

Information Technologies in Automotive Assembly Industry in Thailand

Jirarat Teeravarapug, Usawadee Inklay

Abstract—This paper gave an attempt in prioritizing information technologies that organizations should give concentration. The case study was organizations in the automotive assembly industry in Thailand. Data were first collected to gather all information technologies known and used in the automotive assembly industry in Thailand. Five experts from the industries were surveyed based on the concept of fuzzy DEMATEL. The information technologies were categorized into six groups, which were communication, transaction, planning, organization management, warehouse management, and transportation. The cause groups of information technologies for each group were analyzed and presented. Moreover, the relationship between the used and the significant information technologies was given. Discussions based on the used information technologies and the research results are given.

Keywords—Information technology, automotive assembly industry, fuzzy DEMATEL.

I. INTRODUCTION

INFORMATION technology is the application of computer and telecommunications equipment to store, retrieve, transmit and manipulate data, often in the context of a business or other enterprise [1], [2]. In a business context, the Information Technology Association of America has defined information technology as "the study, design, development, application, implementation, support or management of computer-based information systems" [3]. The responsibilities of those working in the field include network administration, software development and installation, and the planning and management of an organization's technology life cycle, by which hardware and software is maintained, upgraded, and replaced [4].

For a long time, little evidence showed that information technology had improved productivity in the aggregate. Solow [5] noted that "we see computers everywhere but in the productivity statistics," an observation that became referred to as the "productivity paradox." Many econometric analyses failed to find any sector- or economy wide productivity benefits for information technology [6]. In the past few years, there have been attempts to measure the productivity benefits obtained from the information technology. Several studies that have used a variety of approaches have concluded that information technology is having a positive effect on

productivity [7], [8]. Nowadays, many organizations have accepted that information technologies would contribute substantially to productivity growth. Therefore, organizations have invested heavily in information technology. The purchase of the technology and its equipment continues to be the largest category of industry spending for all types of capital equipment.

This study started with collecting data about information technologies. The data were analyzed and categorized. Six categories including communication, transaction, planning, organization management, warehouse management, and transportation were given. The result was verified by 5 experts in automotive assembly industry in Thailand. Then questionnaire and survey based on the concept of Fuzzy DEMATEL were given. The significant information technologies of each group were analyzed and presented. Moreover, the relationship between the used and the significant information technologies was given. Discussions based on the used information technologies and the research results are presented in the last section.

II. CATEGORIES OF INFORMATION TECHNOLOGY

Based on the review of literature, information technologies known and used in the automotive assembly industry in Thailand were collected and they could be categorized into 6 groups including communication (C1), transaction (C2), planning (C3), organization management (C4), warehouse management (C5), and transportation (C6). Information technology in communication was composed of Fax, E-mail, FTP and EDI whereas that in transaction was composed of Web service, ebXML, EPOS, E-commerce, RosettaNet, and E-Business. The information technology in planning included MRP, ERP, and APS whereas that of organization management included SRM, CRM, Marketing efficiency, financial efficiency, and customer satisfaction. The information technology in warehouse management comprised VMI, SMI, WMS, Barcode, and RFID. Finally, the information technology in transportation included TMS, GPS, and GIS. Fig. 1 shows six categories of information technology. Table I shows the meanings of information technologies.

III. GROUP SIGNIFICANCE

Based on the classification above, a questionnaire was constructed and surveyed based on the concept of Fuzzy DEMATEL. 5 experts in automotive assembly industries in Thailand including Nissan, Honda, Toyota, General Motor and Auto Alliance were used. The result showed that the most

J. Teeravarapug is an associate professor in Industrial Engineering, Thammasat University, Rangsit campus, Pathumtani 12121, Thailand (phone: 662-564-3001; fax: 662-564-3017; e-mail: tjirarat@engr.tu.ac.th).

U. Inklay was a master student in Industrial Engineering, Thammasat University, Rangsit campus, Pathumtani 12121, Thailand (phone: 661-944-0258).

important group of information technology was planning whereas the second most was warehouse management. Moreover, the analysis was given that four groups of information technologies including planning, warehouse management, organization management, and transportation were the cause group. That meant organizations should consider those groups and by taking the consideration to those groups, it would bring out the other groups including communication, and transaction Fig. 2 shows cause and effect groups of information technologies in automotive industry in Thailand. Based on the figure, it shows that Planning (C3) is the most influenced group of technology.

