

# A Knowledge-Based Innovation for High Technology Industries and Applying to Cross Strait Marketplaces

Chen Te Fu

Lecturer, Cheng Shiu University, Taiwan

Ph.D. Candidate, School of management

University of western Sydney, Australia

Email: [phd2004\\_05@yahoo.com](mailto:phd2004_05@yahoo.com)

**Abstract:** The study discusses after China and Taiwan has finally cleared all the hurdles to gaining World Trade Organization (WTO) membership, joining in November 2001. However, foreign investors in China are increasingly embroiled in disputes with Chinese companies due to innovation barriers. Besides, after China and Taiwan joint WTO, high tech industrial competition faces globalization and digitalization two big problems. Therefore, this paper examines the notion that China's and Taiwan's entry into the WTO and their innovation reforms in line with globalization and digitalization have a significant impact on the entire system of knowledge-based innovation management.

Firstly, the study reviews innovation through a knowledge-based theory lens in the innovation supporting processes to construct a research framework. Internally, the supporting innovation processes include knowledge and technology innovation, Managing & organizing innovation. Externally, the supporting innovation processes include inter-organization networks, innovation networks and e-knowledge networks and cooperation innovation.

Secondly, the study through case studies critically investigates the supporting processes of innovation management in China and Taiwan in the context of their WTO entry, and puts forward exploratory ideas that may assist in creating a blueprint for deepening China's and Taiwan's innovation reforms. Under knowledge based and digital economy, how to overcome barriers of knowledge based innovation over the cross-strait and global markets are the most key factors for firm's survival. To answer these questions, in this paper, a more complete integrated innovation model and knowledge based innovation supply chain (KISC) for exploring and determining innovative supporting process in high tech industries and applying to cross strait (China and Taiwan) marketplace is presented. The results of the study will benefit not only the construction of knowledge based innovation framework, but also the business model transformation of competitive advantage.

**Keywords:** Knowledge management, innovation, high technology, ISC, WTO.

## I. Introduction

### I.1 Background and Motivation

Stepping into knowledge economy in 21 century, after almost fifteen years of lobbying and negotiation, China and Taiwan have finally cleared all the hurdles to gaining World Trade Organization (WTO) membership, joining in November 2001.

In response to the intensification of global competition, many firms throughout the world have developed international operation strategies to establish a worldwide production, distribution, and marketing network. Investments in manufacturing in China are frequently made due to the strategic benefits that they can bring. Fast economic growth, low labor costs, and a potentially huge domestic market have all led to significant increases in foreign investment in the People's Republic of China. Taiwan is the most investment country in China and its economy and high tech industries also is the most significant impact on cross strait (China and Taiwan) markets.

China has one of the world's largest untapped reservoirs of inexpensive labor, the importance of China's labor force is not just in its sheer size, but in its quality, which is improving steadily as a result of the training and educational reforms being introduced throughout the country. Over 14 million Chinese are employed in enterprises created by foreign investment, and more than one hundred Fortune 500 companies have operations in China. Dynamic technological advances and rapid economic globalization have changed China's international business climate to a significant extent. In future, China may influence the world as a source of raw materials, as an international manufacturing center, and as a major importer and exporter of consumer products, capital goods, and high technology. A new economic order in China – the globalization of business – has both shaped and been shaped by the advancements in knowledge and innovation management that have improved the efficiency and effectiveness between markets, manufacturing processing, and resources.

China's unprecedented economic growth and globalization have strained its knowledge-economy and innovation infrastructure to the limit. Knowledge-based innovation – the movement of technology, people, processes and information – has a significant impact on a society's standard of living. The innovative process affects every sphere of human activity and business strategy. Innovation is a significant component of the competitive advantage most enterprises incur, as life cycle of products is shorter and shorter and competing in marketplace is fiercely more and more, particularly in high tech industries. Efficient innovat-

ion management involves a successful integration of knowledge and technology that facilitates the innovative processes of products to the consumers at the right time and right place in accordance with consumer needs. As an increasing number of foreign manufacturers are establishing joint ventures in China, the demand for higher quality innovative management is growing tremendously. The reason for this growth in demand is simple: if foreign companies encounter too many innovative problems and barriers in China, to the extent that the total costs of utilizing China as a manufacturing base become too high when compared with other nations, then China will be excluded from a foreign firm's global manufacturing network.

However, foreign investors in China are increasingly embroiled in disputes with Chinese companies due to knowledge and innovation barriers. With continual innovation reforms, there are tremendous opportunities to fundamentally improve the knowledge-based innovation theory and practice. But the existing literature reveals very little systematic research in this area from the knowledge-based perspective.

In other side, during past twenty years, the most successful two high tech industries are IT industries and semiconductor industries. These two industries represent Taiwan's successfully turn around from labor intensity to capital intensity and technology intensity of high tech industries.

Nevertheless, Taiwan also faces three big problems:

1. The most industries move into China even though high tech industries.
2. Economic decline is increasingly
3. The jobless problems are serious increasingly. Recently, large volumes of industries were shifted out to China for survival even though high tech industries. The large markets and cheap labor cost is attracting for Taiwan's industries. But China this "resource black hole" will inhale how much Taiwan's industries and related resources is the big problem and dilemma for government and industries in Taiwan.

Facing the shifting of Taiwan traditional and high tech industries, the unique development of Taiwan's industries is to develop new domain just can create next wave's industrial survival space. Just like twenty years ago, Taiwan has used PC to replace calculating and game machine.

Taiwan's high tech industries have their advantage, if they could implement continue innovation, sustainable acquiring new knowledge, create new knowledge and applying new knowledge, the they must can sustainable develop successfully.

In these two years, many multinational corporations create innovation and R&D center in Taiwan. For example, there are Dell, HP, Sony, IBM and Microsoft and so on. Under fiercely competitive high tech industries environment, they have willing to invest in Taiwan are because Taiwan has many advantage of high tech industries as below.

1. Complete IT industrial supply chain. Industrial high "group gather degree" and own quickly logistics abilities, thus to form advantage of economic scale. It can decrease competitive cost.

2. Taiwan owns high quality R&D and production manpower and the advantage of lower R&D cost.

3. During past 30 to 40 years, many Taiwanese in USA are CEO or Boss of USA high tech industries. After their life and business are developed until mature term, many of them emerge minds to go back Taiwan.

4. The global main consumer markets is increasingly shift from northern America and Europe to Asia, Taiwan owns the advantage of nearing markets and it can provide integrated system services from designing, developing to manufacturing.

5. Taiwan government promotes supporting of industrial policy. It supply large R&D allowances and preferential of encouraging industries...and so on.

6. In 1990, USA has shifted out their production; this gave strong chance for Taiwan's high tech industries. Currently, USA starting to shift out R&D, Parent companies of USA focus on marketing and brand. This gives chance for turning around and upgrading for Taiwan's high tech industries again.

Base on above advantages, Taiwan's high tech industries need to start integrating design and R&D of USA and Japan and to create Taiwan as a "knowledge based innovation" center for supporting corporate innovation among cross-strait market. Furthermore, to extend Taiwan's high tech industries from "manufacturing style" to "innovation R&D style" and to develop value added of product even though to create own brand. Then Taiwan's high tech industries just can walk toward another milestone under large pressure of industrial shifting out to Mainland China.

## 1.2 Research Problems

Despite the attractive low cost environment, foreign companies and investors may still find it unprofitable to operate in China should there be serious problems in getting innovative sources to the factories and products to the customers in good condition and on time. Evidence from the literature reveals that foreign manufacturing operations in China do not find the innovative resources provided by Chinese enterprises satisfactory. Therefore, the most important issue will be which resources of innovation supporting processes are necessary to manage innovation in the knowledge intensive industry like high tech industries after China's and Taiwan's entry into the WTO?

According to abovementioned, the study assumed there are five research problems as follows:

1. How to through the advancements in knowledge and innovation management to improve the efficiency and effectiveness in cross strait markets, manufacturing processing, and resources?
2. How to acquire the supporting innovative resources from inside and outside of high tech industries?

