Appendix A:

Ceramic Cluster Analysis by NESDB

A.1. General Information

General Information about Cluster	
Location	Lampang Province Upper Northern Thailand
Economic Sector	Ceramic Industry
Product	Tableware, Decorative Item and Souvenir
Supporter	Ceramic Center
Funding	National Innovation Agency (NIA) of Thailand
Potential	Group 4 : High Potential
Groups	1) Ceramic cluster in Lampang 2) Ceramic cluster in Chiang Mai 3) Ceramic cluster in Rachabury 4) Ceramic cluster in Om-Noi 5) Ceramic cluster in Sarabury

A.2. Diamond Analysis

Criteria	Analysis
Government	(+) Local government set provincial strategy as the ceramic center of Asian. (–) Lack of continuous supporting from government to improve product, design and market.
Firm strategy, Structure and Rivalry	(+) Most are SMEs which manufacture by OEM and ODM. (+) Large enterprises focus on exporting by client's order. (+) Many supports from organizations to develop dynamic and sustainable cluster. (+) Focus on niche market than mass market. (+) Cross-linked between food, hotel and ceramic industry. (+) Establishment of National Ceramic Center in Lampang. (–) Strong rivalry in small enterprises by cutting price and copying the design. (–) OEMs are not motivated to develop their design. (–) Lack of own branding in ceramic industry (–) Production cost such as raw material, logistic and fuel are increasing. (–) SMEs lack of knowledge and experience in exportation.
Factor Condition	(+) Largest source of high quality white clay in the country. (+) Availability of LPG factory in the area, which is the main fuel for production. (+) Availability of local high-skilled craftsmen and designer. (+) Located in the middle of the northern Thailand, connected to many provinces which provide the advantage in term of logistic. (+) 17 electrical substations are in service for the factory. (+) Most of raw materials can be purchased in the province. (–) Most of machines have to import from foreign country. (–) Labors lack of responsibility in their task. (–) Entrepreneur lack of awareness in industrial and production standard.

| Criteria	Analysis
Related and Supported Industries	(+) The correlation between related industries is existed e.g. tourism, handicraft, construction and decoration. (+) Availability of ceramic association and ceramic center in the province. (+) Supported by National Innovation Agent (NIA) to create own branding. (+) Distributed production process to the competent factory in the cluster. (−) Low degree of relation with academic institutes. (−) Lack of industry and academic institute who develop technology and machine for production in the supply chain. (−) Weakness of linkage of supply chain in ceramic industry. (−) Clustering in of ceramic enterprises in Lampang still lack of strong collaboration.
Demand Condition	(+) Demanding in the country still has good trend, major market is in Bangkok. (+) Medium to High level customer and foreign customer give important to quality of product. (+) Large enterprises keep track the preference of customers via many channels. (−) Foreign market affect from termination of GSP (Generalized System of Preferences) privilege by European Union (EU). (−) Small enterprises could not access to information about trend and preference of customers. (−) Domestic customers do not concern the quality of the product; feel that Lampang's ceramic is low to medium quality.

