An Empirical Study on the Impact of Organizational Memory on Organizational Performance in Manufacturing Companies

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Abstract

Knowledge is the important asset in organizations. Effective knowledge management plays a crucial role in organizational development. Organizational memory (OM) integrates all kinds of organizational knowledge. It is regarded as the central prerequisite for IT support of knowledge management. The paper analyzes the knowledge structure of OM in manufacturing company from internal and external sources of organizational knowledge. OM in manufacturing company is composed of four types, that is, managerial OM, technical OM, cultural OM and marketing OM. These four types of OM components enhance organizational development jointly. Based on the data from International Manufacturing Strategy Survey (IMSS), factor analysis is used to test the classification of OM and organizational performance (OP), canonical correlation analysis is conducted on the impact of OM components on OP in manufacturing companies. The results from structural equation modeling suggest that OM is a dynamic factor, OM formed in different time has different impact on OP.

Keyword: *Organizational Memory, Organizational Performance, Knowledge Management, Manufacturing Company*

1. Introduction

In today's knowledge-based economy, knowledge has becoming the important asset in organizations. The creation, acquisition, and effective utilization of knowledge are key factors of a successful organization. The sum of all knowledge assets owned by an organization can be considered to be its organizational memory (OM)[1]. OM is a central concept used to describe the repository for organizational knowledge[2].

OM was considered as the means by which previous knowledge is brought to bear on present activities, thus resulting in higher or lower levels of organizational effectiveness[3]. OM integrates all kinds of organizational knowledge, and extends and amplifies this asset by capturing, organizing, disseminating, and reusing the knowledge[4]. So OM is regarded as the prerequisite for IT support of knowledge management. From the fields of organization science, marketing, and strategy, some researchers[5,6,7,8] consider that OM is fundamental to competitive advantage. OM enhance the organization's competitiveness by improving the way in which it manage its knowledge, so as to enables organizational learning (OL) and continuous process improvement.

OM should provide the knowledge required for current tasks. Keeping an OM, an organization should also be able to look back on performed actions and learn from its behavior. In this point of view, OM is to some extend a prerequisite for organizational learning[4]. Huber[9] considers OM as one of the four constructs linked to OL. Effective development of OM can make OL more tractable[10]. Learning is not possible without memory[11].

Nowadays, technology advances and market changes from time to time. How to improve performance of manufacturing company has been an impressing problem. Organization is developing on the basis of the organizational knowledge that is the important aspect of OM. To improve OP, manufacturing companies should pay attention to their OM, analyze the knowledge component of OM, and know the impact of OM on OP.

Based on OM components and theoretic hypotheses, this paper aims to empirically classify OM and test the impact of OM on OP in manufacturing companies. The analytical methods used include factor analysis, canonical correlation analysis and structural equation modeling.

2. Literature Review

Over the last few decades, many theories and practices on OM have been offered. Especially, Hawaii International Conference on System Science (HICSS)[12,13,14] set KM/OM/OL mini-track, International Joint Conference on Artificial Intelligence (IJCAI) and European Conference

∗ This research was supported by the NSFC (70172033) and the project 863 (2001AA414250).
Project (HIT.2002.60) Supported by the Scientific Research Foundation of Harbin Institute of Technology

on Artificial Intelligence (ECAI) held KM/OM workshops, which largely promote the research on combination of OM and information technology.

Recent OM research concentrates on several fields, such as organizational behavior & learning, computer science (artificial intelligence, engineering), management information system, and information science. The first area of OM research is about the theoretical foundation and implementation of OM. In the first area, Nonaka and Takeuchi[15] studied the social aspect of OM and knowledge creation. Walsh and Ungson[5] provided the definition and structure of OM. Stein[3] defined OM and considered OM can impact present activities, such as decision making, organizing, leading, designing, controlling. Jennex and Morrison[16] discussed the relationships among OM, KM and OL. Comparing definitions of OM and knowledge, Jennex and Olfman[17] suggest that knowledge is a subset of OM and that the acquisition and use of OM include the acquisition and use of knowledge. Huber[9] and Schwartz[18] considered OM as the basis of organizational learning (OL). Moorman and Miner[8] discussed the impact of OM on performance of new product and innovation from the perspective of new product development. In other fields of OM research, Abecker[19] studies intelligent system for OM and system realization for several of OM systems, which improved the integration of OM and organizational knowledge. Ackerman[20] studies the development of OM, which leads to the combination of KM, OM and information technology.

These previous OM studies lay the theoretical foundations of knowledge management, OM, and OL. Based on the first field of OM research, this paper aims to report the study on the OM components, namely empirically test the classification of OM and test the impact of OM on organizational performance.

