

Interaction between Manufacturing and Marketing from an Information Technology Perspective – A Case Study*

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Abstract

This paper explores how information technology (IT) impacts the interaction between manufacturing and marketing departments. Literature review is made to understand the relationship between interfunctional goals gap and activities conflict within the two departments. The application of IT function is proved to be an effective means which can reduce the degree of interfunctional goals gap, thereby reduce the conflict on activities level.

This paper studies the interaction between manufacturing and marketing departments of six firms, located in the Hsin Chu Science-Based Industrial Park (HSIP) in Taiwan, from an information technology perspective. The methodology employed herein is based on case study, the analysis of six cases has lead to 9 hypotheses. This exploratory study aims at the decision-making, and communication capacity of IT on manufacturing and marketing departments, through interdisciplinary research.

Keywords: manufacturing, marketing, gap, conflict, information technology (IT)

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1. Introduction

Post-industrial organizations must increasingly cope with an information explosion accompanied by increased complexity and turbulence (Sambamurthy and Scott 1992). According to Rockart & Short (1989), IT may serve as a novel means of resolving one of management's oldest organizational problems: effectively managing interdependence.

Manufacturing and marketing are the two most interactive departments within a corporation. Many studies have conferred that the quality of their interaction is closely related to corporate performance (Crittenden 1992; Crittenden, Gardiner and Stam 1993; Hayes and Wheelwright 1984; Karmarkar 1996; Miller and Roth 1994; Power and Sterling, Wolter 1988; Prabhaker, Goldhar and Lei 1995). Given the different functions in which manufacturing and marketing perform within an organization, their goals marked vary thus frequently lead to conflict in executing related activities.

Despite their goals exist some divergence between manufacturing and marketing, a certain degree of interdependency exists in common decision resolution. Such interdependency belongs to reciprocal interdependence as

proposed by Thompson (1967). Owing to this interdependent relationship, this study investigates the ability of their coordination using IT to resolve problems arising from interfunctional interaction. Furthermore, most of previous studies on this field are primarily of normative orientation, with relatively little focus on IT as a facilitative tool to resolve problems of interfunctional interaction. Thus this study tries to apply an interdisciplinary integration research.

Manufacturing and marketing strategies are functional ones in that they play an essential role of the larger corporate strategy. Once the overall strategy is established, these functional strategies are imperative for effectively applying resources capability to achieve corporate goals. Crittenden (1992) contended that pursuing optimal departmental performance will lead to more interfunctional problems, eventually impeding overall corporate or other departments performance. Many previous studies postulated that resolving interfunctional problems (i.e. goals gap and activities conflict), largely depend on identifying the nature and source of conflict before applying coordination techniques (Crittenden 1992; Crittenden, Gardiner and Stam 1993; Powers, Sterling and Wolter 1988). Crittenden (1993) observed that other than the

four conventional coordination functions (i.e. organizational design, evaluation systems, communication and simulation models), a fifth approach is to use advance IT such as computer network or group decision support system to resolve most of the conflict areas of two departments. St. John & Hall, Jr. (1991) also proposed three coordination mechanisms: committees and task forces, planning processes as well as rule-based control procedures. The above two authors' frameworks of coordination mechanisms resemble each other but they did not further elucidate the role of IT. The role of IT is attributed to the nature and source of the conflict between two departments originates from the organizational structure of information flow. Most discussions on the future of organizations increasingly emphasize on groups' interdependency and on new communication and decision support technologies to rapidly integrate changing structures (Sambamurthy and Scott 1992).

Although previous studies have seldom incorporated IT into interfunctional interaction, this paper combines IT with the interaction between manufacturing and marketing departments. The two departments' goals and activities are thus evaluated in term of whether or not the functional role of IT can reduce their

goals gap and activities conflict. Based on above discussion, this paper mainly focuses on two areas:

1. The interaction interface in which includes the degree of goals gap and activities conflict within two departments.
2. The manner in which four various formats of IT's application may improve the degree of goals gap and activities conflict within two departments.

