Chapter 2

Literature Review

2.1 Chapter Overview

In this chapter, the relevant literatures are reviewed and presented. Firstly, since this research focuses on the framework to increase the value to the Teak product in Thailand, Teak and its related literatures are given. This is to provide basic understanding about Teak, its supply chain, Teak products, and problems in the Teak industry. Secondly, the creative economy concept is explained. This is because this concept focuses on and provides method to increase economic value to the tradition and intellectual assets. This concept is then applied in this research. This is especially the utilization of style and architecture. Lastly, the knowledge engineering and management are presented in this research, the knowledge engineering especially CommonKADS, is applied to capture and construct the knowledge model of colonial style, crafting and manufacturing. The knowledge creation is then applied for the new knowledge creation.

2.2 Teak

Since one of the main focuses of this research is to assist the relevant stakeholders in the Teak industry and its products, it is inevitable to understand and has comprehensive understanding of Teak, the Teak industry and the resulting products. Hence, the following subsection provides the description of Teak and natural resources in general. The next subsection then explains and investigates the Teak supply chain. This could potentially assist in the formulation of the research problem and scope focused in this thesis. Finally, the reviews of other literatures in Teak and its industry are given.

2.2.1 Thai Teak and Natural Resources

Teak has its scientific name “Tectona grandis’ in the family of Verbenaceae. Its origin is in southern India, Burma, Thailand, Indonesia, and East Indies. Teak is a tropical plant which can be in the equatorial zones, and sub-tropical monsoon climate, and humid sub-tropical climate. Teak is found mostly in South Asia, or the Indian subcontinent, and Southeast Asia or Indochina and Malaya, as well as East Indies, which comprises of Indonesia, the Philippines, New Guinea and some parts of Northern Australia. Teak is highly preserved and considered one of the most economically valuable species in the world. (Barney, Keith, 2001). Teak is durable and resistant to a variety of climate and terrain, insect infestation, and mold. With its unique quality, Teak is popularly used as materials to build palaces, royal temples, temples, houses, furniture, decorative items, carvings, and various kinds of handicrafts. (Smartwood, 2008)

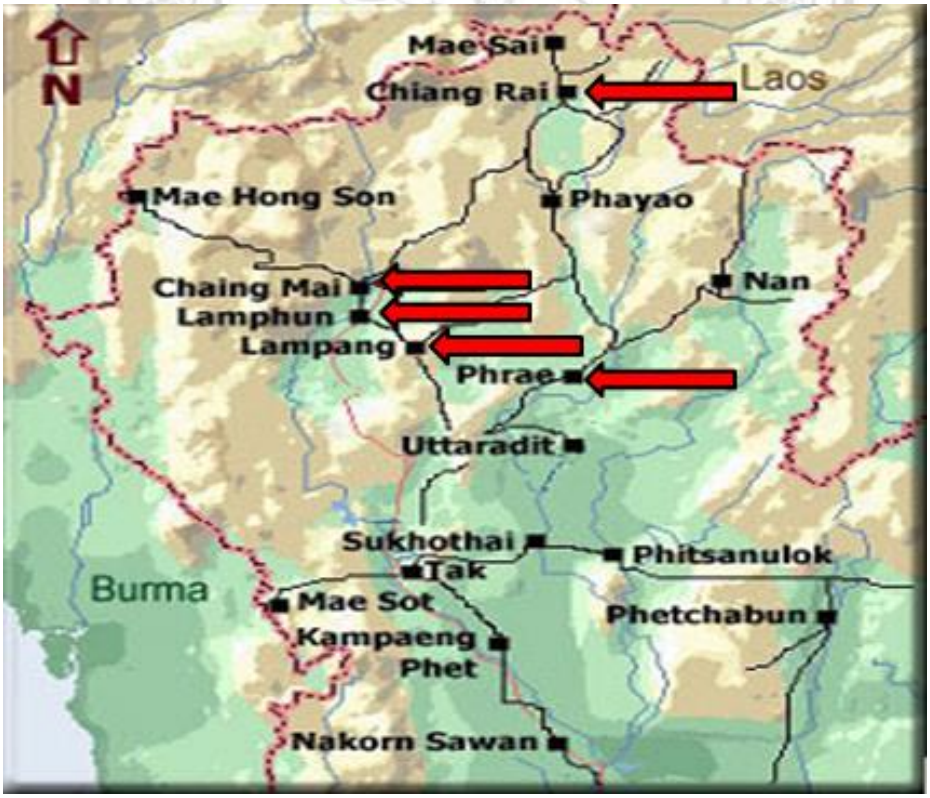


Figure 2.1 Thai teak resources in the northern part of Thailand

Figure 2.1 shows the five main Teak bearing areas in Thailand around B.E. 2499/2500 in Chiangmai, Chaingrai, Lamphun,Lampang, and Phrae that was invented by Loetsch (Loetsch, 2500), where Teak resources were surveyed and it was found that those five provinces had more Teaks. More details are given as :

(1) Five provinces, namely, Chiangmai, Chaingrai, Lamphun, Lampang, and Phrae, have total area of 61,010 square Kilometers (38 million rais)

(2) Forest area which is lower than 1,000 meters from the sea surface level, a level of Teak growing and the real Teak flourishing area is 26,540 square kilometers (16.5 million rais or 43% of 61,010 square kilometer's area) and

(3) Five provinces have Teaks densely growing approximately 20,259 square kilometers (13 million rais or 33% of 61,010 square kilometer's area) 30 cm high or above, with growing stock of 12 million cubic meters and increment of 300,000 cubic meters per year (0.025 cubic meters per year). But 590,862 cubic meters of them are cut a year (legally 270,763 cubic meters and illegally 320,098 cubic meters) or 2 times of increment, which use up the cost every year. By calculation, the Teak has 12 million cubic-meter cost, which will be vanished in the next 40 years or 1987 (B.E. 2530) which is near Teak forest cancellation B.E. 2532. (Sato, 2003).

Types of Teak: Knowledge about the characteristics of Teak is transferred from carpenters/sawyers and furniture makers. Colors, decoration, solidity, and durability are considered the main features of Teak. Illegal tree cutters are aware of the types, health, and the cracks on barks, which are indicators of Teak trees, where they are 5 types of Teak will be discussed as followings.

(1) Sak Thong is general grown around ravines on fertile soil. It grows in dry and humid condition, with complete top shape and medium-sized leaves. The wood is easy to cut and has a straight line on the texture.

(2) Sak Yuak is grown in dry condition and around ravines. The trees are straight with crack barks. The top shape is complete. The leaves are middle-size. The texture shows light brown color and is easily cut or carved.

(3) Sak Khai is grown in dry terrain. It tends to grow slowly. The bark has wide ridges. The trunks grow straight with slim top shrub. Carpenters can identify *Sak Khai* as they will find wax in the texture, which is difficult to polish or paint with lacquer. Its color is dark brown tinted with yellow.

(4) Sak Hin is found in dry forest at higher altitude. The bark has deep ridges and the top shrub looks meager. The leaves are small. It can be identified only when the trees are cut down as the texture is harder than other types of Teak, yet quite brittle. The color of this Teak is dark brown.

(5) Sak Kikwai grows in dry terrain in mixed forest and is always found in transition zone of different kinds of forests. Branches are not healthy as some of them are always found dead. The barks show uneven deep cracks. Sak Kikwai can only be identified when it is cut down as the texture shows green with brown color, mixed with dark brown, and light brown randomly.

2.2.2 Teak Supply Chain

The Vertical Supply Chain of Teak industry (Aungyureekul N. and Sivaborvonwattana N.,1979), as shown in Figure 2.2, consists of 3 sub-sections.

(1) Upstream industry. Teak planting nowadays requires seeds or rootstocks. However, the seeds used by most farmers are of lesser quality. As natural sources of Teak seeds are decreasing, Forest Industry Organization (FIO) is determined to employ technology in tissue culture to increase the number of seedlings to be sufficient for the planting substitution. The result is not yet sufficient for reforestation. Certain technologies should, therefore, be applied with screening and preparing good quality of seeds for farmers. The capability for tissue culture should also be enhanced so that the seedlings for reforestation sufficient for at least 5,000 acres can be produced. Tissue culture technology seems to be the only method that is able to increase the number of seedlings in a great quantity and with good quality in the future. Also important is the development of Teak strains that can resist beetles through bio-molecular technology. It also requires investment in research development on elimination and prevention of the outbreak of beetle wood. Examples can be Biocontrol technology and organic production technology as well as organic substances. The aim is to urgently prevent the outbreak and minimize the damages. It is, therefore, critical that certain development efforts are made for human resources, research and development, and necessary infrastructure for the upstream industry. A goal is set for the upstream industry that 24,000 kg of good quality Teak seeds are produced each year and 2 million seedlings of Teak with a survival rate of 90% are produced. It is also expected that each

year losses from an outbreak of beetles is reduced at a rate of 20% of the Teak plantations.

(2) Middle stream industry focuses on optimizing the production and processing of Teak wood to add more value. It is found that Teak growers are now selling Teak wood as a whole lot to the manufacturers. The prices are relatively low compared to the time for Teak trees to grow. The government should seek means to encourage farmers to earn more revenue in shorter time by including farmers to participate in the value chain with added value. For the initial assemble of furniture, the government should invest on factories, the requirements that cannot be done by farmers. It is also found that during the processing of wood operated by small entrepreneurs and FIO, there is a great loss and the products are not assured with good quality and do not meet the demands of the customers. A more effective manufacturing process that can reduce the loss during the processing should be invented to reduce the loss of least 8% by the use of computerized software as well as advanced machinery. The goal should be that the price of Teak products can be raised at least 6 times.

(3) Downstream industry focuses on developing channels of distribution and communications to stimulate purchasing of products and on increasing its exports by 20%. The sales value is expected to be increased 10 folds. To achieve the goals, Teak Valley, a center for displaying, selling, and learning about Teak, is established in Phrae Province to serve as a significant tourist site with environmental conservation focus in the north or Thailand. Information Technology and database are also used in the management of production and operation.

Three sections of Teak supply chain are consisted of knowledge worker, which is related to the seed production, seed selling, Teak plantation, wood selling, Teak processing, Teak import, Teak export, carving, Teak furniture manufacturing, packing etc. In this thesis, carving and Teak furniture manufacturing are selected to study, in which the maximum add value can be obtained according to the creative economy. (Viboonchart, 2013)

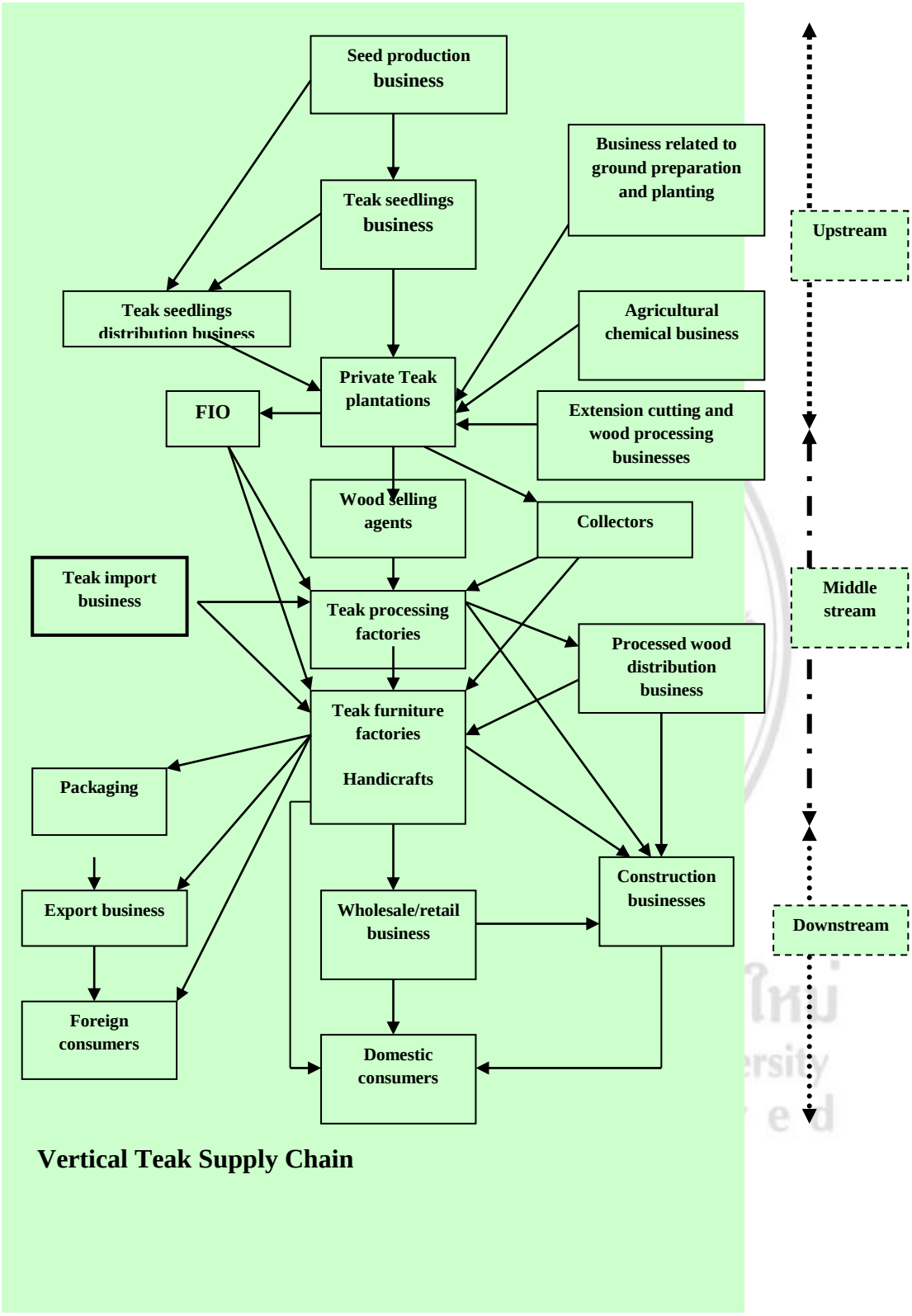
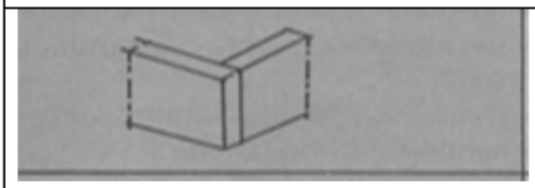
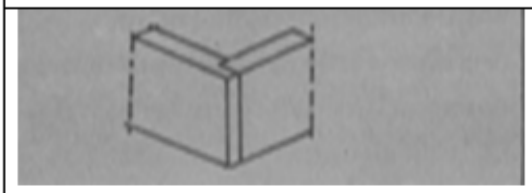
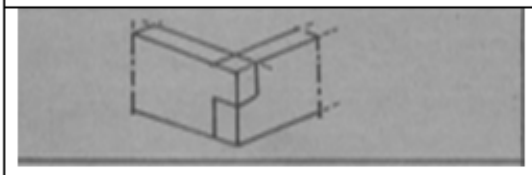
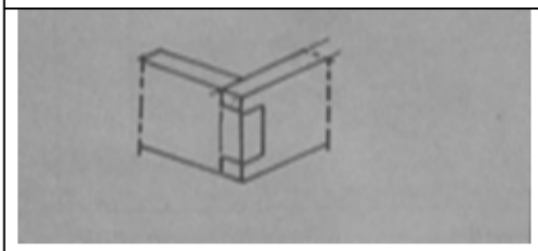
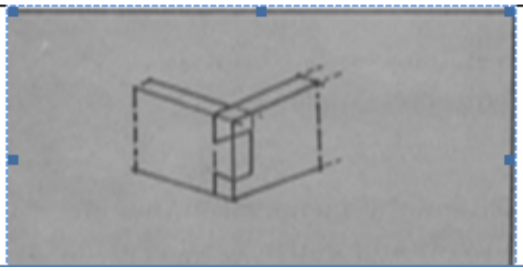


Figure 2.2 Vertical supply chain of Teak industry in Thailand

2.2.3 Patterns of teak joints

Joint is the connection tool between 2 pieces of equipments and nail replacement, where the various applications are widely used for Thai style houses. There are many joint types, which depend on the usage objectives. The joint connection tools are as shown in Table 2.1

Table 2.1 The patens and property of joints

Patterns of joints/splice	Description of joints/splice
	Sideway Butt joints • Easy, not complicated • Skilled workers not needed • Less strength
	Groove joints • More exposure space between pieces of wood • Fairly strong
	Alternate joints • Fasten by overlapping • Fairly strong
	Finger joints • More space for attachment especially on the grooves • Stronger than previous types • Fairly beautiful
	Dovetail joints • Strong fasten, automatic interlocking, nails not needed • Greatest strength compared with other types • Beautiful

2.2.4 Reviews of Other Literatures in Teak

In the previous section, the general descriptions of Teak, Teak industry and its resulting products are given. This is to provide basic and comprehensive understanding for the formulation of the research problems presented in this thesis. In this subsection, the reviews of other literatures in Teak are then provided. This is to illustrate some of the main research issues interested by other researchers within the field of Teak and Teak industry. Furthermore, this is to differentiate the scope and contribution of the research presented in this thesis from the Teak's perspective.