Since OM was proposed, many researchers discussed its components. Walsh and Ungson[5] distinguish a number of general components of organizational memory, which include organizational culture, work processes, social and physical structures, and external archives. Day[21] looks OM as a repository for collective insights contained within policies, procedures, routines, and rules that can be retrieved when needed. Moorman and Miner[22] define OM as the collective values, behavioral routines, or physical artifacts. Robey[2] views that OM consists of both cognitive and behavioral components. Schwartz[23] considers OM as two main components: a knowledge base and a well-defined set of meta-knowledge. A knowledge base contains the content or knowledge that is of value to the organization. A well-defined set of meta-knowledge is used to determine how and when the knowledge or content should be applied.

Although useful, previous studies didn't analyze OM components from internal and external source of organizational knowledge, and didn't provide empirical evidences of the OM classification either. What's more, there are few empirical studies on the impact of OM components on OP. This paper aims to build the OM components from the aspects of the knowledge structure of OM, empirically test the classification of OM and the impact of OM on OP. Future research is explored finally.

3. Conceptual Framework

3.1. Organizational Memory Components

Knowledge is the core of OM. According to Alavi and Leidner[24], internal organizational knowledge and external knowledge are sources of organizational knowledge. Davenport and Prusak[25] consider that organizational knowledge embedded not only in documents or repositories but also in organizational routines, processes, practices, and norms. In addition, some researchers[26,27,28] generally agree that organizational knowledge resides in: individuals, including managers, technical support staff, and direct production workers; the organization's technology, including its layout, hardware, and software; the organization's managerial systems, including its organizational structure, routines and methods of coordination; and the organization's culture. According to Barton[29], core capabilities are consist of four types of knowledge, which is employee knowledge and skill, physical technical systems, managerial systems, values and norms. These kinds of knowledge consist of the internal source of organizational knowledge. On the other hand, Orr[30] points out the external source of organizational knowledge, which is collected and retained by competitors, suppliers and customers of an organization.

In the paper, we use the work of Barton as the reference to analyze the structure of OM in manufacturing companies. From the point of knowledge, physical technical systems can be considered as technical knowledge; managerial systems as managerial knowledge; values and norms as cultural knowledge. External knowledge is an important source of organizational knowledge, which is mostly about market. So marketing knowledge must be included in organizational knowledge. Then OM can be classified into technical OM (T-OM), managerial OM (MG-OM), cultural OM (C-OM), marketing OM (MR-OM), which are elaborated below.

3.1.1. Technical Organizational Memory

T-OM means a series of memory based on professional knowledge, including the technology and related experiences, which force the development and support the normal operate of the organization[31]. The variables include product development system, production control method, production information control system, the use of IT and internet, equipments, technique style, re-engineering in the past, total quality management, etc. These factors affect the produce efficiency, product quality and the production cost of the company.

T-OM is especially important in manufacturing companies, which supports the company and can make a company a leader in its field. So employees must share the common T-OM so as to improve the productivity. Technology develops everyday, so organization must innovate, pay attention to outside technologies, and learn from the outside. But the confidential T-OM of organization itself must be protected from being leaked to the competitors.

3.1.2. Managerial Organizational Memory

MG-OM refers to knowledge that controls the operation of an organization, it can be described as the management method and the structure of the organization, such as knowledge management method, factory layout, human resources management, the short-term and long-term strategies, equipment management, production management, document management, training for members, enrolment, and crisis management.

MG-OM often based on the organization history and stable relatively. It is not easy for competitor to learn the spirit of the MG-OM. But it must be known by the employees, so that employees can understand the strategy and basic management method. Thus employee can do as the request of management and then the aim of the company can realize easily.

3.1.3. Cultural Organizational Memory

C-OM can be defined as mental wealth that was accumulated along the development of a company[32]. C-OM exists almost everywhere in any organization, such as the history of the organization, shared values, informal organization, suggestions from the employees. Schein[33] defined organizational culture as the organization's "embedded memory." Schwartz[34] describes collective memory itself as a cultural system. C-OM is the way people think, communicate and work together.

C-OM is also formed in the history of enterprise and stable. Although it as affected by the external culture, it is hard to change once it was formed. Besides, C-OM affects the individual's action, orients their intentions, sets their moods, and enables them to act. So, C-OM should be understood and practiced by most employees. Good C-OM can contribute to the development of other OM.

3.1.4. Marketing Organizational Memory

MR-OM implies the OM related to the supplier, the middleman and the customer and concerning sale and purchase. It includes customer relationship management (CRM), marketing strategy, external cooperation, principles of choosing supplier and middleman, subscription, channels, 4P and so on.

MR-OM is another important component of an enterprise, which is concerned with the foreground of the enterprise, and impact the normal operation of the enterprise. So new knowledge of market must be protected from being known by competitors. What's more, market is changing all the time. So enterprise must obtain the information of market and forecast the demands of customers, which will guide the development of T-OM.

Generally, these four types of OM components play an important role in an organization. With the help of OM, the managers and the decision-makers can use relative knowledge to guide present activities, so as to make good decisions.

