

# Customer Knowledge Management--A Case Study of Taiwan's Plastic Industry

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## Abstract

This paper investigates customer knowledge management activities of Taiwan's plastic industries. The results demonstrate that the bulk of customer knowledge comes from data related to customer purchase orders and complaints. Furthermore, marketing, production, and research and development are the main departments that developed and reuse customer knowledge. The benefits derived from knowledge management for enterprises do not vary with the position of the vendor on the business scope. In addition, the benefits derived by customers from knowledge management are directly related to the benefits gained by the five major business functions, while the benefits derived from the customer knowledge management are also directly related to customer satisfaction. Summarizing the above results, an Acquisition—Development—Reuse (ADR) model is proposed and can provide the enterprises with a systematic reference model when the business attempts to construct a customer knowledge management system.

**Key Words:** Knowledge, Knowledge Management, Customers Knowledge Management, Plastic Industry

## 1. Motivation

After land, labor, capital, and technology, knowledge has become the key to success in enterprise. On the other hand, customers represent the most important variable that can impact the enterprise's business results. Therefore, customer knowledge is the most critical piece in the business organization. In a traditional economy, the customers are buying "integrational resources", which are material based. In the new economy, however, the customers are buying "integrational information", which is information-based. Every company should be aware of the concept "customer knowledge", since customer satisfaction translates

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directly to business results. However, for most enterprises, their focus is still on the products. What they see is nothing more than the products and production technology to make those products, while the demands by customers are largely ignored.

What generates additional customer requirements is customer satisfaction, while customer satisfaction will be built upon customer knowledge management (CKM). As an enterprise faces a transformation, how does it implement CKM to make itself more competitive? This is the motivation behind this paper. To establish the relevance of CKM to the five major functions of any enterprise: sales and marketing, production, research and development, human resources, and accounting and finances, the relationship between the benefits derived from CKM and the enterprise's business results will be examined.

## 2. Literature Review

### 2.1 Definition and Implications of knowledge management

Knowledge is formed from the spiral cycle of creation (Nonaka et. al., 2000). Knowledge can be classified as tacit, explicit, or self-transcending (Sharmer, 2001). The steps toward knowledge formation are data — information — knowledge. Raw data that are recorded become data, which can turn into information through classification, consolidation, analysis, and interpretation. The fluid composition resulting from information then defines knowledge (Devenport and Pausak, 1998). Customer knowledge is an integrated type of knowledge. Following information exchange with the customers, five levels of customer knowledge will emerge: market, segmentation, purchasing units, decision influencers, and individuals. Knowledge can be further classified into types that can be explained, expressed, explicit, verbalized, and conveyed. All of these types of knowledge are of the explicit type, while implicit type of knowledge is something that cannot be conveyed, explained, or owned by an individual through observation. Implicit knowledge serves practical purposes and is often acquired on the job (Ambrosini and Bowman, 2001). The literatures relevant to knowledge management and CKM have been organized into the following orientations from a knowledge strategy point of view: an orientation toward knowledge derived externally and created internally, a knowledge basis orientation, and a market production orientation. In terms of the different areas governed by their respective knowledge, there are four types of knowledge: corporate-wide knowledge, technical knowledge, product innovation knowledge, and customer knowledge. These are listed in Table 1 below.

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**Table 1.** Relevant Literatures on Knowledge and Customer Knowledge

