation excluding prior experience of a similar sort elsewhere, hence longer-term post-implementation ES use), and (3) the firm must be large so that complex processes can be studied. All potential interviewees were initially contacted by email. From the original pool of approx. thirty candidates contacted, fourteen interviewees across the two studies confirmed their participation and were subsequently contacted to arrange interview times and dates, and to provide their working-profile details. The demographics, and profile descriptions of each of the fourteen interviewees and their organisations are summarised in Appendix 1 and Appendix 2.

3.2 Data Collection and Analysis

Data collection was conducted through face-to-face and telephone interviews. Each interview lasted sixty to ninety minutes. We used an interview protocol (Firestone et al. 1982) to facilitate the interview (Robson 1993). We did not maintain strict adherence to them (Myers 2009) and included a mixture of probing questions (Taylor et al. 1998), as we seek to retain the elements of freedom and variability within the interview (McCracken 1988). The protocol does not indicate the order of the questions during the interview, as these are intermingled according to the direction that the interview takes. Sample questions in the protocol are attached in Appendix 3. When new themes were identified in initial interviews, questions were added to the protocol for subsequent interviews to test such themes. Questions generally pointed to the main constructs in our conceptualized model. Interviews were recorded and transcribed to ensure that a complete record was maintained (Bryman et al. 2007; Seidman 2006) and data analysis proceeded at the same time as data gathering.

We perform selective coding on the collected data (Strauss et al. 1990). The purpose is to abstract a set of themes from categories coded from the interview transcripts (Bryman et al. 2007) that we can use. We revised the statements from one manager and compared other details of the interview and our theoretical underpinnings against the revision. We continued to compare the revisions with the second, third and subsequent interview notes. Constant moving back and forth between initial statements, the first sets of statements from the interview data, theoretical perspectives, and consulting relevant literature becomes the foundation of the coding activity. Data collection was conducted across a two year period, from 2010-2012. Data from the interviewees is supplemented with company publications and corporate websites, to add questions and to understand the topic fully.

4 STUDY FINDINGS

The objective of this paper is to examine how management innovation is developed to lead IT-enabled operational agility in supply chain, such that agile supply chain is a critical determinant for firms' success in responding to customer demands and producing product and service value for consumers. Therefore, when conducting the cross-case analysis, both case studies were focused on their management innovation actions in supply chain. Supply chain performance can be easily measured by how well systems modules support the cash-to-cash cycle time - in other words, supporting the material flow across a supply chain and related, value-adding business functions: procurement,

production, distribution as well as sales. Herein, the planning process (long term to short term) permeates and dominates all the four processes (Stadtler 2004). Therefore, the influence of management innovation on those supply chain processes is our first theoretical angle for analysing subsequent cross-case findings.

According to the logic sequence of those supply chain processes, we consolidated three process categories: planning (and procurement) tasks, production tasks, sales and distribution tasks. When analysing the cross cases, by following the theoretical constructs, for each process category, we first excavated the challenges they were confronting for management innovation, and then deeply analysed how management innovation actions were executed due to the implementation of the enterprise IT systems, through dissecting their interdependent networks and coordination mechanisms. Finally, the outcomes related to operational agility in supply chain processes, resulted from the management innovations, were consolidated. For each theoretical construct, empirical constructs were revealed from the case data and grouped with their representative quotes from both case study interviews.

4.1 Planning Tasks

Highly perishable foods with a very limited shelf-life like milk and dairy products are often referred to as Fast Moving Consumer Goods (FMCG) (Nijssen 1999). FMCG are sold quickly at relatively low cost, the absolute profits made on FMCG products are relatively small, and FMCG, in general, are sold in large quantities. The nature of FMCG therefore poses many challenges for the firms' cash-to-cash cycle and its' planning systems.

Aus-P is a major milk and dairy supplier for large and small distributors and retailers in Australia. Price elasticity – fluctuant demand of consumer causes differences in prices – is another key consideration for forecasting future demand and what the company should produce and in what capacity. Moreover, seasonality requirements affect the development of detailed production schedule following demand planning, impacting further on the determining of the amount and timing of raw material orders (materials requirements planning), and ultimately on staffing and production.

Unlike other industry sectors, FMCG companies produce goods that must be delivered and stored in warehouses under extreme controls, and require systems that will not only execute the processes but make critical adjustments when customer demand differs from forecast. Hence, achieving operational agility in planning and procurement becomes critical for Aus-P to maintain high level customer satisfaction and competitive advantage.