As far as manufacturing companies are concerned, technology and management knowledge have consistently been considered as contributing aspects to the productivity gains observed with increasing experience[35]. By contrast, culture did not emerge as being particularly important in these settings, although in may be more important in organizations that produce less tangible products. Culture is certainly a repository for some knowledge in these manufacturing companies. In order for culture to explain the changes in organizational performance associated with experience, however, it would have to change as the organizations gained experience. Thus, knowledge about organizational performance improvements in manufacturing companies is primarily embedded in T-OM, MG-OM and MR-OM[25].

3.2. Organizational Performance

According to the four types of OM components, this paper considers OP as four parts: technical OP (T-OP), managerial OP (MG-OP), cultural OP (C-OP) and marketing OP (MR-OP).

T-OP includes capacity utilization, product quality, labor productivity, etc. Generally speaking, T-OP can be described as performance mainly in manufacture processing. MR-OP is a series of variables connected with the management of the enterprises. The indicates include payoff of R&D level development, quality management and business process reengineering (BPR), overhead costs and the increase of delegation and knowledge level of workforce. C-OP reflects the relationship between the employees and the enterprise and the contacts among the members in the organization. Team spirit, satisfaction with work, morale and acceptance with the main culture are involved. MR-OP consists of delivery reliability, manufacturing lead time, volume flexibility, time to market product customization ability and other variables related to the supplier, middleman and customer.

3.3. Impact of OM on OP

There have been few studies on the effects of OM on OP[36]. Although Moorman and Miner[8] did some research, the research was about the new product development and lacked empirical evidences. Besides, there are few studies on the impact of OM components on OP. Based on the classification of OM, this conceptual framework focuses on the influence of OM on OP.

As shown in figure 1, the types of OM are according to the previous research. T-OM is the technical basis of the common work, which can be used in many activities, such

as production, management and sale. C-OM is the cultural basis of employees' actions, which can influence employees, either implicitly or explicitly. MG-OM is the frame of organization and management method. MR-OM is the organizational knowledge about relative organizations and people outside own organization, which lead to the operation of organization.

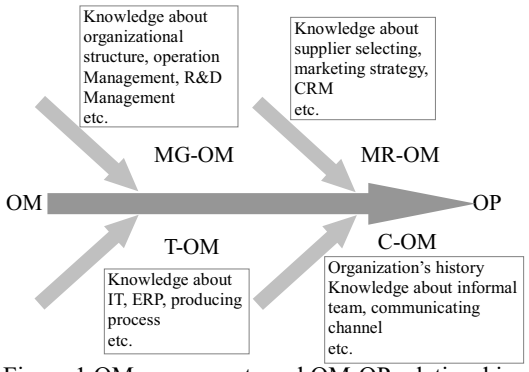

Figure 1 OM components and OM-OP relationships

In the effecting process, some influences are formal and can be observed easily, while some others are informal and implicitly. Due to these reasons, to describe different impacts clearly and completely, statistics and analysis of the data are necessary besides the conceptual framework.

Owning to the limitation of survey, which is designed to investigate the strategies and practices in manufacturing companies, there are not enough questions to reflect the research on all the OM and OP variables. So, this paper chooses the T-OM, MG-OM, MR-OM, MG-OP and MR-OP to do data analysis.

According to Stein and Zwass[37], organizational memory can impact the present activities. Improving OM can result in improved organizational performance and adding value to the organization. And managers can improve performance by deliberately developing organizational memory and using the growing stores of knowledge to guide organizational activities and decisions making[38]. Knowledge is an important aspect of OM. From the survey, Alavi and Leidner[24] conclude that proper knowledge management can lead to explicit and important aspects of organizational performance. The impact of OM on OP is taking in many channels and forms. For example, if a series of successful and constant training is taken for the employees especially workers about the security in produce process, the safety factor of the organization will increase. This is a sort of effect of MG-OM on T-OP. Be similar to that, proper equipment management can improve the productivity of equipments. The appliance of Internet in transport, procurement and inventory management can affects manufacturing lead time. The appliance of Internet belongs to T-OM and the manufacturing lead time is a kind of MR-OP. Therefore, it is hypothesized that OM has an impact on OP in term of T-OM, MG-OM and MR-OM.

H_1: OM has a positive impact on OP.

T-OM is the base of norm work. It impact OP (refer to MG-OP and MR-OP) in a steady way and the function lies on the type of technology. In this research, T-OM is mainly refers to the appliance of Internet. The use of Internet involves inventory management, transportation planning and procurement of strategic parts, etc.

Through the development of an organization, the increase of OP always depends on reengineering, and the reengineering always begins with new technology, such as appliance of E-commerce and Internet. This kind of change is essential but not corrected in minor details. Therefore, it is hypothesized that T-OM has an impact on MG-OP and MR-OP.

H_2: T-OM has an impact on MG-OP.

H_3: T-OM has an impact on MR-OP.