Strategic Type	Author	Description	Knowledge Areas
Externally Derived and Internally Created	Daft ( 2001 )	Management model based on people—document, people—people	Corporate-wide knowledge
	Schamer ( 2001 )	Complement the company's activities, execution, strategy, and mindset with internal, explicit, and self-transcending knowledge to form the three activity levels of knowledge management: knowledge related to work, knowledge related to work performance, and knowledge related to ability to trace back to the work's origin.	
	Gold et al. (2001)	Combine internal knowledge, explicit knowledge, and basis of knowledge to form the knowledge management model.	
Knowledge Basis Orientation	Tsoukas& Vladimirov ( 2001 )	Strive for the balance point between two important activities; continue to create new knowledge that can be shared and knock down the walls and barriers that separate the organizations. Transfer knowledge by leveraging it.	
	Kransdorff ( 2001 )	Experience, knowledge accumulation, intuition, learning by accident, regurgitation, and prediction.	
	Nonaka et al. (2000)	The process consisting of the vision, assets, and transformation process, and transformation platform of knowledge.	
	Dixon ( 2001 )	Emphasizes on the mutually complementary relationship between transfer of knowledge and transfer of flow processes. The formation of a decision tree model will also take place based on the following types of transfer: continuous, differential, strategic, and expert.	
Market Production Orientation	Leonard-Bartoln ( 1995 )	Model consisting of problem resolution through sharing, implementation and integration of new technologies, process flows, and other tools.	Technical Knowledge
	Liebowitz and Lyle ( 1997 )	Create knowledge through information flow and job exchanges.	Product innovation knowledge
	Wayland & Cole ( 1997 )	Planning, goal setting, integration and analysis, and sharing and utilization.	Customer knowledge
	Nonaka et al. (2000)	Knowledge created from the interaction between a company's production and mindset.	

## 2.2 Deriving and Creating Knowledge

The creation and derivation of customer knowledge can be divided into two types: results oriented and creation oriented, which are described below:

- (1) **Results Oriented:** Maintaining a certain level of contact with the customers. The information transmitted through contact with the customers is how sales and marketing derive customer knowledge (Duncan and Moriarty, 1998). On the other hand, knowledge about the market, that is, the product selling process, includes such items as current and potential markets, customer data, and customer habits, and may have an impact on the external environment (Liebowitz, 2001).
- (2) **Creation Oriented:** The six sources to derive knowledge from are innate talent, learning from the past, learning by experimentation, gauged learning, learning from the customer, and recruiting talents from competitors. As for deriving customer knowledge, there are four ways to do that: interaction with others, through observation, personnel prediction, and experience accumulation.

### **2.3 Knowledge Transfer, Implementation, and Maintenance**

What knowledge management means to an enterprise is that knowledge formerly scattered throughout the various departments and individuals can be consolidated through the use of tools. Consolidated knowledge can then be shared with and used by other employees, thus lowering the cost of searching for the knowledge and maximizing the reuse value of knowledge. Throughout the process of CKM, enterprise must effectively utilize the derived knowledge about the customers, which may then qualify as successful knowledge management. In addition to an efficient information technology environment, an enterprise must also adopt appropriate business processes to construct CKM systems. In practical applications, research scholars have divided the transfer, implementation, and maintenance of customer knowledge into the following models: top-to-bottom, bottom-to-top, middle-to-top-then-bottom, middle-to-bottom-then-top, and all-inclusive (Table 2).

### **2.4 Evaluation for Knowledge Based Performance Results**

The purpose of evaluating the performance results is to motivate and inspire the management to take actions that will yield the greatest benefits for the entire company. There are three difficulties associated with measuring knowledge. First, the exact nature of knowledge will be difficult to measure. Second, the knowledge can only be measured its result. Last, knowledge based performance indicators should support all decisions related to knowledge (Neef, 1998). The implications of intellectual assets are as follows: (1) human capital, (2) structural asset, (3) customer assets. These assets can be calculated individually or collectively. Collective calculation will be based on (1) market value / book value, (2) Tobin's Q value, and (3) pricing for intangible assets. If calculated individually, the most representative example is the intellectual

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asset model constructed by Scandia. This model looks for and establishes many key indicators from five different focus areas to form the basis for measuring a company's true value. These focus areas are finances, customers, processes, human resources, innovations, and development focus (Edvisson & Malone, 2001). The market based on customer knowledge is usually less efficient than market based on finances, but the management can formulate strategies through creation and application of superior customer knowledge.