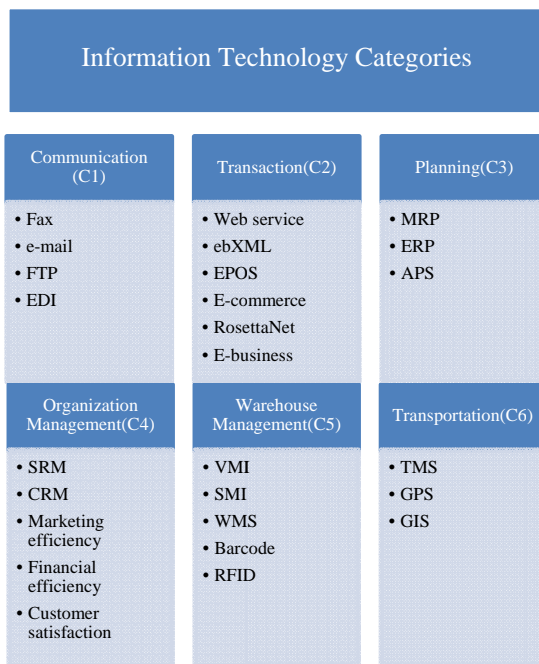


Fig. 1 Six categories of information technology in automotive industry

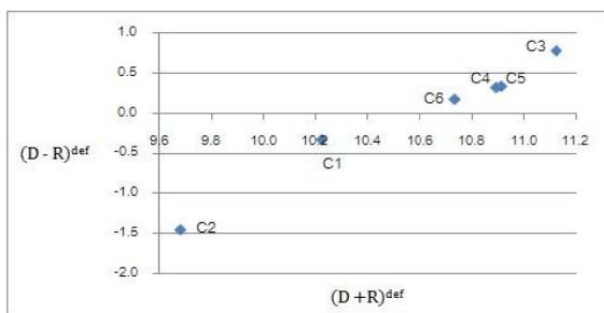


Fig. 2 Cause and effect groups of information technologies in automotive industry in Thailand

TABLE I
 NOTATIONS

Terms	Meanings
Fax	Duplicator that transmits the copy by wire or radio
E-mail	Electronic mail; a digitally encoded message sent from one computer to another through an electronic communications medium, especially by means of a computer network.
FTP	Protocol that allows users to copy files between their local system and any system they can reach on the network
EDI	Electronic data interchange, a document standard which when implemented acts as common interface between two or more computer applications in terms of understanding the document transmitted
Web service	A method of communication between two electronic devices over World Wide Web
ebXML	The Extensible Markup Language (XML) is used to standardize the secure exchange of business data
RosettaNet	The RosettaNet standard is based on XML and defines message guidelines, interfaces for business processes, and implementation frameworks for interactions between companies.
E-business	The application of information and communication technologies (ICT) in support of all the activities of business
MRP	Material requirements planning, a production planning and inventory control system used to manage manufacturing processes. Most MRP systems are software-based, while it is possible to conduct MRP by hand as well.
ERP	Enterprise resource planning, a cross-functional enterprise system driven by an integrated suite of software modules that supports the basic internal business processes of a company
APS	Advanced planning and scheduling, a manufacturing management process by which raw materials and production capacity are optimally allocated to meet demand
SRM	Supplier relationship management, the discipline of strategically planning for, and managing, all interactions with third party organizations that supply goods and/or services to an organization in order to maximize the value of those interactions
CRM	Customer relationship management, a model for managing a company's interactions with current and future customers. It involves using technology to organize, automate, and synchronize sales, marketing, customer service, and technical support
Marketing efficiency	The degree to which stock prices reflect all available, relevant information
Financial efficiency	How well the dollars invested in each alternative produce revenues
Customer satisfaction	A measure of how products and services supplied by a company meet or surpass customer expectation
VMI, SMI	Vendor managed inventory and supplier managed inventory, a family of business models in which the buyer of a product (business) provides certain information to a vendor (supply chain) supplier of that product and the supplier takes full responsibility for maintaining an agreed inventory of the material, usually at the buyer's consumption location (usually a store)
WMS	Warehouse managed system, a key part of the supply chain and primarily aims to control the movement and storage of materials within a warehouse and process the associated transactions, including shipping, receiving, put away and picking.
Barcode	An optical machine-readable representation of data relating to the object to which it is attached. Originally barcodes systematically represented data by varying the widths and spacings of parallel lines, and may be referred to as one-dimensional (1D) or two dimensions (2D)
TMS	Transportation management system, a subset of <u>supply chain management</u> concerning <u>transportation</u> operations and may be part of an <u>enterprise resource planning</u> system.
GPS	Global positioning system, a space-based <u>satellite navigation</u> system that provides location and time information in all weather conditions, anywhere on or near the Earth where there is an unobstructed line of sight to four or more GPS satellites.
GIS	Geographic information system, a system designed to capture, store, manipulate, analyze, manage, and present all types of geographical data