As a kind of rule, the influence of MG-OM is all-sided. According to the current condition and strategy plan, the purpose of managers can be reflected through managerial activities such as planning, organizing, leading and controlling. Compared with T-OM and MR-OM, MG-OM is more subjective and flexible. Proper management can improve the positivism of members and accelerate the rational configuration of enterprise resources. For example, appropriate flow of human resource can bring fresh air to the organization. But if the fluid is too low, the enterprise will lack of energy while if the fluid become too high, the training cost will increase. Therefore, it is hypothesized that MG-OM has an impact on MG-OP and MR-OP.

H_4: MG-OM has a positive impact on MG-OP.

H_5: MG-OM has a positive impact on MR-OP.

MR-OM is the actions correlated with the outside based on intention. Its function is not as comprehensive as T-OM and MG-OM. It reflects the method how the organization cooperates with the outside. Therefore, it is hypothesized that MR-OM has an impact on MG- OP and MR-OP.

H_6: MR-OM has an impact on MG-OP.

H_7: MR-OM has an impact on MR-OP.

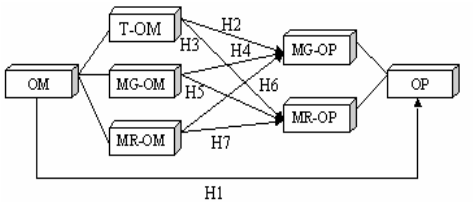

Figure 2 Impact of OM on OP

Figure 2 illustrates the model as well as the afore-formulated hypotheses (H_1, H_2, H_3, H_4, H_5, H_6 and H_7).

In view of the knowledge renewal in an organization, OM should be a dynamic process. OM and KM aim at assuring the effective use of existing knowledge and at creating the conditions for the generation of new knowledge[36]. Existing OP is also one kind of organizational knowledge, and will constitute of new OM, which impact on future organizational performance.

Therefore, it is hypothesized that existing OM and existing OP have an impact on future OP.

H_8: Existing OM and existing OP have an impact on future OP.

4. Method

4.1. Survey

The empirical data for this research comes from the International Manufacturing Strategy Survey (IMSS), initiated by London Business School and Chalmers Universities of Technology in 1993. IMSS is a worldwide research project, which was designed to explore and identify the strategies and practices utilized by manufacturing companies around the world. IMSS covers 20 countries and 600 companies. Most of the companies are in the ISIC 38 industries, i.e. manufacturers of fabricated metal products, machinery and equipment. IMSS was introduced into China in 1997, and the second round of survey in China was carried out in 2001. The two rounds of survey were conducted by the authors. Though IMSS survey questions are designed to explore the strategies and practices in manufacturing companies, there are some questions relate to the degree of knowledge use, which indicates the OM level to some extents.

Based on the data from 2001 IMSS, this paper focuses on the impact of OM on OP in manufacturing companies. According to the survey questionnaire, this paper chooses 22 variables (see Appendix A) that are relevant to OM and the degree of knowledge uses. Additionally, 16 variables about relative payoff relevant to the OP variables (see Appendix B) are also included. Variables in Appendix C are used to test the impact of existing OM and existing OP on future OP. All of the extracted variables were designed with five-point scale, where 1=none and 5=high.

4.2. Measurement

First, both OM and OP variables are grouped by factor analysis, extracting factor by Principal Component Analysis, rotating by Varimax with Kaiser Normalization. All of the factor loadings values above 0.5 are used as the threshold for accepting the item into the factor, the Cronbach reliability coefficient of each factor is tested by reliability analysis. Cronbach reliability coefficient is a measure of internal consistency. High internal consistency means that the scale items have a strong relationship to each other. It is defined as the proportion of a scale's total variance that is attributable to a common source. The reliability coefficient of each scale is within an acceptable range.

Second, the relationships of OM and OP are analyzed by canonical correlation analysis. Canonical correlation analysis is used to analyze the relationship between two sets of variables. Because it considers each set of variables as a whole, canonical correlation analysis can describe the relationship between two sets. The paper chooses the canonical correlations according to sig. If corresponding sig. is below 0.05, then the two sets are relative distinctly. In this paper, the variables of OM are considered as set-1 and the variables of OP are considered as set-2.

Based on the above-mentioned analyzing methods, this paper chooses 6 variables as existing OM (the degree of knowledge use last 3 years), existing OP (the relative payoff last 3years), and future OP (future payoff within next 3 years). This paper build an equation model to show the relationship among these three aspects, so as to indicate the impact of existing OM and existing OP on future OP by using structural equation modeling (SEM). Amos 4.0 is used to analyze the data. The data for the existing variables was collected in 1997, and the data for future variables was collected in 2001.