**Table 2.** Transfer, Implementation, and Maintenance of Knowledge and Customer Knowledge

Models	Scholar	Description
All-inclusive	Stenmark(2001)	Turning tacit knowledge into explicit knowledge may be done through concretization, insertion, intellectualization, culturalization, and encoding. An atmosphere of trust must also be fostered to enable proper transfer of tacit knowledge.
	Dixon(2001)	Continuous transfer, alike transfer, differential transfer, strategic transfer, and expertly transfer
	Davenport and Pausak(1999)	Knowledge sharing through information technology and construction of a transfer environment.
From bottom-to-top	Scharmer(2001)	Expand knowledge sharing into 3 spiral structures: the learning and sharing spiral for sharing of explicit knowledge, the thought sharing spiral for sharing tacit knowledge, and the sharing spiral for sharing self-transcending knowledge.
	Madhavan & Grover(1998)	Product development is just like knowledge management. It is a knowledge that moves from the inside to the outside, from here an effective and efficient knowledge transfer can emerge.
	Becker(2001)	Construct channels that enable free flow of information; recreate lost knowledge. Build harmonizing mechanisms that help turn employees and company into a learning organization. Divide the organization into smaller units and provide more helpful information to decision makers during their decision making process to help share and further develop knowledge.
From top to bottom	Sinkula(1994)	Customer information can be acquired during business transactions, such as routine meetings and discussions, personal contact, focus groups, and problem resolutions.
	Swap et al.(2001)	Guidance from consultants and story-telling are effective means to effect knowledge transfer. The effectiveness can be strengthened through the use of information technologies.
From middle to top then bottom	Wu(2000)	Four phases to implement and transfer knowledge: customer acquisition, customer purchase, customer service, and customer analysis.
	Markus(2001)	Implementation and utilization of knowledge are divided into four types: production knowledge for others to use, expert knowledge for sharing and learning, looking for problem solutions, new types of knowledge, and production knowledge for self-use.

### 3. Research Methods

#### 3.1 Research Framework and Hypotheses

The goal is to organize the measurable variable items being researched and the research framework as shown in Figure 1. This paper uses the multi-variable quantitative analysis, which targets the data collected using questionnaires. The statistic software, SPSS 8.0, is used as an organizational and analytical tool.

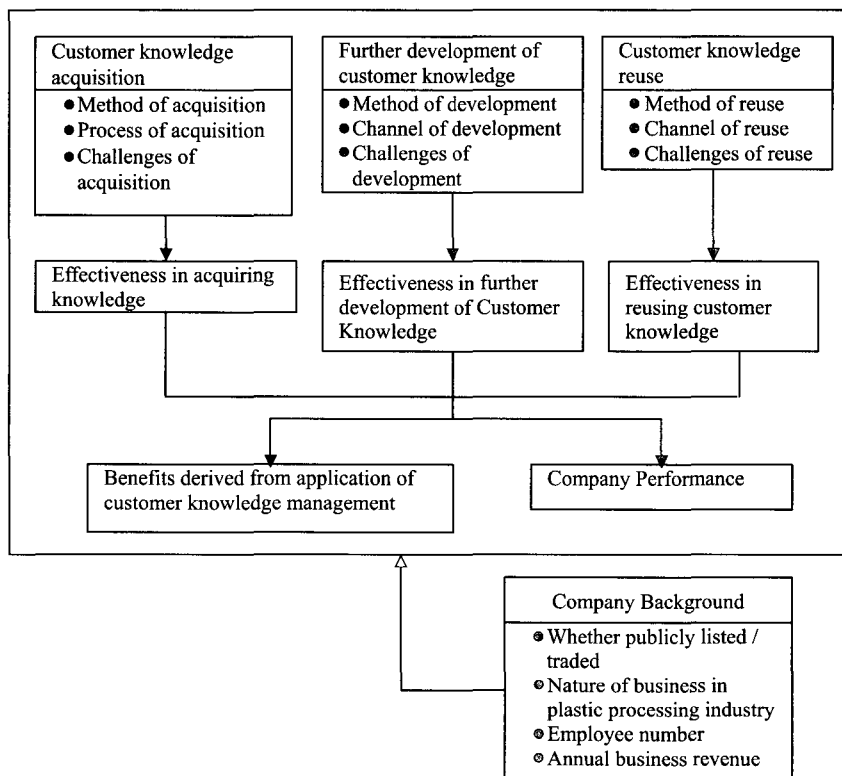


Figure 1. Research Framework

#### 3.2 Research Hypotheses

It is the purpose of this paper to study the current state of application, implementation, and models of CKM. Analysis and discussions will be performed in the following sections, including statistical analysis, matrices and t-test, other relevant analyses, and ANOVA analysis. The hypotheses for this paper are as follows:

- H1 : Company background significantly impacts on how well customer knowledge is acquired.
- H2 : Company background significantly impacts on how well the customer knowledge base is further developed.
- H3 : Company background significantly impacts on how well customer knowledge is reused.
- H4 : Impact on how well customer knowledge is acquired due to the type of method and process used to acquire customer knowledge.
- H5 : Impact on how well customer knowledge base is further developed due to the type of method and channel used to further develop the customer knowledge base.
- H6 : Impact on how well customer knowledge is reused due to the type of method and channel used to reuse customer knowledge.
- H7 : The correlation of the effectiveness of acquiring, further developing, and reusing customer knowledge with regard to the results derived from applying CKM in the five major functional areas of an enterprise.
- H8 : The correlation between company performance and the effectiveness in acquiring, further developing, and reusing customer knowledge.

### **3.3 Data Collection**

Questionnaires are used in this paper to gain insight into the current state of CKM and application in the traditional industries by targeting the Taiwanese plastic industry. The questionnaires are administered by selecting a random sample of 200 among the 942 companies listed in the 2001 directory published by the plastic industry association. Moreover, 100 additional questionnaires are sent out by mid-stream company personnel and distributors to help broaden the sample data collected. In all, 300 questionnaires were sent out, and 110 were returned, making the sample return rate 36.7%. Subtracting from this 3 questionnaires that were voided, and 14 that were improperly and repeatedly filled out, the actual number of questionnaires available for analysis is 93, making an effective return rate of 31%.

### **3.4 Reliability and Effectiveness Analysis**

Relevant analyses are performed on the effectiveness of CKM, the benefits gained in the enterprise's five major functional areas, and contributions toward the enterprise through CKM. This is to prove that the results will be consistent. It is discovered that in each type of analysis the *a* values are 0.85, 0.88, and 0.80 respectively, which all meet the standard. In terms of effectiveness, the questions contained in the questionnaire are based on theories and references to similar questionnaires from the past, with relevant revisions made. Interviews were also conducted with business operators to heighten the effectiveness.

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## 4. Data Analysis and Discussions

### 4.1 Statistical Analysis of Data

The data collected shows that the type of customer knowledge that the plastic companies collected the most is customer purchase orders; this customer purchase orders knowledge that is also shared most often. The type of customer knowledge most often reviewed and worked on is customer complaint data. Sales departments most often share customer knowledge with marketing, production, and R&D departments. Customer knowledge is most often disseminated and absorbed through education and training. The technology tool frequently used for CKM is a database system. The technology to be adopted in the future will most likely be an integrated information system. It is also believed that customer knowledge will generate greater benefits when employees cooperate with each other. The type of managers that are most suitable for the job of integrating customer knowledge comes from the sales departments. The related data analysis is shown on Table 3, Table 4, and Table 5.

**Table 3.** The related data analysis of H1, H2, and H3

Items	Section	F value	P value
H1:	H1-1 (Go to Public)	0.629	0.536
	H1-2 (Nature : Up-Middle-Down stream)	2.568	0.082
	H1-3 (Employee numbers)	1.012	0.406
	H1-4 (Annual Revenue)	1.131	0.347
H2:	H2-1 (Go to Public)	1.107	0.335
	H2-2 (Nature : Up-Middle-Down stream)	4.433	0.015*
	H2-3 (Employee number)	1.987	0.103
	H2-4 (Annual Revenue)	2.956	0.024*
H3:	H3-1 (Go to Public)	1.581	0.211
	H3-2 (Nature : Up-Middle-Down stream)	4.026	0.021*
	H3-3 (Employee number)	0.934	0.448
	H3-4 (Annual Revenue)	1.347	0.259

Significant level: \*\*\*P<0.001    \*\*P<0.01    \*P<0.0

### 4.2 Correlation between Company Background and CKM (Table 3)

Assessing the presence of correlation between companies with different backgrounds, and the companies' effectiveness in acquiring, further developing, and reusing customer



knowledge will help determining whether these companies have achieved difference performance results using CKM. During data analysis ANOVA assessment is performed on company backgrounds and performances. This is to test the hypotheses H1-H3.