Before implementation of the enterprise IT system, some staff had been working in the case for several years and they had been accustomed to their manual calculations on planning reports. At the early stage of the system implementation in 2003, some of those staff was reluctant to change their routine work style. "*It did take time, to take one month or two months for people to accept it.*" said by the Production Planner. Reluctance from the employees was a huge challenge for the innovation of the management. Therefore, IT staff and senior managers spent an amount of time on educating the staff at planning, procurement, warehouse, sales, branches, etc. and persuading them to utilise the new system. The Production Planner continued to explain: "*once people started to see the benefits financially, then they started accepting it.*" After round one year, through the "door-knocking" strategy, all branches and depots formed an interdependent network bounded by the new system. Empowered by the new system, business units were integrated and shared timely, accurate, consistent planning information. Moreover, the standardization of the enterprise IT system compromised the hardness of merging other firms. In late 2009, Aus-P successfully completed the acquisition of fresh milk business from another large food company. Because the acquired company adopted the same enterprise IT product, the acquisition process was smooth and efficient. With the integration of the system, business units commenced to coordinate closely, which has brought operational agility in executing the planning and procurement tasks. A summary of the theoretical constructs, empirical constructs, and representative quotes of how IT-enabled planning and procurement agility was achieve through

management innovation is provided in Table 1.

Theoretical Constructs	Empirical Constructs	Representative Quotes
Management Innovation Challenge	Cost Fluctuations	"Fluctuant demand of consumer causes differences in prices, is key consideration for forecasting future demand and what the company should produce and in what capacity, the amount and timing of raw material ultimately affects on staffing and production."- Demand Planner, Aus-P
	Resistance to Process	"…we had depot managers calculating and sending daily stock requirements in a piece of paper…they have been doing that for decades…to them the change was huge…they did not see a difference between what they calculated and what the system proposed…" - Demand Planner, Aus-P
Constructing an Interdependent Network	Door Knocking	"…In the first year, we went from depot to depot preaching managers of the capabilities of the [SCM] system…we wanted to show them that the [SCM] system is capable of doing IF they use it for their daily demand calculations...and it worked…" - Demand Planner, Aus-P
Coordination Mechanism	Standardization (of Systems)	"The ideal situation is there is a standard SCM system, which all companies are using. All companies are using the same SCM systems, and then the interfaces between different systems are smooth"- Supply Planning Manager, Aus-P
Operational Agility Outcome	Information Sharing and Collaborative Network Established	"APO is more straightforward, like you can see all the calculations. From my point of views, it is perfect…all the data from the same system, we just use like different production profile, like the calculation once a day, we use the same system but we look at different products." - Supply Planner, Aus-P "I think this (integration and coordination of all the links in the supply chain) can be realized later, but not in a short time."- Supply Planning Manager, Aus-P

Table 1. Achieving Agility through Management Innovation in Planning Tasks

4.2 Production Tasks

For manufacturers, production is the core business process, such that production process is directly related to the quality of the products and their supply efficiency. Before the implementation of the system, production staff frequently needed to answer and dial-up calls from sales, planning, financials, procurement and warehouses. Unfortunately, the production process was yet disappointed by multiple sides, such that it was common to forget or delay customers' orders. The Production Manager complained: "*What we did before the system? Well, a lot of confusions. For example, we are producing a key customer order in our assembly line. Suddenly, we got a call from the sales guy, saying that we have new extra order. What we should do? Continue the current production schedule or change it immediately? For this, we have to call other people, like warehouse, financial, and procurement…to negotiate it.*" Moreover, due to the isolated working style of business units, people cannot share insistent and timely information. Such information asymmetry is prone to lead to mistakes in production plans.