Teak (Tectona grandis) is a native and common tropical tree from Indonesia. Its timbers have become the main commodity of forestry industry in Madiun (East Java). Recently, its leaves are known to possess antioxidant activity. Thus, this method was expected to increase the activity of Teak leaves antioxidant. This research highlighted a qualitative phytoconstituents screening on Teak leaves. The utilization of microwave during extraction could increase the yield and concentration of phenolic compound in Teak leaves extract, further affects its antioxidant activity. Microwave-Assisted Extraction exhibited higher antioxidant activity than soxhletation. (Setiawan and others, 2013).

The reputation of Teak timber is due to its matchless combination of qualities such as termite, fungus and weathering resistance, lightness and strength, attractiveness, workability and seasoning capacity without splitting, cracking, warping or materially altering shape. The wood of Teak is being used extensively as electricity and telephonic transmission poles in Ghana, for housing and industrial construction and for furniture manufacture across the West African sub-region. The various parts of the tree are used for medicinal purposes. The leaves are also used for wrapping fresh meat and fish and for thatching. Teak then plays an important economic role in West Africa and sustainable management is required to ensure its continuous feeding to the local and international markets. In this study, an appropriate number of sampled Teak trees were collected from varied eco-climatic zones in Ghana and Coˆte d'Ivoire, spanning different stand ages, tree density and site index. The objective is to study longitudinal form of stems to develop a related stem profile equation for Teak in West Africa (Adu-Bredu and others, 2007).

A density management diagram was constructed using stand inventory data from 193 Teak (Tectona grandis L.f) plantations in Western Ghats of peninsular India. The diagram's utility in predicting and displaying the consequences of stand density manipulations is illustrated with two alternative density management regimes (Kumar and others, 1994).

Economic activities are targeted to create wealth, an indicator of which is the value added. Therefore, the potential of an industry to generate value added is a performance indicator. The value added is shared among various beneficiaries involved in the chain. The ability of smallholder farmers in developing countries to capture a significant share of that value added is a critical policy matter. Studies concluding on the exploitive nature of trade often build only on benefits sharing in value chains. The limitation of this approach stems from the ignorance of the costs borne by traders to perform marketing functions to the benefit of farmers and consumers. Equity, as a performance indicator, is related to how fairly benefits and costs are shared among chain participants. Since participants in a given channel perform various functions to move on the product from production to consumption, they bear various levels of costs that should be taken into account while discussing about equity in the value chain. In this study, we consider both the gross profit and the costs to assess equity in the chain (Aoudji and others, 2012).

Availability of raw materials is important for Indonesia as a furniture exporting country. Teak log as raw materials is supplied to the furniture industry by Perum Perhutani (PP). PP needs to involve carbon trading for nature conservation. PP also has an obligation in the Corporate Social Responsibility program. PP and furniture industry also must prosecute the regulations related to ecological issues and labor rights. This study has the objective to create the relationship model between supplier and manufacturer to fulfill Teak log demand that involving Teak forest carbon sequestration. A model is formulated as Goal Programming to get the favorable solution for Teak log procurement and support carbon sequestration that considering economical, ecological, and social aspects of both supplier and manufacturer(Cahyani and others, 2012).

Teak, classified as one of the most valuable timber species in the tropics exhibits desirable technical and decorative properties. The timber is suitable for various purposes including house construction, shipbuilding, furniture making, poles, veneer, carvings etc. The broad product suitability of the timber, its high demands, price in the international market and short rotation have triggered extensive planting programme throughout the tropics. The utility of molecular markers for analysis of the genetic structure and identification of markers linked with important traits are of prime importance in the domestication, improvement and conservation of the species. Nevertheless, there are only few reports on molecular genetic diversity in Teak. There are also powerful tools for assessing genetic variation within and among populations (Fofana and others, 2013).

A furniture value chain tracks the value added to timber as it moves from growers to furniture producers to the market. The value generated through this global partnership is the primary source of livelihood for millions of people in Indonesia. Through value chain analysis (VCA), we were able to identify numerous inefficiencies along the value chain. Our use of action research ensured the project adopted a participatory approach. Participatory action research (PAR) is a process through which members of a community identify a problem, collect and analyse information, and act upon the problem to find solutions and to induce social and political transformations. PAR enables researchers to understand both the problems and the changes in actors' behaviour more or less simultaneously (Shantiko and others, 2013).

Imbalanced value added distribution among actors participating in furniture value chains weaken the industry. Regional policies such as the ASEAN (Association of Southeast Asia Nations)-China Free Trade Agreement (ACFTA) can worsen the situation of small-scale producers, if they are not strengthened. Power imbalance among actors participating in Teak furniture value chains jeopardizes the sustainability of the furniture industry. The roadmap can strengthen small-scale producers' bargaining position, connect them to wider markets, improve trust from government bodies, and sustain the furniture industry for the benefit of small-scale producers. By having a clear roadmap and its supporting institution, small-scale producers strengthen their bargaining position, improve the commons institution and improve trust from government. The use of PAR in the forest product business to

improve fairness can be implemented in other parts of the world (Purnomo and others,2013)

The present circumstances of Teak wood processing, marketing and future prospects in northeast Thailand were studied in order to improve Teak plantation management by local farmers. Establishment of such log auction markets should be more feasible, if government support can be introduced in the form of loans for purchasing logs and to cover other running costs for log auction markets, etc. For the time being, private forest owner cooperatives or united organizations should undertake the role of management of log auction markets, because such cooperatives have been publicly organized. If a private forest owner cooperative manages a log auction market, members or farmers can expect stable demand for Teak logs at a fair auction price, which paves the way for farmers to become motivated to manage Teak plantations (Komaki and others, 2012).

2.3 Furniture Industry in Thailand

Since the furniture can be considered as the main resulting product from Teak, it is inevitable to explore the furniture industry, especially in Thailand as provided in this section. Furthermore, to increase the value of the Teak product which is the focus of this research, it is essential to investigate the potential from the export's perspective.

2.3.1 General Description of Furniture Industry in Thailand and its Exporting Values

Furniture was one of the critical components required for home and office functionality as well as decoration. Furniture was generally manufactured from different types of raw materials such as wood, metal, leather, and plastic. Most consumers preferred purchasing wood furniture as it displayed beauty, strength, and versatility of styles. Wood furniture was also available in most market as the wood furniture industry had higher proportion than other types of furniture industry. Wood that was used as raw materials was generally hardwood such as Teak, Padauk wood, and Makha wood.

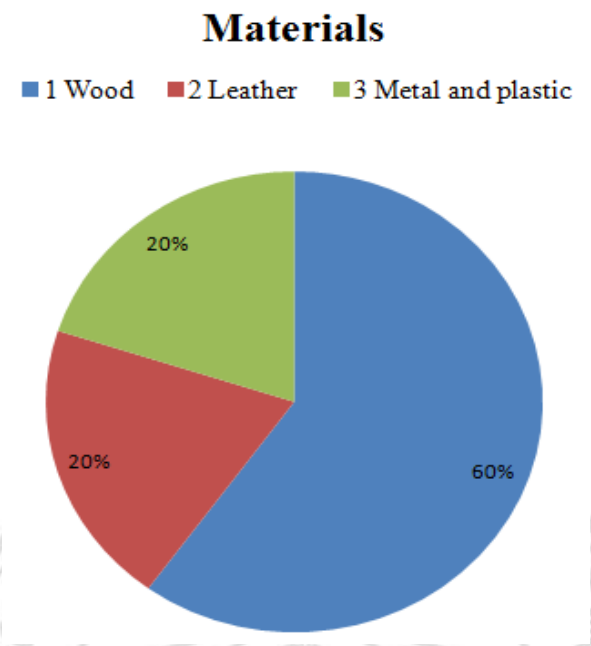


Figure 2.3 The ratio of furniture manufacturing in Thailand classified according to types of raw materials

Figure 2.3 shows the proportion of furniture manufacturing in Thailand classified according to types of raw materials. Furniture industry in Thailand supplied the products for export as well as domestic use. The industry itself was supported by the government as it added values to natural resource through processing and generated income for the country. Furniture industry created employment, career, and income for communities, which naturally had the impact on the country's economic and social development. There were 2,596 domestic manufacturers and 2,514 cases were classified as small and medium-sized enterprises or SMEs (up to 200 employees). 86 cases were large sized enterprises (more than 200 employees) (Ministry of Commerce, 2012). Since 2007, the industry sector has increased by 4.91 per cent and the growth of furniture industry directly related to the real estate industry. According to the data of residential registration of Real Estate Information Center, there was an increasing growth rate of housing in Bangkok and its vicinity. In the year 2007, there were 75,530 units registered as completed residences. The number was 85,579 in 2008, 94,977 in 2009, and 106,893 in 2010 (Real Estate Information Center, 2011).

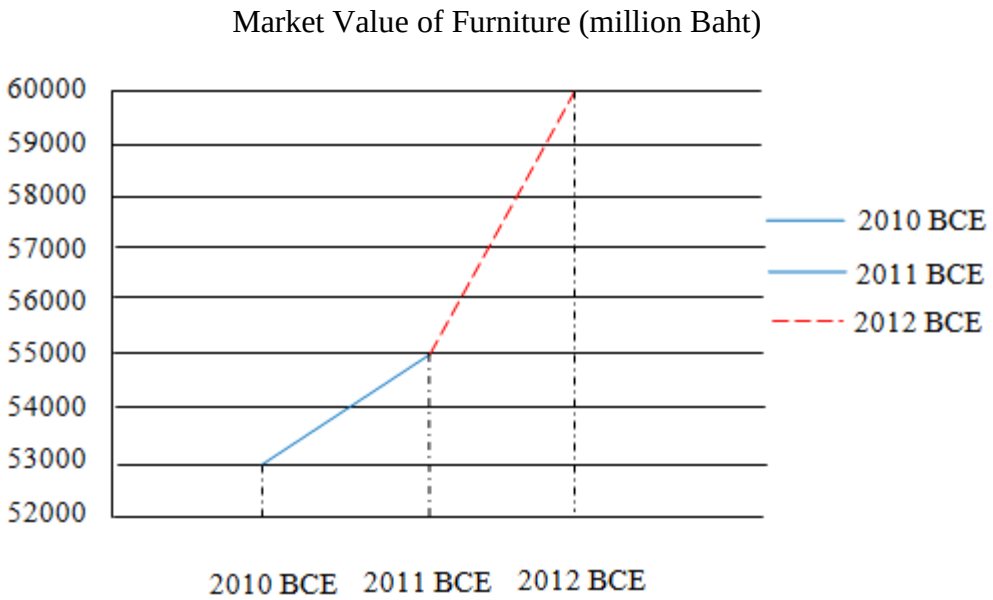


Figure 2.4 Market value of furniture

In 2011, the market value of furniture was approximately 55,000 million Baht, which represented 2-3 percent growth rate compared to the previous year, which is shown in Figure 2.4 The declining demand for furniture and home decorative items was evident in the fourth quarter of the year 2011 due to catastrophic effects caused by big floods damaging vast areas in the North, Northeast, Central, Bangkok and its vicinity. Furniture business, furniture products, people's houses, and offices were all affected by the natural disaster. The demand for furniture was declining substantially with obstacles in terms of volume of production, channels of distribution, and logistics / transportation. It was expected that in the year 2012 the market value of furniture would reach 59,000 to 60,000 million Baht, or 7-10 percent expansion rate compared to the market value of the year 2011. An increase of the demand for furniture could be driven by the need to buy new furniture to replace the ones damaged by the flood. A government's policy of 'first house owners' was carried out by the Government Housing Bank (GHB). And that also massively contributed to a larger number of residences and higher sales of furniture (Kasikorn Research Center, 2011).

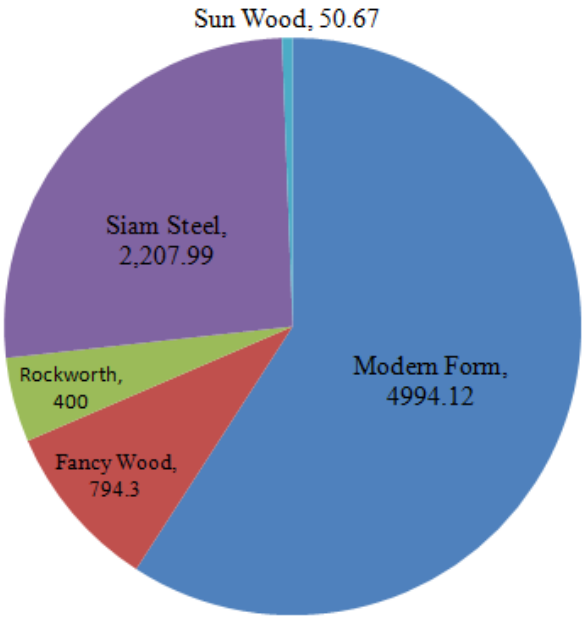


Figure 2.5 Investment value of furniture and parts companies registered in the stock exchange of Thailand

Figure 2.5 shows the investment value of furniture and parts companies registered in the stock exchange of Thailand (Million Baht). When investigating the investment value of furniture and parts companies registered in the Stock Exchange of Thailand, it was found that there were 5 leading furniture companies in Thailand that were registered in SET and had investment value in the market as much as 9,000 million Baht (SET, 2012). Thailand also exported furniture and wooden products worldwide with constant export value every year. When investigating the types of products, it was found that the value of exports of wood and wooden products has increased by an average of 12 percent per year. The value of exports of furniture and parts has increased by an average of 7 percent per year, generating no less than 62,000 million Baht per year to the country (Ministry of Commerce, 2011). Analyzing the environment and the potential of the entrepreneurs of furniture SMEs in Thailand revealed that the development of the entrepreneurs' potential has been so far facing with problems and obstacles, especially the inability to access to capitals. As a result, the application of new technologies was scarce. There was still the lack of research and development while the administration was still considered traditional. Communication

in foreign languages was limited to certain groups and there was the lack of communication with government agencies due to informal establishment of enterprises. These weaknesses inevitably had some impacts on the styles or designs of furniture that the furniture manufactured were out of fashion and unattractive shapes. Moreover, the volume of the manufactured furniture was quite low and the products still lacked quality. Forms and brand names were not effectively promoted and very little of new products were developed and offered to the markets. Clearly, these obstacles hindered the potential of the entrepreneurs to compete on the international level that primarily focused on product quality and design. On the other hand, to compete in the lower market, Thai entrepreneurs would face fierce competition in terms of price as there was furniture from China ready to compete with lower price (Office of Small and Medium Enterprises Promotion (OSMEP), 2010).