A.3. Ceramic cluster's supply chain
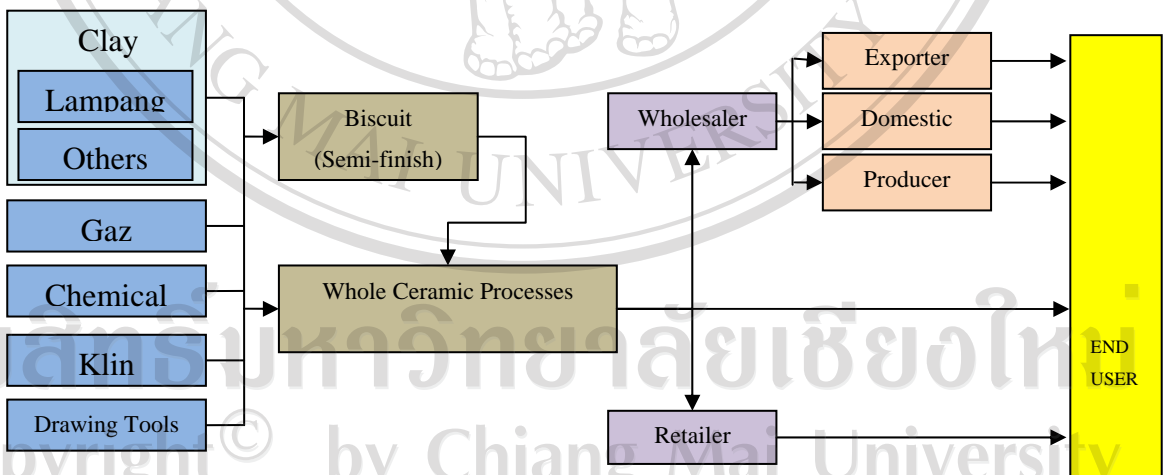
Figure A.2: Supply chain of Lampang's ceramic cluster

A.4. Business cycle of Lampang's ceramic cluster

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
P-1	Obtain information about new global trend	Summer					Winter						
P-2	Design new product												
P-3	Find market opportunity				BIG+BIH	Germany Ceramic Fair		Germany Ceramic Fair		BIG+BIH			Lampang Ceramic Fair
P-4	Contact customer												
P-5	Product development												
P-6	Manufacturing			Peak Manufacturing				Peak Manufacturing					
P-7	Shipping				Peak Shipping				Peak Shipping				
P-8	After sales service												
P-9	Sales mosaic, B and C grade products	Grade B				Grade C and Mosaic					Grade B		

Figure A.3: One-year cycle of ceramic business in Lampang
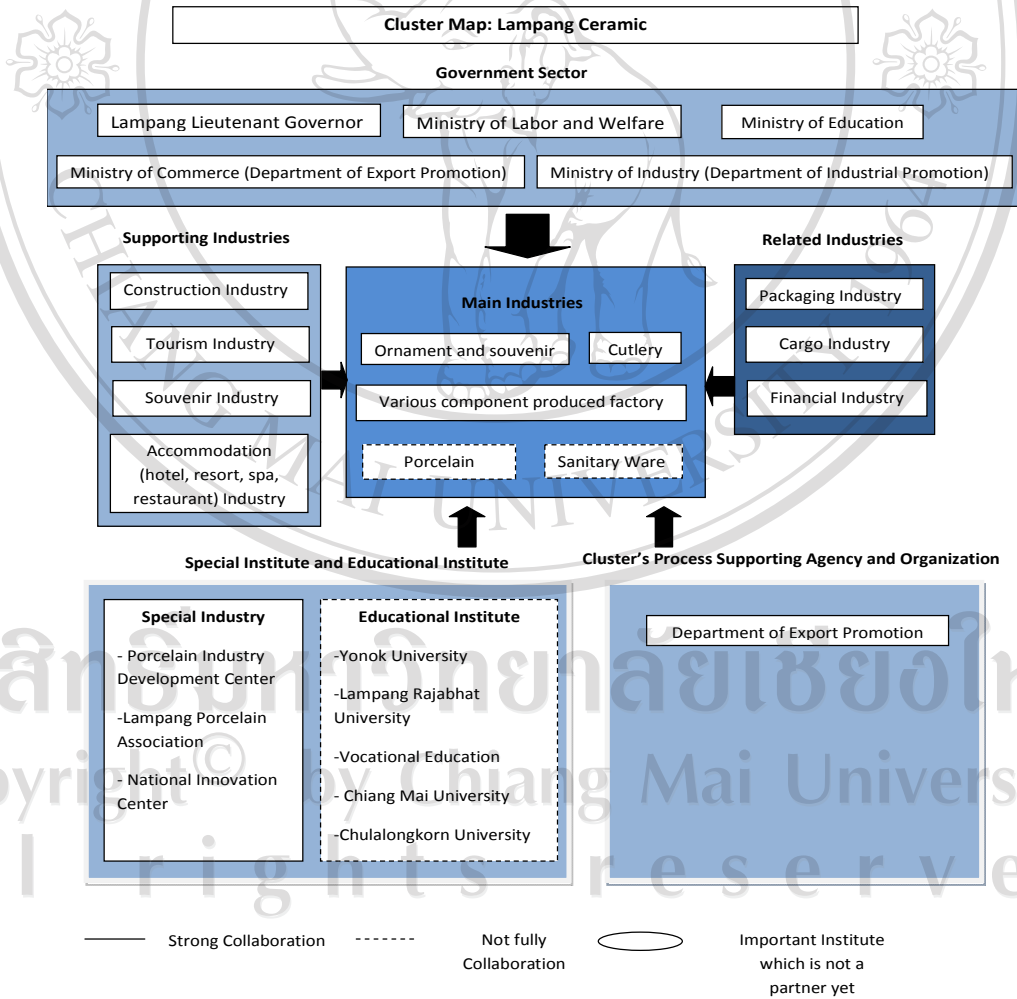
A.5. Cluster Map