In order to overcome those challenges and achieve operational agility in the production process, production management in Aus-P took full advantage of the new system to establish their financial priority chain position and expand the production network. Due to the powerful function of the system, accurate production planning and detailed scheduling were formulated. The supply planning manager in the Head Office assigned the total customer orders to different regional subsidiaries, and made detailed production scheduling for each factory. This has greatly improved the efficiency of

production and the interlacing of processes in Aus-P. Coding structure is the master data of the system, and is also the foundation of coordination between business units. Both Aus-P and the four firms in the second case study designed unique goods coding structures to enhance internal coordination and differentiate from the outside partners. Through such IT-enabled management innovation, the production process has achieved operational agility and a sequence of interrelated benefits. The Logistics & Supply Chain Manager explained: "*the satisfaction and service is the end-in, and financial performance is obviously critical. You will have more money coming in or your cash flow will improve once you have got tight in your core business…when we are trying to achieve this, the most important thing is that it has to be linked, it has to be done efficiently, so I would rate efficiency as the second most important thing… you're trying to achieve high levels of customer satisfaction, you have to achieve in an efficient manner. And the quality control of efficiency will lead to, you know, productivity improvements and all that.*" A summary of the theoretical constructs, empirical constructs, and representative quotes of how IT-enabled production agility was achieve through management innovation is provided in Table 2.

Theoretical Constructs	**Empirical Constructs**	**Representative Quotes**
Management Innovation Challenge	Coordinating Disparate Units	"Everybody knows that the concept of coordination, but now, the interface between systems are horrible, you use yours, and we use ours." - Supply Planning Manager
Constructing an Interdependent Network	Priority Chain	"Yes, the financial improvements probably would be the next in line, because the impact of the financial is a main thing. So I just make that priority No. 2."- Logistics & Supply Chain Manager
Coordination Mechanism	Sequential IT	"IT is driving our operations, and our delivery efficiency…that is almost like beginning thing, you are relying on the sequences"- The Logistics and Supply Chain Manager, Aus-P
	Coding Structures	"For example, now we have created a code for our materials. If the raw material is from the outside, it will have different code. Or if the material is manufactured from outside and if you have used a different system from an outside facility, they will return to our company with a separate code." Assistant Operations Manager, TPA Limited, Techno-commercial department
Operational Agility Outcome	Process Interlace and Efficiencies	"I see a sequence of benefits (one after the other) rather than an overlap"- Logistics & Supply Chain Manager, Aus-P

Table 2. Achieving Agility through Management Innovation in Production Tasks

4.3 Sales and Distribution Tasks

FMCG products are generally replaced or fully used up over a short periods (some within days), thus logistics (transportation and warehousing) becomes particularly important. Before the system, sales and distribution staff faced an amount of issues in their routine work, due to knowledge constraints. The sales guys attended weekly meetings with planning and financial departments to derive detailed demand planning, supply network planning, production planning and scheduling, through providing sales history reports and sales order forecast. The sales staff needed to spend a large amount of time on analysing the sales history and forecast. When new orders come from customers, sales staff was responsible for coordinating with warehouse, production, procurement, financial, etc. to check out whether the warehouses and the factories have the capability to supply the new order on time. Exceptions and contradictions occurred when the cross-department coordination were conducted. The straightforward consequence was lower customer satisfaction. Furthermore, due to knowledge constraints on designing the most effective transportation line to distribute goods to customers, increased transportation cost and complaints from customers were common.

Theoretical Constructs	Empirical Constructs	Representative Quotes
Management Innovation Challenge	Knowledge Retention/Constraints	"She taught me only what she used to do. If software can give me 100 solutions, but if she only knew 20 solutions, then I only know 20 solutions." - Assistant Product Manager, TPA Limited, Marketing division
Constructing an Interdependent Network	Ad-hoc and Flexible Added to Established Protocols	"There are protocols, you've to follow some protocols in doing things...but if I have issues that are very important, I can't figure out; I'll go first to the finance people. They're better…that will be my first point of contact." -Store Manager, F group, Store operations
Coordination Mechanism	Continual Adjustments to Reporting and Requirements	"Every month we run the reports and tell HQ where they should be focusing their efforts. Whenever we are free, we will try to produce different formats, representations of same reports." - Assistant Payment Manager, TP Limited, Treasury and Finance "When customers have new requirements, they can tell our sales guys. If the [SCM] system shows our factories are very busy now…and if the customers are OK with delays, Then our sales guy input the new order to the system and our demand planners will adjust the demand and production plans." - National Demand & Supply Manager, Aus-P
Operational Agility Outcome	Flexibility in Process Structure and Information Sharing	"There's a separate way I do my work now. Even the lady does her own way. My steps are defined and tells me how I can create efficiency, nobody tells you. It's very subjective."- Assistant Product Manager, TPA Limited, Marketing division