**Table 4.** The related data analysis of H4, H5, and H

Items	Section	t value	P value			
H4:	Acquiring method	Corporation	0.771	0.443		
		Externalization	2.821	0.006**		
		Integration	4.507	0.000***		
		Internalization	2.352	0.021*		
	Acquiring process	Top-to-Bottom	0.910	0.365		
		Bottom-to-Top	0.198	0.844		
		Middle-to-Bottom-then-Top	-0.518	0.606		
		Middle-to-Top-then-Bottom	2.701	0.008*		
H5:	Developed method	KM department to promote	1.141	0.257		
		Training	2.969	0.004**		
		Internal meeting	3.725	0.000***		
		Intranet	2.786	0.006**		
		Seminar	0.442	0.674		
		Project team to promote	1.887	0.062		
	Developed Channel	Intranet	3.305	0.001***		
		Database system	2.786	0.006**		
		Document transmission	3.867	0.000***		
		Verbal information exchange	-2.029	0.045*		
		Technical support system	4.998	0.000***		
		Project implementation	1.763	0.081		
		H6:	Reused Method	Database system	3.5	0.001***
				Collection from department itself	-0.057	0.955
Expert team to promote	0.826			0.411		
Collection from employee-self	-1.532			0.129		
Reused Channel	Intranet		3.953	0.000***		
	Database system		2.804	0.006**		
	Collection from employee-self		-2.719	0.008**		
	Technical support system		3.953	0.000***		
	Project management		2.090	0.039*		

Significant level: \*\*\*P<0.001    \*\*P<0.01    \*P<0.05

**Table 5.** The related data analysis of H7 and H8

Items	Section	Customer Knowledge acquiring	Customer Knowledge expand	Customer Knowledge reuse
H7:	Marketing	0.475**	0.699**	0.470**
	Production	0.448**	0.459**	0.454**
	R&D	0.355**	0.443**	0.398**
	Human resource	0.361**	0.373**	0.413**
	Finances	0.206*	0.263*	0.321*
H8:	Business operation	0.006	0.158	0.122
	Sales growth	0.098	0.05	0.085
	Profitability	0.012	0.009	0.081
	New business growth	0.005	0.064	0.02
	Customer satisfaction management	0.172*	0.206*	0.18*

Significant level : \*\*\*P<0.001    \*\*P<0.01    \*P<0.05

- (1) After analysis it was discovered that such factors as whether a company is publicly listed and traded, the company's {something is missing here}, the nature of the company's business, the number of employees, and the size of the annual revenue have no prominent effect on the effectiveness of acquiring customer knowledge. Thus, Hypothesis H1 is not supported.
- (2) The effectiveness in further developing customer knowledge base has little to do with whether a company is publicly traded or its employee numbers. It, however, ties in with the nature of the company's business in the plastic processing industry, and its annual business revenue. The effectiveness is especially pronounced for the upstream suppliers in the supply chain, and those with larger business revenues. This partially supports the H2 hypothesis.
- (3) The effectiveness in reusing customer knowledge has nothing to do with whether the company is publicly listed and traded, its employee number, or its annual business revenue. It does have to do with the nature of the company's business, while the upstream suppliers in the supply chain also tend to yield better effectiveness in this area than downstream suppliers. This also partially supports the H3 hypothesis.

#### 4.3 The Method of CKM in Relation to the Effectiveness of CKM (Table 4)

Assessment is also made on the effectiveness of applying, further developing, and reusing

customer knowledge due to the different methods and channels in acquiring, further developing, and reusing customer knowledge. In this assessment, every item is divided into two groups, one with adoption and one without. T-test is performed separately on these groups to prove Hypotheses H4, H5, and H6.