5. Results and Discussion

5.1. Classification of OM and OP

5.1.1. Classification of OM

The results of factor analysis show that Kaiser-Meyer-Olkin Measure of Adequacy (KMO) is 0.864. And Bartlett's test of sphericity shows that Approx. Chi-Square is 3800.96, df is 820 and sig. is 0.000. So the variables of OM are suitable for factor analysis.

Data from 22 OM variables were used in the exploratory factor analysis. The results are shown in table 1. The number in table 1 is factor loadings values (sorted by size, suppress absolute values less than 0.5).

Table 1 Factor analysis of OM

OM variables	Factors		
	OM1	**OM2**	**OM3**
DPFM	0.69		
DED	0.69		
DEM	0.68		
DPPM	0.65		
DQI	0.61		
DPA	0.59		
DUPE	0.54		
DICT	0.58		
DSSM	0.52		
IM		0.82	
TP		0.79	
PSTA		0.79	
OPT		0.73	
PSTR		0.70	
PPS		0.70	
CSS		0.63	
DI			0.62
LCT			0.61
SII			0.57
PPDF			0.56
ESP			0.54
QPS			0.52
Eigenvalues	6.000	4.979	4.198
Percentage of variance explained	14.635	12.144	10.239
Percentage of cumulative variance explained	14.635	26.779	37.018
Cronbach reliability coefficients	0.833	0.896	0.668

Extraction Method: Principal Component Analysis

Rotation Method: Varimax with Kaiser Normalization

Rotation converged in 5 iterations.

Table 1 shows that OM variables are sorted into three factors: OM1, OM2 and OM3. The first sort, OM1, consists of 9 variables, which can be called managerial OM. The Cronbach reliability coefficient of the 9 variables in this sort is 0.833 (382 samples). The second sort, OM2, consist of 7 variables, which can be technological OM. The Cronbach reliability coefficient is 0.896 (378 samples). The other 6 variables can be considered as the third sort, OM3, which is called marketing OM. The Cronbach reliability coefficient of these variables is 0.668 (374 samples). Each Cronbach reliability coefficient is within an acceptable range, which suggests these variables belong to their own sort. The eigenvalue for each factor is greater than 1.0 (6.000, 4.979 and 4.198), the cumulative variance explained is 37.018%. Based on the data processing, the classification of OM can be tested.

5.1.2. Classification of OP

The results of factor analysis show that the KMO (0.752) and Bartlett's test of sphericity (Approx. Chi-Square is 754.083, df is 253 and sig. is 0.000) show that the variables of OP are suitable for factor analysis.

There are 16 OP variables were included in the exploratory factor analysis. Table 2 shows the results of factor analysis of OP. The number in table 2 is factor loadings values (sorted by size, suppress absolute values less than 0.5).

Table 2 Factor analysis of OP

OP variables	Factors	
	OP1	**OP2**
PQI	0.69	
PEM	0.63	
PSSM	0.62	
PNPD	0.61	
PED	0.59	
PEC	0.57	
PE	0.53	
PPA	0.52	
POS	0.52	
PPFM	0.50	
VF		0.76
MF		0.75
TTM		0.63
DR		0.56
MLT		0.55
MC		0.54
Eigenvalues	4.495	3.297
Percentage of variance explained	19.544	14.334
Percentage of cumulative variance explained	19.544	33.878
Cronbach reliability coefficients	0.820	0.698

Extraction Method: Principal Component Analysis

Rotation Method: Varimax with Kaiser Normalization

Rotation converged in 3 iterations.

Table 2 shows that two factors are sorted into OP, the eigenvalue for each factor is greater than 1.0 (4.495 and 3,297), the cumulative variance explained is 33.878%.

From table 2, MG-OP1 to MG-OP10 can be considered as one sort, OP1, which is called managerial OP (MG-OP). The reliability coefficient of this sort is 0.820 (123 samples). And MR-OP1 to MR-OP6 can be considered as the other sort, OP2, which is called marketing OP (MR-OP) in this paper. The reliability coefficient is 0.698 (417 samples). Each Cronbach reliability coefficient is within an acceptable range, which suggests these variables belong to their own sort.

In the factor analysis, OM is divided into three parts: managerial OM, technological OM and marketing OM (without cultural OM) and OP is separated into two parts. For example, in managerial OM, the variables include process focus management, empowerment and training, equipment management, pull production management, quality improvement and control, process automation, update of process equipment, use of information technologies and supply strategy restructure and management. The reason for this is that the correlation among them is larger than others, which means they are more similar. And the reliability coefficient shows that the variables can describe the same part of matter. The result can support the conceptual hypotheses well and be conformable in empirical study.

5.2. Impact of OM on OP

5.2.1. Hypothesis 1

According to the test of dimension reduction of canonical correlation analysis, 6 canonical correlation coefficients (corresponding sig. are below 0.05) are kept in table 3. Proportion of variance of OM explained by its own canonical variables is 38.8%. Proportion of variance of OM explained by OP is 28.9%. Proportion of variance of OP explained by its own canonical variables is 49.9%. And proportion of variance of OP explained by OM is 37.1%. All the analysis data is high enough, so the conclusion that OM and OP are relative can be drawn.