3. How to through innovation supply chain to help Taiwan's high tech industries to maintain sustainable competitive advantage and reengineer from past manufacturing center to innovative research & development center.
4. Which resources of innovation supporting processes are necessary to manage innovation in the knowledge intensive industry like high tech industries after China's and Taiwan's entry into the WTO?

How to develop a complete integrated innovation model to reach above goals.

### I. 3 Research Objective

In future, China may influence the world as a source of raw materials, as an international manufacturing center, and as a major importer and exporter of consumer products, capital goods, and high technology. A new economic order in China – the globalization of business – has both shaped and been shaped by the advancements in knowledge and innovation management that have improved the efficiency and effectiveness between markets, manufacturing processing, and resources. According to the best market place nearing position and large volumes of high tech talent, Taiwan should be changed from past manufacturing center to innovative research & development center. This strategy could help Taiwan and China to acquire win-win situation.

As one of the most important points of knowledge, innovation organizations should embody the ability to create, disseminate and transfer knowledge. Organizational innovation should be a major prerequisite for other innovations. This has special significance for innovation organizations. However, there is an urgency to study the best structure, management methods and functions of organizations in order to establish a healthy research atmosphere and create a new culture of innovation organizations.

The main objective of the study is to provide a complete and practical integrated model for high tech industries and applying to cross strait (Chinese and Taiwan) markets. The existing literature reveals very little systematic research in this area from the knowledge-based perspective. With continual innovation reforms, there are tremendous opportunities to fundamentally improve the knowledge-based innovation theory and practice.

Therefore, firstly, this paper will examine the notion that China's and Taiwan's entry into the WTO and their innovation reforms in line with globalization and digitalization have a significant impact on the entire system of knowledge-based innovation management. Secondly, this paper will critically investigate the supporting processes of innovation management in China and Taiwan in the context of their WTO entry, and puts forward exploratory ideas that may assist in creating a blueprint for deepening China's and Taiwan's innovation reforms and for supporting high technology industrial continues innovation.

Finally, for reaching above goals, the study will develop

an integrated innovation model to support internal and external innovative processes for high tech industries between China and Taiwan. The objectives of the study is to provide a more complete and practical integrated innovation model to link theory and practice for high tech industries and applying to cross strait (Chinese and Taiwan) markets.

## II. Literature Review

### II. 1 Sources of Innovation

The foremost management consultant of our time, Peter F. Drucker [52], promoted a provocative concept on how to make a profit: "Because its purpose is to create a customer, the business enterprise has two--and only two--basic functions: marketing and innovation. Marketing and innovation produce results: all the rest are 'costs'." He further taught that bright ideas are the riskiest and least successful source of innovative opportunities. Instead, he advised the systematic, managed, purposeful and organized search for changes and the systematic, managed, purposeful and organized analysis of the opportunities such changes might offer for innovation.

He said that to 'practice' innovation, we must be students of change, and suggested monitoring seven sources for innovation opportunities. Four of these lie within the enterprise and are primarily visible to people within that industry or service sector. Three involve changes outside the enterprise or industry. Here is a list of the seven sources, taken from his book, *Innovation and Entrepreneurship: Practice and Principles*.

1. The unexpected. The unexpected success, failure or outside event.
2. The incongruity-- between reality as it actually is and reality as it is assumed to be or as it "ought to be."
3. Innovation based on process need.
4. Changes in industry structure or market structure that catches everyone unawares.
5. Demographics-- population changes.
6. Changes in perception, mood and meaning.
7. New knowledge, both scientific and nonscientific.

John Stark Associates [35] in their innovation management articles assumed innovation sources in the future as follows ([www.johnstark.com](http://www.johnstark.com)).

1. Customers' customers
2. The company's customers
3. In-house and external marketers
4. In-house and external R&D
5. The company's suppliers
6. The company's management
7. Engineering staff
8. Production workers
9. The company's competitors

### II. 2 Knowledge-based Innovation

#### Towards a knowledge-based theory of the firm

Building on Polanyi [54] and Wittgenstein [70], Sveiby [63] [64] defines knowledge as a capacity-to-act (which may or may not be conscious).

Knowledge is dynamic, personal and distinctly different from data (discrete, unstructured symbols) and information (a medium for explicit communication). Since the dynamic properties of knowledge are most important for managers, the notion individual competence can be used as a fair synonym to a capacity-to-act.

People use their capacity-to-act in order to create value in mainly two directions; by transferring and converting knowledge externally and internally to the organization. The value grows each time a knowledge transfer or conversion takes place. The strategy formulation issues are concerned with how to utilize the leverage and how to avoid the blockages that prevent sharing and conversion. Activities that form the backbone of a knowledge-based strategy are to be aimed at improving the capacity-to-act both inside and outside the organization. (Karl-Erik Sveiby, 2001)

### **A knowledge-based theory for strategy formulation**

It follows from the discussion above that strategy formulation should start with the competence of people. Inspired by McLuhan, Sveiby [45] [71] suggests that people in organizations create external and internal structures in order to express themselves. Most "things" in organizations are such relationships, People in an organization can use their competence to create value in mainly two directions: externally or internally. The external structure family consists of relationships with customers and suppliers and the reputation (image) of the firm. The internal structure consists of patents, concepts, models, and computer and administrative systems. These are created by the employees and are thus generally "owned" by the organization. The structure is partly independent of individuals and some of it remains even if a large number of the employees leave.

From an organizational viewpoint the knowledge has effectively doubled. Knowledge shared is knowledge doubled. The key to value creation lies in how effective these communications and conversions are and the major issue strategy for formulation is: how can the leverage be used to create value for the firm? The value creation is primarily determined by the tacit/explicit transfer of knowledge between individuals and in the conversion of knowledge from one type to another [50] as Figure 2-1. Knowledge transfer between individuals tends to improve competence of both individuals and teamwork tends to be a team co-creation of knowledge. However, it helps strategy formulation and action planning to distinguish directional components of the activities. Since knowledge cannot be managed the knowledge strategist looks at enabling [67] activities rather than command-control activities.

According to above, we can distinguish knowledge transfers, which create value for the organization. Enabling activities that form the backbone of a knowledge strategy are to be aimed at improving the capacity-to-act of people both inside and outside the organization.

The external transfer involves intangible relationships with customers and suppliers and forms the basis for the reputation (image) of the firm. Some of these relationships can be converted into legal property such as trademarks and brand names. The value of such intangible resources is primarily influenced by how well the company solves its customers' problems. The internal transfer relates to explicit administrative processes, internal networks, organizational culture and the competencies of individuals. [64]

Knowledge-based theories are the key to explain determined firms' behaviours such as:

1. Strategic alliances [32]; [37];
2. Mergers and acquisitions [6];
3. Firms' internationalisation [34];
4. Diversification [51]; or
5. Production plants' competitiveness [38].

### **The genesis of knowledge-based competition**

Two intertwined strategic forces are compelling companies to reconsider fundamental business assumptions. These are, first, globalization and, second, digitization with connectivity brought about by revolutions in information processing, telecommunication (or infocom) and Internet technologies. These two forces - more aggressive global competition and accelerating technological change - translate into competition that is increasingly knowledge-based. This increasingly knowledge-based nature of competition is driving change in how value chains are being managed within and across firms. Managers will certainly have to augment their ability to manage diversity, complexity and ambiguity in employee, supplier and customer relationships in the New Economy.

### **The new management imperatives**

Driven by these two forces, we are in the midst of an economic transition from an era of competitive advantage based on information to one based on knowledge creation. Today, intangibles such as customer service, innovation, speed, agility, etc. are more important than tangibles such as equipment, materials and hardware. To survive in the knowledge economy, new business models must be created, because many business axioms of the old economy are no longer applicable. Scarcity is a non-issue for digital assets. As such, the competitive dynamics of digital products differ greatly from that of physical products. In cyberspace, new economies of scales and economies of scope prevail [36].

