

INVESTIGATION OF KNOWLEDGE MANAGEMENT AND TECHNOLOGY ABSORPTION ATTRIBUTES TOWARD TECHNOLOGY TRANSFER SUCCESS IN AUTOMOTIVE INDUSTRY

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ABSTRACT

Knowledge Management (KM) and Technology Absorption (TA) have been a great issue of concern among researchers and companies for some time now and one of the factors that determine the success of technology transfer. Moreover, these areas contribute greatly to productivity and organization effectiveness as well as economic development. Hence, countries such as Malaysia concern very much for managing knowledge and adopting new technology as determining factors for technology transfer processes. Over the years, Malaysia has invested millions of ringgits to achieving knowledge transfer and is more involve in technology transfer especially the adoption of new technology. This paper will explore the potential attributes of knowledge management and technology absorption and how these attributes will determine the technology transfer successfulness in the automotive industry in Malaysia.

Keywords: Knowledge management, Technology absorption, Technology transfer success, automotive industry.

INTRODUCTION

The issue of technology transfer in today's globalized world has assumed critical dimensions. It has gained immense importance since it has been widely recognized that its impact on economic growth and development is enormous. Many researchers agreed that the understanding of technology transfer involve two parties (i.e. technology owner and technology recipient) (Krull, 2003; Coates, 2001 and Khalil, 2000). Successful technology transfer requires dealing with several kinds of knowledge such as knowledge that created the technology and knowledge about how to operate the technology as well as the capability to absorb new technology. The automotive industry in Malaysia can be considered as one of the most important and strategic industries in the manufacturing sector. Compared with other industries in the manufacturing sector in Malaysia, the automotive industry has been earmarked to boost the industrialization process so that Malaysia can be a developed nation of 2020. The development of an automotive industry in Malaysia provides the means to upgrade local engineering and technical skills as well as to transfer technology and expertise. For the period 1999-2008, GDP grew by 5.6% supported by TFP growth of 2.0% while the manufacturing sector registered TFP growth of 2.3% contributing 34.4% to output growth (Productivity Report, 2008). These contributions to higher TFP growth in GDP and manufacturing sector are due to higher

investments in technology, employment of skilled labour as well as training and retraining of employees.

Most of the automotive industries in Malaysia are beginning to understand the importance of managing knowledge which influence by people, technology, organizational culture, organizational structure and process as a component within the technology transfer process. Several investigations into the application of knowledge management techniques and tools to support technology transfer have recently been published (Laidlaw, 2003; Li-Hua, 2003). However, there are many barriers faced by industries that may impede knowledge and technology transfer (Davenport and Prusak, 2000). Furthermore, productivity of the organizations are also very much depending on the technology absorptive capacity of these organizations which consist of communication, organizational culture, interaction mechanisms, knowledge transfer and R&D that lead to the successful of technology transfer. However, the ability to transfer the knowledge and facilitate the technology transfer process is critical and become a major problem to organization. Individuals are lack of trust in people because they misuse the knowledge, poor communication and interpersonal skills and difference in education levels. Moreover, organization shortage of formal and informal spaces to generate and share knowledge, lack of transparent rewards and recognition systems that would motivate their people to share knowledge and lack of leadership and managerial support to facilitate knowledge sharing. Therefore, this study will focus on all level of expertise which consists of middle managers, supervisors and workers at Proton and Perodua. The purpose of this study is to identify the relationship of knowledge management and technology absorption attributes toward the successful of technology transfer.

STATEMENT OF PROBLEM

Technology transfer is not a new phenomenon but has become a subject of considerable interest to many groups such as government, multinational corporations and education institutions because of the close relationship between technology transfer and economic growth. The impact of technology transfer to the productivity and business effectiveness of an organization are very obvious.