2. Literature Review

2.1 Interaction between Manufacturing and Marketing Goals

Cost, quality, delivery, flexibility and innovation are used as the foundation for investigating their interaction with five marketing goals of product, price, channel, promotion, and after-sales service. Hayes and Wheelwright (1984) indicated that the existence of the manufacturing and marketing boundary is more than those among other departments. This owing to that, in principle, marketing goals need requirement stimulation. On the other hand, the manufacturing goal is more towards supply management, which attempts to derive information on the basis of market needs prior to

determining production volume. St. John & Rue (1991) further postulated that manufacturing and marketing serve different functions in organizational structure which dictate various responsibilities and goals. St. John & Rue (1991), however, interdependent to a considerable extent in terms of decision-making with two departments. This owing to that manufacturing must provide a enough product volume than the nature of competition. Such identification originates from the priority of corporate competition as determined by marketing for manufacturing to carry out. The type of decision interdependency is among those postulated by Thompson (1967), a reciprocal interdependency. Greater interfunctional difference requires more coordination efforts to integrate their interdependency (Malone and Crowston 1994; Rockart and Short 1991; Van et al. 1976). Saavedra (1993) contended that corporate interdependency could be classified into three different types of tasks, goals and reciprocals. Task-oriented interdependency consists of the four formats of pools, sequential, reciprocal and task force ones. When goal interdependency exists, the common goal among departments can be extended to task interdependency into the goals interdependency

requires reciprocal interaction from two or more groups.

From above discussion, we can inferred that the interaction between two departments originates from their interdependency (from goal to task to reciprocal), implying that the goal gap emanates from their interdependency with each other. Thus, we believe that manufacturing is more responsive to cost control in terms of goal than marketing while the latter focuses more on product quality and customization. Therefore, an integration mechanism is essential for achieving a coordination balance between the two departments.

2.2 Interaction between Manufacturing and Marketing Activities

Manufacturing activities are the actual implementation of manufacturing goals (Groff and St. John 1990; Roth and Miller 1992). Groff & St. John (1990) believed that once manufacturing goals are established, manufacturing activities must be carried out to garner productivity with the aims at of wielding it as a competitive edge in the market. This situation is the same for marketing activities.

Some interfunctional activities serve each other while others are contentious. Hayes &

Wheelwright (1984) and Crittenden (1992) observed that the interaction between manufacturing and marketing is quite strong and frequent. The nature of activity conflict between the two departments stems from structural variance and resource allocation for marketing is more responsive to external information (customer needs and satisfaction) while manufacturing is more inclined internal information (cost control). Once the difference in nature is established, the origin of conflict can be investigated. Table 1 summaries the scope of conflict between manufacturing and marketing sorted out from related studies.

2.3 IT Functional Role and Manufacturing as well as Marketing Interaction

Crittenden (1992) proposed five co-ordination mechanisms to resolve conflict. Among those, the fifth item is enabled by advanced IT that can improve on the conflict scope of the two departments. According to Prabhaker et al. (1995) advanced IT, particularly for manufacturing such as FMS, CIM and GDSS, allows an organization to integrate manu-facturing and marketing. However, their studies only described as a conceptual framework.

Table 1、Manufacturing and Marketing Conflict Scope

Shapiro (1977)	Powers (1988)	Crittenden (1993)
1. Capacity planning & long-term sales forecasting	1. Orientation	1. Managing diversity *Product line length/breadth
2. Production scheduling & short-term sales forecasting	2. Information flow: within the between organization & environment	* Product customization * Product line changes
3. Delivery & physical distribution	3. Product flow: to the environment	
4. Quality assurance	4. Product flow: within the organization	
5. Breadth of product line		2. Managing conformity
6. Cost control		* Product scheduling
7. New product introduction		*Capacity/fac-ility planning
8. Adjunct service		3. Managing dependability * Delivery * Quality control

Sequential numbering does not represent corresponding relation.

A manufacturing system with greater flexibility and cost benefit provides customers with more product choice and better product

quality. On the other hand, the marketing department can conduct a long-term evaluation of customer needs for driving synchronization with the needs of manufacturing in deriving from interfunctional efficiency and effectiveness that yields competitive market niche for an organization. Karmarkar (1996) also recognized that IT can be used to generate positive interaction between the two departments.