A firm's performance depends on how much its managers can mobilize the knowledge resources individuals and teams in its value chain and how well they can turn these resources into activities that lead to value creation in hyper-competitive markets. Challenges presented by the knowledge economy make it necessary for organizations to harness the competencies of its knowledge workers, customers and suppliers, if sustainable competitive advantage is to be achieved as figure 2-1. [36]

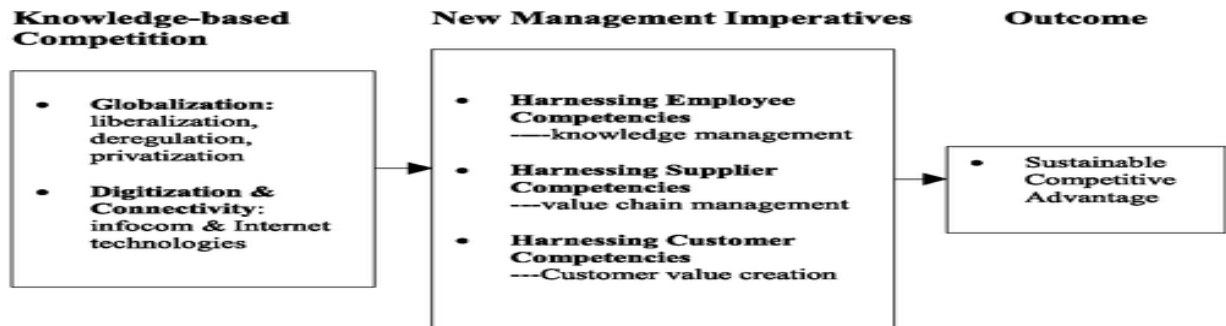


Figure 2-1: New management imperatives Source: [36]

Josephine Chinying Lang, [36] argues that there are linkages between aspects of the New Economy, including globalization and digitization, knowledge generation and competencies. Harnessing worker, customer and supplier competencies within the context of knowledge-based competition is the response called for.

The coming of globalized knowledge-based competition demands that management must attend to its knowledge workers, suppliers and customers in a new way. The real value of information systems lies in connecting people to people to enable them to share what expertise and knowledge they have at the moment, given that cutting edge knowledge is always changing. The solution is not to try to warehouse everything your workers ever knew but to connect questions to answers or to people who can help you find answers.

### II. 3 Knowledge and Innovation in High Tech Industry

The study chose Markusen *et al.*'s [42] definition of high-tech, which is based on the percentage of high "human capital" jobs in an industry. High human capital jobs include engineers, technicians, scientists, mathematicians or some combination thereof. By this definition, there are 100% high-tech industries. One of the most important advantages of this definition over others is that human skills highly correlate with other indicators of "technological" performance, such as R&D [4], stock of capital, information intensity and, more importantly for the study, innovations.

In high tech manufacturing firms, the increasing importance of innovation in which knowledge turns into the main source of competitive advantage [47]. The importance of knowledge as a source of competitive advantage is still higher for those sectors on which innovations are being continually developed [18]; [53]. Also, knowledge management is crucial for successful launching of new products [40] and for the innovation process [56]. Therefore, organizations base competition on efficiency when acquiring [50], transmitting and integrating [71] and applying [62] knowledge.

Innovation in high tech firms is progressively turning into a systematic process, especially for determined high tech industries such as electronic products. Specific departments for management of R&D activities are created.

Also, a higher contact with customers increases the role that customers play in the innovation process [14]. Therefore, both R&D departments and customers become the main source of inputs for innovation.

However, innovation patterns in high tech manufacturing is for organizational and process innovations. The impossibility of patenting this kind of innovation and, therefore, protecting the returns generated out of these innovations shortens the life cycle of innovations dramatically [3]. Hence, the innovation process must be intensive because innovations are implemented and copied at such a speed that continuous innovation efforts are required to keep up with a determined degree of differentiation in order to support the firm's strategy [68].

Today, economic competition has become increasingly important in international commerce. High-tech dominates economic competition. Governments around the world realize that only by strengthening technological innovation, possessing their own intellectual properties and grasping high-tech resources can they take the initiative in economic competition. So, technologically advanced countries adopt various policies to protect their intellectual property rights. They try to achieve a market monopoly through a technology monopoly. It is spurring the public to place greater value on knowledge-technological resources. They realize that in the future world knowledge is the most important basis for economic growth. A country's "capability of creation, distribution and use of knowledge" will become the core of its competitive power.

In knowledge-based hyper-competitive markets, sustainability of competitive advantage will depend on a firm's innovative capacity. The rapid creation and diffusion of knowledge within and between firms have thus become a top priority for management, because it is now recognized that knowledge is the only real source of sustainable competitive advantage. That is, a firm's performance depends on how much its managers can mobilize the knowledge resources of individuals and teams in its value chain and how well they can turn these resources into activities that lead to value creation in hyper-competitive markets.

### II. 4 Innovation Capacity Link between the Inside and Outside

Elson Szeto [22] assumed innovation capacity refers to a continuous improvement of the overall capability of firms to generate innovation for developing new products to meet market needs (customer needs). The capacity can be incrementally or radically increased through the participation of activities that triggers the supply of innovation resources and conversion of the resources as the knowledge base of the firm in an interactive environment [22]. The interaction is a process that provides stimulation to the firm from external sources that may be convertible into innovation resources.

Internally, a firm can further develop the innovation impulse as resources and apply it to new product development that will be turned into the knowledge base of a firm if appropriate codification is systematically implemented. Externally, inter-organizational network is an environment for the interaction and activities such as joint projects, collaborations or alliances for a specific R&D item and may benefit the participants in various degrees.

"What is unique about the way Japanese companies bring about continuous innovation is the linkage between the outside and the inside. Knowledge that is accumulated from the outside is shared widely within the organization, stored as part of company's knowledge base, and utilized by those engaged in developing new technologies and products" [50].

What "outside" environment is suitable for the development of innovation capacity of firms? Elson Szeto [22] assumed researchers of different perspectives still debate whether innovation can be generated from within firm hierarchy or from within a networked environment. Studies from a network perspective [5]; [23]; [2], inter-organizational network, becoming a new organization form, provides different stimulation through the collaborative activities with network members. Nohria and Ghoshal [49] find that the hierarchical structure of the conventional organization form was inadequate for the shift towards customization of product development and global linkages of product markets.

However, Drucker [20] suggests a systemic analysis of the possible sources to maintain "purposeful innovation" when entrepreneurs start their innovation processes within their resources and Whitley [69] looks for the governance systems that affect firm capabilities in performing various activities. The fundamental issue is how these organizational environments increase and support the firm's capacity of innovation for the continuous improvement of competitiveness, the answers is the internal and external supporting processes of innovation which reviewed as below.

## II. 5 The Internal Supporting Processes of Innovation

### II. 5. 1 Knowledge Management and Innovation

The innovative efforts are the right consequence of the investment in knowledge and knowledge workers. If KM is positively influenced by the search of innovations, the investments in the development of new knowledge may propel companies into new business in more rewarding

markets.

Innovative efforts have to be strategically combined with a competitive orientation and its consequent movements. This combination depends vitally on the highest level of individual knowledge and on its technological basis. Many companies are taking into account that new technologies and management approaches are changing the traditional perspective of managing intellectual resources. Knowledge acquisition, integration and application etc. knowledge management approaches can facilitate innovation, besides, we also need to consider competitors' knowledge when implement innovation. Improved techniques for knowledge integration lead to higher innovation levels [16].

KM, then, is about harnessing the intellectual and social capital of individuals in order to improve organizational learning capabilities, recognizing that knowledge, and not simply information, is the primary source of an organization's innovative potential [43]; [10]. The objective of KM can be to enhance exploitation (i.e. where existing knowledge is captured, transferred and deployed in other similar situations) or exploration (i.e. where knowledge is shared and synthesized and new knowledge is created [39]. The purpose of exploitation is to reduce problems of "reinventing the wheel" by using existing knowledge more efficiently. Although this is important for innovation, it is largely exploration through knowledge sharing that allows the development of genuinely new approaches.