Knowledge management and technology absorption have been a great concern among researchers and companies for some time now and one of the factors that determine the success of technology transfer. Issues such as lack of communication within enterprise, lack of organizational culture in promoting knowledge sharing, little commitment of managers in knowledge sharing and transfer process, lack of motivation from superiors for knowledge sharing and different technological background have raised the question whether the automotive organizations have been on track in terms of their knowledge management and technology absorption capabilities to facilitate the technology transfer successfulness. In Malaysia scenarios, some individuals are proprietary on the knowledge they possess, believing that their advancement and status depend on their demonstration of unique or exceptional knowledge. Some managers fear that they may lose control if their department's knowledge is made available to others. Some staff members feel, at least initially, that they are required to make an extra effort to share knowledge without deriving any benefit from the process. Some supervisors are uncomfortable with the idea of staff members spending time on knowledge sharing rather than completing their tasks.

Nevertheless, a study by Zaidah et al. (2007) showed that MNCs are reluctant to transfer the key technological knowledge to Malaysia. Furthermore, Suhaimi and Yusof (2006) indicate that Malaysia was unable to produce indigenous technology. The other study by Jegathesan et al. (1997) and Lall (2002) also suggested that Malaysian workers were unable to adapt and conduct sophisticated repairs due to limited theoretical knowledge which disallow the locals to conduct operation independently from the technology providers. These studies support previous studies by Narayan and Wah (1993) and Zainal (2004), which indicate locals are still at a low level of technological activities. Based on the above issues and scenarios, this paper will explore the potential attributes of knowledge management and technology absorption and how these attributes will determine the successful of technology transfer.

LITERATURE REVIEW

Knowledge Management

Over the last couple of years, knowledge management (KM) has become one of the most popular and important topics in academic research and management practices. KM has recently been discussed in several key articles (Alavi and Leidner, 2001; Nonaka et al., 2001 and Grant, 2001). Interest in KM has grown because of the belief that the sharing and transfer of knowledge is essential to long-term organizational productivity and effectiveness (Jennex, 2007).

Knowledge management is hard to define precisely and simply (Rebecca and Philip, 2000). Jennex (2005) defined KM as the practice of selectively applying knowledge from previous experiences of decision making to current and future decision making activities with the express purpose of improving the organization's effectiveness. Another key definition of KM includes Holsapple and Joshi (2004), who consider KM as an entity's systems and deliberate efforts to expand, cultivate and apply available knowledge in ways that add value to the entity in order to accomplish its objectives or fulfill its purposes. The entity's scope may be individual, organizational, Tran organizational, national and so forth. Presented with a concrete foundation, Lehaney et al., (2004) referred KM to the systematic organization, planning, scheduling, monitoring and deployment of people, processes, technology and environment with appropriate targets and feedback mechanisms, under the control of a public or private sector concern and undertaken by such a concern to facilitate explicitly and specifically the creation, retention, sharing, identification, acquisition, utilization and measurement of information and new ideas in order to achieve strategic aims, such as improved competitiveness or performance subject to financial, legal, resource, political, technical, cultural and societal constraints.

Knowledge Management Attributes

Shera (1983) viewed KM in terms of: 1) People – How do you increase the ability of an individual in the organization to influence others with their knowledge. 2) Processes – Its approach varies from organization to organization. There is no limit on the number of processes. 3) Technology – It needs to be chosen only after all the requirements of a knowledge management initiative have been established. 4) Culture – The biggest enabler of successful knowledge-driven organizations is the establishment of a knowledge-focused culture. 5) Structure – The business processes and organizational structures that facilitate

knowledge sharing. According to Hasanali (2002), the success of KM initiatives depends on many factors, typically can be categorized into five primary categories namely leadership, culture, structure, technology infrastructure and measurement. Likewise, the APQC (1999) included strategy and leadership, culture, technology and measurement in their framework as enablers which can support the operation of KM.

Handzic and Zhou (2005), in their book, have examined that organizational culture, leadership, structure, incentives and rewards, and measurement act as major knowledge catalysts that facilitate the process of knowledge creation, sharing and transfer. As KM infrastructure is the foundation on which KM resides, it includes four main components; organization culture, organization structure, communities of practice and information technology infrastructure (Becerra-Fernandez et al., 2004). Binwal (2001) has addressed that the components of KM are: 1) People management – recognition of the skills of people and 2) Process management – links into the identification and deployment of practices may be associated with business process re-engineering. While Egbu (2000) looked at knowledge transfer in ways of people, culture, process, infrastructure and technology. KM can be thought of as the deliberate design of processes, tools, structures, etc. with the intent to increase, renew, share or improve the use of knowledge represented in any of the three elements; Structural, Human and Social of intellectual capital. (Seemann et al, 1999).

