

## **LITERATURE REVIEW**

### **2.1 Introduction**

In the last two decades of 20<sup>th</sup> century, a resource-based theory of the firm (Hamel G. & Prahalad C.K, 1990), (Blackler, 1995), (Wernerfelt, 1995) has received attention as an alternative to the traditional product-based or competitive advantage (Porter, 1980) view. Generally, resource-based view (RBV) indicates that firms with valuable, rare and inimitable resources have the potential of gaining competitive advantage (Barner, 1991).

Knowledge and skills are important tools to implement a lot of physical work in many industries. Knowledge and skills enable a firm to innovate products and processes more effectively and efficiently, thus gaining the firm competitive advantage (Nonaka & Takeuchi, 1995). Grant (1996) added to this point that the resource-based view knowledge is gaining increasingly as an important source of competitive advantage in today's world.

Relative to the resource-based view, there is an increasing interest of knowledge transfer in the context of construction enterprise recently. In construction industry, knowledge, capabilities and resources are built up in the firm through executing projects over time. Owing to the uniqueness and temporary character of the construction projects, construction firms are

inherently flexible and re-configurable. As knowledge and skills encourage innovativeness, Seaden et al. (2003) reviewed in their study that many construction firms introduce new approaches in information and construction technologies as well as in business practices. A large number of this innovativeness was found to provide significant competitive advantage.

## **2.2 Knowledge-based View**

According to Sijtsema and Postma (2004), knowledge-based view (KBV) can be considered a subset of the resource-based view (RBV). Knowledge-based view indicates that firms with valuable, rare and inimitable knowledge, skills and expertise have the potential of gaining competitive advantage. Generally, knowledge-based view literature can be divided into two main categories, which are tacit knowledge and explicit knowledge.

### **2.2.1 Knowledge Dimensions**

According to Polanyi (1966), there are two different levels or dimensions of knowledge, which are mutually exclusive: Knowledge about the object or phenomenon that is in focus – explicit knowledge; and, knowledge that is used as a tool to handle or improve what is in focus – tacit knowledge.

Explicit knowledge refers to knowledge and knowing about facts and theories. On the other hand, tacit knowledge refers to the knowledge of knowing how, which are accumulated through experiences over years. Explicit knowledge is data and information that can be codified and transmittable in a formal systematic language whereas tacit knowledge is personal, context specific, more abstract and therefore hard to formalized and communicate (Nonaka, 1994). Research found that explicit knowledge is easier to transfer since it can be codified while tacit knowledge is more costly and uncertain since it cannot be codified (Kogut and Zander, 1992).

In addition, Sveiby (1997) states that the explicit and tacit dimensions are complementary. He further explained that tacit knowledge functions as a background knowledge that assists in accomplishing a task that is in focus. Tacit knowledge varies from one situation to another. For example, when reading a text, words and linguistic rules function as tacit subsidiary knowledge while the attention of the reader is focused on the meaning of the text.

Similarly, Kogut and Zander (1992) explained that tacit knowledge is revealed through its application and is also referred to as experiential knowledge or knowledge by doing. This knowing-how knowledge is often rooted and is difficult to transfer (Nonaka, 1994). On the other hand, Polanyi (1966) reviewed that explicit knowledge is defined as knowledge that can be

transmitted in formal, systematic language, whereas tacit knowledge refers to knowledge that has a personal quality and is therefore difficult to formalize and communicate.

### **2.2.2 Hierarchy Of Knowing**

Bertil Rofl (1991) suggests that the process of knowing is based on how the rules are followed: The lowest level of knowing is to follow rules which can be controlled by the subject itself, these level of knowing are widely found in pre-school and lower grades education where children at this stage are depending on the explicit knowledge from books and tacit knowledge transferred from their teachers, parents etc; Skill, the next level is to follow rules which are established by a social context outside the individual; Know-How, the highest level is to be able to change the rules.

#### **2.2.2.1 Skill**

According to Polanyi (1966), skills combine muscular acts which are not identifiable, according to relations that we cannot define. It is an ability to act according to rules which depend on feedback from a non-social environment.