However, the growing emphasis on innovation through "knowledge work" and "knowledge workers" and on the leveraging of "knowledge assets" suggests that the need to manage knowledge will endure as a core business concern, even if the label may change [20]. This is not to say that knowledge was ever insignificant - what is distinctive about the current period is that knowledge now acts upon itself in an accelerating spiral of innovation and change. Castells [10] summarizes this shift:

*What characterizes the current technological revolution is not the centrality of knowledge and information but the application of such knowledge and information to knowledge generation and information processing/communication devices, in a cumulative feedback loop between innovation and the uses of innovation ... For the first time in history, the human mind is a direct productive force, not just a decisive element of a production system.*

There are also clearly organizational trends which are aligned to this focus on KM in innovation. In organizational terms, the new "era" is typified by flatter structures, debureaucratization, decentralization, and co-ordination through increasing use of information and communication technologies (ICT). However, as businesses are stretched across time and space, reorganized along process or product lines, and restructured around virtual teams, they lose opportunities for innovation through the casual sharing of knowledge and learning induced by physical proximity.

Gibbons [25] notes further that "modes of knowledge production" are changing from the conventional disciplinary-based model, to a new model where knowledge is

produced interactively at the point of application among heterogeneous groups. In short, innovation processes are becoming more interactive - more dependent on knowledge which is widely distributed - therefore KM is increasingly central. Although the term "KM" may ultimately become another fad, the impetus for it is the profound problems posed by new kinds of organization and innovation.

## II. 5. 2 KM, Innovation and Competitiveness

### KM and the formulation of competitive strategies

In what concerns dynamic organizations, KM is a valuable strategic tool, because it can be a key resource for decision making, mainly for the formulation of alternative strategies. KM should be able to combine innovation efforts, updated IT, and knowledge development in order to achieve a set of capabilities to increase competitiveness. In fact, when this combination is adequately managed, the company can formulate competitive strategies, which integrate innovative products and new technological weapons to face its competitors [1].

In a fast-changing environment, the competitive advantage of many companies is based on the decision to exploit, to develop the power of knowledge development. To find out and exploit opportunities, companies need to establish the main orientations of KM in order to enlarge their growing possibilities based on innovation and competitiveness. If a firm is entirely aware of the vital importance of these factors, management decisions have to consider a complex background where the knowledge of the clients' needs and preferences and the competitors' strategies is decisively important. Practically, this means that a market orientation includes the concept of competitive orientation [61]; [17]. These considerations are already known and well accepted, but we need to extract from them the logical consequences. A competitive decision should be based on a wide and quite firm support, which shall integrate the different relationships among several types of knowledge. As a consequence, a comprehensive knowledge is the vital ground where competitiveness should be built.

## II. 5. 3 Technology Innovation

In a study of 200 firms within the Norwegian IT sector, Johannessen, Olaisen, Bjørn [33] found that focusing on the use of IT might be a promising route for studying the relationship between IT and successful innovations, and between IT and performance. They also found a number of trade-offs between the various performance measures and between successful innovations and performance. Although they were able to find positive effects of IT they argue in favor of developing an information and a knowledge strategy prior to developing an IT strategy. Therefore, IT is only can be an enabler for innovation.

## II. 6 Managing and Organizing Innovation

Based on in-depth interviews of 32 CEOs and top executives in leading European organizations, 40 people known

internationally for their ability to achieve and maintain a position among the top performers in their fields, and a "best practice study" of five leading international companies. Johannessen, Olaisen, Bjørn [33] in their innovation study pointed out, there are four entities: 1. Focus 2. Mastery 3. Intensity 4. Integrity in the management level, and four elements: 1. Process 2. Relationship 3. Commitment 4. Belonging in the organizing level. They have argued that creating the innovation-led company may represent a viable solution for coping with the turbulence and complexity of the knowledge economy. In doing so, it needs to focus both on the level of management and on the level of organising.

## II. 7 The External Supporting Processes of Innovation

### II. 7. 1 Inter-Organizational Network

Flows of knowledge on customers' needs increase the firm's degree of innovation. Need and experiences of customer is the most important source of innovation. Externally, inter-organizational network is an environment for the interaction and activities such as joint projects, collaborations or alliances for a specific R&D item and may benefit the participants in various degrees. When thinking of marketing knowledge, one should think of things such as competition, suppliers, customers, markets, target groups, consumers, clients, users, interested parties, sales, after sales, trade and distribution and relation management. [16]

Knowledge that is accumulated from the outside is shared widely within the organization, stored as part of company's knowledge base, and utilized by those engaged in developing new technologies and products" [50]. What "outside" environment is suitable for the development of innovation capacity of firms? Studies from a network perspective [5]; [23]; [2], inter-organizational network, becoming a new organization form, provides different stimulation through the collaborative activities with network members. The fundamental issue is how these organizational environments increase the firm's capacity of innovation for the continuous improvement of competitiveness.

### II. 7. 2 Innovation Network

#### Innovation processes in a knowledge-based perspective

Due to the increased complexity of modern innovation processes a firm has to master a great number of different knowledge fields. In order to have the necessary access to external knowledge sources, firms, besides their specific competencies, have to provide for an additional broad knowledge base, the so-called absorptive capacity [11]; [8] or receiver competence [21] which allows them to flexibly react on external developments and external knowledge. In the computer industry, for example, the disciplines involved in the innovation process may range from solid state physics to mathematics, and from language theory to management science. So-called go-it-alone strategies or conservative strategies which mean that a firm relies only on its own R&D endeavours, cannot be successful in such a complex environment. Because of the systemic character [31] of

present-day technological solutions, technological development necessarily becomes a complex interactive process involving many different ideas, and their specific interrelationships.

### **Innovation networks in the knowledge-based approach**

Obviously, the above characterisation of innovation processes has significant impacts on the analysis of innovation networks. These networks need to be understood not only in terms of transaction costs considerations, but also in the terms of learning, path dependencies, technological opportunities, and complementary assets. Networks do not only influence the co-ordination of resources but also insert a significant impact on their creation. This has to be seen in a twofold perspective: First, the pooling of different competencies in the network of firms of course enhances this process of resource creation by exploiting complementary effects. However, additionally, the co-operation in networks also creates a real surplus or synergy in this process [7].

In this light networks represent a mechanism for innovation diffusion through collaboration and the interactive relationship becomes not only a co-ordination device to create resources, but an essential enabling factor of technical progress [72]. Here it is not enough just to know what others are doing, but the firms also need to know how the respective technologies function and work together. And to support this inter-firm learning of often long-range cumulative, tacit and local know-how a stable and long lasting collaborative environment is necessary. This way innovation networks offer a possibility to overcome the restrictions of the irreversibilities and instead build on different specific knowledge-bases. With the fusion of different technological capabilities the exploration of new opportunities becomes possible - the cross-fertilization effects. In this respect, the essential dynamic properties of innovation networks become obvious.

Besides this creation of new so-called extensive opportunities [12] which constitutes the synergetic or surplus effect of innovation networks, above also the complementary effects were mentioned. In this respect, it is helpful to recall that the variety of assets and competencies which a firm needs access to in order to successfully commercialise a new technology is likely to be quite large even for only modest complex technologies [66]. Here, innovation networks show to be a promising alternative co-ordination mechanism which allows firm to have access to the complementary assets, which otherwise have to be built up alone - an extremely expansive and time-consuming endeavour, confronting at least small and medium sized firms with often insurmountable difficulties.

Successful innovation requires complex forms of business organisation. Innovating organisations must form linkages to others, upstream and downstream, lateral and horizontal. Advanced technological systems do not, and cannot, get created in splendid isolation. The communication and co-ordination requirements are often stupendous, and in

practice the price system alone does not suffice to achieve the necessary co-ordination [66]. Innovation networks represent such a flexible organisational device.

