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A Learning Path of Process Capital Development - A Case Study of an IC Distributor

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Abstract

Process capital is the capability a firm develops to generate lasting value with investments in process management. Business processes management today is an environment full of business and technology changes. Identifying the required resources and selecting a suitable strategy to reduce the resource gap has become a critical part of process management. In this study we test the application of three theories of management towards process change at an IC distributor. The three theories underline the formation of business capabilities in managing process investments. The three theories, system-determined, people-determined and interaction theories, were gradually adapted by the firm and enabled the evolving of a dynamic capability in reacting to the changing environment. The objective of this case study is to contribute to the development of theory on process capital. The case evidence reveals that through the process of organizational learning by both business users and process designers a firm can build dynamic capability in managing changeable business processes and it can evolve with people, technology and organizational interactions, managed in concert. This capability of managing processes, in the competitive environment, is the process capital that generates value and sustains competitive advantage.

Keywords: process capital, dynamic capability, organizational learning

1. Introduction

Process capital is the practical knowledge of processes, techniques and employee programs that augment and enhance efficiency of manufacturing or the delivery of services used in continuous value creation (Edvinsson & Malone, 1997). It is the capability a firm develops to generate lasting value with investments in process management. Business process management is in an environment full of business and technology changes. Identifying the required resources and selecting a suitable strategy to reduce resource gap in reaction to the complicated and changing environment (Teece et al. 1997; Grant 1991) has become the most critical part of process management.

In this case study we test the application of three theories of management towards process integration technologies at an IC distributor that plays an intermediate role between customers and suppliers in an intensively competitive market. The three theories in question are system-determined, people-determined and interaction theories.

The objective of this case study is to contribute to the development of theory on process capital. The case evidence reveals that, through the process of organizational learning by both business users and process designers, a firm can build dynamic capability in managing changeable business processes and it can evolve with people, technology and organizational interactions, managed in concert. This capability of process management, in the competitive environment, is the process capital that generates value and sustains competitive advantage.

2. Theories applied in academia

In her classic study of organizational adoption of an information system, Markus (1983) identified two divergent theories in the management of process change: the system-determined and the people-determined view. The people-determined theory considers personal and group factors as the keys for successful change. It suggests that user education, people-management policies, and user participation are ways to enhance the use effectiveness of the process-change system. The system-determined theory posits that system factors such as technical excellence and ergonomics determine the success of process change. It assumes that better technology, enhanced system design techniques and modification can increase the adaptation of the system for better processes.

Table 1. Theories of Resistance: Underlying Assumptions

	<i>People-Determined</i>	<i>System-Determined</i>	<i>Interaction Theory</i>
<i>Cause of resistance</i>	<i>Factors related to people and groups</i> ----- Cognitive style Personality traits Human nature	<i>System factors such as technical skill and ergonomics</i> ----- Lack of user-friendliness Poor human factors Inadequate technical design or implementation	Interaction of system and context of use ----- Sociotechnical variant: Interaction of system with division labor Political variant: Integration of system with distribution of intra-organizational power
<i>Assumptions about purposes of information systems</i>	<i>Purposes of systems are consistent with Rational Theory of Management, can be excluded from further consideration</i>	<i>Purposes of systems are consistent with Rational Theory of Management, can be excluded from further consideration</i>	<i>Sociotechnical variant: Systems may have the purpose to change organizational culture, not just workflow</i> Political variant: Systems may be intended to change the balance of power
<i>Assumptions about organizations</i>	<i>Organizational goals shared by all participants</i>	<i>Organizational goals shared by all participants</i>	<i>Sociotechnical variant: Goals conditioned by history</i> Political variant: Goals differ by organizational location; conflict is endemic
<i>Assumptions about resistance</i>	<i>Resistance is an attribute of the intended system user and it is undesirable behavior</i>	<i>Resistances is an attribute of the intended system user, and it is undesirable behavior</i>	Resistance is a product of the setting, users, and designers which is neither desirable nor undesirable

Source: Markus 1983

With evidence supported in the case, Markus (1983) proposed a third view of the organizational change, the interaction theory. Interaction theory holds that people or groups resist or accept systems because of an interaction between characteristics related to the system. It analyzes the impact of process changes in both sociotechnical and political variants. The sociotechnical variation indicates that new information systems may prescribe a division of roles and responsibilities at variance with existing ones. They may structure patterns of interaction that are at odds with the prevailing organizational culture. The political variation explains the difficulty in managing process changes as a product of the interaction of system design features with the intra-organizational distribution of power. Organizational conflicts, from the new patterns of interaction either in the sociotechnical version or the political version, can be the main cause of the problem in managing processes.

