Framework for Measuring Knowledge Management for Service Development in Industrial Distributor

Sofianti, T.D., *Member, IAENG*

Abstract— **Knowledge is asset to enhance the company's competitiveness. By managing knowledge, companies can improve performance in developing products and services to their customers. Many papers discuss the benefits, the process, and the success factors of knowledge management. However, discussion on its performance in B2B environment as a unitary system is still limited. Industrial distributors have customers at B2B level. It supports machines and equipments produced by manufactured by services. Industrial distributors sell the machines together with services to enhance value obtained by the customers from the machines. Services are provided starts from bidding process, ordering the machines from the manufacturer, delivery, installation, until the after sale stage such as maintenance. This paper promotes framework to measure knowledge management performance of industrial distributor in developing its service for the customers. The contribution of this paper is measurement framework of knowledge management in service development.**

Index Terms— **knowledge management, service development, industrial distributor**

I. INTRODUCTION

The competition in industrial market nowadays has been increasing. Companies need to increase its ability to win the competition [1]. The ability to excel the competition no longer lies in the physical and financial capital assets. It lies in company's intellectual capital empowerment. Knowledge has been acknowledged as asset to improve the performance of the company in order to win the competition [2] [3].

Knowledge management is activity to maintain knowledge and transfer knowledge within an organization [4] [5]. The performance of knowledge management should be evaluated to determine the company's ability in converting knowledge and human assets into structural assets. Knowledge as structural asset is defined as knowledge that remains as the property of the company when employees leave the company. Measuring knowledge management performance can also identify additional value that can be obtained from company's knowledge management [6].

Several studies have been conducted to identify knowledge management performance by evaluating the performance of knowledge management in product development ([7] [8][9]). Products and services are output of activity and production process in knowledge-intensive firms. Product of a company may be either tangible or intangible products (or services). Service provided by a service provider is product of the company [6].

The purpose of this study is to learn how company conducts knowledge management in the development of services in the B2B market (market industries). Knowledge management in industrial distributor is observed in this study in purpose to obtain information about knowledge management in service development in B2B market.

In selling products in B2B market, some manufacturers assisted by industrial distributor to sell products. This is due to the limited resources owned by the manufacturer for adding service element to enhance the competitiveness of products. Industrial distributor sells products to B2B market together with supports to their customers, to complement products made by the manufacturer. Industrial distributor develops services to meet the needs of the customer.
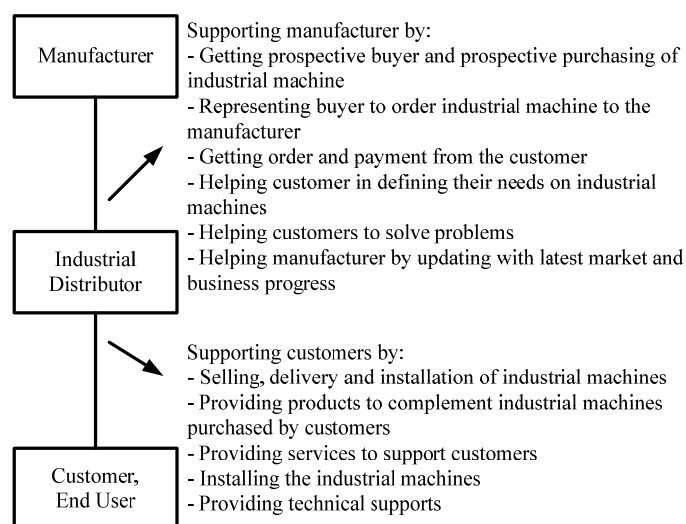

Fig 1.   Relationship of manufacturer, industrial distributor and customers (adapting Mudambi and Aggarwal [10]; Dwyer and Tanner [11])

Services needed include products such as goods, education and training related to the machines, installation, and other technical support. Figure 1 depicts the role of Industrial Distributor for manufacturer and customers.