Information technology is a rather broad concept, few investigations have clearly defined and categorized it. Previous investigations largely adopted the perspective of technical elements which are tools level and systems level (Barrett and Konsynski 1982; Leavitt and Whisler 1958; Olson 1982). Since the late 1980s, IT has served a large scope of corporate functions, which have fostered the accelerated development of functional, IT. IT functional level pertains to integrated application of IT on the tools and systems level. Such IT application produces some characteristics of corporate management which enhances corporate operations as well as more effectively resolves related problems. Scott Morton (1991) proposed after the 1990s, IT will build a corporate information system infrastructure with telecommunication networks in which database or applied system will be constructed on the

infrastructure to achieve the linking and integration of corporate work flow. Yates & Benjamin (1991) indicated IT furnishes corporations with three new opportunities for coordination: time and space compression, use knowledge base for diffusion and conversion along with sustained increase of flexibility. Venkatraman (1991) contended that IT enables organizations with three levels of enhancement in production capacity: individual decision-making, team cooperation and information transmission among organizations.

This paper adopts the interactive relationship on group level for analysis. Recent IT related studies reveal that organizations no longer apply individual IT as a unit for analysis. Instead, an integrated information system institutes the structure allowing IT to merge with corporate operations. Huber's (1990) analysis provides a more understanding of IT characteristics. Huber (1991) recommended that advanced IT should be equipped with "basic characteristics" and "properties characteristics". When applying IT in an organization, the structural design, planning and decision-making are subsequently affected. Huber employed the concept of properties to examine IT's effects on structural design and decision-making. According to his research results, this type of IT

is endowed with the characteristics of communication and decision-making support which are coined as computer aided communication technologies and decision technologies. Table 2 lists the definitions of the two types of properties IT as given by Huber and other researchers.

Table 2、Definition of IT Properties

Nature of Advance IT: Computer Aided Communications Technology	Nature of Advance IT: Decision Support Technology
<ul style="list-style-type: none"> · Breakthrough time and space restrains in allowing easier communication and equipped with cost efficiency · Faster & greater accuracy of target group communication · More reliable record & index of communication contents & nature · More control options over access and participation in communication event or network 	<ul style="list-style-type: none"> · Faster, cheaper storage or access of massive information · Faster, more selective access of external information · Faster, more precise combination or reorganization of information to create new information · Condensed storage, quicker access to judgment and decision mode developed by expert of decision maker · More reliable, cheaper record and access of corporate trade contents and nature

Fulk and Boyd (1991) proposed that computer use behavior by using communication and decision theories with particular emphasis on the two main functional aspects of IT in

communication and decision-making. That investigation postulated that communication and decision are related to corporate tasks. Moreover, Fulk (1993) also discovered that in a task oriented work environment, communication technologies can achieve this end of groups and their tasks communication. Rockart and Short (1991) further stressed that IT can generate interfunctional coordination in solving task conflicts among departments. According to that investigation, a computer network has the following seven characteristics: (1) shared goal, (2) shared expertise, (3) shared work, (4) shared decision-making, (5) shared timing and issue prioritization, (6) shared responsibility, accountability and trust; as well as (7) shared recognition and incentives. Many studies have pointed out that corporates with telecommunication networks may set market position as a strategy or increase performance as a goal. Under above investigation, effective management of departments and personnel is still required. Consequently, IT may allow organizations to effectively manage their interdependency.

From above discussion on related literature, we can infer that the functional application of IT can be classified into communication and decision. Communication technologies solve the

activities conflict between manufacturing and marketing. In decision technologies, it may reduce the goal gap between the two departments. These two technologies allow the two departments to achieve a general consensus from goals to activities. Thus, this paper establishes the degree of four different formats of IT. These different formats are (1) low communication / low decision, (2) high communication / low decision, (3) low communication / high decision, (4) high communication / high decision. The four formats are then applied in shaping IT's framework for examining the roles the two departments' goals decision and activities communication.

3. Research Methodology

This paper develops an interaction in six information/ electronics firms. The framework was developed through three lines of research.

- (1) Desk research: An analysis of the available literatures on the manufacturing/marketing interaction and general management information system theory.
- (2) Comparative research: A telephone survey among 70-3,000 employees, six firms within Hsin Chu Science-Based Industrial Park

(HSIP) in Taiwan, R.O.C., in June, 1997. In each of firms MIS manager and/or CEO was interviewed.