#### **2.2.2.2 Know-how**

Know-how includes skill and is the ability to act in social contexts. Know-how implies problem solving.

#### **2.2.2.3 Expertise**

Expertise or competence encompassed know-how and ability of reflection. Expertise is not a property but a relation between individual actors and a social system of rules (Sveiby, 1997). He further explained that a characteristic of expertise compared to know-how and skill is that the actor has power over this own knowledge, i.e over the rule system which decides quality standards.

In short, each level of knowledge contains both tacit and explicit knowing. It depends on situation whether it is used tacitly or being used explicitly. Tacit and explicit are not levels in hierarchy but are two dimensions of the same knowledge. Skills which are very difficult to articulate and to transfer between individuals thus have a large proportion tacit knowing, whereas a competent person must be able to focus more of his/her tacit process-of-knowing in order to articulate and communicate in a social context (Sveiby, 1997).

## **2.3 Knowledge Creation and Knowledge Transfer**

Information is data endowed with relevance and purpose. Converting data into information thus requires knowledge (Drucker, 1998). Effective transferring of knowledge will ensure an efficient dissemination of information and gain competitive advantage for the organisation.

There is a large amount of studies discuss the importance of context for transferring knowledge. Nonaka (1994) expressed that an important issue in knowledge-based view (KBV) is the transfer of knowledge and the difficulty of transfer. From the resource-based view (RBV), it is clear that firms have high potential to gain competitive advantage if they are inimitable and not readily substitutable (Peteraf, 1993). Porter (1980) shared the same view as his Five Forces Model illustrate that substitutes limit the potential returns of an industry by placing a ceiling on the prices firms in the industry can profitable charge.

Tacit knowledge is essentially personal in nature and is therefore difficult to extract from the heads of individuals (Sanchez). The "tacit knowledge approach" of knowledge transfer typically holds that the dissemination of knowledge in an organization can best be accomplished by the transfer of people as "knowledge carriers" from one part of organization to another. Further, this view believes that knowledge transfer in an organization occurs when individuals come together under circumstances that encourage them to

share their ideas and develop new insights together that will lead to the creation of new knowledge.

In contrast to tacit knowledge approach, explicit knowledge approach holds the principle that knowledge is something that can be explained by individuals. Formal organizational processes can be used to help individuals articulate the knowledge they have to create knowledge assets. These knowledge assets can then be disseminated within an organization through documents, standard procedures, manual, etc. Information system is usually seen as a central role in facilitating the dissemination of explicit knowledge assets within and between organizations.

On the other hand, Nonaka (1994) states that organizational level knowledge is created through a continuous dialog between tacit and explicit knowledge. Indeed, to ignore the interaction of tacit and explicit knowledge is to potentially inhibit innovation vis-a-vis the generation of new capabilities, products and services (Choo, 1998; Nonaka and Takeuchi, 1995). In Nonaka (1994) framework, it is assumed that new knowledge is created through conversion between tacit and explicit knowledge. Nonaka (1994) discusses four modes of knowledge conversion between tacit and explicit; socialization (tacit to tacit); externalisation (tacit to explicit); combination (explicit to explicit); and internalisation (explicit to tacit).

Socialization of knowledge takes place through shared experience. Apprentices learn from mentors through a process of observation and repetition. In construction industry, in interacting a new product or process, a project team would combine knowledge about how best to integrate the product and process. The key to acquiring tacit knowledge is experiencing, particularly some form of shared experience. The transfer of knowledge between individuals would lead to new knowledge of better ways to implement product or process.

Externalisation which involves the process of converting tacit knowledge to explicit knowledge is often time consuming and problematic (Earl and Scott, 1998). As tacit knowledge is not definable directly in language, metaphors are often used to explain the knowledge concept. With a new process or product, the externalisation refers to an individual describing to the team how he or she uses the innovation.

Combination and systemization of concepts through symbols such as language or figures is achieved through media such as meetings and information technology.