It seemed inevitable that furniture industry in Thailand had to be under increasingly competitive conditions. Unable to release viable products, Thai furniture entrepreneurs had to expedite the preparation so they were ready for the ASEAN Economic Community (AEC) fully in the year 2558. As ASEAN Economic Community would bring a great change to Thailand, furniture industry expected 4 major advantages from participating in the ASEAN Economic Community. Those advantages were to serve as the hub of manufacturing and trading of the furniture industry in Southeast Asia. The entrepreneurs can expand or relocate their manufacturing bases throughout Cambodia, Laos, Myanmar, and Vietnam. The new locations can also be served as a base for exports to other countries beyond the AEC, the entrepreneurs can benefit from the status of the Least Developed Countries (LDCs). AEC would provide Thai entrepreneurs with low labor costs as well as Supply & Value chain, in tandem with the cooperation from the entrepreneurs of similar nature to respond to the needs of the global market. Another advantage of AEC, for Thailand, was that Thai entrepreneurs were able to take the tasks referred from other ASEAN countries and then, in turn, distribute other tasks to other countries (The Federation of Thai Industries (FTI, 2011).

The liberalization of trade, services, investment, and labor mobility in the near future brought a serious concern for Thai furniture industry. It was forecast that the ASEAN Economic Community will enlarge consumer market, which will be the opportunity for the furniture industry of Thailand to gain advantages from being the

center of production and trade for furniture industry in Southeast Asia. Yet, Thailand will have to face with indirect impact because the competition will be fiercer from the influx of foreign goods. Imported furniture from Vietnam and China (imported through Malaysia), for example, were cheaper than the furniture of Thailand. Imported furniture from Malaysia can be found with higher quality as the raw materials were new varieties of para woods, coupled with the use of advanced production technology (FTI, 2010).

The import of foreign furniture affected the diversity of products available in Thai markets in terms of brand names, patterns or designs, colors, functionality, and manufacturing innovation. It was worth observing that the governments of foreign countries provided supports to their furniture industry and took the proactive strategies for marketing. Thai entrepreneurs, on the other hand, were classified as small and medium-sized enterprises which seemed to lack the potential to develop products to meet the needs of domestic consumers. Consequently, the consumers became more attracted to in furniture manufactured by foreign countries or furniture made from large enterprises that were innovative and distinctive. This was considered a major problem for Thai entrepreneurs as the improvements were needed for products, pricing, quality, and branding. In essence, the entrepreneurs should focus on responding to the demands of the consumers by offering the uniqueness of the products under the policy of AEC free mobility of the goods. In short, the inception of ASEAN Economic Community affected Thai furniture industry in a way that there were more partners and more competitors from neighboring countries. It was expected that there was an influx of goods into Thailand through an advantage of AEC free mobility of goods and tariff reduction resulting in lower manufacturing costs. All these factors affected the purchasing decisions of Thai consumers. (Purnomo et al., 2007)

2.3.2 Review of Other Literatures in Teak Furniture

In the previous section, the general descriptions of furniture industry in Thailand and its exporting values are given. This is to explore the potential to increase value to the Teak product which is the focus of this research. In this subsection, the reviews of other literatures in Teak furniture are then provided. This is to illustrate some of the main research issues interested by other researchers within the field of Teak furniture and value added proposition. Furthermore, this is to differentiate the proposed

idea and contribution of the research presented in this thesis from the value added's perspective.

Herry Purnomo and other describe the use of systems dynamics to mimic the value chain of Teak from forest to final furniture market using phases of conceptual design, model specification, model evaluation and model uses. The model comprises Perhutani plantation Teak, community agroforest, Teak log trading, furniture manufacturing and market. From the model we observe baseline trends of Teak forest and incomes to various actors participating in Teak business including forest state enterprise Perhutani, local communities, brokers, manufacturers and retailers. We use the model to produce governance scenarios of fair trade and vertical integration, their impacts on actors' income and the sustainability of Teak plantations (Purnomo and others, 2008).

Furniture produced in Ghana for exports is mainly garden furniture. Such furniture products are mostly used in open places where they are partly or wholly exposed to the weather and as such are primarily produced from relatively durable and weather resistant wood species like Milicia excelsa (iroko/odum), Khaya spp. (mahogany), Tectona grandis (Teak), Entandrophragma utile (utile) and Albizia ferrugenea (albizia) either alone or in combination with some metal components. But wood has been the most favorite material for garden furniture globally due to its desirable attributes such as: easy workability when using both hand and machine tools; ability to be fastened satisfactorily with adhesives, nails and screws; natural beauty from variations in figure and colour that blends; and resistance to rust and corrosion. In Ghana, 26 wood species have been identified as being used for the production of various garden furniture parts for exports. These species in addition to others are also being exploite for lumber production for exports and for local markets (Dadzie and others, 2015).

Khalaj and Pedgley present a comparative analysis of designers' intended impressions and users' realized impressions of products, within the context of design communication. Its originality comes from the empirical approach taken, which examines the extent of users' shared impressions from products and their closeness to originating designers' intentions (Khalaj and Pedgley, 2014).

The furniture industry in Malaysia is under a manufacturing sector of the small, medium enterprises (SMEs). This aligns with Tamyez and other's findings that manufacturers have been focusing on increasing sales numbers with minimum emphasis on design or re-design. Specifically, resources to undertake their branding activities are of low capacity which inhibits their endeavor towards achieving a successful brand. Therefore, such a phenomenon has created a concern of whether the current manufacturers have been equipped with the right innovation, branding and originality to reach world-class producers. In this respect, brand performance is one of the main interest among numerous researchers in the area of management. However, limited studies of brand performance are related with design innovation and only linked to innovation in general. The research is closely linked innovation with brand orientation, brand distinctiveness and brand performance (Tamyez and others, 2014).

Furniture plays an important role in satisfying the social needs of the family. Home is not only a physical state but also includes the net of social relations for family members, friends and neighbors. The home also indicates the identity of the person, reflecting his or her lifestyle and personal values. Furniture represents the changeable part of the home and it helps the individual to express his or her personality and feelings. Through furniture, the family can also express their social status and associated it with memories and experiences of their childhood. In general, furniture plays a very stable and essential role in our lives (Hassan and others, 2010).

Furniture sector in Anatolia has consisted in Mesopotamia and Hittite civilizations which were established in ancient age. However, industrial production of furniture has begun 1970s in Turkey. Establishments which get busy at furniture and wood sector in Turkey are generally in the form of small scaled family-owned business. Managing automation has begun after big establishments participated to furniture sector in 2000s. On the other hand, there was an increase in number of middle and big scaled establishments which produced in world class. The furniture sector gets busy some regions where have a large amount of market and raw material. These companies take part in some cities which are Istanbul, Ankara, Bursa, Kayseri, Izmir, Adana. At this study, the present and international trade situation of furniture sector was examined by analyzing documents which were published at various institutions in Turkey (Serin and others, 2014).

The Nigerian forest estate occupies 10.2% (10,006,200 hectares) of the country land mass of 98,321,300 hectares and it has been the source of the wood species used for wooden furniture and other wooden construction in Nigeria. Apart from sustaining the domestic markets, this forest has been under pressure as early as 1930s when the Nigerian timber became known at the international market. In order to satisfy both the domestic and the external markets, exploitation of the forest was intensified and became largely unregulated. Following the large quantity of the wood species that was exploited, Nigeria ranked 2nd in tropical wood export in Africa and until early 1970s, wood export was a major source of foreign exchange for the country. By the middle of 1970s, the forest has been highly degraded and could no longer sustain both the domestic and international markets. Hence, the exportation of roundwood and semi-finished products were banned in 1976 by the Federal Government of Nigeria. Nevertheless, with increasing population, rising standard of living and an increase in the number of wood processing industries in the country, the domestic demand for wood continued to increase. Thus in the last two decades, there has been a large gap in the supply-demand trend of the wood-based industries for wood raw material as a result of the inability of the hitherto endowed forests to sustain the industries (Department of Forestry, 2010).

This research is a web-based investigation utilizing advanced computer and network technology in order to understand factors considered in furniture purchases and furniture style preferences. In interior design, especially for residential environments, furniture has significant meaning, not only because household furniture purchase are the second largest expenditure following a house, but because furniture is a mode to project one's self-image. Despite the significance of furniture, little is known about the influencing factors of furniture selection and furniture style preferences(Yoon and Cho, 2010).

Furniture is among the important personal consumption expenditures for durable goods in the USA. Retailers and manufacturers offer different communication channels to assist consumers all through the process of acquiring furniture. The objective of the present study is to evaluate US consumers' channel use at different steps

of the residential furniture-buying process. The research gives unique insights into consumers' buying behavior that will help to design communication channels properly (Lihra and Graf, 2007).

The urge for differentiation trend the shift in our economy and shopping behaviour of consumers led to a professionalisation of the discipline of retail design, its definitions and its methodology. Research showed that a retail environment can become an important factor in influencing consumers' perception and behaviour in that environment. Furthermore, within this retail environment atmospheric elements have been the focus of scientific research from a marketing point of view, but never from the experience they can create. Consequently, lighting is approached as a way to create an experience that can influence, conscious or subconscious, the consumers' mood and behaviour in retail environments(Quartier and Others, 2008).

2.4 Teak Handicrafts and Carvings

In this section, the methods of handicrafts and carving of Teak products are explored and explained. In this research, it is believed that one of the potential solutions to increase the value to the Teak product is to embed it with the culture and story. In another word, this is to utilize the intangible asset local to increase the overall value of the Teak product together with the tangible asset explicitly and universally accepted in the Teak product in terms of its natural characteristics. This handicrafts and carving can be considered part of the overall creative industry framework presented in the following section.

2.4.1 Relationship between Wood Products, Handicrafts, and Carving

Wood products, wood carvings, and decorative items of Thailand have originated for a very long time. The original production had a main purpose for household use, yet the products now are available in a greater variety. Production has been improved by introducing tools and machinery in certain processes. Consequently, wood products and wood carvings become a crucial occupation that generates income for the households, especially in the rural areas. The industry can be extended into small and medium-sized enterprises that are capable of producing goods in a great quantity

and can be exported to foreign countries. They brought income to Thailand approximately ten billion Baht a year. (Office of the National Culture Commission, 2534)

Wood products and wood carvings are considered decorative items with great acceptance and are given as gifts for various occasions such as New Year's day, birthdays, and housewarming. Major producers are located in the Northern provinces such as Chiang Mai, Chiang Rai, Lampang, Lamphun, Phrae, Nakhon Sawan and Ayutthaya and Bangkok for the central region.

Marketing Circumstances: the markets of wood products and wood carvings for the domestic markets consist of 2 types of markets; retailing and wholesaling. Major distributing places for retail are tourist destinations nationwide, shopping malls, markets, Jatujak Market, and Suan Lum Night Bazaar. Distributors of the wholesale market include major producers in the northern and central regions such as Soi Prachanaruemit, Jatujak Market, and Suan Lum Night Bazaar.

Exporting Markets: major exporting markets of wood products and wood carvings can be currently divided into two categories. The main markets include the US, EU, and Japan. The new markets include the Middle East, Africa and Asia.

The analysis of overall exports of wood products and wood carvings of Thailand shows that the trend is in stable state. From the statistics of export values in the past three years, the average value is similar. In the year 2003, the export value was around 10,500 million Baht. The value was worth 10,900 million Baht in 2004 and 10,100 million Baht in 2005. It is expected that in the year 2006 and the rest the figures tend to be increasing steadily. This is because major client countries such as EU, USA, Switzerland, Japan, and Canada are advanced economically. Their citizens are employed with high income and have good quality of life and that encourages them to purchase more household appliances, home decorative items which include wood products and wood carvings. Partly, this is a result from the participation of Thai entrepreneurs in international trade fairs, helping foreign consumers to recognize wood products and wood carvings. There have been strong and continuous efforts to support and organize exhibition of OTOP products in Thailand, which significantly promotes wood products and wood carvings and their channels of distribution. It is estimated that the value of exported wood products and wood carving is worth about 11,000 million

Baht by the end of 2006 as the products are labeled as OTOP products. With this in mind, the trends or marketing conditions of OTOP products are primarily associated with wood products and wood carvings. From the report of the Department of Export Promotion, Ministry of Commerce in March 2006, 16 exported OTOP products are ranked as followings, where they are (i) Cosmetics, soap and acne cure products, (ii) Silver jewelry, (iii) Furniture and parts, (iv) Tableware, (5) Textiles, (6) Clothes, 97) Wood carvings and wood decorative items, (viii) Wooden utensils, (ix) Candles, (x) Souvenirs and ceramics, (xi) Fabric, (xii) Wood frame, (xiii) Artificial flowers, foliage, and trees, (xiv) Food seasonings, (xv) Rice products and (xvi) Processed fruits.

From the data above, wood products and wood carvings are in the 7th and 8th ranks of OTOP products with highest export values. The total export value of OTOP products during January - December 2005 was 973 million USD, compared to the year 2004 that amounted to 873 million USD. The growth rate was 11.4 percent. The growth of exports in the four groups of OTOP products indicated that herbs for health and beauty was the highest growth rate, followed by food and beverages, textiles and clothing supplies, and home decorative items (including wood products and wood carvings), respectively.

Another piece of information that shows the market circumstances and trends of wood products and wood carvings can be used for the analysis to determine the market trends essential for production planning of this type of product is the data concerning OTOP sales in OTOP to The World Expo held in October 2005. The details can be shown as followings, where they are

(i) The products that have been purchased the most include golden glass, decorated eggshells, leather products, wood products, artificial flowers/Sa paper, ceramic, lacquer ware bowls, spa products, home textiles, and basketry.

(ii) Retail products that had highest sales include wood products, textiles, ceramics, handicrafts, spa products, lacquer ware bowls, metal products, and artificial flowers/natural paper.

(iii) The countries with the highest orders are the United States, Britain, Australia, Canada, United Arab Emirates, Netherlands, Italy, Hong Kong, Qatar, Taiwan, and China, respectively.

(iv)The regions that ordered the goods include Europe, Asia, Middle East, North America, and Africa.

The analysis of market trends, both domestic and export markets in 2006 and prospects in the years ahead shows important information on the development of wood products and wood carvings as well as other craft products that it is likely that these products will meet the demands of the domestic market and foreign markets. The qualified features should be as followings, where they are (i) Trend of fashion and style, (ii0 Easy to use or favorable trend such as environmental friendly, (iii0 High value - added products, (iv) Unique quality with high quality of design, (v) Comfortable, warm, and lovely features, (vi) Displaying sophisticated art and (vii) Special functions.

Currently, wood products and wood carvings as well as other crafts of Thailand play a key role on Thai economy and society at a greater extent. Yet, handicraft industry is still facing the following problems, where they are (i) Wage rates in the country are increasing, (ii) Resources as raw materials in the production become limited and scarce, (iii) Development of advanced production techniques is slow, (iv) There is a lack of data concerning consumer demand, both domestic and foreign markets. The competitors in the export markets gain an advantage in terms of lower rate of wages and have better quality of wood materials (Teak, Padauk wood, Makha wood, mango wood, and Santol wood), (v) Competitors in the export markets have developed production technology consistently. They also have modern features in the design.