In the case study we analyze the organizational view of managing changes with the above three theories and present the evolving path of organizational learning in building a dynamic capability of managing processes.

3. The IC distributor

The IC distributor plays an intermediate role in the electronics industry (figure 2-2). It offers a complete sales network to IC manufactured companies and supplies the latest products to OEM/ODM companies (Hu 2002, Hu 2004, Lin 2003). Enhanced customer relationships and value-added services are offered by IC distributors, including information management, contract design, customer credit control and logistics (Chen 2002).

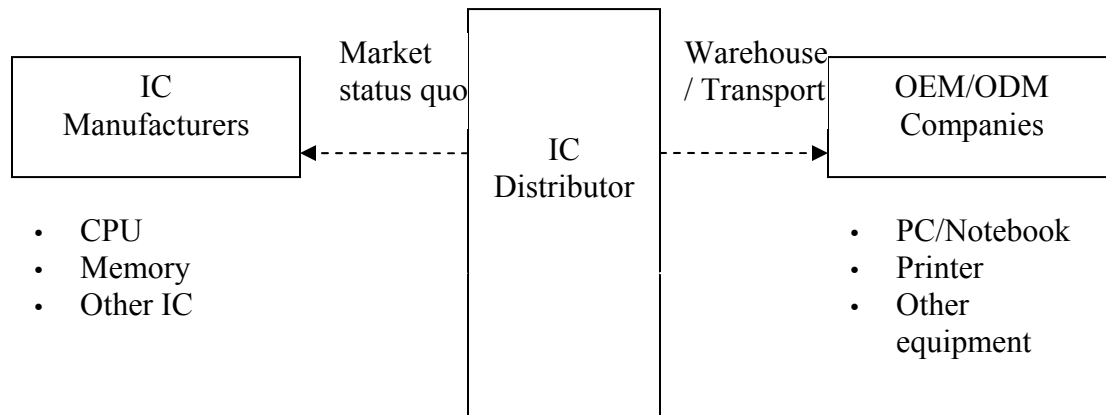


Figure 1. A brief electronics industry value chain, adopted from Chen 2002 and modified by the authors.

Due to the complexity, variety, and multi-functional characteristics of IC components (Lin 2003), IC distributors are dedicate to providing customers value-added service, such as warehousing, to achieve Just-in-Time (JIT) and Build-to-Order (BTO) standards. Moreover, in order to enhance competitiveness, IC distributors train FAEs (Field Application Engineers) to perform specialized assistance and offer total solutions by cooperative product design to their customers.

In addition to the high pressure of serving 3C product customers (computing, communication, and consumer electronics) with timely supply and retaining suppliers with credible offers, IC distributors also face the risks of high stock, high accounts receivable values and high debt to equity ratios. On one hand, they need to invest in integrated processes to provide efficient services with high responsiveness. On the other hand, IC distributors expect the integrated system to control, from end to end, orders within defined margins and procurements within safety levels. For more than a decade, IC distributors have implemented integration technologies such as EDI (Electronic Data Interchange), ERP (Enterprise Resource Planning), CRM (customer management), SCM (Supply Chain Management) and WFM (workflow management) systems to increase service quality as well as reduce risks in sustaining burgeoning businesses (Chen 2002; Lin 2003).

4. The WPI-Group

The WPI-Group was established in 1980 and is headquartered in Taiwan. Its businesses are spread all over the Pacific region, including Hong Kong, China, Singapore, Malaysia, Thailand, The Philippines, and India. Its worldwide staff exceeds 1700. It is the first Asian IC distributor with a yearly income over \$2 billion U.S. dollars. The WPI-Group distributes a range of IC components, such as semiconductors, connectors, passive and electromechanical components and computer and peripheral products for manufacturers such as Intel, TI (Texas Instruments), Philips, Hynix, Vishay, and more than 60 other brands. It also provides a suite of inventory management services, warehousing and logistics support that helps customers achieve cost efficiency in inventory management.