Table 3. Achieving Agility through Management Innovation in Sales and Distribution Tasks

In order to relieve this severe circumstance, managers from Aus-P and the four firms in the second case study were keen to deploy the new enterprise IT system to improve the performance of sales and distribution. Whenever obstacles and exceptions occurred, the sales and distribution staff first checked on the timely financial condition and budget, then viewed the real-time information of other departments, such that through the system integration, the sales and distribution staff can provide a rapid reply to the customers and adjust their sales report and transportation strategy. Furthermore, the system enables the firms to have powerful reporting capability. Sales reports are not only the 'treasured book' of sales staff but also a 'compass' for the whole company. Based on different requirements, by filtering the properties and formats, the system can generate a variety of standardized sales reports, which can be utilised by staff around the company, especially for financial department and senior managers, to make strategic decisions. Through the improved process and flexible reporting in sales and distribution, enabled by the new system, operational efficiency and customer satisfaction have derived. The National Demand & Supply Manager in Aus-P revealed: "*You know, the productivity achievement, process improvement…that's sort of the basic and very top line benefit, but that really happens, really happens in terms of, at the end of it, the customer satisfaction.*" A summary of the theoretical constructs, empirical constructs, and representative quotes of how IT-enabled sales and distribution agility was achieve through management innovation is provided in Table 3.

5 DISCUSSION AND CONTRIBUTION

By integrating the theoretical lens in section 2 and our case study findings (summarized in table 1, table 2 and table 3), a process model of how firms achieve supply chain operational agility through management innovation (refer to figure 1) can be derived. As our model suggests, the achievement of operational agility in supply chain can be decomposed into 3 steps. Given that our model is partially inductively derived from our case study data, the following stream of discussion first provides an

explanation of how the existing literature corroborates our model. Then, from the process model and ffurther analysis, a five-step guide to developing management innovation for operational agility is constructed and interpreted.

5.1 Developing Coordination Loop for Planning (Sensing)

Planning tasks are often the first step of supply chains and require consolidating information from multiple, often autonomous units (Stadtler 2004). These units share low interdependence with each other's tasks. This creates fluctuations in the information and resistance to conform to protocols (Sharma et al. 2003). To counter these management innovation challenges, firms adopt a door knocking approach to generate awareness and establish rules of communication. This is in line with the note that management persuasion is normally needed due to the employee refusal and complaints for new IT adoption (Rivard et al. 2012). In addition, in order to enable the protocols established in the previous step, the standardization of IT systems is further required. This mitigates fluctuations and resistance (Kettenbohrer et al. 2013) encountered in the sensing phase of the supply chain. This coordination amongst interdependent units for planning tasks occurs in a loop. This is in line with that note that the IT-enabled management innovation can never be 'once and for all' and reversely it is a continual improvement process (Hansen et al. 2009). Through the continuous evolution and accumulation of coordination loop for planning, especially with enhanced collaborative communication among multiple units and IT-enabled standardization, agility in the form of information sharing and collaborative network (Bang 2008; Li et al. 2006), can be derived in first sensing step of supply chain.

5.2 Developing Coordination Loop for Production (Acting)

Production tasks are often the second step of supply chains and require coordination between departments of procurement, outsourcing, financials, warehouse, etc. (Stadtler 2004). These units share linked interdependence with each other's tasks. However, without the integration supported by enterprise IT systems, the linkage of interdependencies between those units are constrained to a certain extent. For example, our case study data reveals that before the integration of IT infrastructure, business units use their own systems and had difficulties "talking" to the production network. This partially linked interdependence creates disparate units either due to the system inconsistencies or department interests safeguard. This is in line with the note that the level of interdependence between organizational units is affected both by technical and social aspects (Parolia et al. 2011; Sharma et al. 2003). To counter these management innovation challenges, firms construct priority chain as an approach to generate adhesion between business units, such that normally financial serves the first priority (Da Silveira et al. 2006). This also requires the consistent IT system across multiple units, to integrate the operations as a whole (Gagnon et al. 2009). Another measure production management can utilise is to establish coding structure for raw materials, semi-products and finished goods, to effectively manage the material procurement and outsourcing. This is in line with the note that the bill of material (BOM) is an effective method for communications between manufacturer partners, or plants of a single manufacturing plant (Watts 2012). The coordination of sequential IT and coding structure in the acting phase of the supply chain can further mitigate the disparate units (Kien et al. 2009). This coordination amongst interdependent units for production tasks occurs in a loop. Through the continuous evolution and accumulation of coordination loop for planning, agility in the form of process interlace and efficiencies (Bhattacharya 2010), can be derived in acting step of supply chain.