- (3) Case studies: For further and more detailed analysis of the manufacturing/marketing interface and IT application with six case studies which have been conducted within six different firms in HSIP. The period of face-to-face interview was taken over a four months period (from July-Nov., 1997).
- (4) The results of this exploratory survey have been used to describe the difference between manufacturing and marketing goals and activities, to identify the coordination mechanisms and to identify IT's support roles and how IT has facilitated the interaction manufacturing / marketing departments interface.

3.1 Case Description

For the initial screening of case subjects, the factors of size, and the overall industry system were considered when selecting candidates from lists provided by the related governmental / industrial organizations. Given the integral relation among the upper, middle and down streams of information / electronics industry, six fully cooperative information /

electronics firms were selected as study groups. The case studies lasted approximately six months. The information / electronics industry in Taiwan whose upper streams include components, semiconductors, middle streams include card / board, down streams include peripherals, communication products, systems and information services.

Case analysis of Kaplan and Duchon (1988) was adopted herein, consisting of triangulation process from interview, questionnaire to further interview which avails the benefit of structural iteration. Case studies provide further insight into the interrelationship of IT with organizational activities and management practices (Doolin 1996). Consequently, in this study, both qualitative and quantitative aspects of this case analysis were covered. Due to the indepth nature of the interviews, most respondents were unwilling to reveal their identities; thus, A, B, C, D, E, F were used to represent the subjects. To validate the actual existence of six firms, Table 3 displays the individual case characteristics and Table 4 summaries the work delegation of the IC industry.

3.2 Case Findings

This paper asked various questions on four issues through telephone interview exploring manufacturing / marketing departments' inter-action as shown in Table 5. According to Table 5, all six firms unanimously recognized the gap and conflict between the interaction of manufacturing and marketing departments. Those firms also indicated that IT supports of the above created positive impact on company competitiveness. This finding serves to form two fundamental hypotheses of this study: ***H1: significant gap and conflict exist in the goals and activities level between the manufacturing and marketing of Taiwan's information / electronics firms.*** Moreover, comparing Table 3 and Table 5 may allow us to formulate ***H2: different location with manufacturing / marketing departments leads to a higher IT application due to IT/Networking reducing the gap and conflict of long distance.*** According to Table 5, all six firms considered E-mail/FTP as the most frequent common coordination mechanism, thus formulate ***H3: E-mail/FTP are the most frequently necessary IT techniques used to resolve two departments' gap/conflict.***

Table 3、Case Characteristics

Cases		Dollars: Unit of Millions					
		A	B	C	D	E	F
1	Establishment years	9	5	10	18	14	12
2	Employees	70	100	2,100	3,000	1,300	270
3	Information/electronics system	Upper stream	Upper stream	Upper stream	Upper stream	Middle stream	Down stream
4	Capital (US\$)	16	10	1500	1370	90	13
5	Revenue(US\$)	13	23	300	1000	430	40
6	Working years at MIS dept. of interviewees	5	4	7	3	3	4
7	Main production plan	MTO	MTO	MTS	MTO	MTO	MTO
8	Same location with manufacturing/marketing dept.	Yes	Yes	No	No	No	No
9	IS compatibility with manufacturing/marketing dept.	Yes	Yes	Yes	Yes	Yes	Yes
10	Sales area	Domestic	Export	Export	Export	Export	Domestic
11	Main product	IC design of Monitor	IC library design	Semiconductor manufacturer	Wafer foundry	Telecommunication card & modem manufacturer	Telecommunication equipment

Table 4、Overall IC Industry Appearance

Product Characteristics	Work Flow	IC design	Mask making	Wafer fabricate	Packaging	Testing	IC sale
	Cases						
Fabless IC design house	A	✓				✓	✓
	B	✓				✓	✓
Semiconductor company	C	✓	✓	✓	✓	✓	✓
IC package							