To solve the problems, manufacturing enterprises in Thailand should focus on the developments in different areas, where they are (i) Implement by value creation strategy, which uses of the advantages of Thailand in terms of the craftsmanship, the wisdom that is displayed in products. These features are difficult to imitate and thus deserve value and high prices, (ii) Government and private sectors of Thailand should cooperate seriously and continuously in conducting research on the trends of market demands of wood products and wood carvings so that the results can be served as a

guiding principle in the development of quality, style and production volume for Thai manufacturers. Market structure of wood products and wood carvings as well as other craft markets that attract target consumers should also be studied. The results of the studies could be beneficial for trading contacts between Thailand and international partners in the future. If Thailand is capable of expanding the markets of wood products and wood carvings in the target markets, it will provide an opportunity for Thailand to export other handicraft products and gain benefits in terms of volume and increased values. Not only it is an opportunity to bring more revenues into the country, it also benefits the country in terms of the continuity of employment in Thai handicraft industry, which reduces the migration of rural labor into big cities. Thailand's economy can be stable and the wood industry can contribute to the creation of added value to the local materials while preserving cultural heritage and traditions of Thailand expressed in forms of handicrafts. (Source: Product Development and Distribution Section, Department of Industrial Promotion)

2.4.2 Patterns of Handicrafts and Carvings

Wood carvings employ different techniques depending on the raw materials and functions of the products. Wood carvings for window panes or doors, for example, can be done on single sheets of wood. The gables of large temples require unconventional approach of compiling single sheets and fixing them together before carving. After being carved, different pieces of wood will be installed to complete the whole picture. For semi-round relief, each piece of wood will be carved as instructed by the design. Then, latches will be used to fix the carved woods on the gables. Carving techniques used nowadays remain the same as in the ancient times, yet certain evolution in terms of tools has become crucial. The new tools used in modern carvings can be ground digging tools and pattern copying equipment for wood works. In the past, craftsmen sprinkled powder colors on perforated paper, or drew patterns on sticks, to make the blueprints. This technique only provides the rough shape or contour. However, the woods have to be painted as practiced in the old days.

2.4.3 Types of Carvings

(1) Engraving is a unique technique which provides the same weight on all lines. This technique is likened to the process of writing on Talipot palm by sharp-head metal. The figure is as shown in Figure 2.6.

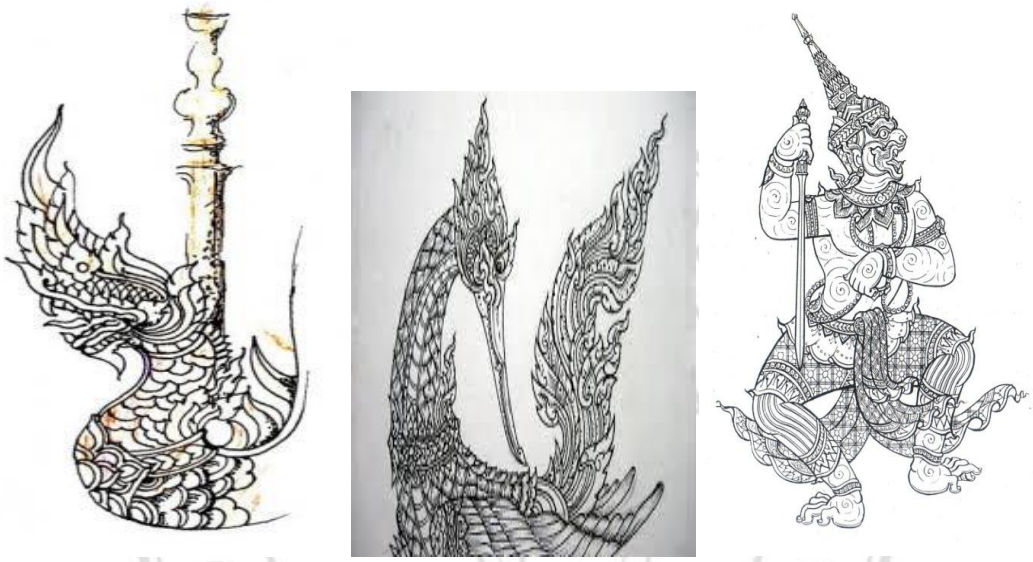


Figure 2.6 Engraving pattern

(2) Bas relief is a technique that allows the viewers to see only the front view as the image is raised slightly from the surface of the background. Bas relief technique also applies to deep carving on the surface of materials or “incised relief.” The beauty of this sculpture can be vivid as the lines will show the strength and solidity of the artists (see Figure 2.7).

Figure 2.7 Bas relief pattern

(3) High relief or half-sided visual image. The viewers can see only a half of the entire image, the figure is shown in Figure 2.8.

Figure 2.8 High relief or half-sided visual image pattern

(4) Round relief requires the creation of artists to present the beauty of the works on all sides and maintain a good balance of the works. Examples of Round relief are standing Buddha statues, seated Buddha statues, statues of important people, monuments, and animal figures (as shown in Figure 2.9)

Figure.2.9 Round relief pattern

According to the analysis and summary of all types of carving, the suitable types for furniture function are Engraving pattern and Bas relief pattern. Both types of carving are flat and shown only front top view which are ease of use for maintenance and give high perspective of art. This can also give the higher value creation.

2.4.4 Reviews of Other Literatures in Handicrafts and Carving

In the previous section, the relationship of wood product, handicrafts and carving are given. This is to illustrate the potential to increase the value of the Teak product by embedding it with the intangible asset (culture and story) through handicraft and carving knowledge. In this subsection, the reviews of other literatures in handicrafts and carving are then provided. This is to illustrate some of the main research issues interested by other researchers on how to utilize the handicraft and carving knowledge in the wood product. Furthermore, this is to differentiate the proposed idea and contribution of the research presented in this thesis from the knowledge utilization's perspective.

The wood carving industry prevailed in many West African communities of the forest zone where both hard and soft wood abound for thousands of years. The industry has passed through many stages of development, from a purely primitive structure to a near-modern business concern. Wood Carving is an important and long established traditional artifact industry in Lagos and Ibadan metropolis which are the study Area. The wood carving industry has a very rich cultural background that has influenced in no small way, its organization, products and survival. An investigation of the various wood species used in carving wood work was carried out and the specific gravity of prime species estimated. The Benefit-Cost analysis was carried out for the business as well as the rate of returns on investment. Wood species such as Khayaivorensis, Terminalia ivorensis, Tectonagrandis, Naucleadiderrichii, Afzeliaafricana, Celtiszenkeri, Mansoniaaltissima and Alstoniacongensis have specific gravity of 0.85, 0.74, 0.71, 0.67, 0.66, 0.62, 0.52 and 0.36, respectively. The beautiful thing about this is that such wood species with low specific gravity that are often rejected in construction and joinery have a place in carving industry. The benefit-cost analyses are in the ratio of 3.33:1 for smaller products and 1.32:1 for bigger products. This makes the business viable since the ratio is greater than one in both cases. Further

more, the rate of returns on investment for the smaller products is 233% and 31.58% for the bigger products at 14% discount rate. This makes the business profitable since the values obtained are higher than the discount and/or the lending rate. The wood carving industry is a business concern with good prospects given the necessary assistance and proper direction. Thus, this research of art that serves as a national heritage must continue from one generation to the other (O.Y. Ogunsanwo and A.O. Owowa, 2012)

The economic situation in Zimbabwe has since shifted because it was affected from woodcarving for both the consumer and the producer.This study looks at wood curio carving in Victoria Falls, Zimbabwe, Africa. Wood carving is contributing to the problem of worrying environmentalists and government institutions. Deforestation threatens not only a healthy ecosystem in terms of the environment, but a lack of woody material also has a direct effect on the people. As one man in Kenya phrased it: "no wood means no work"**.** The purpose of the research is to provide a better understandingof the ways in which wood carving affects cultureand environment, and to explore solutions that maintainecosystem and human being.Interviewswere conducted with 37 carvers and roadside sellers, five shop owners, two airport vendors in Johannesburgand one in Zambia, one rural carver and seller with a curio business out of his home, and one Forest Stewardship Certification (FSC) certified sawmill and furniturefactory owner. Sculpting interviewees were those who carved and sold either in Victoria Falls town, or in the main market in the outskirts along the road into town. Some of the informants were interviewed in their homes in the village of Monde, as the majority of the sellers at the roadside stand are from this village. Selection of interviewees was purposefully nonrandom. The curio carving situation in Zimbabwe affects both the environment and the local culture. More people enter into the carving industry as a way to make a living, tree poaching increases. Thus, conservationists, governmentsand human interest groups are looking for ways to provide wood while maintaining environmental stability.The research exploring the role of men and women as the carving industry progresses can yield important resultsfor understanding cultural changes in terms of how they are connected to plant utilization. Additional studies over the next ten years to asses the success of smaller carvings, FSC certified scrap wood, and utilizing branches to see if they do indeed improve the balance between the carvers

and the forest, could have an important effect on future forestry policy(A.A. Aiyeloja, 2011)

Handicrafts are the visible symbol of cultural behavior and a valuable cultural trait of a society. Bastar a tribal district of Chhattisgarh is the Land of Handicrafts & Natural Resources. The artistic traditions are also reflected in Bell metal craft, wooden art, iron art, bamboo, terracotta, jewelry and other items of finery and aesthetic sensibilities. The tribal society of Bastaris the district of Chhattisgarh is one of the tourist destinations in India. It is famous for their excellence in making exotic handicrafts with a variety of designs and shapes. Basta, being a district full of forest, containing finest quality of Teak and other types of woods from which very attractive wooden carving crafts and various types of furniture are being made by the skilled and experienced hands of the tribal's. Surveys were carried out since 2008 in all the blocks of Bastar region of Chhattisgarh, following standard method to get the information of the handicrafts product of Bastar. Personal interviews with the village head, group discussion an dassistance of local informants were used**.** It was found that bell metal craft (Dhokra art / Ghadwa art), wrought iron art, terracotta craft, wood carving, bamboo craft, tribal jewelry art and Cotton Fabrics are indigenous product of BastarThe traditional handicrafts product of Bastar is very popular among the tourist. By promoting the handicraft of Bastar, there are not only revealing the hidden talents of the artisans to the world but also strengthening the Indian culture by escalating it in the global scenario(ANUPAM KUMAR TIWARI, 2000)

The handicraft industry has an important source in Kneya. The wood carving industry is highly dependent on indigenous tree species. These species take between 100-150 years to mature. The purpose of study is to examine the extent to which the practice has impacted on the raw materials used in the production of the craft. The study was on woodcarving handicraft among the Kamba community in Wamunyu location of Mwala District in Kenya. A total of 100 woodcarvers participated in the survey. These were purposively sampled for the reason that in each location, the target respondents were organized into a major association. In Wamunyu the major association is Wamunyu Cooperative Society. Other study respondents included cooperative officials and, programmer managers of local non-governmental organizations. Questionnaires, in-depth interview guides, focus group discussions,

observation and photography were used in collecting data. The findings suggest a need for woodcarvers to carry out their trade in a sustainable way. Required are afforestation and reforestation programmer and, as relates to leftovers from the craft, adaptation of good waste management practices. For example, use of cut-offs in carving smaller items and making of compost manure rather than setting ablaze the resultant leftovers. The cooperative societies should be in the forefront of ensuring that sustainable wood carving is done. There is need for urgent extensive mobilization of all stakeholders to start nurseries and plantations with the sole purpose to grow raw materials for use by the craft. The conservation education would come in handy in promoting sustainable woodcarving. Suggested as well is a need for resident non-governmental organizations to expand their activities and train and empower the wood carvers in aspects such as resource conservation, water harvesting techniques and, diversification of income generating activities.(Jane Mutinda, 2013)

Wood carving is one of the most lucrative industries in Kenya. It is highly associated with the tourism industry and enjoys large volume of export market worldwide.The handicrafts from Kenya on the American and European markets are on an upward trend presenting alot of opportunities for the local players. The main objectiveof the study was to determine physical, macroscopic and microscopic features of Kenyan wood carving species anduse these properties to classify them. Samples for 52 wood carving species (including the potential alternativespecies) were obtained from Coast, Eastern and Nairobi regions. A sampling programmer was designed to obtain wood samples.Other relevant details such as the distribution, treecharacteristics, durability, and the main uses were also obtained from various publications. The wood characteristics were determined at KEFRI Forest Products Laboratory using standard procedures. Information on local names, tree characteristics, wood characteristics, geographical distribution and uses are also provided. The 52 species are ranked based on macroscopic features, density and hardness and classified into 3 categories; major (4), minor (7) and alternative (41). The alternative ones are further classified into 3 groups i.e. high potential (23), medium potential (15) and low potential (3). The results indicate that some of the salient macroscopic features important for wood carving species are: heartwood darker than sapwood, non- irritating odor, minute pores and rays, fine to medium wood texture, straight grains and distinct growth rings. High wood

density is also found to be an important feature and about 80% of the species have densities ranging between 0.60 g/cm3 to 1.23 g/cm3. Wood hardness is also an important feature. Most of the wood carving species is moderately hard to very hard (4 to 20KN). The important microscopic features are: minute rays (1-3 cells wide), pores solitary or in radial multiples of 2 or more, vessels with simple perforations, very thick walled fibers and few parenchyma cells.(Muga M.O, Githiomi J.K and Chikamai, B.N,2014)

Indonesia is one of the biggest furniture exporters in the world, along with China, Italy, Vietnam and Malaysia. The wood-furniture industry plays a very important role in the Indonesian economy, as this industry has great potential not only for domestic but also international trade. Small and Medium Enterprises (SMEs) are the major players in the wood furniture industry in Indonesia. Previous studies suggested that innovation has become fundamental for achieving competitive advantage. This article attempts to explore the innovation perceptions within Indonesian SMEs in the wood-furniture industry in Central Java, Indonesia. Qualitative research was employed by interviewing SMEs managers/owners. The study showed that SMEs' perception of innovation was not necessarily related to 'newness' or 'novelty' as suggested by some scholars. The innovation carried out by the majority of SMEs in this study is likely to be considered as incremental innovation. The characteristics of the wood-furniture industry and SMEs are believed to contribute to the different perspectives concerning innovation than those reported in the literature. Even so, they are unlikely to prevent Indonesian SMEs to become entrepreneurial land competitive firms. (Amie Kusumawardhani and Grace McCarthy, 2015)

The wood waste and agrofiber waste have used to produce renewable fuel, bricket, animal feed, fertilizer, and so on. There are several kinds of biocomposite which are oriented strand board, cement board, particle board, fiber board (hardboard, medium density board, insulation board). The solid woods have been widely utilized to obtain particle board but wood waste and agrofiber waste have been narrowly used and been developed in wood industries due to limited information on how to produce particle board well with high quality and recovery. The utilization of biocomposite board is caused by the global environmental concerns for materials. Collecting data

from literatures and publication for summary. The sustainable forest products of biocomposite board could be gained by accelerating three pillars of Sustainable Forest Management (SFM), which is in accordance with Sustainable Environment, which are economic, ecological, and social benefits. These benefits can be achieved directly and indirectly or tangible and intangible material. It will helps to increase the income of industries by optimizing the wastes and by adding aesthetics of the furniture products. Socially, it helps to maintain the local indigenous and culture in carving wood. (ACHMAD SOLIKHIN, 2013)