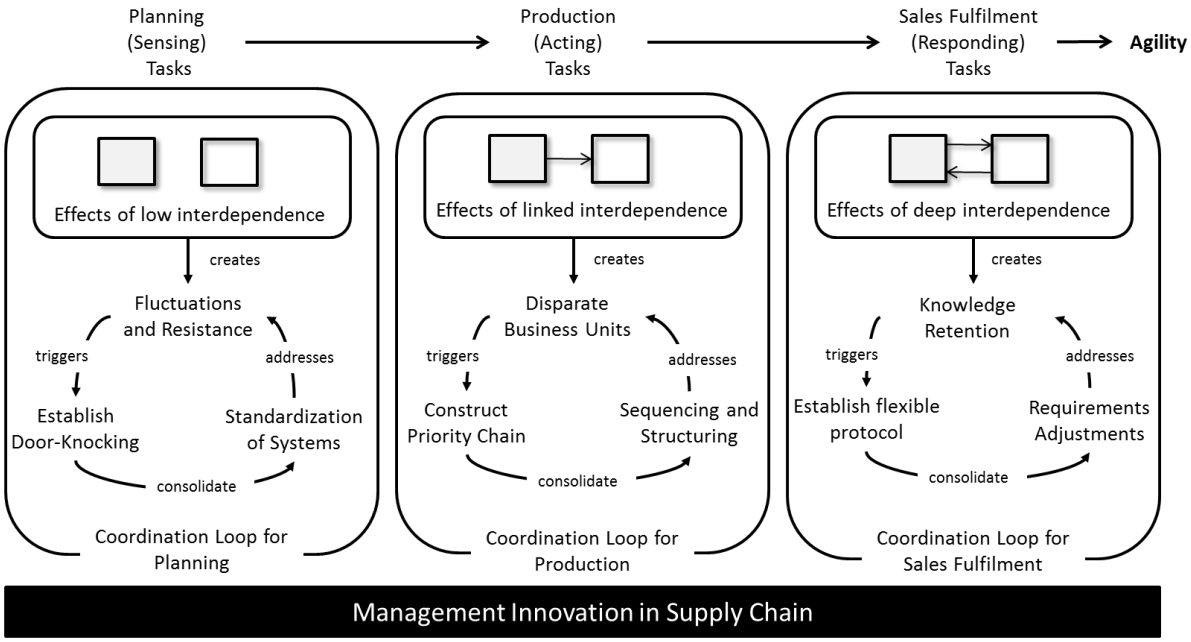

Figure 1. How firms achieve supply chain operational agility through management innovation

5.3 Developing Coordination Loop for Sales Fulfilment (Responding)

Sales Fulfilment tasks are often the last step of supply chains (Stadtler 2004) and require consolidating information from multiple units. These units share deep interdependence with each other's tasks, so as to achieve a high level customer satisfaction. As noted by the literature, high levels of interdependence typically imply tasks are likely to create an increasing level of uncertainty in the decision-making context, and the absence of standardization at high levels of interdependence makes it difficult to anticipate which problems will be encountered during task execution (Gerdin 2005). Therefore, high level interdependence requires high level knowledge of skills (Sharma et al. 2003). This leads to knowledge constraints in sensing the fluctuated customer requirements and rapidly changeable market (Gerdin 2005), and causes difficulty for knowledge retention in the sales fulfillment tasks (Mao et al. 2013). To counter these management innovation challenges, firms initiate standardized protocols among those highly interdependent units, and whenever exceptions occur, flexible revision on the protocols are allowed. Furthermore, in order to handle instant customer orders and variable reporting requirements, continual adjustments to reporting and requirements are necessary. This is in line with the note that when confronting dynamic environment, management should always leave certain space for strategy adjustment and revision (Groth 1999; Sharma et al. 2003). Approach of flexible protocols and requirement adjustments will mitigate the knowledge constraints in the responding phase of the supply chain (Wang et al. 2011). This coordination amongst deep interdependent units for sales fulfilment tasks occurs in a loop. Through continuous evolution and accumulation of coordination loop for sales fulfilment, agility, in the form of flexibility in process structure and information sharing (Huang et al. 2012), can be derived in the third responding step of supply chain.