Table 3 Canonical correlation analysis of OM and OP

Canonical Correlations	0.920	0.902	0.856	0.836	0.785	0.722
sig.	0.000	0.000	0.000	0.000	0.001	0.027

5.2.2. Hypothesis 2

After canonical correlation analysis, only one canonical correlation is kept according to sig. (canonical correlation is 0.605 and sig. is 0.000, which is far below 0.05). Prop Var of T-OM explained by its own canonical variables is 34.8%, and explained by MG-OP is 12.7%. Prop Var of MG-OP explained by its own canonical variables is 25.2%, and explained by T-OM is 9.2%. All the analysis data can be accepted, so the conclusion that T-OM and MG-OP are relative can be drawn.

5.2.3. Hypothesis 3

The test of dimension reduction show that only the first sig. (0.008) is below 0.05. So only the first canonical correlation (0.319) can be kept. And from the redundancy analysis, Prop Var of T-OM explained by its own canonical variables is 46.0%, and explained by MR-OP is 4.7%. Prop Var of MR-OP explained by its own canonical variables is 33.8%, and explained by T-OM is 3.4%. All the analysis data can be accepted, so the conclusion that

T-OM and MR-OP are relative can be drawn.

5.2.4. Hypothesis 4

According to the test of dimension reduction, the first six sigs are below 0.05. So first six canonical correlations are accepted. The Prop Var of MG-OM explained by its own canonical variables is 74.6%, and explained by MG-OP is 45.2%. Prop Var of MG-OP explained by its own canonical variables is 70.3%, and explained by MG-OM is 43.2%. All the analysis data can be accepted, so the conclusion that MG-OM and MG-OP are relative can be drawn.

Table 4 Canonical correlation analysis of MG-OM and MG-OP

Canonical Correlations	0.861	0.834	0.783	0.748	0.628	0.614
sig.	0.000	0.000	0.000	0.000	0.000	0.000

5.2.5. Hypothesis 5

The test of dimension reduction shows that only the first sig. (0.000) is below 0.05. So only the first canonical correlation (0.465) can be kept. And from the redundancy analysis, Prop Var of MG-OM explained by its own canonical variables is 36.7%, explained by MR-OP is 47.9%. Prop Var of MR-OP explained by its own canonical variables is 38.2%, explained by MG-OM is 8.2%. Analysis results show that H5 was accepted.

5.2.6. Hypothesis 6

All sigs in the test of dimension reduction are far more than 0.05, so no canonical correlation is suitable in the statistics. So the hypothesis that MR-OM impacts MG-OP can't be accepted, but refused.

5.2.7. Hypothesis 7

Only one sig. (0.000) in test of dimension reduction is below 0.05, so the first canonical correlation (0.376) is kept. The redundancy analysis shows that MR-OM can explain 35.9% of its own canonical variables and 5.2% of MR-OP. The canonical variable of MR-OP can explain 37.2% of its own and 5.1% of MR-OM. All the analysis data can be accepted, so the conclusion that MR-OM and MR-OP are relative can be drawn.

Canonical correlation analysis is a method to analyze the relationship between two sets of variables. The most important variable is canonical correlation. If the accepted canonical correlation is high, the relationship between the two sets is tight. All the results are shown below in table 5.

Table 5 Hypotheses and results

Hypothesis	Two sets of variables	Canonical Correlation
H_1	OM & OP	0.920
H_2	T-OM & MG-OP	0.605
H_3	T-OM & MR-OP	0.319
H_4	MG-OM & MG-OP	0.861
H_5	MG-OM & MR-OP	0.465
H_6	MR-OM & MG-OP	——
H_7	MR-OM & MR-OP	0.376

The value of canonical correlation can indicate the relative degree of two sets. So the impact degrees of OM on OP are shown in Table 5. The specific explanations are as following:

1. Table 5 shows that the canonical correlation between OM and OP in total is most distinct (0.920). This result indicates that OM has an impact on OP (H_1), and the relationship between them is tight, which is accordant with practice. This kind of influence is composed of several small impacts.

2. The correlations between T-OM and MG-OP (0.605), T-OM and MR-OP (0.319) are above 0.3, which means T-OM has an impact on MG-OP (H_2) and MR-OP (H_3). Moreover, T-OM mainly influence on MG-OP.

3. The correlations between MG-OM and MG-OP (0.861), MG-OM and MR-OP (0.465) are above 0.4, which means MG-OM has a positive impact on MG-OP (H_4) and MR-OP (H_5). Moreover, the impact of MG-OM on MG-OP is much stronger than on MR-OP. From the data processing, we can conclude that the influence of MG-OM is all-sided and obvious. Management is the rule of daily work. It decides how the organization can run and cooperate with each other inside the enterprise. For example, QI (MG-OM) can improve MC (MR-OP), and the impact of DPPM and DPFM (MG-OM) on MF (MR-OP) is significant (>0.3). If DPA (MG-OM) is brought into effect, PE (MG-OP) will increase.