In a posting to the Knowledge Management Forum, Sveiby (1997) identified that KM involves management of people –researchers and practitioners in this field have their education in philosophy, psychology, sociology or business / management. They are primarily involved in assessing, changing and improving human individual skills and behavior. Satyadas (2003) has decided that in developing KM strategy he should highlight and intertwine three areas or elements: people, processes and technology. To summarize, it is found that there are five main attributes of knowledge management as discussed by various researchers that may influence the effectiveness of technology transfer processes. Please see Table 1.

Technology Absorption

Owing to rapid technological changes, short product life-cycles and increasing global competition, acquiring new technology becomes crucial to enable firms to develop new products more quickly. Technology absorption is a costly learning activity that a firm can employ to integrate and commercialize knowledge and technology that is new to the firm (Goldberg et al., 2008). Example of absorption include adopting new products and manufacturing processes developed elsewhere, upgrading old products and processes, improving organizational efficiency, achieving quality certification, etc.

Technology absorptive capacity is important in establishing technology transfer activities in firms. In a study by Kneller (2002), it is suggested that technology absorptive capacity would contribute to firm's ability in adopting a particular technology. Madanmohan et al. (2004) suggested that the extent of firm's technology absorptive capacity will determine their level of participation in technology transfer process and the type of technology that they can operate efficiently. Meanwhile, studies (Adam and Lamont, 2003; Zahra and George, 2002) had also discussed on transformative capacity which could enhance technology absorptive capacity. Griffith et al. (2004) had defined absorptive capacity at the

firm level as a firm's capacity to assess the value of external knowledge and technology, and to make necessary investments and organizational changes to absorb and apply this in its productive activities.

Technology Absorption Attributes

Research conducted by Lin et al., (2002) resulted that technology transfer performance of an organizations are much impacted by the technology absorptive capacity which involves change in the organizational culture, interaction mechanisms and R&D resources investment. Kamien and Zang (2000) indicated that an organization's R&D approach and the budget influence its absorptive capacity as well as the transfer of technology. Dorothy (1992) study has divided an organization's core resources into five categories: financial resources, human resources, physical resources, technology resources and organizational resource. All these resources give major impacts on the successful of technology transfer activities. Many studies pointed out the importance of absorptive capacity in improving technology transfer performance (Santangelo, 2000; Levinson and Asahi, 1995). In addition, several studies proposed that to understand the source of an organization's absorptive capacity, people should focus on the structure of communication between the external environment and the organization as well as among the subunits of the organization (Levinson and Asahi, 1995; Grant, 1996).

Organizational cultures can facilitate or hinder organizational change and learning (Levinson and Asahi, 1995). Study conducted by them also indicated that the organization's interactions and connections with people outside organizations would strengthen the absorption of technology and therefore improve its transfer performance. Simmons (1996) regarded that the organizational culture as a key factor of employee interaction and job execution while Montealegre (1999) referred to organizational culture as one determinant of the efficiency of technology transfer. According to the research into technology transfer, Li-Hua (2003) had identified that without knowledge transfer, technology transfer does not take place as knowledge is the key to control technology as a whole. He also stressed that knowledge transfer is crucial in the process of technology transfer. The technology transfer chain is often long, in terms of both distance and time. Effective communication is thus another essential ingredient in the recipe for successful technology transfer (UNEP-IETC, 2004). To summarize, it is found that there are five main attributes of technology absorption as discussed by various researchers that may influence the effectiveness of technology transfer processes. Please see Table 2.

Table 1: Summary of knowledge management attributes.