Internalisation of knowledge is analogous to the traditional concept of learning. As explicit knowledge is convertible to tacit, in the case of a new technology tool, the act of using the tool enables the internalisation of knowledge.



These four modes form a model called the SECI model. All of the four modes need to be realised as an integrated process of knowledge creation. Figure 2.1 describes processes of self-transcendence placed in organisations that facilitate knowledge creation. The individual transcends him/herself through socialization. Externalisation helps teams to transcend their current knowledge. Combination helps teams to reach the organization level. Finally internalisation transcend the super-personal level and to reach the personal tacit level again. SECI model projected a completely different perspective on organisation as places that facilitate self-transcendence of individuals. Knowledge creation thus indicates a paradigm shift away from old management thinking.

Nonaka (1994) further explained the scenario of knowledge combination through dynamic interactions between all four modes of knowledge conversion as an upward spiralling process. Figure 2.2 illustrates this scenario as the process starts at the individual level and moves up the hierarchy to the inter-organizational level as the result of knowledge conversion and transfer.

### **2.3.1 Familiarity: Internal Development and Diffusion Of Knowledge**

Internal development and diffusion of knowledge and technology is essential in positioning an organization strategically. The more current and complete

the knowledge within an organization, the more advantages the organization stand in the competitive environment.

Therefore, benchmarking against best of class in other industries helps managers calibrate a core technological capability, especially the physical and managerial systems dimensions (Leonard, 1998). For example, Xerox was one of the first companies to use benchmarking extensively, when it struggled to retake copier market from Japanese competition.

Figure 2.3 illustrates the two dimensions of strategic importance and degree of familiarity with the technology which yields four potential technology sourcing situations (Leonard, 1998). Starting from the lower left-hand corner and moving clock-wise, we observe that when the firm has little experience, there is little reason to invest in technology. Technologies which a firm is familiar but extremely low in strategic importance are recommended to be outsourced to specialists. Upper right-hand quadrant shown technologies which are core capabilities that the firm will enhance. The greatest need for external acquisition falls in lower right-hand quadrant, where capability gaps exist; strategic importance is high, but the company's internal knowledge is incomplete.

### **2.3.2 External Source Of Knowledge**

Cohen and Levinthal (1990) state that the transfer of knowledge from external sources is influenced by the absorptive capacity of a firm. Absorptive capacity is the ability of a firm to recognize the value of new, external information and knowledge, assimilate it, and apply it to commercial ends (Cohen and Levinthal, 1990). They stressed that absorptive capacity is critical to a firm's innovative capabilities. Leonard (1998) added that the absorptive capacity has become increasingly important as the world's economy dissolves and the market for knowledge expands.

Companies seek to acquire knowledge from external sources when there is a capability gap – that is, when strategically important technical expertise is unavailable or inadequate internally (Leonard, 1998). Such capability gaps may arise from three main reasons, which are: a deliberate corporate policy to lessen internal research; sizable advances or discontinuities in a given technology; or, newly identified opportunities for technology fusion. In many occasions, alliances with external parties are formed to resolve the capability gap within an organization. As Figure 2.4 suggests, potential technology allies range from institutions with a research mission to consortia comprising competitors or non-competing companies, to customers (Leonard, 1998).

### **2.3.3 Relationship Between Internal And External Knowledge**

As discussed in earlier section, there shall be an efficient coordination of internal and external knowledge with regards to strategic importance and degree of familiarity.

Nooteboom (2000) reviewed that the relationship between the internal knowledge resources of the firm and the external knowledge resources of the network is generally influenced by a set of governance mechanisms that can either hinder or enhance knowledge transfer. These mechanisms are:

- i) Authority as a control mechanism within the firm
- ii) Prices and contracts for market coordination of the external network.
- iii) Trust as a governance mechanism between the firm and the external network.
- iv) The context of institutional regulations
- v) The cultural or values and norms within an industry

## **2.4 Knowledge-based Strategy**

The basic concept of strategy is that of an idea that sets in place a path that responds to multiple internal and external influences (Porter, 1985). On the

other hand, Chinowsky et al. (2000) explained that strategies are concepts that contain no intrinsic steps to achieve the final destination. Similarly, Quinn (1980) and De Wit & Meyer (1998) stated that a strategy is the pattern or plan that integrates an organization's major goals, policies, and action sequences into a cohesive whole.