4. Though the canonical correlation between MR-OM and MG-OP (H_6) is 0.432, the sig. is more than 0.05, there is no impact of MR-OM on MG-OP. However, the canonical correlation between MR-OM and MR-OP (0.376) is above 0.3, which means MR-OM has an impact on MR-OP (H_7). This means that MR-OM does not have any impact on MG-OP but only on MR-OP.

5. MG-OP is mainly affected by MG-OM and T-OM. The relationship between MR-OM and MG-OP is too slim to be observed in the result. In this research, the supplier selecting and coordinating planning decisions and flow of goods with customers mostly composes the contents in MR-OM. It doesn't contain the core processing of the enterprise. In this point of view, MR-OM's chief function is the effect on MR-OP but not MG-OP.

6. The canonical correlations between MR-OM & MR-OP and T-OM & MR-OP are a little less. The cause might be that MR-OP can image the OP through the market achievements. It is not only concerned with the one sort of OM, but with every sort of it. Taken DR as an example: it is concerned with DPFM (MG-OM), LCT (MR-OM) and IM (T-OM), etc. So, discuss the impact of each sort of OM alone seems exparte and inconspicuous.

5.3. Impact of Existing OM and OP on Future OP

View of the knowledge in OM is renewing at all times, the content of OM is also renewing. That is, existing OM impact on existing OP, which will constitute of one kind of OM, both of them impact on the future OP (H_8).

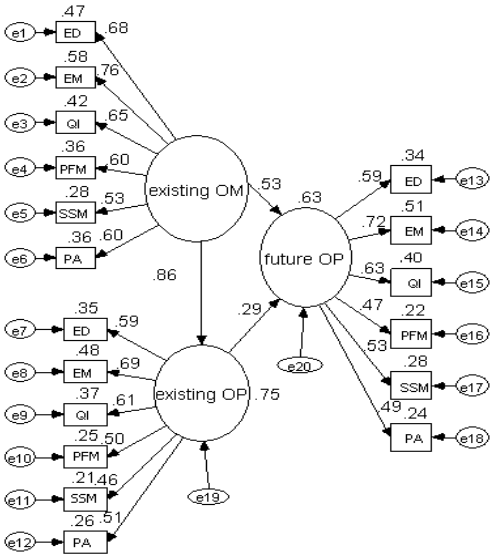

Figure 3 Relationship among existing OM, existing OP and future OP

Figure 3 presents the relationship among existing OM, existing OP and future OP. Figure on the arrow is the standardized path coefficient. The impact of existing OM on existing OP is obvious (path coefficient is 0.86, R^2 is 0.75). Both of existing OM and existing OP impact on future OP (path coefficients are 0.53 and 0.29, R^2 is 0.63), moreover, the impact of existing OM on future OP is stronger than the other one. Therefore, the manufacturing companies should not only note their OP, but also pay more attention to their OM, which contribute more to their future performance.

6. Conclusion

This research analyzes the knowledge structure of organizational memory, and divides OM into four types. From the internal source, OM components include technical OM, managerial OM and cultural OM. And marketing OM is the important part from the external source of knowledge. These four types of OM components promote organizational development jointly. Based on the variables extracted from the 2001 IMSS data, this paper uses factor analysis to classify OM and OP. T-OM, MG-OM, MR-OM, MG-OP, and MR-OP can be use to do data processing. This paper provides an initial attempt to test the impact of OM on OP in manufacturing companies. By using canonical correlation analysis, the impact of OM on OP was tested; the impacts of T-OM, MG-OM and MR-OM on MR-OP were tested. The impacts of T-OM and MG-OM on MG-OP are also tested. While the impact of MR-OM on MG-OP don't be tested in this paper. Finally, the results from structural equation modeling suggest that OM is a dynamic process, OM formed in different time has different impact on OP.

In the survey, there are few questions about organizational culture and relative payoff. So the classification of C-OM and the impact of this on OP were ignored.

In future research, we will try to test the impact of C-OM on OP by a KM-OM-OL survey in China manufacturing companies, whose intention is to raise the awareness of more companies to pay attention to their OM, so as to make full use of their OM to improve OP. Through statistical analysis, the state of OM in Chinese manufacturing companies can be tested. At the same time, we will investigate how to improve OM through KM and OL.