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   Sofianti, T.D., a lecturer of Industrial Engineering Department of Swiss German University, Indonesia. Her research interest is the implementation of knowledge management for innovation and product/service development. (e-mail: tanika.sofianti@sgu.ac.id)

During project development services occurs, knowledge flows between industrial distributor and customers in a variety of forms, including knowledge of the customers, customer knowledge about a product that is required, knowledge about services that can be provided, the customer experience in using the products, and knowledge which should be given to customers, i.e. knowledge related to products and services being offered. The intensity of communication between the industrial equipment distributor and customers as knowledge flows between them causes the needs to execute knowledge management.

Knowledge management can strengthen, spread and expand knowledge for the benefits of industrial distributors [15]. Knowledge management can also improve the performance of new service development and innovation in company [16] [17] [18] [19] [20] [14]. Based on observations in several industrial distributors, knowledge that flows in services development performed by an industrial distributor can be depicted as in Figure 2.

Production function of knowledge is considered to be abstract in some previous studies. Thus they identified customer knowledge management performance by determining the level of efficiency, effectiveness, and productivity of knowledge management. Determination of productivity level of knowledge management has been carried out by Sumanth [21] and Demarest [22]. Productivity is defined as the relationship between output (e.g. goods produced) and inputs (i.e. resources used) in manufacturing process of transformation [21]. Rate of production of knowledge management by Demarest [22] was identified from output generated by knowledge management. Based on this understanding this study defines productivity of knowledge management as the ratio of output level to input level of knowledge management. Result of Demarest [22] represented the company performance improvement produced by knowledge management in term of new services development. Input represents resource used by knowledge management to produce output.

There are some researches that have been done related to knowledge management for the development of new services such as Matthing et al. [16], Lagrosen [17] and [14]. Some studies also built a measurement framework and correlation models to evaluate knowledge management in product development including Li and Calantone [23], Li and Cavusgil [24], Veldhuizen et al. [19], and Belbaly et al. [20]. Other researches that related to knowledge management for new products development by industrial distributors are Li and Calantone [23], Li and Cavusgil [24], Matthing et al. [16], Lagrosen [17], Edvardsson et al. [18], Veldhuizen et al. [19], Belbaly et al. [20] and Kohlbacher [14].

Sofianti et al. [25] proposed measurement framework model to determine the influencing factors of customer knowledge management for service development projects in B2B markets. Object analysis of their study is at project of service development. Results of the study show that the acquisition of knowledge cannot be evaluated at project level. Reward system to foster the productivity of knowledge management in industrial distributor was not confirmed. Therefore, it is important to evaluate the performance of knowledge management in industrial distributor at individual level to identify the effective way of knowledge acquisition. Further study on reward system to foster the productivity of knowledge management could lead to findings factors that effectively increase the performance of knowledge management.

II. PROBLEM STATEMENT

There are many papers related to knowledge management in service development that considered process, influencing factors and outcome. However, discussion on knowledge management in service development as a unitary system and explain the strategy to improve the performance is still limited. Based on this finding, problem to be solved in this paper is how to measure the productivity of knowledge management for service development in industrial distributor.
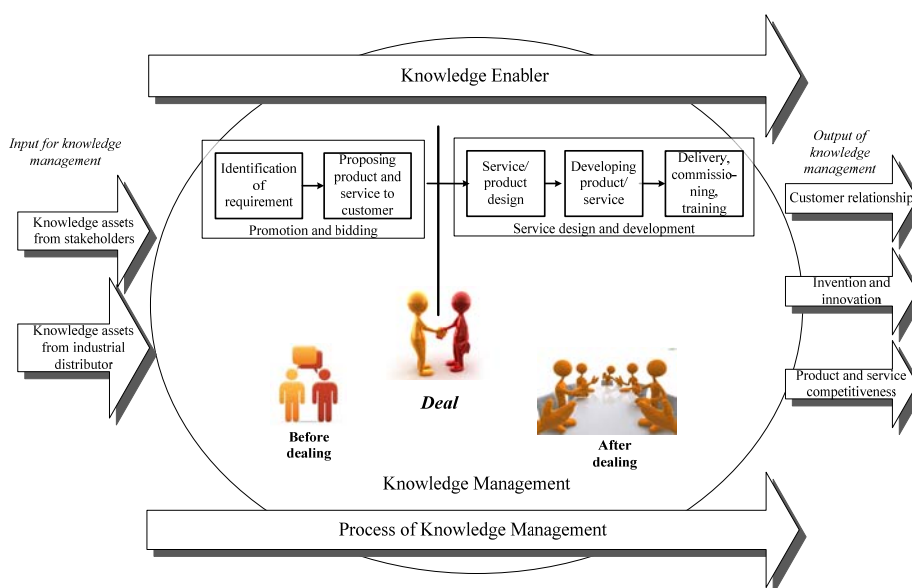