Figure A.1: Ceramic cluster map

Appendix B:
SECI Model

B.1. Nonaka's Sprial Model

Nonaka and Takeuchi [Nonaka 95] propose a model of the knowledge creating process to understand the dynamic nature of knowledge creation and to manage such a process effectively which consists of 3 elements:

1 **SECI** (Socialization, Externalization, Combination, and Internalization)

2 **Ba** (a Japanese word: translated as a place or a shared context in which knowledge is shared, created and utilized through interaction)

3 **Knowledge Assets** (company-specific resources that are indispensable to create values for the firm)

These 3 elements interact with each other organically and dynamically. The knowledge assets of an organization are mobilized and shared in 'Ba' whereas the tacit knowledge held by individuals is converted and amplified by the spiral of knowledge through:
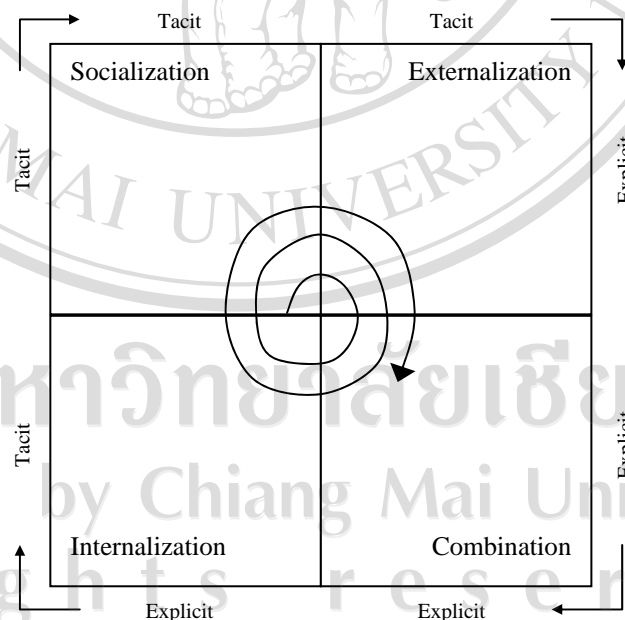

Figure B.1: Nonaka's SECI model [Nonaka 94]

Organizational knowledge transfer is occurred when members exchange their knowledge. The individual knowledge is able to transform to social knowledge in two modes i.e. socialization and externalization. Accordingly, social knowledge can be

transformed to individual knowledge by combination and internalization. The details of each mode in the SECI model are described below:

- **Socialization**: is the process of sharing experiences, thereby creating tacit knowledge such as mental models and technical skills. Tacit knowledge can be obtained without the use of language (i.e. through observation, imitation and practice);
- **Externalization**: is the process of articulating tacit knowledge in the form of explicit concepts such as metaphors, analogies, hypotheses and models;
- **Combination**: is the process of systemizing concepts into a knowledge system by combining different bodies of explicit knowledge. Explicit knowledge is transferred through media such as documents, meetings, e-mail and phone conversations. Categorizing this knowledge can lead to the generation of new knowledge;
- **Internalization**: is the process of converting explicit knowledge to tacit knowledge and is closely related to learning by doing.