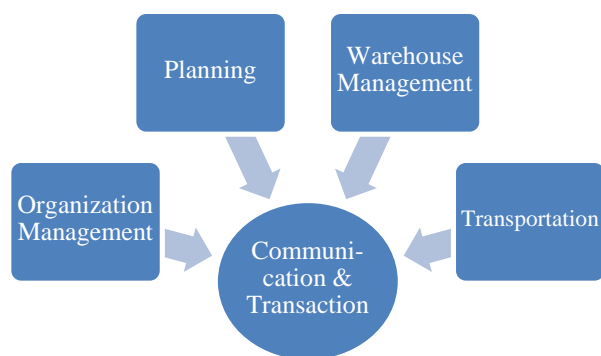


Fig. 3 Illustration of cause and effect groups of information technologies in automotive industry in Thailand

TABLE II
 GROUP SIGNIFICANCE VALUES OF INFORMATION TECHNOLOGIES IN
 AUTOMOTIVE ASSEMBLY INDUSTRY IN THAILAND

No	Group of information technologies	Significance value
1	Planning(C3)	11.12
2	Warehouse Management(C5)	10.91
3	Organization Management(C4)	10.89
4	Transportation(C6)	10.73
5	Communication(C1)	10.22
6	Transaction(C2)	9.68

Organization management (C4), warehouse management (C5), and transportation (C6) are also in the cause group whereas communication (C1) and transaction (C2) are the effect group. Fig. 3 illustrates the result of cause and effect groups.

Moreover, based on the survey, the level of significance of information technologies in automotive industry in Thailand can be prioritized as Planning (C3), Warehouse management (C5), Organization management (C4), Transportation (C6), Communication (C1) and Transaction (C2). The significance values are shown in Table II.

IV. SIGNIFICANCE OF INFORMATION TECHNOLOGY

Using the concept of Fuzzy DEMATEL, six questionnaires were constructed. They were used to analyze the significance of information technology in each group. Five experts were utilized. The cause information technologies in communication included E-mail, Fax, and FTP whereas the cause in transaction included E-business, Web Service, and E-commerce. The cause information technology in planning was MRP whereas the technologies in organization management were CRM, customer satisfaction, and SRM. The cause technologies in warehouse management included Barcode and WMS whereas the cause technology in transportation was TMS. Fig. 3 shows summarization of the cause and effect information technology.

V. INFORMATION TECHNOLOGY USED

Based on the survey to the five main automotive assembly industries in Thailand, it was found that MRP, ERP, Fax, and

E-mail were the information technologies that all organizations were used whereas the use of FTP and EDI were four out of five organizations. Finally, Web service, CRM, WMS, and GPS were used three out of five. Based on the use of information technology, it could be seen that organizations should give more concentration to Barcode and WMS. By giving more attention to those technologies, they would bring out other technologies.

VI. DISCUSSIONS

This paper presented the cause group of information technologies. The cause information technologies in the cause group of information technologies included MRP, Barcode, WMS, and CRM. The cause information technologies in effect group were E-mail, Fax, FTP, E-business, Webservice, E-commerce, and TMS. Those information technologies should be concentrated. Comparing to the information technologies used, the organizations should give more consideration in Barcode, WMS and CRM. The second set of information technologies that should give more concentration included E-business, Webservice, E-commerce, TMS, and FTP.

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