Wood is a major raw material source for the production of requisite furniture with intricateinlay work. Carved walnut wood work is among the most important crafts of Kashmir where is now one of few places in the world where walnut is still available.The wood is hard and durable, its close grains and even texture facilitates fine detailed work. It also presents visually interesting effects with mere plain polished surfaces. Various patterns of wood works were investigated from the traditional old buildings located primarily from Muzaffarabad City and NeelumNalley. These newly created patterns were produced in the form of interior decorations including curtains and bed sheets. These patterns appeared as an fantastically excellent addition to the field of textile designing which may be exploited commercially in the textile industry. It is also a best way to conserve the culture. Various patterns of wood works were investigated from the traditional were produced in the form of interior decorations including curtains and bed sheets. These patterns appeared as an fantastically excellent addition to the field of textile designing which may be exploited commercially in the textile industry. It is also a best way to conserve the culture. (Safina Latif, and others, 2012)

The weaving, wood carving, ceramics, and metallurgy are noted for the expertise in a variety of specialized visual arts. Ahwiaa is a small town and well known for traditional wood carving. The value of carving at Ahwiaa includes teaching morals, maintaining standards of behavior and attitudes, upholding traditions, providing functional, symbolic and purely aesthetic objects. Wood carving is a household work which has been passed on from generation to generation. The concept of wood carving is communal that is an artwork is ownedby many. However, modernity has caused the

emergence of new ways of doing things which are worth studying. The researchers used qualitative method of research to carry out the study. Qualitative Research is a field of inquiry that crosscuts disciplines and subject matters. The researchers used interviews and observation as the basic data collection instruments. In all,13 carvers were interviewed in the course of this research. It was found that the tools used are simple tools made by the local blacksmith which are sharpened and maintained by oiling and storing after use and it is difficult to change the traditions of the carvers. The main source of material, wood is threatened due to the government regulations against the depletion of the forest. This will be detrimental to the industry. Due to heavy customer demand of products, the wood is no longer adequately seasoned before it is carved and this affects the product. Due to traditions, no new skills are being acquired, therefore expansion of the industry is difficult. The carving industry is now a purely business affair and therefore, the industry has become more dynamic. Tourism, Exports, Customers' satisfaction, taste and preferences also affect current trends in the industry. The youth are not much involved in the carving trade therefore the future of the wood carving industry is threatened. Both men and women are free to carve if they so wish(Dr. Joe Adu-Agyem, Dr. Gordon TerkpehSabutey and Mensah Emmanuel, 2014)

In Ghana, traditional wood carving has been an ancient industry. Like any other industry in Ghana, the wood carving industry in the Akuapim Hill has its own prospects and challenges. The key challenges of the Woodcarving industry include the difficulty in the acquisition of wood due to the ban on tree felling by the Government of Ghana, the high cost of available wood due to the activities of commercial timber loggers and chainsaw operator. The lack of financial support for the woodcarving industry as well as the over reliance on outmoded tools, equipment and techniques in the production of artifacts. The research was a qualitative approach with the descriptive research method being the main methodology employed. Data were gathered using interviews and observation. The population of about200 traditional woodcarvers, 70 master carvers at the main center of production were chosen at random. The industry is constrained in a number of ways in terms of quality of the products, costing and pricing of the products due to lack of education and proper orientation. Since wood is the only raw material used for carving in the industry and it is not being replenished, after sometime there will be no trees for carving. The problems confronting traditional

woodcarving, especially in the Akuapem hills, have overthe years reduced the popularity and market value of traditional woodcarvings. Carvers in the industry do not know about safety measures and are therefore open to hazards. Works produced are also open to insect attack since wood is not treated before use at the end of the study and with the introduction of certain intervention of researchers to the carvers in the Akuapem Hill, it came out that the adoption of improved wood treatment techniques such as the use of the Neem tree leaves for wood processing and the use of the additive technique of carving greatly boost the outcome the works produced by the artisan in the Akuapem Hills. (Dr. Joe Adu-Agyem, and others, 2015)

2.5 Global and Thai Creative Economy

In the previous section, the relationship of wood product, handicrafts and carving are explained. Moreover, the type and pattern of handicrafts and carving are investigated. This is to analyze the most suitable type and pattern of the handicraft and carving for the Teak product in this research. To illustrate that the proposed idea complies with the international concept, the creative economy framework is reviewed and investigated.

2.5.1 General Description of Creative Economy Framework

Definitions and scope of creative economy given by international organizations are as followings (see Figure 2.10 and Tables 2.2 to 2.4).

(1) The United Kingdom defined creative economy as "the economy that was composed of industries originated from individuals' creativity, expertise, and talent, which can be converted to prosperity and job creation. These assets can be accumulated and passed down from generation to generation with the protection of intellectual property."

(2) UNCTAD defined creative economy as "a concept of development and creation of economic growth based on the use of assets generated from by creative thinking."

(3) The World Intellectual Property Organization (WIPO) viewed creative economy as "cultural industries that comprised of products related to culture and art,

either in forms of goods or services that required efforts to create the works. Creative works can be produced spontaneously or manufactured through necessary process. The emphasis was given to copyright protection.”

(4) UNESCO regarded creative economy as "the industry formed by expertise, creativity, and potential to create jobs and wealth based on the manufacturing process and the use of intellectual property.”

(5) John Howkins: New ideas, not money or machinery, seem to be the source of success today, where they are

(i) The creative economy: giving new life to the manufacturing, service, retailing and entertainment industries.

(ii) It is changing where people want to live, work and learn, to think, invent and produce.

(iii) The creative economy is based on a new way of working and the output value depends on the uniqueness of the product or on how easily it can be copied and sold to large numbers of people.

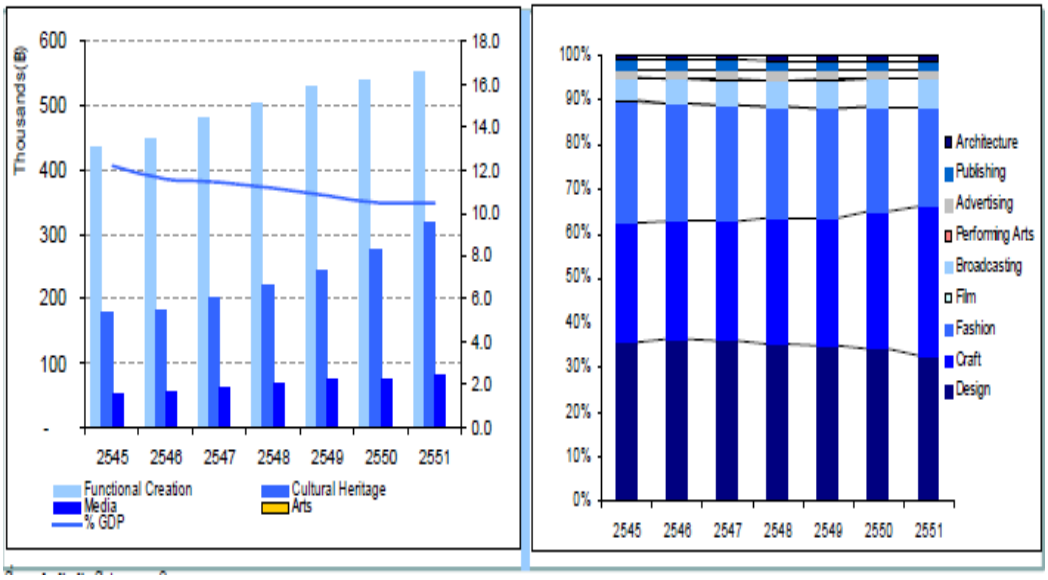


Figure 2.10 The importance of creative economy in Thailand: Economic Value (GDP)

(1) The value of creative economy of Thailand accounted for 10-12 per cent of GDP, which is shown in Figure 2.10 and Tables 2.2 to 2.4, or about 14-17 percent of national income. Groups that generated the highest values were Functional Creation, Cultural Heritage, and Media.

(2) Scrutinizing each sub-group, it was found that design generated the highest value, followed by handicrafts, and fashion. The three sub-groups, when combined,accounted for 9.5 percent of GDP. (Bureau of National Accounts NESDB, 2015)

Table 2.2 Comparison of Thai creative economy and creative economy abroad

Products and Service	DCMS	Symbolic	Concentric	WIPO	UNCTAD	UNESCO	Thailand
1. Ads	✓	✓	✓	✓	✓	✓	✓
2. architecture	✓		✓	✓	✓	✓	✓
3. Design	✓		✓	✓	✓	✓	✓
4. Fashion	✓	✓	✓			✓	✓
5. Film and Video	✓	✓	✓	✓	✓	✓	✓
6.Hardware (equipment)	✓	✓		✓		✓	
7. Tourism Service			✓		✓	✓	✓
8. Literature		✓	✓	✓	✓	✓	✓
9. Music	✓	✓	✓	✓	✓	✓	✓
10.Museum,Gallery, Library			✓	✓		✓	
11.Publishing, Printed Media	✓	✓	✓	✓	✓	✓	✓
12. Software	✓	✓		✓	✓		✓
13. Sports		✓					
14.Performing Arts (Stage Theater and Dancing)	✓	✓	✓	✓	✓	✓	✓
15. Broadcasting		✓	✓	✓	✓	✓	✓
16. Video Games	✓	✓	✓	✓	✓	✓	✓
17.Visualarts, photography, crafts	✓	✓	✓	✓	✓	✓	✓
18. Thai Food							✓
19.ThaiTraditional Medicine							✓

Table 2.2 shows the scope of creative economy of each country or international organization can share certain similarities. Differences in terms of social backgrounds, however, created unique identities. (CAVES, 2000).

Table 2.3 Cultural capital of creative economy

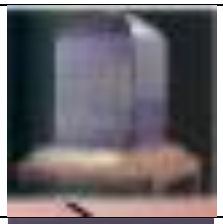
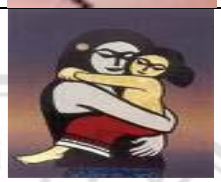
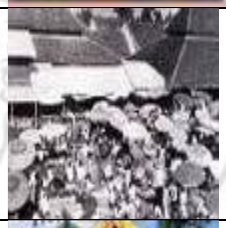
Tangible		Intangible	
	Culinary, local foods, and food etiquettes		Language, dialects, communication
	Arts, architecture, buildings, residents		Family system and relatives
	Costumes, traditional or national costumes		Attitudes towards the world, life, and changes
	Medical, medicines, herbs		Economic system, sufficiency community, market system, trade system
	Technology, mechanics, tools for living		Beliefs, religions, and concepts
	Literature, fables, legends		Political system and administration
	Local sports, festivals, songs, music, performing arts		Tradition, rituals, and local norms

Table 2.4 Case study of comparison of creative economy in different countries

Aspects	United Kingdom	Australia	Hong Kong	Thailand
Scope of creative economy	Creative economy consisted of 13 groups: 1. Advertising 2. architecture 3. Art and Antiques 4. Crafts 5. Design 6. Fashion 7. Film and Video 8. Music 9. Performing Arts 10. Computer and video games 11. software 12. Television and Radio 13. Printed materials	Creative economy consisted of 11 groups: 1. Advertising 2. architecture 3. Design 4. Digital Entertainment 5. Films 6. Information Technology Services 7. Music 8. Performing Arts 9. Printed materials 10. Television 11. Trading of arts, antiques, and handicrafts	Creative economy consisted of 12 groups: 1. Advertising 2. Architectural and Engineering Services 3. Antique marketing 4. Porcelain 5. Design 6. Films and Videos 7. Audio Visual Media 8. Music and Performing Arts 9. Printing 10. Computer software 11. Television and Radio 12. Arts, educational and cultural organizations	Creative economy consisted of 15 groups: 1. Design 2. Fashion 3. Advertising business 4. Films and videos 5. Broadcasting 6. Publishing business 7. Architecture 8. Performing Arts 9. Visual Arts 10 Crafts and handicrafts 11 Cultural tourism 12 Thai medicine 13. Thai food 14. Music 15. Software

From Figure 2.10 and Table 2.2 to 2.4, in this thesis shows creative economy can to add value (see Figure 2.10). Groups of Creative Economy consisted of each country (see Table 2.2 to 2.4). Crafts and Architecture are groups of Creative Economy, which can to add value. In this thesis Crafts and Architecture will add value of Teak furniture industry of Thailand.

2.5.2 Reviews of Other Literatures in Creative Economy Framework

In the previous section, the general description of the creative economy framework is given. This is to illustrate that the proposed solution to embed the Teak product with the intangible asset through carving complies with the creative economy concept. Furthermore, this is to explore the potential value adding through the creative economy framework from the handicraft and carving's perspective. In this subsection, the reviews of other literatures in the creative economy framework are then provided. This is to illustrate some of the main research issues interested by other researchers on the creative economy framework.

This paper discusses the role that the creative university will need to play in the Thai creative economy by examining the managerial issues affecting the role that the creative university which will need to play in the Thai creative economy underpinning the need to enable lifelong learning in Thailand. The research is used an interpretive approach to understand the perceptions of university management experiences in Thai private universities by using a small semi-structured questionnaire creating an a purposeful element of context. The population for this study was university managers in eighteen private universities in Bangkok. After further using Glaser's sampling processes, eighteen universities were approached. Interviews were conducted in English and took approximately one hour. The outcomes indicate that Thailand needs to build a more inclusive innovation educational system customized to support a local creative economy; introduce a creative/innovative culture from schools through to universities; provide more effective government support for lifelong learning and cheaper more effective educational provision that is open to all; reduce the divide between private and public funded universities through research collaboration. Further research is needed that takes the target population into the wider Thai private universities and other respective public universities.(Paul TJ James,2013)

In recent years, the study and debates on the value of artistic and monumental heritage of cultural events are considerable. Among the creative industries, the industry of taste contributes to the socio-economic development of non-metropolitan and countryside territories. In this paper, it was analyzed the development of the

industry of taste in Italy from the 80 examples of an interesting subtle interplay of demand and supply factors, although today Italy food is widely recognized as a cradle of food culture. From the results, it is clear that the Delphi panel agrees shows the evolution of the Italian industry of taste has been strongly driven by a process of improvement both in the level of engagement, skills and experience of customers, who have gradually transformed into prosumers, and in the improvement of quality, professional standards, and ambition of restaurants and of all the players of the food value chain in its entirety. (Martha FRIEL and Pier Luigi SACCO, 2012)

The reach is to find the factor behind the effectiveness of on-line Word-Of-Mouth network (E-WOM) for creative industries. The term creative industries was first used in Great Britain to describe industries that generate significant economic and social value from creative and knowledge-based inputs. The 102 participants were surveyed with self- administered questionnaires. The survey was multi-topical, and one of its parts concerned interactions scale, measuring declarative willingness to acquire active recommendations. The scale included 6 items (statements measured with 5 – dimensional Likert scale). The creative entrepreneurs take rather passive stance in eWOM process. The most frequently declared forms of eWOM communications include presence in the social media, mainly Facebook, and email communications, indicating not so creative approach to on-line informal communications. However, it is worth noticing, that the majority of respondents were aware of ethical aspect of eWOM engagement, as they found generating false recommendations questionable. These results suggest that to certain extent respondents repeated common opinions regarding eWOM, not probably fully aware of the nature of the process. It would be worth researching, whether, and to what extent this was due to their relative lack of business experience, lack of experience in on-line communicating to customers, or both these factors combined.(Jolanta Tkaczyk and Marcin Awdziej,2013)

The paper is to examine how entrepreneurship in creative industries which is impact on their business behavior. The context that has been neglected by literature reviews on entrepreneurship. The identifications are two main axes (being-having modes and agency-structure perspectives) relating the general field of entrepreneurship to specificities of the context of creative industries. Thus, the selected

publications are analyzed based on concomitant criteria. First, the selected publications that mention “entrepreneur” or “entrepreneurship” in the title or abstract and second, the only include academic texts that focus on creative industries or use similar vocabulary to describe them, such as cultural industry, cultural sector, media industry, arts organizations, or focus on their subset, namely music, cinema, theater, museums, and visual and performing arts. The analysis based on the intersection of two axes can lead us to make several observations. A central specificity is the conflicting relationship between art, commerce and economy. It is expected that studies on entrepreneurship remain strongly oriented towards agency perspectives, and a long tradition of economic studies on entrepreneurship lead orientation towards a having mode. Nevertheless, the studies working with a structure-being orientation are not undesirable. The being mode and the Aristotelian logic of proportion emerge as key insights for orientating entrepreneurship in both research and practice(Eduardo Davel and Fernando Fachin,2014)

This paper reviews conceptual and operational issues in defining the creative sector and its arts and cultural core. By examining how cultural sector employment is conceptualized in three pioneering cultural economy studies. Each driven is distinctive by policy agendas and constituencies. The choices are about which industries, firms and occupations to include affect the resulting size and content of the cultural economy. The criteria for Inclusion in the Cultural Economy are first, the cultural that is clearly distinguishable from other domains in the economy, second, the particular constituencies and policy arenas in mind. This commitment to policy relevance often shapes the definitions chosen and third, the available data sources. Although the multiple and of relatively high quality, are often frustratingly aggregated by industry, by occupation, and by region in ways that clash with conceptual approaches and policy needs. In comparing these three studies are shown that the Boston metro's creative economy varies in size from less than 1% of its workforce to 49%, the latter using Florida's creative class, although most cultural definitions range from 1% to 4%. In closing, there are explored how policymakers might use a combination of all three methods to produce a richer characterization of the regional cultural economy and reflect on the relevance of good numbers to cultural policy and creative region formation. (Ann Markusen and others, 2013)

2.6 Colonial Style and Architecture

As mentioned earlier, this research proposes to increase the value of the Teak product by embedding it with the intangible assets. More specifically, the intangible asset is culture and/or story which is internationally accepted. In this research, the colonial style is selected as the possible intangible asset to increase the value of the Teak product through handicrafts and carving. As a consequence, the colonial style and architecture are explained and reviewed.