The *knowledge spiral* is a model for creating and transferring knowledge in the organization. These four processes aim at creating competitiveness of organization from fresh knowledge of members. As same as the industry cluster, the competitiveness was developed from the collaboration of members in core and supporting cluster. The new knowledge was jointly created from cluster activities such as marketing, product development, training, etc.

Appendix C:

Questionnaire Outline

Questionnaire No……………
Date.........Month................Year..........
Interviewer...................................

Questionnaire (for ceramic manager or owner(
Research Subject: *Knowledge Sharing and Collaboration in the Cluster*

Part 1: General information about company

Company name...Cluster Name…………….…….

Address...

Running this business for ....year(s) Duration of being a member of cluster………year(s)

1. Your company producing which kind of ceramic product?) Can answer more than one

    ( ) Table ware   Ratio...................%

    ( ) Hotel Accessory   Ratio...................%

    ( ) Spa Accessory   Ratio...................%

    ( ) Gift ware   Ratio...................%

    ( )Garden ware   Ratio...................%

    ( ) etc. please identify.   Ratio...................%

2. Which type of product manufacturing that your company working) Can answer more than one

    ( ) OEM: Original Equipment Manufacturing   Ratio...................%

    ( ) ODM: Original Design Manufacturing   Ratio...................%

    ( ) OBM: Original Branding Manufacturing   Ratio...................%

    ( ) etc. please identify...   Ratio...................%

3. Which is your distribution channel) Can answer more than one(

    ( ) Sale to End User   Ratio...................%

    ( ) Sale to Retailer   Ratio...................%

    ( ) Sale to Wholesaler   Ratio...................%

    ( ) Sale to Exporter   Ratio...................%

    ( ) Sale to Buyer Agent   Ratio...................%

    ( ) etc. please identify...   Ratio...................%

4. Approximate sales ratio in domestic and international
      Domestic.............................%   International................................%

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5. Please mark √ in the box that equal to your expectation and satisfaction for your cluster

Level of expectation for the collaboration in the cluster before you joined					Topics	Level of satisfaction for the collaboration in the cluster after you joined.				
Most expect Least expect						Most satisfy Least satisfy				
5	4	3	2	1		5	4	3	2	1
					5.1 For exchanging information/knowledge and create business network					
					5.2For consulting and solving the problems together					
					5.3For increasing opportunity to acquire supporting from government					
					5.4For reducing production cost, such as aggregate purchase quantity and negotiate with the supplier					
					5.5For reducing marketing cost, such as investing together for exhibiting in ceramic fair					
					5.6For reducing research and development cost, such as co-invest in developing new formula of ceramic product.					
					5.7For reducing human resource development cost, such as organizing training together					
					5.8For reducing cost of building the infrastructure, such as requesting for some infrastructure investment from government					
					5.9For improve the innovation for products and services together					