Looking forward, Drucker (1998) contends that knowledge management will have a major impact on the structure of future organizations. He predicts that knowledge-based organizations will have half the number of management layers found in businesses today - and the number of managers will be cut by two thirds. Mertins et al. (2001) noted that knowledge is an intellectual capital which has become a decisive competitive advantage for a modern company. A firm that wants to evaluate and utilize its intellectual capital "needs therefore to monitor the formation and investment of intellectual capital toward evolving the firms' intellectual capital programs over time. However, Leonard (1998) states that the link between strategy and knowledge is often weak or missing, and the deficiency may exist at either end of the desired connection.

On the other hand, Sveiby (2001) urged that knowledge-based strategy formulation can be established via transferring and converting knowledge externally or internally to the organization by the primary intangible resource: the competence of people. Gulati et al. (2000) states that an important source of the creation of inimitable value-generating resources lies in a firm's network

of relationships. This evidence of knowledge transferring process can be witnessed via an effective network of a firm. A firm's network allows it to access to internal and external resources such as information, goods, services and technologies. This will enhance the competitive advantage of the firm (Gulati et al., 2000).

In contrast to tangible goods, which tend to depreciate in value when they are used, knowledge grows when used and depreciates when not used. For example, if a language is not widely spoken or used, it gradually dissipates. Apart from that, intangible value in a value network grows each time a transfer takes place because knowledge does not physically leave the creator as a consequence of a transfer. Thus, from an organisational viewpoint the knowledge has effectively doubled during knowledge transfer. Knowledge transferred is knowledge double (Sveiby, 2001). However, from an individual view, knowledge shared may be an opportunity lost if the effect of the sharing becomes lost career opportunities. Knowledge transfers, in this case is competitiveness lost.

Knowledge transfer or conversions form the backbone of a knowledge strategy, which have the potential to create value for an organisation. Generally, there are eight forms of basic knowledge transfers:

#### **2.4.1 Knowledge Transfer Between Individual Professionals**

Knowledge transfers between individuals are efforts to enable communication between employees within in the organisation and determining what type of environments are most conducive to creativity. However, the most important issues in this context are the trust in the organisation.

The formulation of this strategy of knowledge transfer should focused on trust building, teamwork, job rotation, induction programs, etc. For example, The Danish hearing-aid manufacturer, Oticon, which emphasis “live” interaction between employees, has re-designed whole work areas to create an atmosphere of openness, flexibility, creativity and sharing (LaBarre, 1994).

#### **2.4.2 Knowledge Transfer From Individuals To External Structure**

Knowledge transfer from individuals to the external structure is regarding how the organisation’s employees transfer their knowledge to the outer world. The focus of this strategy is how the organisation’s employees improve competence of customers, suppliers and other stakeholders?

Evidence of this form of knowledge transfer can be witnessed in the US based consulting firm, McKinsey, which its employees are encouraged to spent time on publishing their research and methods in order to build the reputation of the firm (Harari, 1994). A firm can actually gain competitive advantage via this

form of knowledge transfer because the more published research paper from a firm, the more prominent the firm become and thus gaining respect within from the society and industry.

#### **2.4.3 Knowledge Transfer From External Structure To Individuals**

Knowledge transfer from external structure to individuals can be established through employees learning from customer, supplier feedback such as ideas, new experiences and new technological knowledge. Knowledge obtained via training and courses are also considered knowledge transfer of this category. These forms of knowledge transfers are common in many firms in their continuous learning and training programme. Individual obtained knowledge from courses conducted by external parties and apply the knowledge in the working context within the organisation.

#### **2.4.4 Knowledge Transfer From Competence To Internal Structure**

This knowledge transfer is regarding the conversion of individually held competence to the organisation. Every individual is unique and contained special competence in them in particular field. Organisation engaged these special competences to help in operations and bring up organisation's profile. However, this special knowledge that one has often contained within him/herself. If the organisation can transfer the knowledge of individual's



competence to other employees in the organisation, it will doubled the capabilities of the organisation and enhances its competitiveness in the industry.