Mask making							
Wafer foundry	D		✓	✓	✓	✓	✓

Table 5、Summary of the Q & A Session

Q & A \ Cases	A	B	C	D	E	F
1.The gap/conflict dimensions	Flexible, Quality, Delivery, Cost	Flexible, Quality, Delivery, Cost	Flexible, Quality, Delivery, Cost	Flexible, Quality, Delivery, Cost	Flexible, Delivery, Cost	Quality, Delivery, Cost,
2. Coordinating mechanisms	Committees & task forces; IT; Rule-based control procedures	Committees & task forces; IT; Rule-based control procedures	Committees & task forces; IT; Rule-based control procedures; planning processes	Committees & task forces; IT; Rule-based control procedures; planning processes	Committees & task forces; IT; Rule-based control procedures	Committees & task forces; IT; Rule-based control procedures
3. IS developed domain	Software package	Software package	Developed by MIS dept.	Developed by MIS dept.	Software package	Software package
4. The most frequent using of IT types between manufacturing/ marketing dept.	Excel, E-mail, FTP	E-mail, FTP	E-mail, FTP, Lotus Notes, Shop floor control, Sales management system, Video conference	E-mail, FTP, Shop floor control, Sales management system, Video conference	E-mail, FTP, T-TOP software package	E-mail, FTP, T-TOP software package

The questionnaire of this study was developed after an initial telephone interview, followed by the researcher's face-to-face interviewing of the six firms for further confirmation of the framework of this study. Tables 6, 7 and 8 summarize the contents of the questionnaire. Likert 5-point scale was used as the measurement tool; of which, 1 represents

complete disagreement, and 5 indicates thorough agreement.

Table 6 summaries analysis of the goals interface issues mentioned as follows: (1) All surveyed firms believed that IT strongly facilitates the reduction of costs through waste reduction and labor productivity improvements.

Thus constitutes *H4: information/electronics improvements*. (2) C and D firms are the larger semiconductor company and wafer foundry. Survey results indicate the two companies' IT application has the most powerful support with reducing the overall goals gap.

Table 6 · Goals Interface with IT Support of Manufacturing and Marketing

Goals Interface of Manufacturing & Marketing	Likert Scale	Cases Selected 3-5 Scale
1. Increase market share	1 2 3 4 5	C, D
2. Increase sales volume	1 2 3 4 5	C, D
3. Improve profit margins	1 2 3 4 5	C, D
4. Develop a fuller line of products	1 2 3 4 5	D
5. Improve quality of product shipped to customers	1 2 3 4 5	C, D
6. Improve speed of delivery of orders shipped to customers	1 2 3 4 5	C, D
7. Reduce costs through waste reduction and labor productivity improvements	1 2 3 4 5	A, B, C, D, E, F
8. Reduce costs through new process improvements	1 2 3 4 5	A, B, C, D
9. Reduce the lead time between product development and commercialization of new products	1 2 3 4 5	C, D, F
10. Reduce costs by focusing on a more limited line of high volume products	1 2 3 4 5	C, D, F

Table 7 · Activities Interface with IT Support of Manufacturing & Marketing

Activities Interface of Manufacturing & Marketing	Likert Scale	Cases Selected 3-5 Scale
1. Production capacity planning: Short, mid term (Production scheduling) Long term	1 2 3 4 5 1 2 3 4 5	A, B, C, D, E, F C
2. Product customization: producing particular product	1 2 3 4 5	A, B, E, F
3. Delivery: capable of quick order handling and on-schedule delivery	1 2 3 4 5	A, B, C, D, E, F
4. Quality conformity & stability	1 2 3 4 5	B, C, D,
5. Production capacity flexibility	1 2 3 4 5	A, B, C, D, E
6. Rapid change of product design	1 2 3 4 5	A, B, C, D, E
7. Capable of increase labor force productivity, reduce	1 2 3 4 5	A, B, C, D, E, F

new process cost and production cost		
8. After-sales service, logistics	3 4 5	
9. Rapid launch of product innovation	1 2 3 4 5	D
10. Outsourcing delivery, quality, quantity	1 2 3 4 5	A, B, C, D

According to Table 7, analysis of the activities interface can be summarized as follows: (1) All surveyed firms believed that IT significantly supports production scheduling which constitutes **H5: information/electronics industry, be in upper, middle or lower stream, the firms recognize that IT contributes considerable support to production scheduling.** (2) All surveyed firms who believed that IT ends support to their product delivery; nevertheless, particularly A, B, C, D are subject to the delivery, quality and quantity of their outsourcing. From which, **H6: is construed: notwithstanding, the organizational size, all IC design/foundry firms deem using computer network to communicate with their outsourcing in supporting product delivery, quality and quantity as crucial.** (3) With respect to product flexibility and rapid product design change, only F company had a negative view of IT support. This view might be attributed to the company being a down stream company in telecommunications equipment, and that its products belong to the category of heavy capital density rather than general consumer product orientation. (4) All six firms concurred that IT can increase the productivity of labor force,

reduce costs of new process and production as such are the basic functions of IT.