Part 2: Activities in the cluster

6. What is the major activities that you have done with your cluster
)Please mark √ in the parenthesis and able to answer more than one(
   ( ) 6.1 Meeting or exchange information/knowledge between members of the cluster
   ( ) 6.2 Meeting or exchange information/knowledge between cluster and government, academic and financial institute
   ( ) 6.3 Organize training course or seminar for workers
   ( ) 6.4 Visual education for domestic and international market
   ( ) 6.5 Join the R&D for products or packaging
   ( ) 6.6 Plan and solve problem of production together
   ( ) 6.7 Share order to the companies in the same cluster
   ( ) 6.8 Grouping together to have more power to negotiate with supplier, buyer or government
   ( ) 6.9 Joint funding among the cluster
   ( ) 6.10 Find more alliance to join in the cluster
   ( ) 6.11 Exhibit in ceramic fair in domestic or international
   ( ) 6.12 Invest public relation together, such as website, media
   ( ) 6.13 Create new market channel together, such as setting a showroom for the member
   ( ) 6.14 Setup a company to sales products of members
   ( ) 6.15 Etc. please
   identify..…………………………………………………………………

Part 3: Information and communication technology that used in the SMEs

7. Is your company using these technology and how often of usage?
   (Please mark √ in the box below (

Technology	Very often	Frequently	Seldom	Never
Technology for collaboration				
7.1 Telephone/Fax/Mail				
7.2 E-mail				
7.3 Messaging Tools				
7.4 Web-based Application				
Technology for designing				
7.5 CAD/CAM				
7.6 Design Automation				
Technology for production				
7.7 Material Management				
7.8 Process Automation				
7.9 Accounting				
Technology for marketing				
7.10 Website				
7.11 e-Commerce/Online Store				
Technology for CRM				
7.12 Customer Database				
7.13 Delivery				
7.14 After Sales				
Technology for HRM				
7.15 Training				
7.16 Evaluation				
7.17 Resource Development				

Part 4: Willing to share information and knowledge of the company

Definition for level of collaboration
Core Cluster: Ceramic producers
Cluster: Ceramic producers + Government agents + Academic institutes + Supportive industries
Anonymous: People, Company or Organization that are not related to your cluster

8. Do you willing to share these information or knowledge to each level of collaboration below
   (Please mark √ in each level of collaboration)

Topics	Anonymous			Cluster			Core Cluster		
	Strong 3	Medium 2	Low 1	Strong 3	Medium 2	Low 1	Strong 3	Medium 2	Low 1
8. General Information, such as contact address, e-mail, capability of company									
8.2 Business opportunity, such as details of exhibition, low interest loan, training									
8.3 Techniques and Experience, such as product selection for international fair									

Part 5: Characteristic of collaboration in the cluster

9. How do you think about your cluster for characteristic of collaboration below?

Topics	Strongly agree	Agree	Not sure	Not agree	Strongly not agree
Environment					
9.1 Long history of collaboration in the community.					
9.2 The collaborative group is seen as a legitimate leader in the community.					
9.3 A favorable political and social climate.					
Membership Characteristics					
9.4 Mutual respect, understanding, and trust for members and their respective organizations.					
9.5 An appropriate cross section of members.					
9.6 An appropriate cross section of members.					
9.7 Your company sees the benefit from collaboration.					
9.8 In case of any problem about collaboration between you and your partner, you and your partner solve the problem together.					
9.9 In case of any problem about collaboration between you and your partner, you and your partner try to avoid the conflict.					
Processes and Structure					
9.10 Members share a stake in process and outcome.					
9.11 Multiple layers of participation.					
9.12 Flexibility in both structure and methods.					
9.13 Development has clear policy guidelines.					
9.14 Members understand their roles.					
9.15 Adaptability or the ability of the collaborative group to sustain itself in the midst of changes.					
9.16 You can abort the collaboration without losses.					
9.17 It is easy to stop the collaboration and start a new one.					
9.18 Cost of establishing the collaboration would be high.					
9.19 Partner has a good collaboration and co-development.					
9.20 Member actively seeking for suggestions for improvement from partner.					
Communication					
9.21 Open and frequent communication.					
9.22 Communication is complete and reliable.					
9.23 Communication is exact and on time.					
9.24 Established informal and formal communication links.					
9.25 Partner keeps informing useful information to each other.					
9.26 Partner share information about them to each other.					
9.27 You share some confidential information among the cluster.					
Purpose					
9.28 Clear attainable goals and objectives that are communicated to all partners and can be realistically attained.					
9.29 Cluster has the unique purpose.					
9.30 The collaboration achieves the objective.					
9.31 Member in the cluster have same vision.					
Resource					
9.32 Cluster has sufficient funds, staff, materials, and time to maintain the collaboration.					
9.33 Cluster has skilled leadership to take care of the collaboration.					