Colonial Architecture first entered into Thailand in the reign of King Rama V and King Rama VI. People at that time often called the style introduced "Western Mansion." The patterns of colonial buildings can vary depending on the influences of different ethnic groups. Initially, colonial patterns were the imitation of the architecture of the colonizers' countries, which displayed in forms of buildings in the colonized countries. The patterns then were adapted to suit the environmental conditions of each local area. This type of architecture was then called "colonial architecture." Evidences of colonial buildings are now reflecting the classic influences while certain type of architecture was influenced by Romantic group as seen in buildings decorated with carved woods or commonly known as "gingerbread house." Colonial architecture was first introduced when a group of missionaries arrived in Thailand. The architecture was also called "Mission Style."

Colonial style has become an answer for residences during the period that Roman Empire ventured to colonize new territories. The lands gradually absorbed local culture and slow paced lifestyle. European colonizers also discovered new lands in Polynesia, Africa, and other countries. There can be two distinct areas of colonial style. The first style is the effort to imitate all the characteristics of buildings and architecture from the motherland as close as possible. The second style is the use of objects reflecting European lifestyle. Colonial buildings exhibit natural decorative items such as silk, wood, bronze, gold, and ivory tusks. The colors used are bright colors such as white cream, green, and yellow. Lighting is one of the most important elements in colonial architecture. Teak is heavily used for furniture in colonial style because of its unique property that can resist damages from termites and insects. Inside colonial buildings, vases, statutes, and gifts are stored and that gives an impression of a small

museum collecting samples of culture and arts from around the world. Rattan furniture has been widely used as rattan is durable material and gives impressive look under the light. On the colonized lands, indigenous animals and plants are considered exotic. Therefore, in colonial houses, there are decorative items based on the natural elements such as animal hooves or paws. Colonial style relies heavily on natural materials such as wood, soil, metal, leather, and feathers. Curtains in colonial houses are often made of silk and the colors preferred are white cream. The major concept of beauty is to create the contrast between the light background and furniture.

Colonial interior decoration became significant during the European colonization of the colonizers like England and Holland. Colonial style of America was developed around 1608 – 1830. During the reign of Britain's Queen Victoria (1837 - 1901), colonial architecture increased rapidly in the Middle East and Asia, which covered India, Myanmar, Vietnam, Indonesia, Malaysia, and Philippines. European houses were built in the colonized lands reflecting the beauty and atmosphere of peace in the Eastern world. Fine features of Western culture were synthesized with the Oriental culture. For many years, cultures from England, France, Spain, and Portugal have been incorporated in the creation of Colonial architecture in the Eastern world. Not only the colonial decoration styles were brought into the colonized lands by the colonizers, the quality of furniture was also improved by local craftsmen. Interior decorative items used in colonial architecture are often handmade as they give the warm and lively feelings. Animal features are also incorporated into furniture as seen in colonial sofa with lion paw shaped base. Ivory tusks are often placed behind sofa. Pictures in colonial houses can be the ones of turtles, monkeys, and crocodiles. Other decorative items can be amulets and talismans. In short, furniture in colonial style reflects the co-existence of human being and animals and is generally made of materials that are environmental friendly. Teak furniture is widely used as it is suitable for all climates and resists humidity. Other types of woods that can be seen in colonial style can be para wood, Eucalyptus, Asia walnut, mahogany, and rattan. In some cases, bamboo and rattan are used together, along with leather. Colonial buildings should be surrounded by relaxing and natural environment. The interior is often spacious. The walls are generally painted with white, beige, or pastel colors. In modern colonial style, wooden closets, parquets, floorboards, laminate, and ceramic tiles are being used. On

the floor, large rugs or carpets in geometric shapes and floral designs are placed to create the cozy feelings. Other items include textiles, silk pillows, and embroideries. A significant element in colonial buildings is lamp or lighting. The impression of interior also comes from candle holders, carvings, murals, chandeliers, and mirrors. Items for wall decoration can be animal horns or wood carvings in dark colors. Colonial style houses can be surrounded by exotic flowers, palm trees grown in large clay pots, and bamboo trees to create an atmosphere of freshness and warmth of the tropical forests in Asia.

2.6.1 Analysis of the Identity of Colonial Architecture

• The buildings are built in square and symmetrical shapes which are as shown in Figure 2.11.

Figure 2.11 Identity of Colonial built in square and symmetrical shapes.

• The emphasis is on the central door as shown in Figure 2.12

Figure 2.12 Identity of Colonial the emphasis is on the central door.

• The style features colonnade to protect the buildings from wind, rain, and sunlight. Colonnade was also used as the arch or facade to provide the entrance – exit area.

Figure 2.13 Identity of Colonial the Colonnade was used as the arch or facade to provide the entrance – exit area.

• The windows and doors are designed to be in the same line or row. The walls are mostly decorated with overlapped woods in tandem with the cement structure. Lotus stucco and cornice can be decorated around the eaves or the window frames(see Figure 2.14).

Figure 2.14 Identity of Colonial the windows and doors are designed to be in the same line or row.

• Extended balcony is usually built around the buildings as shown in Figure 2.15.

Figure 2.15 Identity of Colonial the extended balcony is usually built around the buildings.

2.6.2 Place of Colonial Architecture

Figure 2.16 The Dutch Embassy Residence is a Colonial house

Figure 2.16 shows the building location: 106 Wireless Road, Bangkok , Architect/Designer : Unknown Proprietor : The Dutch Embassy, Date of Construction : circa 1895-1900 AD. Conservation Awarded : 1987 AD. The Dutch Embassy Residence is a Colonial house, 2-storey, gable roofs, with a 3-storey tower. Distinguished features are the double roof of the tower and the decorative gable corners made of woodcarvings. The first owner of the house was Dr. Alphonse Poix, a French doctor who was a royal physical to King Rama V. after the WW II, the Dutch Government bought the house in 1948 to be used as a residence for the Ambassador.

Figure 2.17 The American Embassy Residence is a Colonial house

Figure 2.17 shows the building location: Wireless Road, Bangkok, Architect/Designer : Mr. Horatio Victor Baily Proprietor : American Embassy, Date of Construction : 1914 AD. Conservation Awarded : 1984 AD. The American Embassy Residence is a Colonial style building with wood structure and elevated roof. The front reception room is a large hall surrounded by windows and open to the front lawn. The rooms are with high ceilings, decorated with fretwork at light windows.

Figure 2.18 The British Embassy Residence is a Colonial house.

Figure 2.18 shows the building location: Wireless Road, Bangkok, Architect/Designer: Mr. William Alfred Rae Wood and the British Ministry of works, UK, Proprietor: the British Embassy, Date of Construction: 1923-1926 AD. Conservation Awarded: 1984 AD. The architecture is Colonial, rectangular-planned with a middle porch where the Emblem of England is embellished on the pediment. The building is well ventilated by several windows and openings, and is decorated with wood fretwork and stucco. The overall appearance is stately, resolute, and dignified. As for functions, the ground floor has been used as the embassy office and the upper floor has been the residence.

Figure 2.19 The French Embassy Residence is a Colonial house

Figure 2.19 shows the building location: Soi Rong Phasi, Charoen Krung Road, Bangkok, Architect/Designer : Unknown, Proprietor: the French Embassy, Date of Construction: King Rama IV period. Conservation Awarded: 1984 AD. The French Embassy Residence is a Colonial architecture situated on the Chaophraya riverbank. It is 3-storey wood house, with a 2-storey front porch with 2 outdoor staircases on both sides. The decorations are wood fretwork and woodcarvings in simple design, every floor surrounded by verandahs. The overall atmosphere is light, friendly and homely.

Figure 2.20 The Portuguese Embassy Residence is a Colonial house.

Figure 2.20 shows the building location: 6 Soi Captain Bush, Charoen Krung Road, Bangkok, Architect/Designer: Portuguese designer, Proprietor: Portuguese Embassy, Date of Construction: 1860 AD. Conservation Awarded: 1984 AD. The Portuguese Embassy Residence is a 2-storey Colonial style building with hipped roof and a gabled front porch, an indication of Neo-Palladian influence. The entrances on the ground floor, as well as the window frames comprise 3 connecting round arches alternated with pilasters. The grand is located on the ground floor and upper floor is flanked with verandahs along the front and rear. The entrance is decorated with blue-and-white ceramic tiles from Portugal.

Figure 2.21 River Pavilion, Bank of Thailand

Figure 2.21 shows the building location: Bank of Thailand, 273 Samsen Road, Khet Phra Nakhon, Bangkok, Architect/Designer : Mr. Emilio Giovanni Gollo, Proprietor: Bank of Thailand, Date of Construction: 1914 AD. Conservation Awarded: 2001 AD. The house was built as a residence of a princess, daughter of Prince Krommaphraya Thewawongwaropakan. She suffered an infectious disease thus this house was suitable for her. In 1996, the Bank of Thailand who has restored and used as a reception hall until now acquired it. The river Pavilion is a wood house, Colonial style design by Mr. Emilio Giovanni Gollo, Italian engineer. The north and the south are colonnades, between the columns are fitted with wood louvers sunshades and decorated with wood fretwork brackets. It is airy, comfortable and beautiful in compact scale.

In summary, the colonial style has many interesting characteristics such as the big space of building and the different type of square and arc decoration. According to reviews given above, The colonial style shows grand design for the exterior architecture and interior design as well as the functionalities. As a consequence, this is typically suitable for high and premium market.

2.7 Knowledge Engineering Methodology

In the previous section, this research proposes to utilize the intangible asset and local knowledge to increase the value of the Teak product. In this section, the knowledge engineering methodology is explained and reviewed. This knowledge engineering methodology is applied in this research as the framework and tool for the development of the relevant knowledge packs. These are the knowledge pack on the colonial style to be used in the knowledge creation for the innovative design of the Teak product and the knowledge packs on the carving and manufacturing from relevant stakeholders to design an alternative processes and pattern for the Teak product. These can be considered one of the novel contributions of this thesis.

The process of acquiring knowledge from experts and building a knowledge base is called knowledge engineering. The activity of knowledge engineering is defined in the pioneering work of Feigenbaum and McCorduck (Feigenbaum and McCorduck,1983) as the art of bringing the principles and tools of artificial intelligence research to bear on difficult applications problems requiring the knowledge of experts for their solutions. Knowledge engineering involves the cooperation of human experts in the domain working with the knowledge engineer to solve real problems. The field is related to software engineering..

Knowledge engineering can be viewed from two perspectives: narrow and broad. According to the narrow perspective, knowledge engineering deals with knowledge acquisition, representation, validation, inferencing, explanation, and maintenance. According to the broad perspective, the term describes the entire process of developing and maintaining intelligent systems. In this thesis, the researcher used the narrow definition. The knowledge possessed by human experts is often unstructured and not explicitly expressed. The knowledge-engineering process includes five major activities as

(1) Knowledge acquisition.

Knowledge acquisition involves the acquisition of knowledge from human experts, books, documents, sensors, or computer files. The knowledge may be specific to the problem domain or to the problem-solving procedures, it may be general knowledge, e.g., knowledge about business), or it may be the meta-knowledge

(knowledge about knowledge). By meta-knowledge, we mean information about how experts use their knowledge to solve problems and about problem-solving procedures in general. Byrd (1995) formally verified that knowledge acquisition is the bottleneck in ES development today; thus, much theoretical and applied research is still being conducted in this area. An analysis of more than 90 ES applications and their knowledge acquisition techniques and methods is available in (Wagner et al.,2003).

(2) Knowledge representation.

Acquired knowledge is organized so that it will be ready for use, in an activity called knowledge representation. This activity involves preparation of a knowledge map and encoding of the knowledge in the knowledge base.

(3) Knowledge validation.

Knowledge validation (or verification) involves validating and verifying the knowledge (e.g., by using test cases) until its quality is acceptable. Testing results are usually shown to a domain expert(s) to verify the accuracy of the ES.

(4) Knowledge Utilization

It is a process promoting the use of the outcomes of scientific research both outside academia and by other academic disciplines. This process frequently requires interaction between the researcher and the potential knowledge user and such interaction may occur at any stage of the research, from the formulation of the research question right through to the dissemination of the results.

2.7.1 The CommonKADS Methodology

CommonKADS are considered the leading methodology to support structured knowledge engineering. It has been gradually developed and has been validated by many companies and universities in the context of the European ESPRIT IT program. It is now the European de facto standard for knowledge analysis and knowledge-intensive system development, and many companies have adopted it in whole or partly incorporated it in existing methods. CommonKADS enables the recognition of opportunities and bottlenecks in how organizations develop, distribute, and apply their knowledge resources, so it is a tool for corporate knowledge management. CommonKADS also provides the methods to perform a detailed analysis of knowledge-intensive tasks and processes. Finally, CommonKADS supports the

development of knowledge systems that support selected parts of the business process. For details, see (Schreiber et al.,2000).

Knowledge modeling is a process of creating a computer interpretable model of knowledge or standard specifications about a kind of process and/or about a kind of facility or product. The resulting knowledge model can only be computer interpretable when it is expressed in some knowledge representation language or data structure that enables the knowledge to be interpreted by software and to be stored in a database or data exchange file, where there are three levels as followings.

(i) Task knowledge describes what goal(s) an application pursues, and how these goals can be realized through the decomposition into subtasks and inference.

(ii) Inference knowledge describes the basic inference steps required for making use of the domain knowledge. The inference level is also employed by the inference engine for retrieving required knowledge.

(ii) Domain knowledge specifies the domain-specific knowledge and information focused on the particular task. The knowledge modeling allows experts in the industry cluster to present their knowledge in graphical form, also called the knowledge map.