- (1) The following methods of acquiring customer knowledge have greater impact on the benefits derived from customer knowledge: externalization, integration, and internalization. After comparing average scores, the group having adopted these methods gains greater benefits than the group that has not. During the process of acquiring customer knowledge, only the middle-to-top-then-bottom process model has any impact on the benefits derived from customer knowledge. When the average scores are compared again, it is discovered that the group having adopted the methods scored higher, proving that there must be appropriate management processes in acquiring customer knowledge.
- (2) The methods to further develop the knowledge base about the customers having prominent impact on the effectiveness of such expansion include education and training sessions, internal meetings, and communication through intranet. After comparing the average scores, it is seen that the group having adopted the above measures do better in getting greater effectiveness from the expansion. With respect to expansion channels, the effectiveness in customer knowledge expansion is closely tied in to the use of an intranet, database systems, document transmissions, verbal information exchanges, and technical support systems. With the exception of verbal information exchange, other channels have prominent effect in yielding better effectiveness in knowledge expansion.
- (3) In the area of customer knowledge reuse, those having adopted information databases achieve better results than those that have not. Those that have adopted an intranet system, database technology, technical support systems, and project management techniques perform better than those that have not. This proves that database is the most appropriate mechanism in the area of customer knowledge reuse. In terms of channels for customer knowledge reuse, a company that has sharing mechanisms built into its channels also performs better. This proves that the customer knowledge reuse channels must allow sharing among the employees to gain the greatest benefits.

#### **4.4 Relationship between the CKM Benefits and Applied Performance (Table 5)**

Based on the effectiveness in acquiring, further developing, and reusing customer knowledge, and the benefits derived from application of CKM in the five major functional areas of an enterprise during the past three years, an analysis to assess the correlation between them is performed to prove the validity of hypotheses H7 and H8.

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By organizing the researching results, it can be shown that effectiveness in acquiring, further developing, and reusing customer knowledge is directly related to the application of CKM in managing the marketing, production, R&D, human resources, and finance aspects of an enterprise. This supports Hypothesis H7 of this research. But in terms of performance results over a three-year period, only the customer satisfaction area is showing a definite impact due to the customer knowledge. Other areas like business operation, sales growth, profitability, and new business growth do not show as clear an impact. This partially supports Hypothesis H8.

**4.5 Consolidating the above information and conclusions, the results of this research are summarized in Table 6.**

**Table 6. Results Summary**

Hypothesis	Results	Explanation
H1	Not supported	Company background does not have prominent impact on the effectiveness in customer knowledge acquisition.
H2	Partially supported	Effectiveness in further developing the customer knowledge base has to do with the nature of the company's business in the plastic processing industry, and the annual business revenue.
H3	Partially supported	Effectiveness in customer knowledge reuse has to do with the nature of the company's business in the plastic processing industry.
H4	Partially supported	Those adopting externalization, integration, and internalization approach in acquiring customer knowledge have better performance. For acquisition process, those adopting the middle-to-top-then bottom process show better performance.
H5	Partially supported	Dissemination and further development of customer knowledge is directly related to the availability of education and training sessions, and the use of internal meetings held over the intranet. Development channels are tied in to the use of the intranet, databases, database systems, document transmissions, verbal communication, and technical support systems. However, the verbal communication channel tends to be less effective than the other channels.
H6	Partially supported	For effectiveness in reusing customer knowledge, companies adopting database systems show better performance. Others using the intranet, databases, technical support systems, and project management techniques also show better performance in knowledge reuse.
H7	Fully supported	Direct impact on marketing, production, R&D, human resources, and finances due to the application of CKM.
H8	Partially supported	Business performance results are only related to customer satisfaction. No correlation with company's business results, sales growth, profitability, and growth in business volume.

An A-D-R (Acquisition-Development-Reuse) model based on the results proven by real-world data in and organized in this research has been developed for reference purpose by enterprises wanting to start out on the CKM program. Figure 2 explains relevant the CKM process using a process flow chart.