The WPI-Group now has regional service networks in Taiwan, China, and Southeast Asia (figure 2-2). Each subsidiary has a focus market. For example, ChainPower specializes in wireless communication and Bluetooth technology, while Teksel can satisfy Japanese customers in Asia with its staff, all of which can speak Japanese.



Figure 2. WPI-Group Service Network

5. The implementation of process integration

In order to increase efficiency as well as enhance control of enterprise processes, the WPI-Group invested in a series of process management projects, starting in 1999.

There were four major processes involved: purchase request control, purchase control, customer order control, and customer credit control. These are key processes in the IC distributor industry that deal with dynamic demands from customers and suppliers.

Table 2 Four chosen processes in the WPI-Group

Industrial pressure	Purchase request	Purchase order	Sales order	Customer credit control
High stock	*	*		
High accounts receivable			*	
High debt/equity ratio		*		*
# of participants	1100	350	650	750

WPG started process integration by first automating paperwork, then linking processes within business units and then integrating the process globally and finally continuously improving the processes. Descriptions of the phased implementation are summarized in Table 3.

Different technologies and management activities were applied in each phase to achieve purposes for that particular time period. Different management priorities were also noted in these phases. These different views of process integration seemed to be triggered by problems experienced in the previous phases.

Table 3 Process integration implementation

Phase	Time	System	Purpose	Region
Automation	1999/10 ~ 2000/05	Lotus Notes Client-server Network	To convert paper sheets to electronic forms and to combine them with the ERP system	Taiwan
		Independent system in each region		
Local Integration	2000/06 ~ 2004/12	ACTIF workflow MS ASP Integration with ERP	<ul style="list-style-type: none"> • To execute transformation of Taiwan approval system • To impel electronic approval system in China and SE Asia • To combine ACTIF webflow to ERP system • To improve efficiency in remote dial-up and approval 	Taiwan China SE Asia
		Independent system in each region		

Global integration	2004/05 ~ 2005/09	Design WPI in-house Webflow	<ul style="list-style-type: none"> To develop WPI-fit electronic approval system To improve efficiency in electronic approval system To integrate three regional system into one. 	Taiwan China SE Asia and newer business units
		Globally centralized system		
Continuous Enhancement	2005/10 ~	BPM function established report directly to CEO	To continuously improve process efficiency and effectiveness with technical and organizational environment analyzed and enhanced	All global business units
		Globally centralized system with selected local processes		

The following case stories describe the adoption of different integration technologies, difficulties experienced and the consequences and lessons learned for further improvement. A summary of the phased implementation is presented in Table 4.

5.1 Automation phase

WPI earned a contract from Intel in 1998, a major milestone for the company. As the company is extending continuously into more business areas, customers require more efficiency and the suppliers are insisting that manual processes are becoming a barrier to company growth. WRI decided to start a project to automate the processes. Order, purchasing, financial, personnel and accounts receivable forms were made paperless. Lotus Notes on a client server platform was used to manage communications across departments. Since business users were under pressure to achieve targets and they considered this project a technology solution, the project was lead by the IT department, with no involvement from users.

Several problems were encountered after the system was implemented. First, the client-server environment was slow, taking a much longer time for users to request goods than before. There was also no real-time data exchange between Lotus Notes and the ERP system. The disconnected data flow between ERP and workflow systems had reduced user confidence in the new process. Furthermore, most users, who had little experience in using computers, were uneasy about the electronic process. They preferred to do it the old way. These users were not only unaware of the objectives of the automation project but also lacked the skills to use the system. The IT department spent much time fixing the problems with speed, user-friendliness and errors between the ERP and Lotus Notes systems.

After six months of using Lotus Notes, the WPI-Group sought another solution to solve these system problems.

5.2 Local integration phase

The WPI-Group started a new project in mid-2000, purchasing ACTIF webflow to manage its processes. In this phase, WPI extended its electronic plan to its other two regions, China and Southeast Asia. There were about 100 connections in Taiwan, 35 in China, and 35 in Southeast Asia transferring electronic forms and integrating with the ERP system. ACTIF provided a speedy process, 30 seconds faster than Lotus Notes. Meanwhile, the WPI-Group took a lot of time to preach the benefits of the new system and to educate users on its use. Users started to accept the system.