Fig 2. Customer knowledge management for new service development by industrial distributor [12] [13] [11] [14]
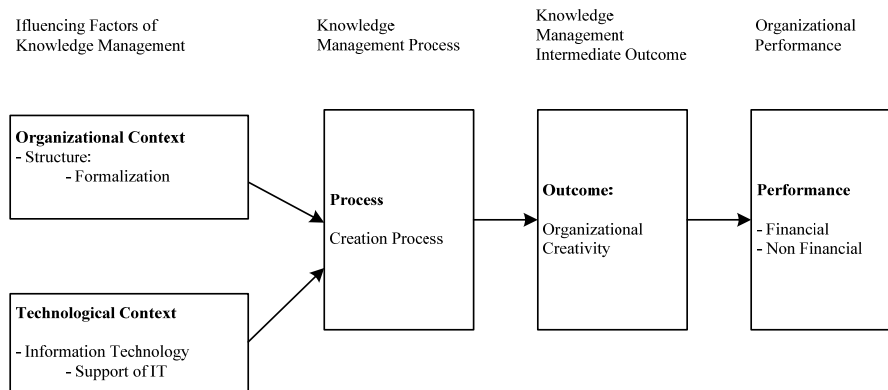
Fig 3.   Relationship model of influencing factors, process and the organizational performance [26]

III.   RESEARCH PURPOSE

The purpose of this paper is to develop measurement framework to measure the productivity of knowledge management for service development in industrial distributor. Measuring the performance could reveal the way to improve the performance in managing knowledge in the relationship of industrial distributor and its customer in service development projects.

IV.   METHODOLOGY

The methodology of this research consists of three main stages: literature review, observation, and framework development. The literature review stage consists of analysis and synthesis on previous researches related to process, influencing factors and outcome of knowledge management. Framework for measuring knowledge management performance was developed in framework development stage. The relationship between the knowledge enabler, knowledge creation, intermediate outcome and organizational performance of a knowledge management system was described by adapting Lee and Choi [26] as depicted in Figure 3. This diagram was used to develop the measures of performance of knowledge management in this research.

V.   THEORITICAL PERSPECTIVE

Many companies consider knowledge management to be difficult and only a few can run it well [15] [27]. One of the reasons is the absence of adequate framework for understanding the knowledge management [28]. The other reason is because knowledge management is defined and implemented in a very diverse way; depends on how company defines knowledge management [29] [30].

Belbaly et al. [20] describes the relationship between enablers and processes in knowledge management by identifying their impact on new product development project. However, framework and quantification of knowledge management productivity are not well elaborated yet. The relationship between customer perceived value, expected value, customer satisfaction and customer relationship at the outcome dimension of KM are already described. KM is considered to bring benefits to company in term of customer loyalty, customer trust, customer satisfaction and quality and timing of customer relationship. Thus, this paper promotes measurement framework that is

compiled from existing frameworks in previous researches, and validates this framework through empirical study. This is purposed to fill the gap in researches about measurement of knowledge management productivity.

VI.   PERFORMANCE MEASUREMENT FRAMEWORK OF KNOWLEDGE MANAGEMENT

The measurement framework of knowledge management in this paper is developed based on many literatures. They are researches on performance, process and influencing factors of knowledge management [26], knowledge in new product development [8], collaboration network [31], knowledge management dimension [32], customer knowledge creation in new product development [20] and the enabling factor of knowledge management [13].