#### **2.4.5 Knowledge Transfer From Internal Structure To Competence**

This strategy is to improve the individual's competence by using systems, tools, etc. Investment of the organisation towards individual's development is important in this context. For example, IKEA, the Swedish furniture company, uses customised simulations for speeding up the learning of its warehouse employees (Garvin, 1993). This form of knowledge transfer is involving introducing new technologies that can enhance the efficiency of the individuals and thus increases the competitiveness of the organisation.

#### **2.4.6 Knowledge Transfer From External To Internal Structure**

This category of knowledge transfer refers to transfer of technology, expertise, etc from an external sources such as institutions, consultants, etc to the organisation. This form of knowledge transfer takes place especially while forming a joint venture or alliance with external parties. The main purpose of joint venture and alliance is to gather expertise from different parties in order to implement a challenging task. During the process, a lot of interactions and exchanging ideas take place and thus knowledge was transferred amongst

the project teams. An effective transfer of knowledge from external to internal structure will gain the organisation new technologies and increase its capabilities and competitiveness.

#### **2.4.7 Knowledge Transfer From Internal To External Structure**

Knowledge transfer of this kind refers to knowledge transfer from an organisation to another organisation. This form of knowledge transfer also occurred especially via joint venture or forming alliances with external parties. As mentioned in earlier section, this form of knowledge transfer can enhance the capabilities of the recipient if new knowledge and technologies are transferred. However, the transfer only occurred if there is a strong tie and mutual trust developed between the parties.

#### **2.4.8 Knowledge Transfer Within Internal Structure**

This category of knowledge transfers stressed on the interaction and sharing within an organisation, whether between departments, between management and employees, etc to enhance innovation and improvement in operation. This knowledge transfer exists in most organisations. However, they tend not to be coordinated in a coherent strategy, because management lack the full perspective that a knowledge-based theory may give them (Sveiby, 2001).

## **2.5 Knowledge Transfer and Innovation In Construction Industry**

Based on an interview with the management Guru, Peter Drucker by Rutigliano (1996), Peter Drucker reviewed that with knowledge-based innovation, we are immediately in the spotlight and have far more competition and little room for making mistakes. The management Guru further explained that knowledge-based innovations presuppose the convergence of several knowledge areas and need to be far more planned and analytical.

According to Yongxiang (1998), knowledge innovation refers to a cognitive process from which new knowledge of basic and technological sciences are acquired through scientific research. The aim of knowledge innovation lies in the pursuit of new discoveries, exploration of new principles, creation of new theories, contrivance of new methodologies and accumulation of new knowledge. Knowledge innovation provides new theories and methods for revolutionizing one's thoughts and understanding

From the illustration, it is obvious that knowledge-based innovation requires long-term planning with strong technical support, both internally and externally of an organisation. The bases of knowledge innovation should maintain numbers of talents of international level groups of internationally famous experts, vigorous scientists and efficient ingenious administrative personnel for technical support (Jiang Mian).

Construction markets currently face many challenges such as shorter schedules, decreased investment, increased client's requirements and higher standard project performance, etc. Increased integration and innovation are important means to respond to these challenges (Tatum, 1999). Tatum (1999) further urged that effective integration of construction technology requires shared knowledge within the industry. Knowledge transfer, thus, is an essential foundation for innovation in construction.

Owing to the uniqueness of the construction projects, management of the construction firm need to cope with changes in the environment and making adjustment to its strategy, diversifying as necessary, modifying operations, altering its methods of employment of manpower, updating its approach to managers, changing its organisational structure and making constant adjustments to its financial and pricing policies. These management of change is a form of innovation in construction industry can best be obtained via efficient and effect of knowledge transfer between external and internal parties of the industry.