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Appendix A

OM Variables

(Five-point scales, where 1=none and 5=high)

PSTA--The extent of using Internet to integrate the procurement of standard parts/materials

PSTR--The extent of using Internet to integrate the procurement of strategic parts/materials

IM--The extent of using Internet to integrate the inventory management

PPS--The extent of using Internet to integrate the production planning and scheduling

TP--The extent of using Internet to integrate the transportation planning

OPT--The extent of using Internet to integrate the order processing and tracking

CSS--The extent of using Internet to integrate the customer service and support (CRM)

QPS--The extent of using quality of products/services offered as the criteria of selecting your principal parts/material suppliers

DI--The extent of using willingness to disclose cost/other information as the criteria of selecting your principal parts/material suppliers

LCT--The extent of using legal/contractual terms as the criteria of selecting your principal parts/material suppliers

ESP--The extent of using evaluation of supplier potential (development program/past performance record) as the criteria of selecting your principal parts/material suppliers

IL--The extent of coordinating planning decisions and flow of goods by sharing information about the inventory levels with your customers

PPDF--The extent of coordinating planning decisions and flow of goods by sharing information about production planning decisions and demand forecast with your customers

DUPE--The degree of updating your process equipments to industry standard or better in last 3 years

DPA--The degree of engaging in process automation programs in last 3 years

DICT--The degree of implementing Information and Communication Technologies and/or Enterprise Resource Planning software in last 3 years

DSSM--The degree of rethinking restructuring your supply strategy and the organization and management of your suppliers' portfolio in last 3 years
DPFM--The degree of restructuring your manufacturing processes and layout to obtain process focus and streamlining (e.g. reorganize plant-within-a-plant; cellular layout, etc.) in last 3 years
DPPM--The degree of undertaking actions to implement pull production (e.g. reducing batches, setup time, using Kanban systems, etc.) in last 3 years
DQI--The degree of undertaking programs for quality improvement and control (e.g. TQM programs, 6 σ projects, quality circles, etc.) in last 3 years
DEM--The degree of undertaking programs for improvement of your equipment productivity (e.g. Total Productive Maintenance programs) in last 3 years
DED--The degree of implementing actions to increase the level of delegation and knowledge of your workforce (e.g. empowerment, training, improvement or autonomous teams, etc.) in last 3 years

Appendix B

OP Variables

(Five-point scales, where 1=none and 5=high)

PPA--The relative payoff of engaging in process automation programs in last 3 years
PE--The relative payoff of reorganizing your company towards e-commerce and/or e-business configurations in last 3 years
PSSM--The relative payoff of rethinking restructuring your supply strategy and the organization and management of your suppliers' portfolio in last 3 years
POS--The relative payoff of concentrating on your core activities and outsourcing support processes and activities (e.g. IS management, maintenance, material handling, etc.) in last 3 years
PPFM--The relative payoff of restructuring your manufacturing processes and layout to obtain process focus and streamlining (e.g. reorganize plant-within -a-plant; cellular layout, etc.) in last 3 years
PQI--The relative payoff of undertaking programs for quality improvement and control (e.g. TQM programs, 6 σ projects, quality circles, etc.) in last 3 years
PEM--The relative payoff of undertaking programs for improvement of your equipment productivity (e.g. Total Productive Maintenance programs) in last 3 years
PED--The relative payoff of implementing actions to increase the level of delegation and knowledge of your workforce (e.g. empowerment, training, improvement or autonomous teams, etc.) in last 3 years
PNPD--The relative payoff of implementing actions to improve or speed-up your process of new product development through e.g. platform design products modularization, components standardization, concurrent engineering Quality Function Deployment, etc. in last 3 years
PEC--The relative payoff of putting efforts and commitment on the improvement of your company's environmental compatibility and workplace safety and healthy in last 3 years
MC--The amount of change of the manufacturing conformance over the last 3 years
VF--The amount of change of volume flexibility over the last 3 years
MF--The amount of change of Mix flexibility over the last 3 years
TTM--The amount of change of time to market over the last 3 years
DR--The amount of change of the delivery reliability over the last 3 years
MLT--The amount of change of the performance of manufacturing lead time over the last 3 year

Appendix C

Variables about existing OM& existing OP & future OP

(Five-point scales, where 1=none and 5=high)	Degree of use last 3 years (existing OM)	Relative payoff (existing OP)	Expected payoff within next 3 years (future OP)
PA--The respective payoff of engaging in process automation programs within 3 years	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
SSM--The respective payoff of rethinking restructuring your supply strategy and the organization and management of your suppliers' portfolio within 3 years	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
PFM--The respective payoff of restructuring your manufacturing processes and layout to obtain process focus and streamlining (e.g. reorganize plant-within-a-plant; cellular layout, etc.) within 3 years	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
QI--The respected payoff of undertaking programs for quality improvement and control (e.g. TQM programs, 6 σ projects, quality circles, etc.) within 3 years	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
EM--The respected payoff of undertaking programs for improvement of your equipment productivity (e.g. Total Productive Maintenance programs) within 3 years	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
ED--The respected payoff of implementing actions to increase the level of delegation and knowledge of your workforce (e.g. empowerment, training, improvement or autonomous teams, etc.) within 3years	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5