Lee and Choi [26], Feng and Tian [13], and Berbaly et al. [20] developed the correlation models that can be used to build the model to evaluate the correlation of productivity, process and enablers of knowledge management for service development in industrial distributor. Sofianti et al. [33] developed the correlation model to identify the influencing factors of customer knowledge management in service development as can be seen in Figure 4. The dimension of measurement to be constructed refers to Figure 4 and produced the measurement framework as described in Table 1.

A. Stakeholders contribution in term of knowledge

In performance measurement of a process, Kennerly and Neely [34] used a stakeholder contribution point of view or stakeholder centric. Ulrich and Eppinger [35] considered stakeholder contribution in measuring product development based on inter-disciplines insight in the process. In this paper the contribution of customers, suppliers, vendors and industrial distributor are assigned to the input dimension.

B. Process in Knowledge Management

Knowledge process in this paper consists of exploitation and acquisition of knowledge that provides knowledge for the customer. Knowledge exploitation is required since invention without knowledge exploitation will not produce innovation [36]. This knowledge is more focused on information and specification of services developed by the marketing or R & D. The acquisition of knowledge is considered based on the understanding that knowledge to be managed should be collected and absorbed by industrial distributor.
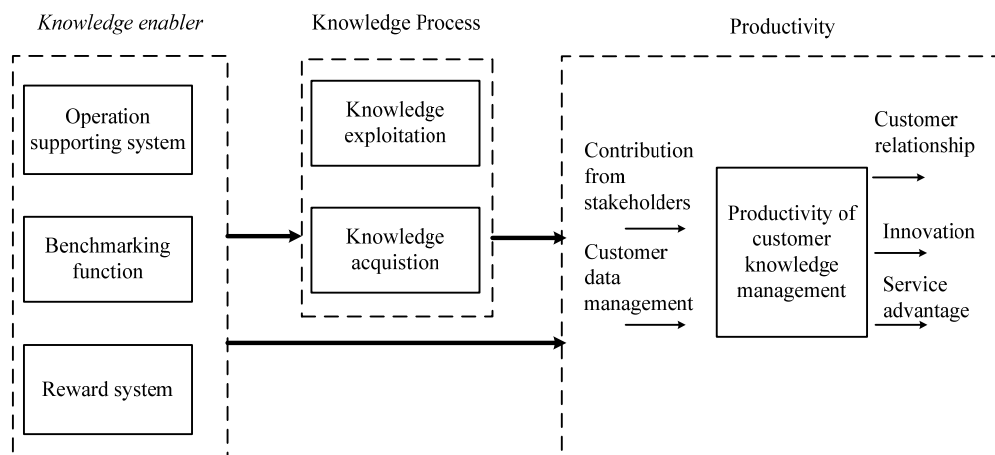
Fig 4. Framework to identify influencing factors of customer knowledge management in service development [33]

C. Influencing Factors of knowledge management

Framework to measure influencing factors in this research considers operational supporting system, benchmarking function and reward system. The operational supporting system is considered by adapting previous studies on influencing factors of knowledge management [26], enabling factors of knowledge management in product development [8][20], enabling factors of knowledge management [13] and enabling environment and factors of collaborative network [31]. This paper promotes standard operation procedure also information system and technology as the operational supporting system of knowledge management.

Lettice et al. [8] includes competitive context based on the idea that organizational performance is influenced by the competitive context in which the organization operates. Competitive context is mechanism to capture knowledge about competitor, thus in this research this is used as benchmarking function. Rumizen [37] promotes organizational alignment to support knowledge management. Organizational alignment is activities to run organization as a team; this includes the provision of rewards or incentives [38]. In this paper, this measure is adapted as reward system, which is able to foster the employee and customer to work together in developing service.

D. Outcome of knowledge management

Knowledge management for product and service development has been widely studied to increase innovation and competitiveness [14] [39] [20] [18]. In this research the output of the knowledge management is to increase innovation, new service advantage, service market performance and customer relationship. Lettice et al. [8] promoted innovation as impact of knowledge management in new product development. Innovation is the indicator of the creativity. Li and Cavusgil [24] promoted product advantage and product market performance as the impact of market knowledge on new product development. Product advantage is the key success factors of NPD [40]. The process of customer knowledge positively correlated with new product advantage [23]. Feng and Tian [13] promoted level of customer relationship as the outcome of knowledge

management. This is the consequences of the customer perceived value, customer loyalty and customer satisfaction. Customer relationship indicates the customer perceived value obtained from customer knowledge process [13].