In summary, there are three major implications within the knowledge-based approach innovation networks: 1. Through accelerating and supporting the diffusion of new technological know-how, they are seen as an important co-ordination device enabling and supporting inter-firm learning. 2. The exploitation of complementarities becomes possible within innovation networks, which is a crucial prerequisite to master modern technological solutions characterised by complexity and a multitude of involved knowledge fields. 3. Through the amalgamation of different technological competencies, innovation networks constitute an organisational setting which opens the possibility of the exploration of synergies. By this, innovation processes are fed with new extensive technological opportunities, which otherwise would not exist, or whose existence would at least be delayed.

### **Functions and forms of innovation networks**

#### **National and regional systems of innovation**

An important strand of literature focuses from a national angle on the institutional setting within which innovation processes and the specific interactions between the different actors involved take place. They coined the notions of national systems of innovation [41]; [48] and development blocs [15]; [9].

#### **Formal and informal networks**

The design of a specific innovation network can vary on a spectrum between formal contractual agreements and loosely coupled informal networks. Freeman [24], by surveying the empirical literature states:

*Although rarely measured systematically, informal networks appeared to be most important. Multiple sources of information and pluralistic patterns of collaboration were the rule rather the exception.*

In this respect, following Hakanson [28], also a dynamic component exerts influence: with an increasing duration of formal R&D co-operative relationships, they mutate to informal relationships as mutual trust and confidence between the partners is built up.

#### **II. 7. 3 E-knowledge Networks**

The universal adoption of the Internet has created the opportunity for firms and other organizations to establish collaborative networks of partners, with whom they may exchange strategic knowledge in order to achieve mutually beneficial objectives. This electronic commerce knowledge can be termed "e-knowledge" [29]. These "e-knowledge networks" could not have existed just a few short years ago because there was no widely-accepted platform for continuous and unattended exchange of information and knowledge about markets, customers, demand, inventories, and so forth. Today, such collaborative networks are

evolving in every economic sector in support of business-to-consumer commerce, business-to-business commerce, government-to-citizen interactivity, peer-to-peer exchanges, and internal connectivity through intranets [27]; [44] The technology of the Internet has become the greatest enabler of knowledge exchange within and between companies!

E-knowledge networks combine the positive benefits of knowledge management (KM) systems with those of inter-organizational systems (IOS). They also address some of the pitfalls of each, creating a powerful driver for advancing organizational objectives. Merrill, Ravi, Vijayan, [46] highlights some of the characteristics of e-knowledge networks. When firms engage in e-knowledge networks, they are able to share valuable knowledge, often created with emerging automated technologies such as data mining and intelligent agents, with their strategic partners, thereby enabling improved organizational effectiveness. Furthermore, entirely new business models are facilitated with the development and adoption of certain newer e-knowledge networks. Many of these emerging networks are characterized by automated exchange of rich customer knowledge by unattended computer systems, programmed to capture and evaluate knowledge with data mining algorithms, share it with strategic allies, and direct the operation of key interactive processes.

The keys to success in this evolving new economy are situational awareness and flexibility. These goals can be achieved by implementing electronic systems that generate immediate (real-time) knowledge about internal functions and processes, about customers and markets, about strategic partners, and about supply chain partners - suppliers, vendors, dealers and distributors. Such systems allow firms to be dynamic and flexible, thereby allowing rapid changes in their strategies and activities. Firms can use this knowledge to create new internal and external structures and relationships, leading to further improvements in knowledge, which leads to continuous strategy improvements.

Merrill, Ravi, Vijayan, [46] highlight the exchange of information and knowledge between e-knowledge network partners that are altering the implementation of B2B supply chain practices. These partners, in many cases, are altering their procurement practices to leverage the benefits of rich knowledge exchange for long-term success. They suggest that as the Internet expands its reach, along with ubiquitous and often automated information sharing capabilities, the ability to create knowledge-based networks of partners will be critical to maintaining competitive advantage. Firms will learn to rely on strategic partners for both core and peripheral functions, and will outsource significant processes to organizations who specialize in such functions and activities.

## **II. 8 The Innovation Supply Chain**

### **II. 8. 1 What is Innovation Supply Chain?**

According to the definition by Sciquest Company [60], the innovation supply chain is a methodology used to efficiently

integrate suppliers and research-intensive organization to ensure materials and information are made accessible and distributed at the right qualities, to the right locations, at the right time, in order to speed the process of innovation, reduce costs and improve quality. The ISC provide a framework for a seamless, streamlined approach to planning, sourcing and delivering products, As in manufacturing, optimizing the ISC is critical to maximizing throughput and enabling flexibility. ISC introduces intellectual capital, information management and regulatory compliance into tradition supply chain methodology. ([www.sciquest.com](http://www.sciquest.com))

### **II. 8. 2 How to Achieve the Goal of a Well-Managed Consumer Experience**

#### **The innovation supply chain**

It is getting harder and harder to satisfy consumers in mature markets like C&EE (Consumer & Electronic Equipment) products, high tech manufacturing margins are being squeezed and competition on price is no longer a valid strategy. Increasingly, across many markets, the driving purchase criterion is the consumer's expectation of the overall experience a product will deliver. Those that do not offer a clearly differentiated experience risk being valued as commodities. A more effective strategy for manufacturers is to not only benchmark on price, or even command a small premium but also differentiates on the basis of consumer experience. In other words, behave like a successful service company. [26]

The use of outside supply may enhance an organization's ability, this focus on consumer experiences represents the ultimate challenge for manufacturers. New products are delivered into the economy by teams of professionals from different disciplines. In some of these - marketing and sales, for example - the knowledge focus is clearly on the consumer. In other disciplines - technical and creative in particular - the knowledge focus tends to be inward, that is, towards the specification of the product.

In the debate, poor knowledge flow, and entrenched uni-disciplinary attitudes emerge as the main barriers to the creation of better - higher margin - products brought to market in the shortest possible time. Shared goals, leading to collaborative effort and planning, seem to be the key to achieving reliable products with good functionality at a realistic price. However, to achieve the goal of a well-managed consumer experience a much higher level of knowledge transfer is needed, between consumer-facing disciplines such as marketing and design towards delivery disciplines such as engineering and manufacturing [26].

To achieve this higher level of integration, the innovation process needs to be seen as a knowledge supply chain - whose efficiency is measured by the extent to which a vision of the target experiences reaches each link in the chain. In parallel, other factors, such as intense price competition, are working to make integration even harder. To achieve maximum efficiency, professionals in different disciplines tend more and more to work for different

companies, often in different countries or on different continents. Commercial and cultural barriers abound. Information technology is helping information flow and is a parallel catalyst for change in the innovation process. However, to achieve any effective change, current underlying attitudes need to be understood and altered if they present an obstacle to progress. [26]

In practice, Gus Desbarats [26] assumed a framework namely "The Innovation Supply Chain" as follows: The problems involved when marketing to consumers in mature markets. Emphasises the need to build a direct knowledge of their consumers and to differentiate the service, product and brand from those of competitors. Asserts that small, distinct service experiences will combine to create a strong overriding impression of quality and value, and this mechanism is the foundation of achieving a strong brand. However, to be achieved in practice, these service targets need to be understood and communicated clearly up and down the innovation supply chain. This involves full co-operation between marketers, designers, manufacturers and distributors.

### II. 8. 3 The Elements of ISC

In recent years, innovation supply chain (ISC) has attracted increasing attention as a comparatively mature organizational innovation mode, and this concept is still developing. The "ISC", has now become a common phrase in daily business life, similar corporations temporality joining together into meta-enterprises, and that of manufacturers, suppliers, distributors and even customers linking together in an enduring relationship built on mutual trust [26]. The innovation revolution is the defining business transformation of our generation." The *Taiwan Economic Daily* [65] held that though ISC can deal with production, sales, design, finance and other functions, enterprises have no such internal organization to carry out these functions. That is to say, the enterprise will not relinquish its key functions. Concerning the rest of the company's functions, due to limited resources and insufficient competitiveness, the enterprise must become a virtual company.

It must use every means to borrow strength from outside to increase its competitive edge. The target of this borrowed strength might be the upstream suppliers or the competition or the customer. Whatever the form, the guiding principles of ISC are to break the limitations of enterprises and extend the scope of the entity by using a strategy called "integration of external resources". This is a break from the former strategy - "selection of internal resources". In general, ISC is a type of dynamic union to respond quickly to market changes. There are 7 elements of ISC as follows [26].