On which, **H7: is then formulated: despite the stream distinction, the overall industry system is convinced that IT enhances labor productivity, reduces new process costs and production costs.**

Based on the indepth interview of this study, the levels of IT application for the six firms are as listed in Table 8. **H8: Larger scale IC design houses of upper stream imply a greater level of IT application as well as greater competency in resolving the interaction problems between manufacturing and marketing departments.** Table 8 obviously reveals that when IT is used in supporting the common interface between manufacturing and marketing, the C and D firms among the respondents were the most affected in terms of resolving interfunctional problems. The cause of which might be the greater IT application capability of the upper stream firms, meanwhile IT may serve as backup support for the middle and down streams. On the basis of such reasoning, **H9 is then built: located on high communication/high decision of IT formats**

(Hochstrasser 1994). This accounts for why there is a so called "productivity paradox" saying, suggesting that IT investment does not ensure a positive return. However, Advanced IT's development stage is located in "network computing" era that emphasizes information sharing as the promise which makes related organizations have a common IT infrastructure for organizational operations. This paper has the following practical implications:

- (1) Organizational communication is the antecedent of organizational decision-making, communication technologies are facilitators that can offer capabilities to overcome constraints on time and distance. Tools such as E-mail and FTP are the most popular communication technologies within the six cases because their manufacturing and marketing departments are usually located in different sites even in foreign countries.
- (2) All six firms recognized how conventional IT fails to provide such functions as enhanced efficiency and after-sales service. This might be attributed to the past failure of integrating many non-compatible aspects in information system infrastructure. The consensus of the six firms is to achieve

integration of information/electronics industry through Intranet and Extranet in the near future. Advanced IT/Networking technology can pave the way for resolving current problems.

- (3) Among the six cases, C, D companies are representative of the "high communication / high decision-making" format in the application dimension of IT that tends to support the basic assumption of this study: "high communication / high decision-making" technologies are the most useful technologies for improving interaction problems between manufacturing and marketing departments.
- (4) Functional interdependence between manufacturing and marketing departments leads to the requirement for coordination and conflict resolution that the main conflict areas concerning production capacity planning, orientation and setting and meeting delivery lead-times. The results demonstrate that these interfunctional conflict areas as those originally coming from the gap and conflict information flow with each other. Thus organizations should fully realize the merits of IT applications.

The main contribution of this study is to confirm the following viewpoint: more information rich media, its coordination degree is higher, then its capabilities for solving the problems of interfunctional interaction are also higher. Of course, this paper chose information / electronics industry as case samples, implying this industry is quite appropriate for IT application.

Most previous studies on interfunctional interaction examine the conflict, interactive scope and management rules from behavioral or strategic perspective. However, the problems addressed herein, yield only a passive description on the phenomena of interfunctional interaction. Such an investigative approach rests with the "what" level of theoretical discussion. This study, however, examines the role of IT, with its decision-making and communication capacities, in generating the interaction between manufacturing and marketing from the perspective of IT application. Such undertaking allows us to theoretically interpret the "how" Level. The future research direction could be addressed such as whether or not IT application in the interaction between manufacturing and marketing is likely to produce different results due to such factors as industry type, corporate size, industry system (upper, middle, down

streams), primary production plan (MTO, MTS, ETO), corporate characteristics, etc.

This paper will be continuing to explore some related issues include large-scale questionnaire surveys targeting on Taiwan's Hsin Chu Science-Based Industrial Park (HSIP) and the nation's top 500 manufacturing firms. The interaction of other departments with IT application will also be engaged. A series of related studies will facilitate organizations interfunctional interaction and its effects on corporate competitiveness.

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