As performance rose, requirements were gradually proposed by business units. Many system changes simply added more control points. However, an unexpectedly long cycle time appeared. Critical order credit and procurement requests often queued for more than a week, waiting for various signers' actions. This was a result of the workflow process being designed to be so flexible that there were no limits for adding controls. To reduce the risks of approving improper requests, business managers implemented as many control points as they could effectively share while burdening the responsibility for authorizing credits and purchases. In addition, the integration job was delegated to local regions that designed their own processes, using the same technology. This led to a lack of cooperation among business units. Cross-regional approval was difficult because each organization had its own systems and processes. Moreover, the ACTIF webflow could not support the increasingly expanding business. It was also a bother that the ACTIF webflow could not handle complicated flows with intelligence. For example, control steps could not be combined if different roles were being filled by the same person. Consequently, the WPI-Group started another project afterward.

5.3 Global integration phase

For the purpose of solving the capacity problems occurring in previous phases, WGI-Group started to design their own webflow system to fulfill the complicated needs of the process management. An in-house designed webflow system was designed in May 2004 to replace the old system and to integrate global regions. This time, WPI was familiar with the process of implementing new systems involving employees from all regions and was thus well trained. Project managers learned that some errors that had occurred were not the result of the system but rather the design of business processes. Therefore, job responsibilities were adjusted and an assessment of controls was conducted to assure the proper control of credits and inventory.

Meanwhile, to reduce the high risks of debts, inventory, and accounts receivable, an asset control function was established in the head office to control and monitor the quality and quantity of procurement and customer credits. The complexity of processes has since increased greatly with new businesses acquired and new products created. To comply with global standard processes, a sales order served by a small business unit of 11 staff in Singapore would need to be approved by 11 other people around the world. Although mobile web approval through PDAs was used, it could still take more than a week to process the order, especially when people moved around and no substitutes were assigned.

The asset control function also introduced a central procurement policy to further improve the cost structure. This policy centralized the procurement of commodities. Customized orders were still handled by local units. However, this newly integrated process induced another wave of user resistance from the regional offices. They were intimidated by the fact that the centralized process might take their power over purchasing and replace their relationship with local suppliers. Although the local inventory was reduced, it also reduced the local flexibility of reacting to unplanned needs, which happened quite often in emerging markets like China and India.

5.4 Continuous enhancement phase

To fix the problem of excessive control and difficulties in the local offices, a business process management (BPM) function was formed, comprised of six senior business users who had worked in the processes for more than ten years. The team deals with and reports to directly the CEO. The team's goal is to review the efficiency, effectiveness and control of business processes and organize the necessary tasks to improve them.

A process-tracking system was first developed to verify the rationality of each approval. Impact analysis was done on each process and levels of authorization were reviewed for appropriateness in different regions and products. While the related workload, responsibilities, and resources were reallocated with measurements and reward, systems were redesigned to make the changes proceed more smoothly.

Further process integration is progressing with the global expansion of the WPI group. The CEO is relatively comfortable with the coming changes for the growing technical and business capabilities.

Table 4 The process integration phases

Phases	Focus	Integration technologies Management Activities	Results	Lessons learned and Capabilities evolved
Automation 99/10-00/05	System	Lotus Notes client-server network	Increased workload for data entry Slow process Inaccurate data Low acceptance due to problems with the system Low acceptance due to low user skill and understanding	<ul style="list-style-type: none"> • technology can be a barrier • user skill needs to be matched • customer acceptance is important
Local Integration 00/06-04/12	System People	ACTIF and MS ASP data integration with ERP users participating in decisions, education and communication	ACTIF could not support the increasing level of data Data errors between workflow and ERP Disparate data across regions and reduced global efficiency Excessive tinkering due to the easily implemented control function for the system Local region implemented process integration	<ul style="list-style-type: none"> • the system limited the extensions of integration • low-level employees used the adaptable system to implement excessive controls • too much control can cause deficiency
Global Integration 04/05-05/09	System People Interaction	Self-developed workflow system user design, communication and education process management team	Self-developed workflow technology Cross region integration	<ul style="list-style-type: none"> • social factors such as workload, responsibilities, reward systems ...need to be aligned with processes • knowledge of both technology and business is needed • capability of identifying social and technical problems and implementing improvement with both planned aspects is needed
Continuous Enhancement 05/10-	System People and Interaction	BPM team implemented that reports directly to the CEO	Centralized and standardized processes enable the transformation of newly merged firms Mature capability in solving problems with a holistic view of the process with external relationships and internal power distribution Analyzed and planned implementation with social factors considered	<ul style="list-style-type: none"> • as technology has stabilized the process, the main problems are with business designs of power

6. The dynamic capability of process capital development

From the case presented above, one can see some characteristics in the progress of WPI-Group's implementation of process integration. The learning process in WPI reveals that the capability of managing the process change is a mix of technical and organizational challenges. Throughout years of managing processes in different ways, the organization has built its capability using the three combined views of managing changes.