5.4 Guideline to Developing Management Innovations for Operational Agility

Based on the analysis and deriving from our empirical model above (Figure 1), we construct a five-step practical guide (see Table 4) to aid managers attempting to coordinate departmental interdependencies-through management innovations-for operational agility.

Step 1: Identify task and resource needs for operational agility: Firms must identify purpose, information and other resources needed for operational agility. This includes what business processes are to be integrated and which departments are involved in the cooperation. Managers need to consider existing stresses of coordination as different departments create significantly different resource requirements to facilitate workflow, discussed in Steps 2 and 3.
Step 2: Evaluate the cost of management innovations for operational agility: Following Step 1, managers must be sensitive to existing resources and mechanisms given firm setting or constraints. Managers must consider the cost of resources and how to minimise them, especially through shrinking budgets. If the specification in Step 1 is not absolute, departments must contend with more combinations of resource deployment decisions, contingencies and nature of inter-department interactions.
Step 3: Identify existing effects of interdependencies on management innovation challenges: Steps 1 and 2 are crucial for Step 3 as it is difficult to attribute interactions between departments during operational agility processes to a single dimension. Firms must build a typology of interdependencies which provides a snapshot of interwoven relationships between offices. All interdependencies (low, linked, deep) must necessitate the subsistence of complex firms.
Step 4: Introduce coordinating mechanisms for interdependencies and challenges: Coordinating mechanisms should pertain to identified interdependency described in Step 3 but it is contingent on specified budget discussed in Step 2. For example in planning tasks when appropriate response is strategised, the IT systems must cater for consolidating vast knowledge and material. Information needed must be current and timely and must pertain to unpredictable events. Coordinating mechanisms maybe introduced such as door knocking to establish awareness and protocols.
Step 5: Adjustment of management innovations and coordinating mechanisms: As coordinating mechanisms shape dependencies, interdependencies between departments influence department and overall management innovation. Firm performance is enhanced when there is an appropriate 'fit' between interdependencies, IT systems and management innovation processes. Coordinating mechanisms reinforce management innovations. Differing coordinating mechanisms discussed in Step 4 cause processes to alter from their existing ways, such that activities may be demoted and at times maybe dropped totally as a result. Hence Steps 3, 4 are repeated (represented in Figure 1).

Table 4. Five-Step Guide to Developing Management Innovations for Operational Agility

6 CONCLUSION

Despite knowledge of management innovation development to achieve IT-enabled operational agility, few suggest how. The contributions of this paper are two-fold. Firstly, based on our empirical study, we construct a process model of how firms achieve supply chain operational agility through management innovations. The model has filled a gap in literature, showing how management innovation development could achieve IT-enabled operational agility. We conceptualize that to achieve IT-enabled operational agility, firms must develop management innovation through establishing firm structures, interdependencies and resources. The model suggests that the achievement of operational agility in supply chain can be decomposed into a series of steps- through the coordination in planning, production and order fulfilment. Secondly, the study prescribes a set of actionable guidelines to help managers classify, and manage innovative firm management practices. We propose a stepwise guide to managing and reinforcing coordination mechanisms. Due to limitations of the study—including only comparing two case studies, and study conducted in the context of manufacturers and service providers in Australia and India—we seek to reach further theoretical saturation by conducting a comprehensive multi-case analysis and triangulating our study findings against extant literature. In summary, this article studies the relationships between management innovation, interdependencies and IT-enabled operational agility. The study builds on extant literature on the above topics that seek to develop our understanding of how firms sense environmental changes and respond effectively in an increasingly competitive and digital landscape[1].