Framework for measuring knowledge management in service development is developed through literature review and verified through interview to representative staffs of four industrial distributors. The framework developed is as depicted in Table 1.

TABLE 1.
FRAMEWORK TO MEASURE THE PERFORMANCE OF KNOWLEDGE
MANAGEMENT FOR SERVICE DEVELOPMENT IN INDUSTRIAL DISTRIBUTOR.

Variables	Definition
Input	
Level of contribution from the stakeholders	Level of contribution from stakeholders, including from customer and industrial distributor itself, for service development. References: Feng and Tian [13], Smith and McKeen [32], Lettice et al. [8]
Customer and supplier data management	Level of customer and supplier data management References: Beuren et al. [41], Belbaly et al. [20], Smith and McKeen [32], Feng and Tian [13]
Output	
Customer relationship	Measure of level of value obtained by the customer as the impact of knowledge management. Reference: Feng and Tian [13]
Innovation	Number of invention and new service design as the output of knowledge management References: Kohlbacher [14] , Matthing et al. [16] Kogut and Zander [42]
Service advantage	Level of service advantage compared to service provided by other distributor References: Li and Cavusgil [24], Li and Calantone [23]

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FRAMEWORK TO MEASURE THE PERFORMANCE OF KNOWLEDGE
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Variables	Definition
Process	
Knowledge exploitation	Level of efforts to exploit knowledge to customer and supplier to increase the opportunity of service to be absorbed by market. Reference: Trott [36], Lee and Choi [26], Lettice et al. [8]
Knowledge acquisition	Level of activities for new knowledge collection and acquisition from customer and supplier during the execution of service development project. References: Lee and Choi [26], Feng and Tian [13], Lehtimäki et al. [43]
Knowledge Enablers	
Operational supporting system	Level of utilization of system to support knowledge management Reference: Lee and Choi [26], Feng and Tian [13], Lettice et al. [8], Belbaly et al. [20], Moenaert et al. (1994) in Massey and Kyriazis [9]
Benchmarking function	Number of activities to increase service quality by doing benchmarking with the competitors References: Lettice et al. [8], Li and Cavusgil [24], Drew [44]
Reward system	Appreciation given by distributor to the employees, customers and suppliers based on of their performance assessment in term of knowledge management. References: Rumizen [37], Lettice et al. [8], Belbaly et al. [20], Ho [38]

VII. DISCUSSION, CONCLUSION AND RECOMMENDATION

Table 1 depicts the measurement framework to evaluate knowledge management for service development in industrial distributor. By considering Table 1 and discussion in the previous paragraphs, it can be concluded that areas related to knowledge management for service development in industrial distributors are including marketing and CRM. It has been considered primarily to improve the performance of service development and innovation. As maintaining existing customer is acknowledged to be much easier and cheaper than grabbing new customer, then KM integration to the management of customer relationship and marketing will reduce the risk the new product fails in the market. Figure 2 describes the interaction between industrial distributor and customer that occur at every stages of service development project conducted by industrial distributor. Thus, the management of customer knowledge should be considered together with knowledge of manufacturer, knowledge of supplier and knowledge of industrial distributor itself. As the relationship with the stakeholders occurs in long term, the influence of the manufacturers, suppliers, and customer perception and knowledge in articulating the idea into a design should not be rejected.

Although knowledge obtained from personal interaction with the stakeholders brings benefit to companies, knowledge enablers such as culture and incentives should be engineered for implementation purpose. Therefore,

constructing success factors of the knowledge management implementation in service development projects should consider KM enablers such as technology, structure, people and culture. It can be proceeds by developing the performance measurement tools for maintaining the benefits obtained from this implementation.

The recommendation for further study is to elaborate the measurement framework into list of indicators for questionnaire development purpose. For validity and reliability testing it will be necessary to involve more than thirty correspondences. The purpose of involving such correspondences is to enable factor analysis for data validation.

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