On the other hand, there are several studies shown that the supplier contributes to a large extent to innovation in the construction sector (Dolmans et al., 2003). This is because the suppliers often stressed on product innovation to fulfilled client and project's requirements. The transfer of knowledge from suppliers to the construction enterprises via the process of

construction will encourage and enhance the innovativeness within the construction enterprises.

According to Szulanski (1996), there are four knowledge properties that influence knowledge transfer and application:

- i) The properties of the knowledge transferred include what kind of knowledge is transferred.
- ii) The characteristic of the knowledge recipient
- iii) The characteristic of the knowledge sources
- iv) The context of the knowledge transfer

Based on the discussion in previous sections, a core proposition related to the knowledge transfer between external network partners and the construction firm's internal resources is established:

**Proposition 1:**

More efficient and effective exchange of knowledge between external and internal parties of construction firms leads to higher innovation performance.

**2.5.1 Characteristic of Knowledge Recipient (Construction Firms)**

Construction is a complex industry involving a number of discrete transactions usually undertaken on an ad-hoc, one-off geographically specific basis

(Thomson et al., 1998). The term “construction enterprise” refers to any business entity involved in an aspect of construction. Thus, it encompasses much more than a “contractor” or “building company”. It is relevant to many types of business organizations in the construction sector including general contracting firms, specialist contractors, architectural or engineering design partnerships, cost consultancy practices and development companies (Betts and Ofori, 1992).

There is little research carried out on the knowledge transfer for innovation in construction industry. Due to the temporal nature and fluctuation of members in construction projects, it is difficult to develop a competitive advantage and increase performance in the form of innovative products and processes that can be applied to an organisation or industry wide (Sveiby, 2001).

However, there is still some research conducted on the knowledge diffusion in construction industry. Arditi and Tangkar (1997) explored rate and types of innovation that diffuse in construction industry over thirty-year period and found that innovations in heavy equipment were all incremental in nature but that the rate of introduction of new models, a proxy for innovation rate, had increased.

On the other hand, Lutzenhiser and Biggart (2003) reviewed that all innovations in the building industry were incremental in nature and the

structure of the industry inhibited innovation. Winch (1998) added to this point that project based working can act as a major limiting factor for innovative potential. Projects can create barriers to change, by privileging short-term localised task performance over long-term knowledge accumulation and learning (Bresnen et al., 2003)

Construction industry often focuses on ad-hoc strategies for specific project and it is often learnt that upon completion of the project, the cooperation and knowledge is hardly evaluated and transfer to new projects. (Sijtsema and Postma, 2004). However, due to the increasing competition from globalisation, many construction firms have developed long-term strategies in knowledge transfer and alliances within their organization's network.

**Proposition 2:**

A long-term view in construction firms enhances the firm to adjust to changes in the environment and increase innovation performance.

As discussed in the earlier section, the absorption capacity of a construction firms deals with the permeability of internal and external knowledge. In order to enhance efficient transfer of knowledge between stakeholders in the network of a construction firm, the focus of the firm should not only be internally oriented. Construction firm shall obtain new skills or combining skills and expertise via innovativeness to gain competitiveness in the market.

**Proposition 3:**

The better developed the absorptive capacity of the construction firm, the higher the innovation performance.

**2.5.2 Characteristic of Knowledge Sources**

As discussed in earlier section, sources of knowledge transfer can be identified through eight forms of basic transfers via internal and external network of an organisation. For the knowledge transfer involving the wider network of inter-organisation relationships, coordination among the organisations is essential to enhance performance in the form of partnership and alliances (Bresnen & Marshall, 2001)

**2.5.3 Context Of Knowledge Transfer**

The context of the knowledge transfer is crucial as it is important for the recipient to understand fully the nature and characteristics of the knowledge. Context of knowledge includes value and norms, institutional characteristics, organizational and industrial context. The more throughout the recipient understand the context of knowledge transfer, the higher the absorption capacity of the recipient towards the knowledge. A large amount of tacit knowledge is context related and therefore it is important to investigate the



context of knowledge for better understanding of the knowledge transfer and innovation process (Sijtsema & Postma, 2004).