In the early stage, the company took a system-determined view by simply believing the information system could solve process problems and increase business efficiency. The system-determined view was enhanced by learning that impenetrable technology can be a barrier to business change.

The company also learned that people with low skill levels and low awareness of the change's purpose could ignore the strengths of the system and produce inefficient processes. Communication, user participation, and education were then introduced.

On the local integration stage, the system and people-determined views existed simultaneously. However, the workload problems and a mentality of overcontrol created problems in the process. Organizations learned to assess job design and responsibilities. The socio-technical variation of the interaction theory was implicitly applied by the organization. Since vertical power reconciliation (manager control over operational level processes) was not a power loss for the operational staff, the political variation was not noted.

Later, with the global scope of processes, the organization grew developed self-made and customized systems with social factors managed. The self-developed system has enabled the firm to quickly react to business changes. However, conflicts started to appear between the head office and local business units. With the centralized procurement process, the power winner (the head office) and the power loser (local office) reacted differently. The company then incorporated interaction analysis of the power changes in these business units.

From initial technological issues to recent process-oriented design issues, customer demands and supplier relationships are getting more intense and complex and the capability required for reacting to them are dynamic. It took seven years for the company to develop the capability to take a holistic view of process problems with technology, people and interaction factors and analyze related resources to organize or invent enhanced business processes.

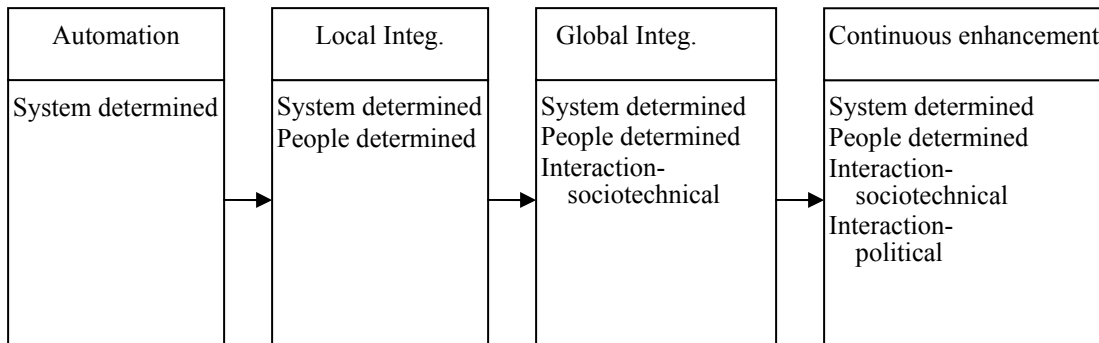


Figure 3. Important impacts of process integration implementation

7. Conclusion

Integrated processes, skilled people, and design technologies are business resources which need to be managed to develop lasting value. Observed through the lens of organizational learning, this longitudinal case study reveals that there is a learning path for the three theories in a firm that practices in a dynamic environment. In the early phase of implementing process integration, the technology-determined view dominated the project team. Only after problems occurred in this phase of process operation, the firm learned to incorporate a people-determined view in the management of process change. With conflicts experienced in local business units, the firm was forced to face the conflicts between corporate control and service flexibility in the integrated process. The firm then shifted to the interaction theory in analyzing the appropriateness of business design and business rules. Additionally, a function watching over the process efficiency and effectiveness with organizational interaction analyzed and redesigned institutions in the firm to sustain the capability of integrating organizational resources for continuous advantage.

Although the learning path reported in this case cannot apply to other organizations, which by no means is the intention of this study, lessons learned are that the development of process capital has a learning path focused on explicit but sometimes implicit areas of business resources. Only with a broad and thorough view of the system, people and process interactions can a firm capitalize its investment in process management.

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