KNOWLEDGE MANAGEMENT (KM) ATTRIBUTES					
RESEARCHERS	PEOPLE	PROCESS AND MEASUREMENT	TECHNOLOGY	ORGANIZATIONAL CULTURE	ORGANIZATIONAL STRUCTURE
Jesse Shera (1983)	how to increase the ability of an individual to influence others with their knowledge.	there is no limit on the number of the processes	technology needs to be chosen only after all of the requirements of KM have been established.	knowledge-focused culture is the biggest enabler in order to establish a successful knowledge-driven organizations.	to construct business structures to facilitate knowledge sharing in the organizations.
Sveiby (1997)	management of people that involves researchers and practitioners who are educated in accessing, changing and improving individual's skills and behaviors.				
APQC (1999)		includes measurement.	includes technology.	include strategy and leadership as dimensions as well as organizational culture itself.	
Seeman et al (1999)	human and social of intellectual capital.				Structural of intellectual capital.

Table 1: Continued.

Egbu (2000)	Knowledge transfer in ways of people.	Knowledge transfer in ways of process.	Knowledge transfer in ways of technology.	Knowledge transfer in ways of culture.	Knowledge transfer in ways of infrastructure.
Binwal (2001)	management of people to recognize the skills of an individual.	management of process that link into the identification and deployment of practices.			
Antony Satyadas (2003)	he highlights and intertwines on element of people to develop KM strategy.	he highlights and intertwines on element of process to develop KM strategy.	he highlights and intertwines on element of technology to develop KM strategy.		
Becerra-Fernandez et al. (2004)			information technology infrastructure as a main component.	organizational culture as a main component.	communities of practices as well as organizational structure itself as a main component.
Handzic and Zhou (2005)		knowledge catalysts include measurement		knowledge catalyst includes leadership as dimension as well as organizational culture itself.	knowledge catalyst includes incentives and rewards as dimensions as well as organizational structure itself.

Table 2: Summary of technology absorption attributes

TECHNOLOGY ABSORPTION (TA) ATTRIBUTES					
RESEARCHERS	COMMUNICATION	INTERACTION MECHANISM	R & D	ORGANIZATIONAL CULTURE	KNOWLEDGE TRANSFER
Dorothy (1992)			organization's core resources; financial, human, physical, technology and organizational resources give major impact on technology transfer activities.		
Levinson and Asahi (1995)	people should focus on the structure of communication between the external environment and the organization as well as among the subunits	organization's interactions and connections with people outside would improve the technology transfer performance		organizational culture can facilitate or hinder organizational change and learning.	
Grant (1996)	people should focus on the structure of communication between the external environment and the organization as well as among the subunits				
Lin et al. (2002)		technology absorption are impacted by interaction mechanism	technology absorption are impacted by R&D resources investment	technology absorption are impacted by organizational culture	
Kamien and Zang (2000)			organization's R&D approach and budget influence the absorption of technology		
Li- Hua (2003)					Knowledge transfer is crucial in the process of technology transfer
UNEP-IETC (2004)	Effective communication as an essential ingredient in the recipe of technology transfer				

Technology Transfer Success

Technology transfer has been a subject of considerable interest to many groups because of the close relationship between technology transfer and economic growth. The success of an industry is largely depending upon their abilities to absorb and transfer technology in a timely manner. According to Hamel and Prahalad (1990), firms or industries can reinforce their technological competence by importing external technologies and then diffusing, assimilating, communicating and absorbing them into their organization. There are many definitions of technology transfer. One of the precise definitions was offered by Krull (1990): Technology transfer is the process by which existing technology is transferred or transformed to fulfill the user's needs. According to Coates (2001), technology transfer is the process of sharing of skills, knowledge, technologies and method of manufacturing to ensure that scientific and technological developments are accessible to a wider range of users who can then further develop and exploit the technology into new products, processes, applications, materials or services.

Some form of KM is required in any successful of technology transfer process. This is apparent by looking at the various kinds of knowledge that must be accessed or transferred in any successful technology transfer. Part of the problem was recently stated by Laidlaw: "Transferring technology is the transfer of both physical and intellectual capital. ...the technology can only be successfully applied when knowledge/know-how is transferred with the technology receiver (Laidlaw, 2003). The implementation of KM provides numerous advantages to the successful technology transfer. Laidlaw (2003) states some benefits of KM in a Motorola case study:

1. KM enhances technology transfer and program management. Technology transfer cannot be completed through the transfer of embodied technology alone. Disembodied technology or intellectual capital must also be transferred in order for the process to be successful.
2. KM has the potential to significantly reduce the cycle-time of developing new technologies, therefore allowing the process of technology transfer to occur more rapidly. This can offer a competitive edge to any organization.