Local rules and regulations on safety, health, environment, conservation, and etc have great influence on the decision-making and product and process development in construction industry. Moreover, the economic recession in the world has had negative consequences for the demand for construction (Sijtsema & Postma, 2004). The Asian financial crisis, which snowballed in July 1997 following the devaluation of Thai Baht, also has had big negative impact on the construction industry in the region. As the demand for construction is decreasing, the buyers and clients will gain higher bargaining power.

Oster and Quigley (1977) investigated the impact of industry regulations on the homebuilding industries in U.K. and U.S. They found that building codes and regulations could hinder the knowledge transferring and slow down the diffusion rate for innovation in the construction industry.

In addition, Sillars and Knagari (1997) state that governments often impose requirements that protect the interest of their constituency. This can become a hindrance to knowledge transfer. A context which a less heavy influence of governmental institution is present, the creation and diffusion of knowledge can be positively influence.

**Proposition 4:**

A context with less strict regulations and restrictions has a positive impact on the development of new knowledge for innovation within construction firms.

**2.5.4 Governance Mechanism**

Dubois & Gadde (2000) states that construction firms deal with four levels of coordination, in which coordination on project and firm level are most prominent. The coordination between construction firms within its network is essential for knowledge transfer and encourages innovation. Sijtsema & Postma (2004) urged that coordination between parties within the permanent network of a construction firm would gain the firm competitive advantage as it enhances the innovativeness of its construction process. The coordination can be applied in various ways such as development of mutual trust and respect, development of social ties and understanding, increasing openness between the different parties and building a long term relationship.

**Proposition 5:**

Coordination between construction firm and its external knowledge resources can help to gain competitive advantage.

Network in construction industry can be categorized into permanent and temporary network. Firms coordinate and cooperate in temporary network

based on project basis. Parties tend to stress on the formality of the contract. The relationship is noted to be contractual rather than relational (Thompson et al., 1998). They further stressed that parties in this temporary network is focusing on optimising work their scope of work and little effort is seen to create a win-win situation for the whole network. Hamel (1991) reviewed that too extensive of contractual focus is hindering information and knowledge exchange, as parties are afraid to disclose information or knowledge.

**Proposition 6:**

Coordination of temporary network, in the form of detailed contracts, has a negative impact on exchange of knowledge for competitive advantage between internal and external knowledge resources in construction industry.

On the other hand, more coordination among the firms in the permanent network would enhance productivity and performance (Bresnen & Marshall, 2001). A long-term relationship in the permanent network between construction firms and its network parties are more based on mutual trust and respect. Knowledge, in this context, is always easier to be transferred. The coordination between parties in a permanent network in construction industry will complement on the knowledge transfer and value exchange. However, it takes a long time to develop a long term and trust relationship (Dubois and Gadde, 2000).

**Proposition 7:**

Coordination of permanent network, in the form of trust, has a positive impact on exchange of knowledge between internal and external knowledge resources in construction industry.

**2.6 Knowledge Innovation and Knowledge Transfer in ASIA**

It is knowledge that contributes to finding solutions to all the complicated problems that mankind faces; similarly, it enables technological innovations and creative exploitation of new markets as well as the development of new products and services (Cheng, 2001).

The world economy in the 21<sup>st</sup> century will be a knowledge-oriented one, the growth of which will be directly driven by the production, dissemination and utilization of knowledge and information (YongXiang, 1998). Knowledge transfer and innovation are blended together and act as a catalyst to spur the economy development especially in the newly evolving markets in ASIA.

**2.6.1 Knowledge and Innovation Development In China**

China has made great progress since it opened its economy two decades ago and began a transition to a market economy (Dalman & Aubert, 2000).

China's continuing transformation from a rural agricultural economy to an urban, industrial and service economy creates strong pressures for continuous restructuring. These pressures will be compounded by the knowledge revolution and accelerated by China's greater internationalisation through accession to World Trade Organization.