1. The age of collaborative innovation
2. A necessary environment to integrate intellect through various fields for co-operative and inter-organization innovation organizations
3. The era of the knowledge economy, and the age of breaking the boundaries of the old research system

4. The flexible organization to facilitate free flow
5. A collective body to encourage people to learn from each other and share common knowledge
6. A parallel network-type organization and the new concept of "leadership"
7. Combination of relaxing environment and team spirit.

### II. 8. 4 Summary

What needs to change and how each discipline helps the collective to deliver better consumer experiences? By examining attitudes along the innovation supply chain, we can see the use of outside supply may enhance an organization's ability to provide a wider product range and to diversify. Quinn et al., [57] pointed out: "Focusing on a narrower range of activities may allow core activities to be more easily levered to achieve a wider product range". In addition, the study proposed: "the total investment required to enter a new business area can be reduced and there can be easier achievement of optimum performance". Suppliers and collaborating partners can assist the innovation process through access to technologies, skills or information [19]; and through providing complementary expertise improve the speed to market of new product developments. In brief, an ISC meets the needs of innovation. It is the inevitable trend of social development.

## III. Methodology

First of all, the study through literature review to develop a research framework. Secondly, the study through case studies to develop a more complete and practical integrated model and six researches propositions for practitioners of high tech industries and future researchers.

The data collection was through analysis of secondary data and interviews. The study interviews with top and middle level of directors who are related to innovation and knowledge management in 5 high tech industries. The interview questionnaires are sent out about 20, the response rate is 85%. The interview questionnaires are designed by informal and semi-structure, before send out to these high tech industries, the study have sent out interview questionnaires for pre-test to someone who are related with innovation and knowledge industries.

In summary, the study through literature review to construct a research framework, base on it, the study developed case studies to examine advantage and disadvantage of theories and constructed a more complete and practical model to link theories and practices for high tech industrial innovation.

## IV. Case Studies and Discussion

### IV. 1 Challenge 2008 - National Development Plan in Taiwan

After joint in WTO and for the new century, current problems facing Taiwan as below:

- Global competition
- Competition in the global economy growing more intense
- Global industrial chains being recognized
- Countries competing for talent and funds
- Mainland China's magnetic effect
- Cheap labor and land
- Vast market and preferential investment measures, luring global capital and technology, and creating industry clustering effects.
- Proposed ASEAN+3 FTA, accelerating the economic integration of China and East Asia.

Therefore, the Executive Yuan formally approved the National Development Plans for the new century on 9, May, 2004, which calls for a total investment of NT\$2.6 trillion over six years in the overall upgrading of Taiwan's living as well as investment and operating environments. The plan to develop a knowledge-based economy in Taiwan. This blueprint for socioeconomic development, with an equal emphasis on knowledge and innovation, economy and culture contains 10 key projects. The study reviews the goals and strategies of which are described below [13]:

- . Cultivation of E-Generation Manpower
- . Establishment of a Base for Innovation and R&D
- . Heightening of Industrial Value
- . Construction of e-Taiwan
- . Development of Operations Headquarters

Four major investments: Personnel, R&D and innovation, global logistics channels, living environment

Challenge Goals: Taiwan World No. 1 in 15 products or technologies, Doubling of tourist arrivals, R&D spending equal to 3% of GDP, Reduction of unemployment to under 4%, Economic growth rate above 5%, More than 6 million broadband households, Creation of 700,000 job opportunities. (<http://www.cepd.gov.tw/service/board/coun-dev.htm>.)

According to above background, motivation and the national development plan, in practice, the study adopts case studies to examine advantage and disadvantage of the integrated model (figure 2-4). After modification, the study constructed a more complete and practical integrated model to link theories and practices for high tech industrial innovation. Finally, the study developed six research propositions for practitioners and future researchers. The study summarizes the results of case studies, interviews and discussion as follows.

### SWOT analysis

For comparing and finding out the advantage and disadvantage for these case studies, the study utilizes SWOT to analyze five cases: TK E-Business Corporation, SOYO Corporation, ELSA Technology, Radiant Innovation

company and Global View Corporation as table 4-1 to 4-5.

### The results of interviews

The study summarized the results of interviews for case studies as follows:

1. All of firms for these case studies are knowledge-based companies.
2. All of firms for these case studies use technology innovation.
3. All of firms for these case studies are high technology industries.
4. All of f firms or these case studies are cross-strait (multinational) corporations.
5. All of firms for these case studies implement knowledge management and innovation orientation.
6. Some of firms for these case studies implement e-supply chain or knowledge (innovation) supply chain.
7. The ISC could guarantee reliability, flexibility, and scalability. ISC also can help high tech industries to get inter-connected with all relevant parties in the commerce process and extend the reach of business to the global market.
8. All of these firms throughout the world have developed international operation strategies to establish a worldwide production, distribution, and marketing network.
9. A new economic order in China and Taiwan– the globalization of business – has both shaped and been shaped by the advancements in knowledge and innovation management that have improved the efficiency and effectiveness between markets, manufacturing processing, and resources.
10. China's unprecedented economic growth and globalization have strained its knowledge-economy and innovation infrastructure to the limit.
11. Knowledge-based innovation – the movement of technology, people, processes and information – has a significant impact on a society's standard of living. And the standard between China and Taiwan is less and less.
12. A typical "innovation (knowledge) supply chain" may involve a variety of stages that include knowledge suppliers, manufacturers, wholesalers, distributors, retailers and customers. Innovation refers to the knowledge, and the management of the movement of knowledge and information, from one place to another as they make their ways from the beginning of the innovation (knowledge) supply chain to the customers' hands.
13. Efficient innovation management involves a successful integration of knowledge and technology that facilitates the innovative processes of products to the consumers at the right time and right place in accordance with consumer needs. The demand for higher quality innovative management is growing tremendously.
14. If foreign companies encounter too many innovative problems and barriers in China, to the extent that the total costs of utilizing China as a manufacturing base become too high when compared with other nations, then China will be

excluded from a foreign firm's global manufacturing network.

15. The innovation barriers identified in the interviews and case studies include high innovation costs, lack of knowledge integration and innovation infrastructure, the monopolistic nature of innovation management, and the poor quality of knowledge and information flow.

16. These obstacles have been recognized as the most common barriers that foreign and local firms have encountered in China. The integrated innovation model constructed from the case studies aimed at identifying innovation barriers and the solutions to those barriers from a knowledge-based perspective. The knowledge/innovation gaps should be filled in to map a more comprehensive picture of the proposition.

## IV. 2 Discussion

### IV. 2. 1 Knowledge Based Innovation for High Tech Industry to Fit Global Competition

Many firms throughout the world have developed international operation strategies to establish a worldwide production, distribution, and marketing network under the intensification of global competition. Fast economic growth, low labor costs, and a potentially huge domestic market have all led to significant increases in foreign investment in Mainland China as investments in manufacturing in China are frequently made due to the strategic benefits that they can bring. In near future, China may influence the world as a source of raw materials and an international manufacturing center. Moreover, as a major importer and exporter of consumer products, capital goods, and high technology.

The globalization of business – a new economic order in China has both shaped and been shaped by the advancements in knowledge and innovation management that have improved the efficiency and effectiveness between markets, manufacturing processing, and resources. China's unprecedented economic growth and globalization have strained its knowledge-economy and innovation infrastructure to the limit. Knowledge-based innovation – the movement of technology, people, processes and information – has a significant impact on a society's standard of living. The innovative process affects every sphere of human activity and business strategy.

Efficient innovation management involves a successful integration of knowledge and technology that facilitates the innovative processes of products to the consumers at the right time and right place in accordance with consumer needs. As an increasing number of foreign manufacturers are establishing joint ventures in China, the demand for higher quality innovative management is growing tremendously. The reason for this growth in demand is simple: if foreign companies encounter too many innovative problems and barriers in China, to the extent that the total costs of utilizing China as a manufacturing base become too high when compared with other nations, then China will be excluded from a foreign firm's global manufacturing network.