THE PROPOSE MODEL FOR SUCCESSFUL TECHNOLOGY TRANSFER

Based on the literature reviewed, it is proposed that the following model where several attributes of knowledge management; people, technology, organizational culture, organizational structure and process as well as technology absorption; communication, interaction mechanisms, organizational culture, knowledge transfer and R&D will become independent variables to the success of technology transfer as a dependent variable.

RESEARCH OBJECTIVES

This study embarks on the following objectives:

1. To investigate the status of knowledge management (KM) and technology absorption (TA) attributes toward the technology transfer (TT) success in the automotive companies selected for this study.

2. To identify the relationships of both of knowledge management (KM) and technology absorption (TA) toward the technology transfer (TT) success.
3. To identify the relationships between knowledge management (KM) attributes with technology absorption (TA) attributes that facilitate the success of technology transfer (TT).
4. To develop knowledge management and technology absorption (KM-TA) model for automotive industry.

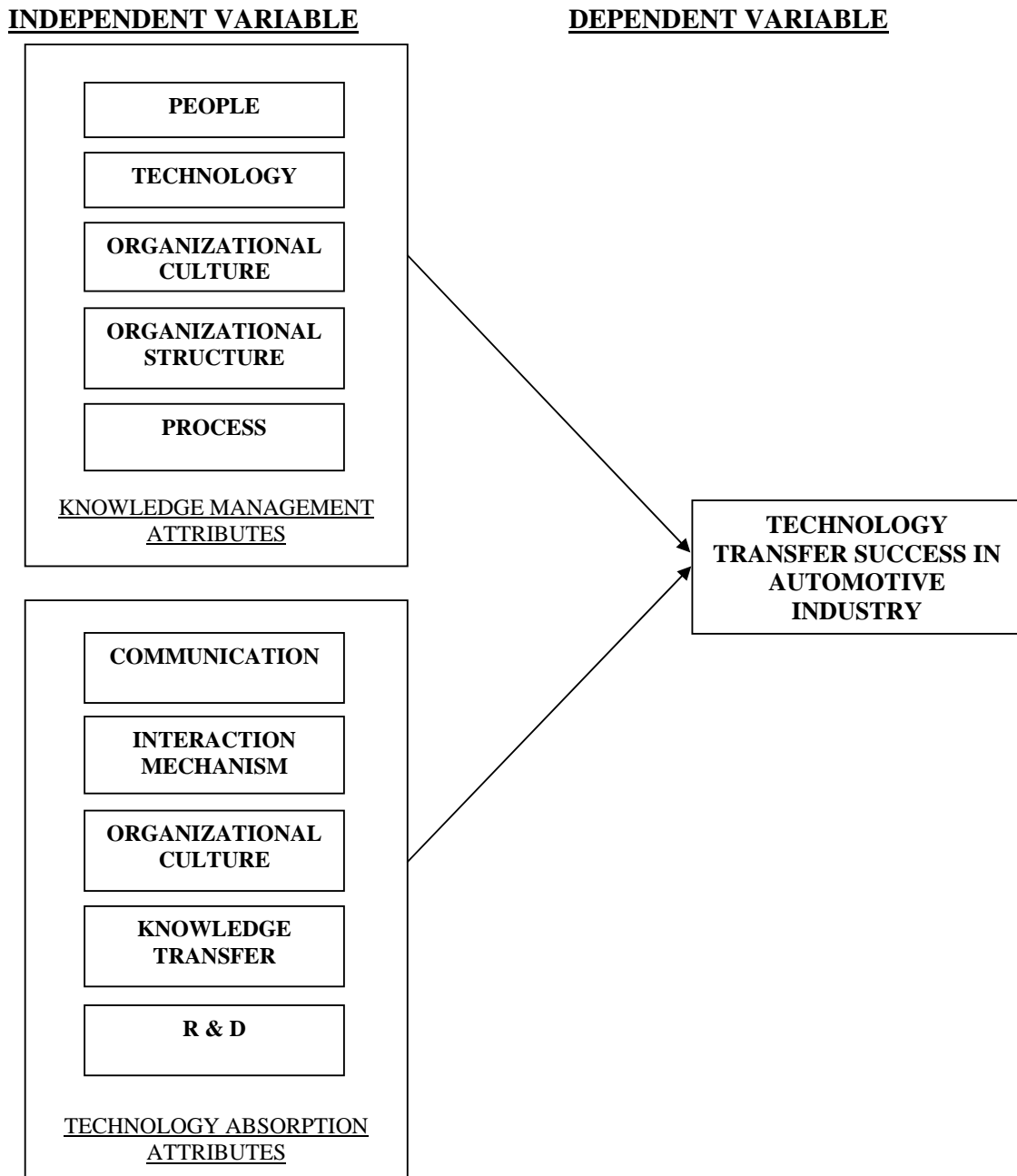


Figure 1: The propose model for successful technology transfer

RESEARCH QUESTIONS

The purpose of the study is outlined in the following research questions:

1. What is the existing status of knowledge management (KM) and technology absorption (TA) attributes toward the technology transfer (TT) success in the automotive companies selected for this study?
2. Are there a relationship of both of knowledge management (KM) and technology absorption (TA) toward the technology transfer (TT) success?
3. Are there relationships between knowledge management (KM) attributes with technology absorption (TA) attributes that facilitate the success of technology transfer (TT)?

RESEARCH METHODOLOGY

The research will be used survey methodology to explore on the perception of Perodua and Proton personnel towards their knowledge management capability in promoting knowledge transfer process that directly support the transfer of technology. This study is limited to automotive industry because most of technology transfer process occurs in this industry. Moreover, automotive technology has evolved so much and so quickly that it has also become a challenge to ensure that all the people involved in the development and transfer process communicate with each other and integrate their efforts. The population of this study will comprise a few of personnel at Proton and Perodua which will consist of middle managers, executives, supervisors and general workers who are directly and indirectly involve in transfer of technology processes. A sample will be selected using stratified random sampling. Sample size will be determined according to rule of thumb by Roscoe (1975), sample size larger than 30 and less than 500 are appropriate for most research and could avoid Type II error (the acceptance of finding when in fact, it should be rejected).