To cope with the challenges brought about by the knowledge revolution and increased international competitiveness, a knowledge-based rather than the current factor-based strategy is needed (Dalman & Aubert, 2000). The knowledge-based strategy consists of making more effective use of new and existing knowledge and technology throughout the whole economy. The knowledge-based strategy stresses on:

- i) An economic and institutional regime that provides incentives for the efficient use of existing knowledge and creation of knowledge
- ii) An educated and skilled population that can create and use knowledge.
- iii) A dynamic information infrastructure that can facilitate effective communication, dissemination and processing of information.
- iv) An effective innovation system where enterprises, research centers and universities can interact effectively to create and diffuse technologies using the growing stock of domestic and global knowledge.

The China accession to the WTO has provided greater opportunities for international contractors to enter the Chinese construction market via joint ventures. Foreign partners have realized that forming JVs with local Chinese firms is the best way of undertaking business in the unfamiliar Chinese economic and cultural environment (Jun Luo et al., 2001). Local Chinese partners can make huge contributions in local business knowledge, labour, and good working relationships with governments.

Various knowledge-based and innovation national program was initiated and launched by the Chinese government. One of them is the Program of Technological Innovation, which aimed at raising China's capability of technological advancement and forming a system of technological innovation. On the other hand, The "211 Program" was designed to improve the teaching quality and standard of research and development in Chinese universities by establishing a new system of higher learning adaptable to the new order of the socialist market economy (Yongxiang, 1998)

However, in a survey investigating innovation and knowledge transfer in China compares to 60 major economies in the world, Dalman and Aubert (2000) found that China still has a long way to go on all dimensions. At present, there is still a large gap between China's innovative capacity and the country's national needs, and between its quo and that of the international community (Yongxiang, 1998).

### **2.6.2 Knowledge Diffusions In Singapore**

Industrialisation of Singapore has brought strong economic growth for the island republic for the past decades. Knowledge innovation involves entities specializing in the production, proliferation and transfer of knowledge with state-funded research institutions and research-based universities as its core, while technological innovation mainly involves enterprises.

Singapore government has noticed the importance of higher learning institution in shaping a knowledge-based society. Institute of higher learning, which cultivate workforces equipped with professional skills, the latest knowledge, and the ability to blaze new trails are responsible for knowledge dissemination. Singapore government has successfully instilled innovation system as an entity in institute of higher learning, exclusively engaged in knowledge and technological innovation, as well as technological dissemination and application.

There are many evidence of transfer of knowledge involves enterprises. The significant knowledge transfer in construction technology was witnessed during the construction of the Mass Rapid Transit (MRT) project. During the initial phase of Mass Rapid Transit (MRT) project in the early 1980s, many foreign-local joint ventures were formed. Many local contractors have worked

with foreign contractors as subcontractors. Therefore, there has been some technology and knowledge transfer (Ofori et al., 2001).

The Singaporean government “open-door” policy has encouraged the knowledge transfer from foreign expertise to local construction industry and led to improvement in local contractors’ performance.

### **2.6.3 Knowledge-based Economy In Malaysia**

Malaysian government has taken extensive measures to transform its economy to reap the greatest benefits and competitiveness in the emerging knowledge-based economy (Cheng, 2001). As a result of the innovations in information and communications technologies (ICT) in the economy, Multimedia Super Corridor (MSC) has been used as the test-bed for more efficient of knowledge transfer via information technology.

However, in the effort of transforming the economy towards a knowledge economy, Malaysia is lagging behind in some major developments, such as computer infrastructure, research and development and so on (Cheng, 2001). Instead of creating its own knowledge personnel, most of the knowledge workers in Malaysia are imported knowledge workers from countries such as India, Singapore and European countries. Malaysia, in this stage, is utilising the “ready-made resources” embedded in imported knowledge workers



without cultivating its own resources. The advantage of exploiting imported resources is the savings of education and training expenditures and these savings could then be channelled to the development of other essential components in the nation's economy.

All in all, Malaysia still has a long way to go towards establishing a knowledge-based economy. More effort need to be put in from various parties including the government, institutes of higher learning, private sectors and so on in order to build a platform for knowledge-based innovation and economy in Malaysia.