The innovation barriers identified in the study include high innovation costs, lack of knowledge integration and innovation infrastructure, the monopolistic nature of innovation management, and the poor quality of knowledge and information flow. These obstacles have been recognized as the most common barriers that foreign and local firms have encountered in China. The frameworks constructed from the literature review suggest that little research has been aimed at identifying innovation barriers and the solutions to those barriers from a knowledge-based perspective. The knowledge/innovation gaps should be filled in to map a more comprehensive picture of the proposition. The study through case studies, SWOT analysis and interviews to propose a solution includes knowledge innovation, integrating internal and external processes for supporting innovation to fill the knowledge/innovation gaps and to map a more comprehensive picture of the proposition.

### IV. 2. 2 The Greatest Challenge and the Long-term Influence

There should be two aspects: the information condition based an electronic network and human relationships based on people and organizations in a complete foundation for the development of society, economy and technology should have. It is necessary for ISC systems to assist in the forming and improving of the latter basic aspect.

Changing a mindset is the greatest challenge. China has not yet formed the mechanism to invest in "men". Most people cannot accept the concept of ISC. When you talk about "virtual" organizations, many people, including those who are for so-called organizational innovation and advocate the concept of "advanced organizations", still pay first attention to the organizational scale, administrative ranks and the power and right. Their immediate consideration is not how many results that users or markets will adopt.

### IV. 2. 3 Towards the Sixth-generation Innovation Process

The innovation supply chain is a methodology used to efficiently integrate suppliers and research-intensive organization to ensure materials and information are made accessible and distributed at the right qualities, to the right locations, at the right time, in order to speed the process of innovation, reduce costs and improve quality. The ISC provide a framework for a seamless, streamlined approach to planning, sourcing and delivering products, As in manufacturing, optimizing the ISC is critical to maximizing throughout and enabling flexibility.

In short, the study proposed a distinct from the 5G innovation process [59], to summarize the key aspects of the process for ISC and assumed a new KISC (knowledge based innovation supply chain) towards the sixth-generation innovation processes as follows:

- Integration (inside and outside innovation sources; virtual and physical; technology and knowledge; supply chain members; managing and organizing)

- Flexibility (organizational structures; decision making)
- Networking (inter-organization; innovation and e-knowledge networks)
- Cooperation and collaboration
- Quick response (Efficiency and effectiveness); real time information and knowledge processing
- Stability (information and products)
- Maximizing satisfaction (products and services)
- Minimizing cost (processes cost and communication cost)

## V. An Integrative Knowledge Based Innovation Model for High Tech Industries

According above literature review, content analysis, case studies and discussions. The study develops an integrative knowledge based innovation model for high technology industries to fit the objectives of the study as Figure 5-1, and describe as follows.

The study integrated customer needs, knowledge-based and innovation networks related theories into a more complete and practical model for high technology industries. Customers (markets) needs are the most important innovation sources, according to customer (markets) needs and knowledge, high tech industries could develop innovation capacity. The core of the model is innovation capacity (supporting by internal and external processes). If high tech industries want to reach sustainable competitive advantage through innovation, it is necessary to integrate internal and external innovation supporting processes due to markets (customers) needs and finally through KISC (knowledge based innovation supply chain) to reach continue innovation and create sustainable competitive advantage for high tech industries.

### V. 1 Knowledge Based Innovation Supply Chain (KISC)

KISC gathers people from different fields and technological backgrounds and organizes teams according to specific goals and systems to create superior environments for inter-organization innovation and integration of knowledge and intellect. For creating a more flexible, versatile, faster and robust innovation organization, the study integrated and presented an knowledge based innovation supply chain (KISC) model for integrating and determining innovative supporting process in high tech industries and applying to cross strait (Chinese and Taiwan) marketplace. High technology industries should use KISC perspective for easy and innovative knowledge sharing and flowing.

A new KISC (knowledge based innovation supply chain) as follows:

- Integration (inside and outside innovation sources; virtual and physical; technology and knowledge; supply chain members; managing and organizing)
- Flexibility (organizational structures; decision making)
- Networking (inter-organization; innovation and e-knowledge networks)

- Cooperation and collaboration
- Quick response (Efficiency and effectiveness); Parallel (real time) information processing
- Stability (information and products)
- Maximizing satisfaction (products and services)
- Minimizing cost (processes cost)

### V. 2 Research Propositions of the Study

According this integrated innovation model, the study to integrate internal and external innovation processes, and through ISC to make corporate innovation capacity to reach real performances and to reach sustainable competitive advantage. Also, the study proposed one main research proposition and six sub research propositions for future researchers as follows:

RP: High tech industries increase innovation capacity and reach sustainable competitive advantage through linking corporate internal and external innovative supporting processes.

P1: High tech industries according to sources and flows of knowledge on customers' needs to increase the firm's innovation capacity.

P2: High tech industries improve techniques for knowledge management and use technology innovation can lead to higher innovation levels.

P3: High tech industries use managing & organizing approaches can lead to higher innovation levels.

P4: High tech industries apply cooperative innovation with suppliers, customers and partners to increase innovation capacity and lead to higher innovation levels.

P5: High tech industries apply KISC to cooperate with supply chain members, to cultivate innovation capacity and to integrate internal and external supporting process of innovation

P6: High tech industries combine internal and external supporting innovation processes to lead to innovation capacity and through KISC to reach sustainable competitive advantage.

## VI. Conclusions

Under knowledge economy, which management approaches and technologies are necessary to support innovation in the knowledge intensive industry especially are high technology industries? It's necessary to integrate internal and external supporting innovative processes for high technology industries. The core is innovation capacities for reaching continue innovation, Internal supporting processes include the knowledge management & technology innovation and Managing & organizing innovation, external supporting processes include knowledge from customers, suppliers, partners and competitors and cooperative innovation. Knowledge management plays a fundamental role when managing processes innovation efforts. Process innovations remain a source of competitive advantage in the market for short periods of time. Knowledge management policies are the main drivers of process innovation. Design of new

processes innovation delivery system must take into account possible customers' behaviors and perceptions. Therefore, the more flexible and versatile knowledge management policies are, the faster and more robust innovation efforts are.

For creating a more flexible, versatile, faster and robust innovation organization, the study presented a knowledge based innovation supply chain (KISC) model for determining innovative supporting process in high tech industries and applying to cross strait (Chinese and Taiwan) marketplace. Such a model is developed under the knowledge-based theory lens. High technology industries should use KISC perspective for easy and innovative knowledge sharing. The study examines the notion that China's and Taiwan's entry into the WTO and its innovation reforms in line with globalization have a significant impact on the entire system of knowledge-based innovation management.

The study describes a complete and practical integrated innovation model. Such a model is developed under the knowledge-based theory lens. So, knowledge flows and knowledge integration capabilities of the organization's members are considered as crucial for the innovation processes to be successfully implemented. Final conclusions consider customers (markets) needs as the most important sources of innovation. And to integrate internal supporting innovation processes (knowledge management & technological innovation and Managing & organizing innovation) and external supporting innovation processes (knowledge and innovation from suppliers, partners, competitors and customers) and cooperative innovation as the main impellers of high technology industrial innovation. According this integrated innovation model, the study proposed one main research proposition and six sub research propositions for future researchers and practitioners. Whether which kinds of innovation are based on knowledge and people (knowledge workers). The winning companies of this decade will be those which provide their people with the best weapons with which to compete, that are knowledge and innovation. The results of the study will benefit not only the construction of knowledge based innovation framework, but also the business model transformation of competitive advantage.