Data collection will be relied on primary data (questionnaire and interview method). However, other useful information will be gathered through literature search, websites review, reports and documents. In this research, the questionnaires will be distributed by hand to the respondents using 'drop and collect' methods. The questions will be asking are combinations of open-ended questions and close-ended questions which will be classified into a few sections. Pilot test will be conducted in developing a survey questionnaire. The purpose of conducting pilot test is to detect weaknesses in design and instrumentation. According to Cooper and Schindler (2003), the size of the pilot group may range from 25 to 100 respondents but do not have to be statistically selected. For this study, 30 questionnaires will be sent to the respondents from Proton and Perodua.

Structural Equation Modeling (SEM) method will be used in testing the relationship between variables. Regression Analysis will be used to test the influence of moderator variable. Data will be coded and analyzed using SPSS software version 12.0. Reliability test (Cronbach's alpha) will be conducted to identify the reliability coefficient. The rule of thumb of 0.60 as specified by Jones et al. (1999), will be used as the lower level of acceptability of the alpha. Content validity will be examined through a critical evaluation of the definition of each construct by reviewing relevant theories and research findings. These constructs will be subjected to pilot test in order to ensure that the measure have

sufficient content validity. For construct validity, factor analysis will be used because it allows the examination of the underlying structure of the overall measures.

CONCLUSIONS

The issues of knowledge and technology transfer have been a great interest area for many industries in Malaysia. Hence, organizations strive continuously to become more efficiently. Knowledge management and technology absorptive capacity factors within Malaysia organizations are not different in determining the successful technology transfer processes. It is clear that technology transfer could benefit from a broader understanding and application of ideas from knowledge management as well the capabilities to absorb new technology. Therefore, the purpose of this paper is to explore what are the most potential attributes of knowledge management and technology absorption as well as the relationships of those attributes toward technology transfer processes successfulness.

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