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APPENDIX 1: PROFILES OF PARTICIPANTS IN THE CASE OF AUS-P

No.	Job Role	Description (time Employed at Aus-P , experience with SCMS, main work)
1	IT Business Analyst	Years at the case organization: 7 years + Experience with SCMS: 7 years + Main work: solving technology and business alignment issues of SCMS
2	Supply Planner	Years at the case organization: 2 years + Experience with SCMS: 7 years + Main work: making supply network planning through cooperation with demand planners and production planners
3	Demand Planning Manager	Years at the case organization: 8 years + Experience with SCMS: 7 years + Main work: mastering customers' demand; ensuring overall forecast accuracy
4	Demand Planner	Years at the case organization: 0.5 years + Experience with SCMS: 3 years + Main work: mastering customers' demand; making demand planning and forecasting
5	Supply Planning Manager	Years at the case organization: 3 years + Experience with SCMS: 7 years + Main work: managing production, inventory and capacity planning to ensure high customer service and low stock losses
6	Logistics & Supply Chain Manager	Years at the case organization: 7 years + Experience with SCMS: 7 years + Main work: in charge of the detailed scheduling, logistics & transportation management in the supply chain
7	National Demand & Supply Manager	Years at the case organization: 2 years + Experience with SCMS: 15 years + Main work: monthly checking and monitoring the national sales and operational planning process
8	Production Planner/ Scheduler	Years at the case organization: 9 years + Experience with SCMS: 7 years + Main work: making production planning and scheduling; executing plant supply chain

APPENDIX 2: PROFILES OF PARTICIPANTS IN THE SECOND CASE STUDY

Interviewee Identifier	Company Identifier and Business*	Corporate Profile	Organisational Roles (length of time in role; period spent with ES)	Department/ Size of department (Full-Time Employees)
R1	TPA Limited—Manufacturing, research, and export of therapeutic products	Six marketing divisions. Caters to around 200,000 doctors across the country	Assistant Product Manager (13 months; 13 months)	Marketing division (5)
R2	TP Limited—Generation, transmission and distribution of power	1.9 million customers	Assistant Payment Manager (13 months; 7 months)	Treasury and Finance (35-40)
R3	TP Limited—Generation, transmission and distribution of power	1.9 million customers	Assistant HR Manager (14 months; 13 months)	Human resource department (25)
R4	R Limited—Exploration, production, refining, distribution of petroleum products, and chemicals	Large Oil and Gas acreage holder among private sector companies	Business Development and Sales Manager (12 months; 12 months)	Business Development and Sales (5000)
R5	TPA Limited—Manufacturing, research, and export of therapeutic products	Six marketing divisions	Assistant Operations Manager (14 months; 14 months)	Techno-commercial department (5)
R6	F group—An agri-service cum rural retail chain	One of India's leading rural retailing chain	Store Manager (18 months; 18 months)	Store operations (22)

* In the interests of anonymity, the respondents and their firm are given pseudonyms. Due to the sensitivity, details of the company profiles are not disclosed but they can be obtained from the authors on request.

APPENDIX 3: SAMPLE INTERVIEW QUESTIONS AND PROTOCOL

Profiling: Who are the interviewees, what do they do in their jobs, and how does the systems play a part in what they do?	
Aspect Sought	Questions
Employment level	What role do you have in your organisation? Can you describe your department of work?
Experience in role	How long have you been working in the current organisation? What sort of experience do you bring to this role?
System knowledge	Is this your first experience of using the system? What system were you using previously?
Where does the knowledge for their job come from, how did they get it and is it sufficient?	
Aspect Sought	Questions
Systems	Can you describe the systems you use for your daily role?
Tasks	Can you describe the tasks that you do with the system? What is it about your role that makes you want or not want to do it?
Information	Can you describe the information generated from and put into the system? What are some of the outputs, and how do they compare to those of other systems?
At the early stages, what did they expect of the system, what were the biggest problems and did the system bring changes?	
Aspect Sought	Questions
Training	Can you describe the training you undertook for the current role?
Support	Can you describe the support system (if any) in your organisation?
Initiation	Can you describe what you went through briefly in the early stages of joining the current organisation? Can you describe what major innovative activities the organisation took to diffuse the system?
How comfortable and proficient have you become in using the system, what and how much has changed since using the system?	
Aspect Sought	Questions
Attitude	Can you describe how you felt while using the system today? Why do you feel, or think you feel, this way? When using the system, do you feel challenged, confident, or having a sense of respect?
Appropriateness and Nature of use	What do you see as the difference between this current system and the previous one that you were using? In what can or cannot the system do better? How dependent have you become on the system? For what else do you use the system? Have you tried some innovative actions to perform your job better?
Impacts: What benefits (if any) has the system brought?	
Aspect Sought	Questions
Consensus	Do all the other colleagues feel the same way about these systems as the way you do?
Individual impacts	How would you rate the system and why? In what ways did the system help you in your current role? Do you think you were better or worse off with the introduction of the system?

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