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Table 4-1: SWOT analysis of high tech industries (Case 1)

S	With the collective knowledge and resources of TK's experienced management team who worked for IBM [30], Andersen Consulting, McKinsey Consulting, Intel, Microsoft, Rockwell, Merrill Lynch and vertical industries. TK can acquire strong source of innovation and utilize their expertise of knowledge-based innovation into e-business markets.
W	The major shareholders include China Development Industry Bank, Ta-Jung Logistic Corp., the affiliate of the renowned Hsin Kuang Group, and many other key industry leaders. But lacks of professional marketing channel and supply chain will form a weak situation which let competitors easy to occupy market shares.
O	The large potential benefits between China and Taiwan e-business and e-supply (B2B2C) markets is TK's future opportunity to compete in cross-strait and global markets .
T	The threat for TK is global industries' competition, hard to overcome the block of current technology policy and law from Taiwan government and the lack of protection for intellectual and patent assets from China governments.

Table 4-2: SWOT analysis of high tech industries (Case 2)

S	In this competitive market place, SOYO's strategy to succeed is by continuing to innovate and always position SOYO ahead of the curve. SOYO's contract Research and Development team constantly searches for the latest technology and creative ways to integrate into their motherboards in order to meet the high demands of customers. Knowing their customers is the company's key strength. Launching the right product at the right time is what SOYO believes to be crucial in staying competitive. Best Overall Service. To service its valued customers and to support their needs, SOYO has built a worldwide network of offices. From prompt order processing, speedy and reliable delivery to after sales customer care, SOYO is with its customers every step along the way. The customers are the keys to SOYO's success.
W	SOYO's sales channel in China and Taiwan is still not enough to occupy the popular PC markets. Besides, though SOYO's strategic alliances partners include global famous corporation but SOYO can't get prompt technology transfer from them. This will cause SOYO's innovative product to be delayed time to markets.
O	The SOYO brand is synonymous with quality and creativity, and it is SOYO's goal to continue to grow in today's market place. Through constant search for the newest and the latest and SOYO's ability to deliver products at levels never seen before, SOYO continues to be the industry leader. Their flexible management structure allows SOYO to respond to the market demand quickly. SOYO's goal is to be the best at what it does and to always stay ahead of the curve!
T	<ol style="list-style-type: none"> <li>1. China and Taiwan's channel competitors.</li> <li>2. Price's and quality's competition from the other motherboard's famous brand corporations.</li> <li>3. Global industries' competition and hard to overcome the block of current technology policy and law for Taiwan government and the lack protection of intellectual and patent assets for China governments.</li> </ol>

Table 4-3: SWOT analysis of high tech industries (Case 3)

S	ELSA not only benefits from this central location at the heart of Taipei, but also from the steady stream of highly qualified engineers from this internationally renowned university. Short development cycles and innovative products based on ATI and nVidia core technology remain the cornerstones of their continued growth.
W	Elsa has divided the product lines once again into individual business units directly in the heart of the technology hotbed, in Germany and Taiwan. But lack of China markets. As the link between the markets and the company, the business units are responsible for developing attractive product and marketing strategies tailored to the users within the given market segment in their respective regions. But no significant segment in their respective regions. ELSA also lacks of e-supply chain to link their branches and to link from users and distributors.
O	<p>ELSA's presence on international markets is one of the major factors which will determine their future growth. ELSA's presence in Wuerselen (Germany), Taipei (Taiwan), Seoul (Korea), and Beijing (China) play a key role in the development of international markets with their support in regions that are vital to the industry.</p> <p>ELSA regards the European and Asia as decisive markets not only with regard to procurement, but also for future sales and services. Therefore ELSA has been expanding their sales network and they are currently successful in the distribution business for graphics and multimedia products. ELSA Technology in Germany completes the goal of securing a pan-European presence for ELSA complete product range. ELSA expects to increase its support and services significantly. The existing and new relationships with distribution partners will also strengthened through the presence.</p>
T	<p>The existing and new other distribution partners will form threat to ELSA.</p> <p>Global industries' competition and hard to overcome the block of current technology policy and law for Taiwan government and the lack protection of intellectual and patent assets for China governments.</p>

Table 4-4: SWOT analysis of high tech industries (Case 4)

S	Radiant has obtained ISO 9001 and EN46001 certifications. The IR Ear Thermometer, their first product, has been EU CE and USA FDA certified. Radiant has two solid shareholders Sunplus a very experienced IC design company, and Global View, a leading palm-size electronic dictionary manufacturer. With the aim of providing better customer satisfaction, Radiant designs and creates uncompromised quality PHC products with competitive pricing.
W	Radiant lack of strong sales channel in China this most population markets. Also they lack of good channel relationships to promote their products.
O	The trends for aging society and quality living, PHC products have become necessities of life. Radiant will be continuously introducing a series of top PHC products in the near future. Through Radiant steady investments, innovative R&D, and the quality of production, they will become a world class PHC supplier.
T	Radiant are also seeking for ODM and OEM partners around the world. This will cause patent problems and other competitor's imitation. Global industries' competition and hard to overcome the block of current technology policy and law for Taiwan government and the lack protection of intellectual and patent assets for China governments.

Table 4-5: SWOT analysis of high tech industries (Case 5)

S	Ongoing Innovation, Contribute value to Society, Corporate Philosophy, Integrity Innovation Quality Service. Corporate Culture, Business and Customer Oriented, Speed and Simple, Respect, Team Work, Open-Mind discussion, Entrepreneurship
W	At present the company has subsidiaries in Mainland China, Korea, Taiwan, and Hongkong, with more than 1500 employees. But they lack of knowledge base innovation team. Also, they lack of strong marketing channels.
O	With their world-class high-tech know-how, they are committed to LINUX operating systems and GV OS Technology Platform in order to provide clients with powerful and economical overall solutions to software and hardware.
T	The low price competition from China and Korea. The high technology innovation competition from HK. And Taiwan. Global industries' competition and hard to overcome the block of current technology policy and law for Taiwan government and the lack protection of intellectual and patent assets for China governments.

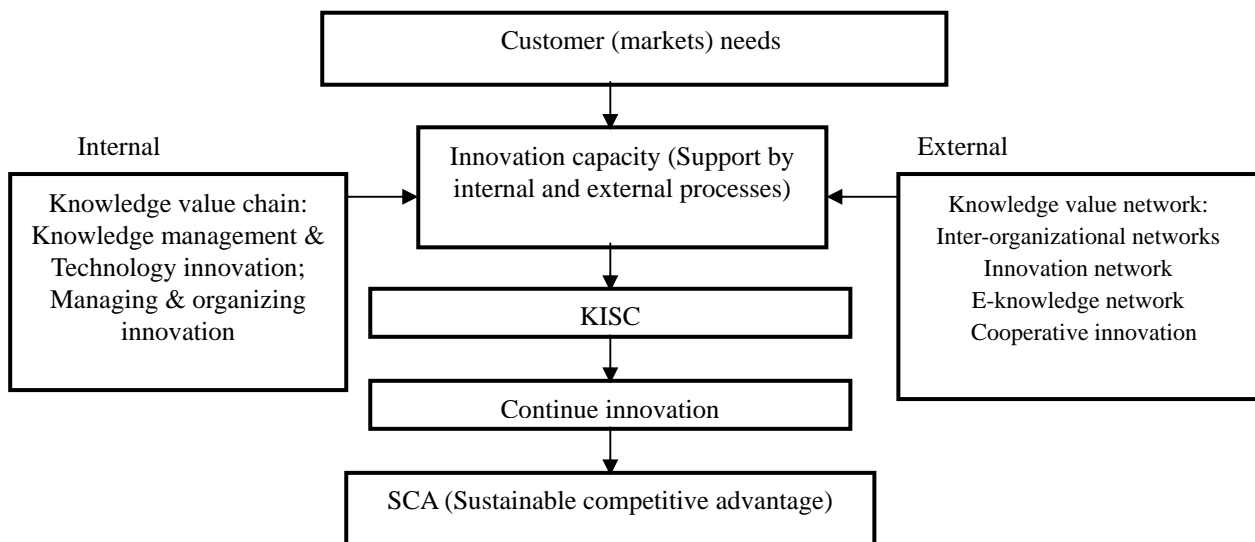


Figure 5-1: An integrated model of knowledge-based innovation for high tech industry