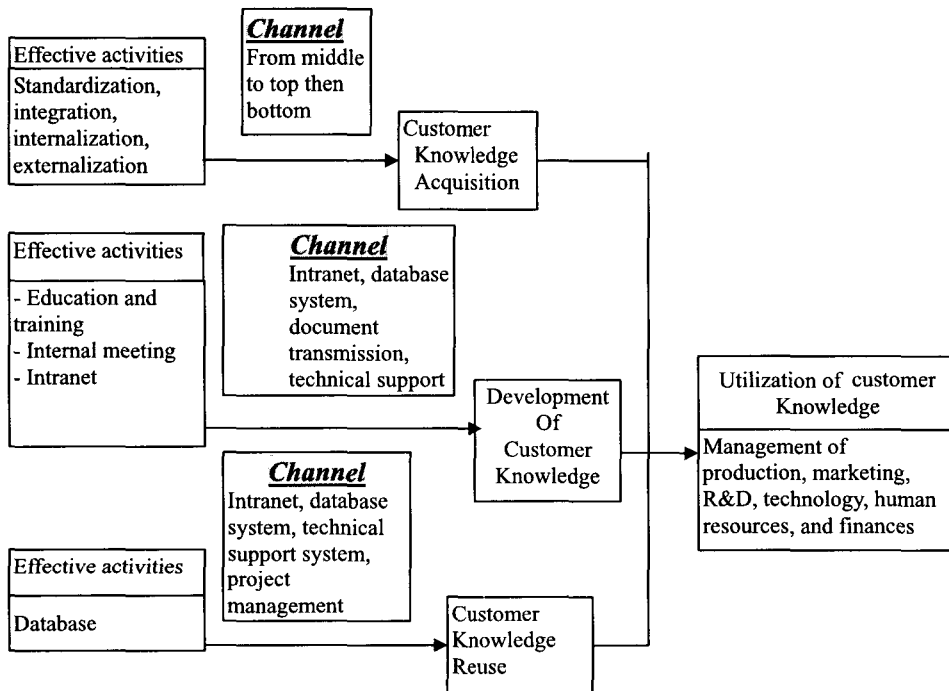


Figure 2. A-D-R CKM model

The most effective activities of acquiring customer knowledge are as follows: standardization, externalization, integration, and internalization. During the process of acquiring customer knowledge, the middle-to-top-then-bottom process model is better channel and is appropriate management processes in acquiring customer knowledge.

To develop the customer knowledge, the most effective activities of expansion include education and training sessions, internal meetings, and communication through intranet. With respect to expansion channels, the effectiveness in customer knowledge expansion is the use of an intranet, database systems, document transmissions, and technical support systems.

In the area of customer knowledge reuse, the knowledge database is the most appropriate mechanism in the area of customer knowledge reuse. In terms of channels for customer knowledge reuse, enterprises that have adopted an intranet system, database technology,

technical support systems, and project management techniques perform better than enterprises that have not. In addition, a company must have a sharing mechanism among the employees so as to gain the greatest benefits.

## 5. Conclusions and Recommendations

During this research which looks into CKM activities by Taiwan's plastic industry vendors, it is found out that the percentage of enterprises that collect and share customer data, while expressing that they have no problem doing so is a scant 13.3%. The percentage of those who say that there is no problem with further developing the knowledge is only 15.6%; and those with no problem reusing the knowledge, 18.3%. This indicates CKM lacks effective processes and mechanisms to be properly implemented. It is also determined that customer purchase orders and customer complaint information are the two main sources of knowledge about the customers. The primary enterprise departments that further develop and reuse customer knowledge are marketing, production, and R&D. The benefits derived from the application of CKM are the greatest for the marketing department, followed by production, R&D, finances, and human resources. The benefits that an enterprise may gain do not vary with the position on the supply chain that the enterprise occupies, the amount of business revenues, or the number of employees. In addition, the benefits derived from CKM are directly related to the management performance of the five major functional areas of an enterprise. Those benefits are also directly related to customer satisfaction. Lastly, by combining academic discussions and real-world data, an A-D-R model for CKM was developed to offer the enterprises a systematic approach in constructing a CKM system. Summarizing the above the author believes that this research has contributed in the following ways:

1. Using a systematic approach and combining academic theories and real-world data, the A-D-R model for CKM is developed for reference purpose by enterprises wanting to implement a CKM program.
  2. Enterprises should effectively implement the process for CKM, which would allow the benefits gained to be reflected in the performance by the five major functional areas of an enterprise.
  3. As an enterprise implements knowledge management program, they should begin with customers who are closest to the market. This allows knowledge to generate benefits. The
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enterprise should also turn knowledge into an asset, which is an important issue in knowledge management.

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