2.7.2 Knowledge types and knowledge map classification

First of all, it is needed to clarify what is meant by knowledge in knowledge mapping. There are two knowledge types, explicit and tacit (Pavel and Vacek, 2011) Explicit knowledge can be documented, illustrated and symbolized. On the other hand, tacit knowledge is in individuals' minds and hard to express or document. The other classification of knowledge consists of three categories. (1) Descriptive knowledge (know-what), also referred to as declarative, provides a description of an object, situations and facts or methods. (Watthananon and Mingkhwan, 2012) (2) Procedural knowledge (know-how) specifies doing something, actions or manipulations. In general, it describes a method or behavior.(Tadao,1989) (3) Strategic knowledge (know-why, know-when) is the category form which the decision process benefits the most.(Nickols, 2010) Knowledge map classification gives a general idea of the issues and helps to find the suitable problem solving method among the potential mapping techniques. Classification decreases the difficulty of determining the desired

knowledge map design for the target context (Eppler, 2008) Moreover, classification clarifies similarities and differences of the knowledge mapping techniques. Principles of classification adapted from (Suyeon et al., 2003) are the following questions:

- What is our purpose of creating a knowledge map? (“why” questions)
- Who is going to use the map, in what situation and which phase? (“When” and “To Whom” questions)
- Which domain of knowledge is the focus? (”what” questions)
- Which graphical method is preferred who is to construct it? (“how” questions)
- Where the firm’s knowledge is rooted and expected to produce? (“where” questions)

2.7.3 Knowledge mapping techniques

As mentioned, there are several mapping techniques useful for learners or open sense making communities. Through these techniques, they can create knowledge maps to explore learning materials, solve activities, systematize ideas, construct and represent their argumentation, and organize and share additional references. The comprehensive literature review led us to identification of fifteen knowledge mapping techniques. (Zhai et al., 2010).

(i) Mind Maps

Mind mapping (or ‘‘idea’’ mapping) is a representation of ideas and the relation between them in a nonlinear visual manner. Mind maps consist of a network of concepts in relation with each other. Its main help is in memory retention and organize ideas in relation together (Davies, 2011)

(ii) Conceptual Maps

Developed by Prof. Joseph D. Novak around 1972, Concept map is a structured way to help groups to develop conceptual frameworks used in planning or evaluation. (Suyeon, 2003)

Concept mapping is different with mind mapping and not to be confused thus it is more formal and structured. Starting from a question or phrase, in a ‘tree’ structured hierarchy ideas lay in layers (primary, secondary and tertiary ideas). (Yan et al., 2010)

(iii) Argument Maps

Invented by J.H. (Wigmore et al., 2000) this map is considered relatively new to help in the analysis of legal arguments. This class of technique decomposes an argument into claims, reasons and objections.It is also used for preparing and presenting arguments and for developing critical thinking skills, both individually and collectively. (Okada, 2006)

(iv) Causal Maps

Causal maps (cause maps or cognitive maps) represent the cause-effect relations between experts' opinion in a directed graph. (Sucheta, 2004) There are many diagrams known as causal maps like Ishikawa (fish bone) diagrams or cause and effect diagrams that are used to help teachers or students. (Scavarda, 2004)

(v) Knowledge Asset Map

As it comes from the name, it consists of mechanisms enabling organizations to identify their knowledge assets, their inter relations and needed knowledge to fulfill the development plans.(Ann e l., 2004) Provides a framework that allows organizations to identify the critical knowledge areas of their company. (Marr et al., 2004)

(vi) Social Network Analysis

SNA studies, measures and maps any knowledge processing element in a network of connected nodes (people, groups, organizations, computers, and est.) and captures the flow of knowledge among them.(Definition Process Mapping (online), 2004) SNA studies actors, how they blend or act in the overall network and relations, how the actions make a change in whole network.

(vii) Topic Map

Topic maps (TM) organizes knowledge describes the relations between knowledge domains and links to knowledge resource. (Yan e l., 2010) Topic Maps (TM) help to visualize information routing within organization. (Zhai et al., 2010)

(viii) Folksonomy

"A folksonomy is the collectively and/or collaboratively form of the tags that can emerge from user-generated metadata". (Kiu andTsui, 2011) Which is used instead of formal taxonomies for organizing resources. The word is a combination of the worlds 'folk' and 'taxonomy' to refer to an informal collection of related vocabulary. (Trant, 2009) A way of sorting content on the internet by social tagging; social classification generated by employees reflects the real situation of knowledge understanding.

(ix) Process Knowledge Mapping

Process knowledge mapping identifies current knowledge and needed knowledge in business process. Process knowledge mapping analyzes a business process or method to identify knowledge bottlenecks (where), knowledge requirements (what), and how to acquire them (or by who). (USAID Seminar, 2003) Process mapping aids organizations in productivity, efficiency, error omitting, aim customer satisfaction and add to profit. (Pavel, 2011)

(x) Functional knowledge mapping

It is sometimes mistaken with process knowledge mapping but functional knowledge map's main focus is on experts or people. This map illustrates each position in an organization, individual possessing that position, his skills, experiences and academic education, also depicts the social relation of all individuals and resources. Functional knowledge map provides an organizational directory of knowledge resources; inter relations of personal and their skills. (Jafari, 2009)

(xi) Competency Mapping

Competency Mapping represents organizational structure, with jobs description and personnel requirements; it does not reveal the real expertise and Individual's knowledge. (Pavel, 2011)

(xii) Information Flow Analysis

This type using complex programs, investigates formal and informal networks and processes in the enterprise and reports every knowledge resource is used by who, and how often. (Pavel, 2011)

(xiii) Petri nets

A Petri net is a graph with place or transitions as nodes. They are two parted graphs with directed edges and have formal semantics. (Rachid and Benatallah, 2003) It is a well known tool for information processing system study. (Lin et al., 1991)

(xiv) Semantic Map

As it comes from the name, this map tries to represent relation of documents and explain the data economically with semantics. (Philip and Worden, 2012) A semantic mapping technique aims to simplify implementation by building precise transforms from canonical message and document structures to 'flattened' formats where readily meaningful business names replace machine-orientated fixed attribute codes in deeply nested structures. (Kitchin and Jacobson, 1997)

(xv) Cognitive map

This map tries to show how people see their environment and captures their comprehending, learning or keeping knowledge. (Bouzine-Chameeva et al., 2001) This map facilitates the mutual understanding by depicting several views in team members and helps to reach a solution based on an integrated understanding. (Liebowitz, 2005)

2.7.4 Template for Knowledge Model

Table 2.5 Overview of analytic types (Schreiber, 2000)

Task Type	Input	Output	Knowledge	Features
Analysis	System observations	System characterization	System model	System description is given.
Classification	Object features	Object class	Feature-class associations	Set of classes is predefined.
Diagnosis	Symptoms / complaints	Fault category	Model of system behavior	Form output varies (causal chain, state, component) and depends on use made of it (troubleshooting).
Assessment	Case description	Decision class	Criteria, norms	Assessment is performed at one particular point in time (cf. monitoring).
Monitoring	System data	Discrepancy class	Normal system behavior	System changes over time. Task is carried out repeatedly.
Prediction	System data	System state	Model of system behavior	Output state is a system description at some future point in time.

Table 2.5 shows analysis Task types include classification, Diagnosis, Assessment, Monitoring, Prediction. Each Type is the knowledge that different. In this Thesis Classification template will be used to analyze the style.

Table 2.6 Classification General Characterization

Goal	Classification is concerned with establishing the correct class (or category) for an object. The object should be available for inspection. The classification is based on characteristics of the object.
Typical example	Classification of an apple. Classification of the minerals in a rock.
Terminology	**Object:** the object of which one wants to find the class or category, e.g., a certain apple.
	Class: a group of objects that share similar characteristics, e.g., a Granny Smith apple.
	Attribute: a characteristic that can either be observed or inferred, e.g., the color of an apple.
	Feature: an attribute – value pair that holds for a certain object, e.g., "color = green."
Input	The object of which the class needs to be established.
Output	The class (es) found.
Features	Classification is one of the simplest analytic, tasks, for which many methods exist. Other analytic tasks can sometimes be reduced to a classification problem. Especially for diagnosis is this.

Table 2.6 shows analysis tasks well-known analytic task type is classification. The classification of plants and animals is the prototypical example of this task type. In classification, an object needs to be characterized in terms of the class to which it belongs. The underlying knowledge typically provides for each class constraints on the values of objects features. Classification usually involves "natural" (not manmade) objects.

Knowledge engineering deals with the development of information systems in which knowledge and reasoning play pivotal roles. Managing knowledge within an organization is inconceivable without the use of advanced information systems; the design and implementation of such systems pose great organization as well as technical challenges.

2.7.5 Review of Other Literatures in Knowledge Engineering

From the software process model, use cases are described using OO (Object Oriented) notation and the interactions are formalized with MSC (Message Sequence Charts).This brings risk-driven approach. The new method proposes an agent-oriented methodology to reduced risks. The usage of well-defined syntax and semantics is for specifying interactions in multi-agent systems. This methodology integrates seven techniques of CommonKADS such as Agent modelling, Task modelling, Coordination modelling, Knowledge modelling and Organisation modelling. The new development of the coordination model is specifying the prototypical interactions between the agents. The rest of the models are subject of further improvement. (Carlos A. Iglesias and Others,2013)

There are two bottlenecks in the assessment: First, the required information stored in heterogeneous databases, the query is not easy. Second, the assessment relied on the experienced professionals and specialized domain knowledge is very complex and difficult to transfer the rules into the automated system. The CommonKADS methodology is used to review with an experienced expert assess (Knowledge Based) by using the rules of the insurance fraud prevention for comparison. The statistical techniques to explore the incidence of fraud cycle are Logistic Regression, Fuzzy C-means, Artificial Neural Network and Line Regression. The implementation of the knowledge model is using the visual rule technology, Visi-Rule or Prolog. The adjustment and weighting can be made combined with data mining technology to increase the reasoning accuracy. (Yao-Hsu Tsai and others, 2011)

The new forms of Collaborative Networks (CN) have been emerged to changes in the business environment such as cloud and grid computing. It is not only in industry, but also in service sector. The concept of Virtualization Technology (VT) and its components are needed to be understood and commonly agreed with CN. Unfortunately, there is no single formal modeling, tool, approach that covers all perspectives. A collaborative network can be observed and analyzed through different perspectives. It is a complicated because it has both internal and external organizational relationships. The new regulation needs to be defined in each business context and organization behavior. The integrated framework is combined the existed modeling

perspectives which are organizational behavior and CNO federation modeling. By using this approach, the view of Collaborative Networked Organization (CNO) becomes clear and unified. This minimizes the business negotiations and gets more business opportunities.(Morcous M. Yassa and others, 2012)

Increased demand of farm productions and depleting natural resources compelled the agriculture community to enhance the use of Information and Communication Technology (ICT) in various farming processes. The Agricultural Decision Support is developed using CommonKADS modeling framework for web based application. This is possible to develop comprehensive (not crop or task specific) decision support system for the manager a broad idea of what the support system. The model approach is developed to construct the multi-tasking and general problem content which can be break down into the smaller parts. The designated model is the component of organization, agent, task, communication, knowledge and design models. The system offers decision support for scheduling and weather based disease forecasting for the popular crops of India. The proposed framework along with the required expert knowledge, provide necessary platform on which the larger Decision Support System (DSS) can built for any crop of given locations. (Jignesh Patel and Chetan Bhatt, 2013)

Many researches in AI & Medicine have been concerned with developing methodologies. The new method is needed to go in depth for building complex systems with specific type of knowledge. PROforma is a newly developed methodology for knowledge based systems. This is intended for decision support systems and in particular for clinical procedures in the medical domain. The model supports the complete process from early knowledge acquisition. It related to requirements of medical reasoning and mapping between the languages. (Arjen Vollebregt and others, 2010)

Nowadays Knowledge Engineering is no longer simply a means of mining the knowledge from the expert. It encompasses methods and techniques for knowledge acquisition, modelling, representation and use of knowledge. This id needed new template of Knowledge Model. The developing ontology is to present the template knowledge model in a knowledge representation language that can be easily understood and shared in the knowledge engineering community. Hence OWL is used as it has

become a standard for ontology and also it already has user friendly tools for viewing and editing. The designed template can help decrease the communication gap between these two experts, which is one of the reasons for knowledge acquisition bottlenecks. The main difficulty faced during the creation of the ontology was the representation of the control structure. B. (A. Gobin and R. and K. Subramanian, 2013)

Many of Knowledge-based systems (KBSs) have been studied. The paper gathered the information about building KBS and aimed to re-use the results of KBSs' successful implementations to map the identified applications of KBSs which were different phases of knowledge management lifecycle. The knowledge-based system(s) are surveyed by the time in the 1990-2004 period. From the total of 209 projects funded by the EU are mentioned in the research. KBSs have become a basic technique applied in various current research developments, such as ambient intelligence, artificial vision, pattern recognition etc. The study confirmed that the interest in KBSs as research topic has not ceased, but the topic itself shifted toward a more secondary role - KBSs being today generally embedded in other types of systems.(Gabriela Avram, 2011)

The Malaysian Games (MG) has been held every two years by a different fourteen states. CommonKADS has been used as tools in the MG analysis to identify the problems in the MG. Knowledge Management (KM) is used to indicate the tacit knowledge in MG. Tacit knowledge is derived from personal experience. In the MG, the games management system is the core knowledge source to update users with the latest games news, contingent information, and information on medal tally and record breaking. The hosting state chooses a system based on its own specifications and provisions by the federal government. CommonKADS description of the MG organizational aspects that relate to KM initiatives organizational aspects that relate to KM initiatives. The sports event management needs its own KM framework that is most accurate and appropriate and is certainly to extend what had previously been done by CommonKADS. (Azizul Rahman Abdul Ghaffa and others, 2010)

This article reviews the current approaches to the development of an agent-oriented (AO) methodology which is similar to object-oriented methodologies but agents are not simply objects. Thus, object-oriented methodologies do not address these different aspects. Any agents can be characterised by their mental state, and object-

oriented methodologies do not define techniques for modelling how the agents carry out their inferences, their planning process, etc. The definition of the knowledge of an agent can be considered as a knowledge acquisition process, and only this process is addressed in these methodologies. Several solutions have been proposed for multi-agent systems modelling extending CommonKADS. The paper is reviewed between CoMoMAS and MAS-CommonKADS. The reviewed AO methodologies can be compared since they use the same key concepts: mental state, tasks, interactions and group modelling. They propose complementary modelling techniques, though the degree of elaboration of these methodologies is quite different (Carlos A. Iglesias and others, 2012)

The paper aims to define an ontological approach to elaborating expertise models for the CommonKADS methodology. The paper shows the construction of expertise models in conformity1 with the CommonKADS methodology, based on the building of ontologies. The OntoKADS ontology is made up of two main sub-ontologies: a problem-solving ontology (independent of CommonKADS) and an ontology of CommonKADS' modelling primitives (knowledge role). The OntoKADS ontology can be summarized as follows:

• The Knowledge Role primitive is a meta-concept (just like other primitives), i.e. a concept classifying other concepts or having them as instances.

• This meta-concept classifies participative roles in reasoning. The Inputs (a primitive specialising the Knowledge Role primitive) classify reasoning data and the outputs classify reasoning results.

• These reasoning data and results are played by Propositions which have Domain-Concepts as subjects.

• The Domain Concepts classify the objects of the domain, their qualities (attributes) and the states and processes in which these objects participate (Sabine Bruaux and Gilles Kassel,1999)

The aim is to offer new generic models in order to help the knowledge engineer to interpret the expertise documents (for example obtained after elicitation sessions); such models focus on solving problems of multiple expertise and of

explanatory knowledge acquisition.The paper shows the guidelines (GL) of developing CommonKADS method. A guideline database containing the conceptual structure of the breast cancer prognosis (and therapy) domain should have different applications. The CommonKADS was a satisfactory methodology to conceptualise prognosis, since it guided us to approach the problem in a structured way (Roberto Sacile,2013)

The demand for more efficient (business to) business processes requires the interconnection and interoperation of different information systems. But information access and integration is not an algorithmic task that is easy to solve: much knowledge is required to resolve the semantic differences of data residing in two information systems. Thus Knowledge Engineering has become a major technique for information integration. The method is used the kernel concept which is defined by two major achievements of KE research: the notion of ontologies and problem-solving methods. These two concepts provide the backbone for the information exchange between various information sources and the information integration and extraction to build structured and reusable knowledge models. The emerging application areas like Semantic Web, Information and Reasoning Services as well as Knowledge Management have an obvious need for such conceptual knowledge models (Rudi Studer and others, 2011)

2.8 Knowledge Creation

In the previous sections of this chapter, the problems and scope of this research is presented and supported by the literature reviews. This is to propose an alternative method to increase the value of the Teak product by combining the existing, universally accepted tangible asset (natural characteristics) with the intangible asset (culture, story, style) through know-how on the handicrafts and carving. This complies with the creative economy framework which states the potential room to grow for the Teak product in terms of sales and export. However, to fully realize this potential, the existing knowledge workers which are carvers and manufacturers (selected in this research) need to work together and elevate current knowledge. Hence, in order to provide the tools to do this, the theory of knowledge creation is selected and applied in the final step of the proposed framework in this thesis. More specifically, the SECI model is applied to two groups of knowledge workers mentioned above and the existing knowledge on joints is

injected in the combination process for the creation of new knowledge to develop innovative product from Teak.

2.8.1 Theory of Knowledge Creation

The knowledge creation process (**SECI**) according to Professor Ikujiro Nonaka, knowledge creation is a spiraling process of interactions between explicit and tacit knowledge. The interactions between the explicit and tacit knowledge lead to the creation of new knowledge. The combination of the two categories makes it possible to conceptualize four conversion patterns. Nonaka also suggests different 'Ba's which facilitate the knowledge conversion for his Knowledge creation model. The four conversion patterns of knowledge are illustrated in Figure 2.22. (Nonaka and Takeuchi, 1995)

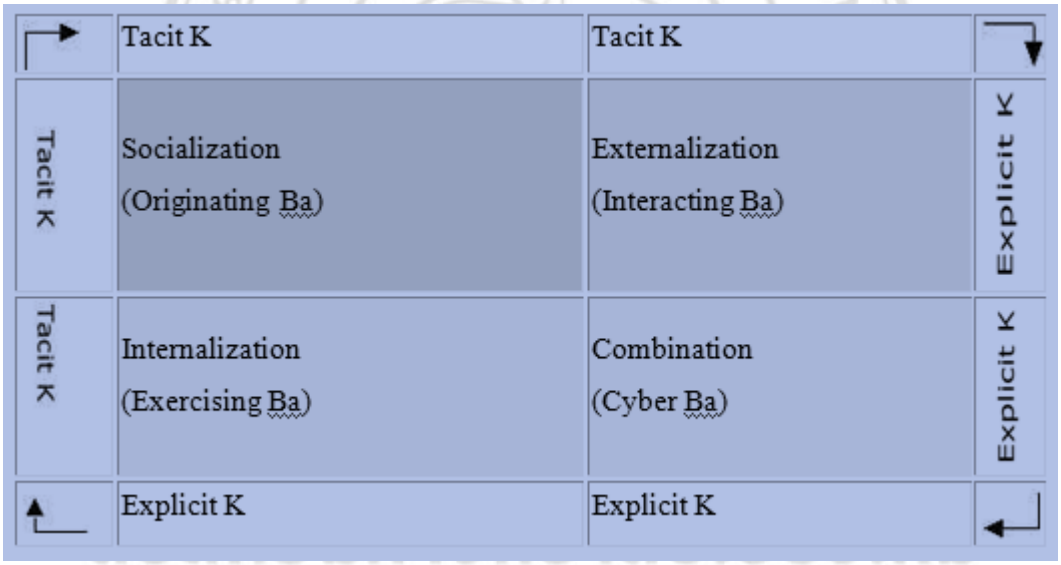


Figure 2.22 SECI model

Figure 2.22 the knowledge creation process (SECI) shows the schematic diagram of the knowledge creation framework which is selected and applied in this research. It can be seen that the SECI model is divided into four steps to allow the conversion of the tacit and explicit knowledge as well as elevating the knowledge from individual to organizational dimension. The explanation of each step is given as follows:

Socialization: This mode enables the conversion of tacit knowledge through interaction between individuals. One important point to note here is that an individual can acquire tacit knowledge without language. Apprentices work with their mentors and learn craftsmanship not through language but by observation, imitation and practice. In a business setting, on job training (OJT) uses the same principle. The key to acquiring tacit knowledge is experience. Without some form of shared experience, it is extremely difficult for people to share each other' thinking process. The tacit knowledge is exchanged through join activities – such as being together, spending time, living in the same environment – rather than through written or verbal instructions. In practice, socialization involves capturing knowledge through physical proximity. The process of acquiring knowledge is largely supported through direct interaction with people.

Externalization: Externalization requires the expression of tacit knowledge and its translation into comprehensible forms that can be understood by others. In philosophical terms, the individual transcends the inner and outer boundaries of the self. During the externalization stage of the knowledge-creation process and individual commits to the group and thus becomes one with the group. The sum of the individuals' intentions and ideas fuse and become integrated with the group's mental world.

In practice, externalization is supported by two key factors.

First, the articulation of tacit knowledge—that is, the conversion of tacit into explicit knowledge –involves techniques that help to express one's ideas' or images as words, concepts, figurative language (such as metaphors, analogies or narratives) and visuals. Dialogues, "listening and contributing to the benefit of all participants," strongly support externalization.

The second factor involves translating the tacit knowledge of people into readily understandable forms. This may require deductive/inductive reasoning or creative inference (abduction).

Combination: Combination involves the conversion of explicit knowledge into more complex sets of explicit knowledge. In this stage, the key issues are communication and diffusion processes and the systemization of knowledge. Here, new knowledge generate in the externalization stage transcends the ground in analogues or

digital signals. In practice, the combination phase relies on three processes. Capturing and integrating new explicit knowledge is essential. This might involve collecting externalized knowledge (e.g. public data) from inside or outside the company and the combining such data. Second, the dissemination of explicit knowledge is based on the process of transferring this form of knowledge directly by using presentations or meeting. Here new knowledge is spread among the organizational members. Third, the editing or processing of explicit knowledge makes it more usable (e.g. documents such as plans, report, market data). In the combination process, justification – the basis for agreement – takes place and allows the organization to take practical concrete steps. The knowledge conversion involves the process of social processes to combine different bodies of explicit knowledge held by individuals. The reconfiguring of existing information through the sorting, adding, re-categorizing and re-contextualizing of explicit knowledge can lead to new knowledge. This process of creating explicit knowledge from explicit knowledge is referred to as combination.

Internalization: The internalization of newly created knowledge is the conversion of explicit knowledge into the organization's tacit knowledge. This requires the individual to identify the knowledge relevant for one's self within the organizational knowledge. That again requires finding one's self in a larger entity. Learning by doing, training and exercises allow the individual to access the knowledge realm of the group and the entire organization. In practice, internalization relies on two dimensions:

First, explicit knowledge has to be embodied in action and practice. Thus, the process of internalizing explicit knowledge actualizes concepts or methods about strategy, tactics, innovation or improvement. For example, training programs in larger organizations help the trainees to understand the organization and themselves in the whole. Second, there is a process of embodying the explicit knowledge by using simulations or experiments to trigger learning by doing processes. New concepts or methods can thus be learned in virtual situation. (Nonaka and Takeuchi, 1995)

2.8.2 Review of Other Literatures in the Knowledge Creation

The study of literature revealed that there are three distinct phases of knowledge management: before the 90s, the early 90s and the late 90s. The paper is to present an overview of the organizational knowledge creation. In the first phase of knowledge management mangers focused on data and information processing, and on information systems management. The goal was to observe, gather, store in data bases, and manage existing knowledge in information systems as any other assets. In the second phase, knowledge management focused on the organizational knowledge sharing process. In the third phase the focus changed to the sources and stimulating factors of knowledge creation. Nonaka's contribution to the knowledge creation theory development integrates the knowledge creation process (SECI or Nonaka's knowledge dynamics model) with the place (the concept of Ba as a space for knowledge creation), and with the enabling conditions (leadership, organizational culture, learning). This theory emphasizes the importance of knowledge context and stimulating conditions within an organization. Knowledge dynamics models try to explain the organizational knowledge creation, in a larger perspective of both tacit and explicit knowledge. (Constantin BRATIANU and Ivona ORZEA,2007)

The paper presents key empirical aspects of Nonaka's model of knowledge creation. The SECI processes remain a key element but "ba", or shared context of knowledge creation, and "knowledge assets" have replaced the "ontological" dimension. Combination thus apparently consists of four kinds of activities: using language (talking, listening, reading and writing). There are weak points stand out for SECI model such as first, there are difference between information and knowledge. So Nonaka theory might therefore at best be regarded as a theory of semantic information creation rather than of knowledge creation. Second, the SECI model is a process model, and its validation must therefore require validation of processes, not simply 'content'. Third, the notions of combination and internalization have not been clearly described, and are multi-activity processes involving activities between which no common features have been demonstrated. (Stephen Gourlay,2010

The paper shows the use of the SECI model in Construction Management (CM). The work of Nonaka points out the complex relation of knowledge, knowledge creation and learning, distinguishing between tacit and explicit knowledge, and introducing contextual factors to the KM domain by pointing out the various ‘Ba’ in which the two modes of knowledge are converted. Many various CM authors develop a modified SECI model with an emphasis on the 'S' – the social interaction. The SECI model is good for the assembly lines in manufacturing companies. The SECI model with its Ba's can be applied in two ways: as an analytical tool to describe SECI conversions, but also as a base for developing Ba's for ‘high quality’ learning experiences. (Ludwig Martin and David Root,2012)

The paper shows effect on innovation Nonaka‟s SECI model of knowledge creation process by the Egyptian banks. There is limited research on knowledge management in banks in developing countries. There are just five studies, two of them were in Malaysia (Ali and Yusof, 2004; Ali and Ahmed, 2006), one was in Libya (Kridan and Goulding, 2006), one was in Jordan (Central Bank of Jordan, 2008), and the last one was in Lebanon (Karkoulian et al., 2008). These studies were just exploratory studies to increase awareness among employees and managers of the importance of adapting KM in their banks. Knowledge creation process in organizations is defined as the process of making available and amplifying knowledge created by individuals as well as crystallizing and connecting it to an organization's knowledge system. These findings considered that the effect of SECI on innovation is reflected in the process of generating ideas related to services, products and processes. Both quantitative and qualitative findings confirmed that each SECI process positively affects the innovation process, the findings highlighted that the effect share of each process is different. The multiple regression tests showed that socialisation process had the lowest effect on innovation (7.2%). This findings were confirmed when the factor analysis marked that socialisation process had the lowest share of importance among all SECI processes and when the interviewees suggested some important limitations that considerably minimised the importance of this process in banks as mentioned earlier. (Nasser Easa,2011)

The paper shows that knowledge transfer capabilities, which aims to monitor and improve the organisational processes and performance of large, complex portfolios of change. Information can only be transformed into knowledge when it is internalized by the individual. The challenges that many programme management organisations face in establishing effective knowledge transfer systems. The knowledge transfer is much higher and the SECI cycle time is faster, crucial in an increasingly dynamic corporate environment. By establishing open communications, employees feel empowered. They have access to information relating to all projects within the portfolio, not just the projects with which they are involved. Performance indicators are used, which are the basis for discussion, rather than an absolute measure of performance. (Martin Wickes and others, 2012)

In applications development, the knowledge conversions are mobilized through the use of tools (video conference, development editor) and practices (code review, design patterns, pair programming). However, the model is criticized for having strong Japanese cultural influence and little empirical basis in practice resulting in several debates on its applicability, existence/non-existence of the SECI cycle and unidirectional/multidirectional property of the conversions. The paper shows how tacit and explicit knowledge are converted (tacit-tacit, tacit-explicit, explicit-explicit, and explicit-tacit) in an empirical setting and explored what the implications are within the context of applications development using the Theory of Knowledge Creation's SECI Model. It is by immersion in a non-Japanese organization where applications development tools and practices were employed. Interviews, document reviews, and observations were used as primary data gathering techniques, which consequently required qualitative study analysis, specifically phenomenological, and discourse analysis techniques. The qualitative approach is used, the justifications for the case study, and the discussion on the data gathering and analysis techniques. This study confirms that knowledge matures and converts from one form to another; however there is not agree that knowledge conversions go through a unidirectional cycle defined in the SECI Model, in which the transitions from one mode to another are believed to be "smooth". Instead, knowledge conversions happened due to several conditions and

through non straightforward steps in the process. Specifically, this can be done by presenting the knowledge conversion concept defined in the Theory of Knowledge Creation as applied in applications development may be used and/or revised to effectively manage knowledge between ICT professionals such as application developers, quality assurance testers, and other possible sources of knowledge (tutorial videos, technical documents, etc.). By understanding the implications of the employment of tools and practices to the conversion of knowledge, ICT professionals become more aware of their vulnerabilities caused by internal (self) and external (environment) factors, which then become possible areas for improvements. (Christobal Cayaba and Zelinna Pablo,2013)

SECI model proposed by Nonaka and Takeuchi is very influential in knowledge management community. The aim of this study is to continue this discussion and to explore the limits of applicability of the SECI model in Russian cultural context because

1. the interrelationship between culture and knowledge management has been recently recognized, both on the level of national ,

2. knowledge creation has received much less attention from cross-cultural perspective than the knowledge sharing process,

3. the most of the culture-related knowledge management literature leaves aside the fundamental question of whether the models used to describe knowledge-related processes are culturally biased. What is the conclusion: can SECI be applied in the Russian cultural context or not? Based on our idea that the cognitive processes themselves are culturally universal, we believe that four knowledge conversion modes of SECI apply in Russian context. However, taken into account specifics of the Russian context, we propose that in order to support smooth functioning of these modes, the set of tools managers need to implement, has to differ from what Nonaka and Takeuchi promote. Such set of actions can be focused both on leveraging the conditions and tools that are similar to Japan, and on compensating the differences. What particular set of actions can fit best Russian companies to support knowledge creation, is an interesting question for further research. Yet, based on our analysis, some ideas and hypotheses

can be formulated. The deeper apprehension of the cultural roots and limits of applicability of basic knowledge management concepts will enrich both the understanding of the phenomenon of knowledge in organizations), and practical efficiency of knowledge management interventions through the wider repertoire of metaphors.(Tatiana Andreeva and Irina Ikhilchik,2013)

2.9 Framing Solution Methodology Based on Literature Review

This research applied a globally accepted principle of Creative Economy with the addition of economic value. Knowledge and skills in wood carving were used to enhance the aesthetic elements, which were congruent with Creative Economy. In addition, style was emphasized to add more value and to blend with local culture. The focus was Colonial style furniture. Supply chain in Teak furniture as well as knowledge workers in Teak furniture industry were analyzed focusing on manufacturing and carving. Knowledge engineering was adopted to capture, analyze, and synthesize knowledge of the 2 groups of knowledge workers; the manufacturers and carvers. IPO template was selected as the framework for designing questions to draw tacit knowledge and later to present the knowledge as explicit knowledge. SECI model was implemented in the process of knowledge sharing between the 2 groups of workers to obtain a new set of knowledge, from which the two groups of workers can benefit and added value can be generated.