Annex D: Knowledge Models

In order to build the Knowledge Management System, 8 meetings with the ceramic cluster members were organized. The knowledge from the experts in each process in the specific task was represented in form of the knowledge models which is presented below.

Meeting: M1-T-A01

Topic: The methodology for accessing to the new market opportunity for SMEs

Template selected:

1. Planning template
2. Classification template

Derived Knowledge Model:

Template used	Knowledge Elicitation	Map ID	Map Topic
Planning template	Accessing to new market opportunity	T-A01	Accessing to new the market
Classification template	Products selection	I-A01-014	Product selection for international trade fair
		I-A01-007	Product selection for domestic trade fair
		I-A01-010	Product selection for domestic road show
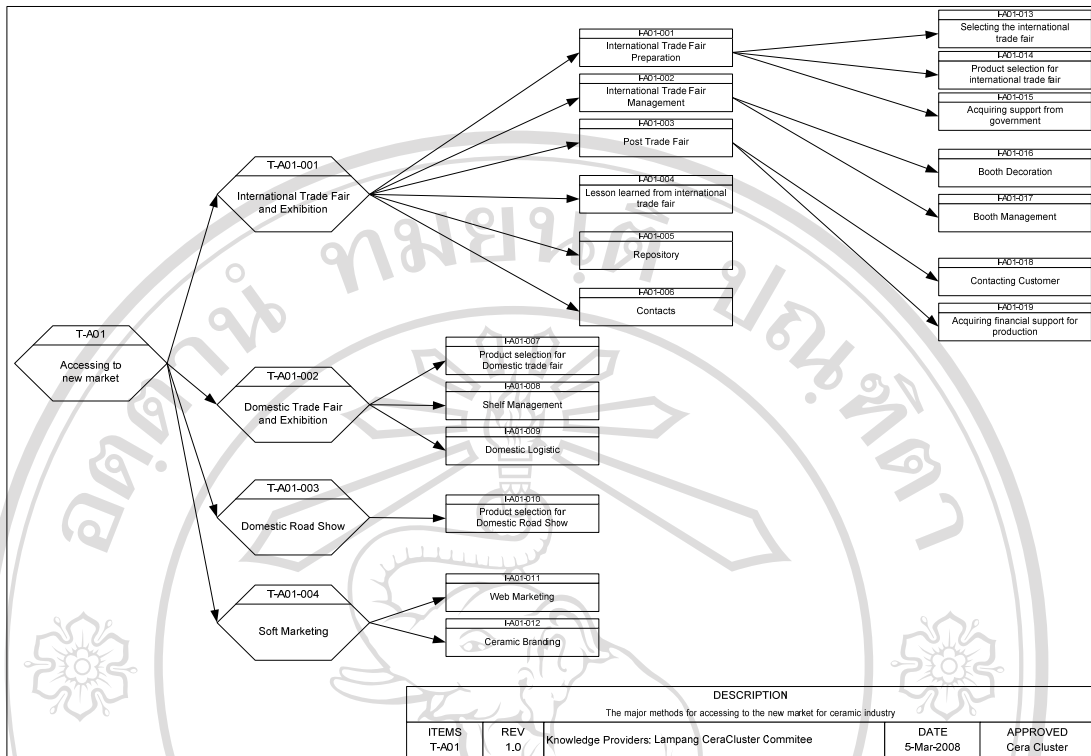
Figure D.1: Accessing to new the market (T-A01)
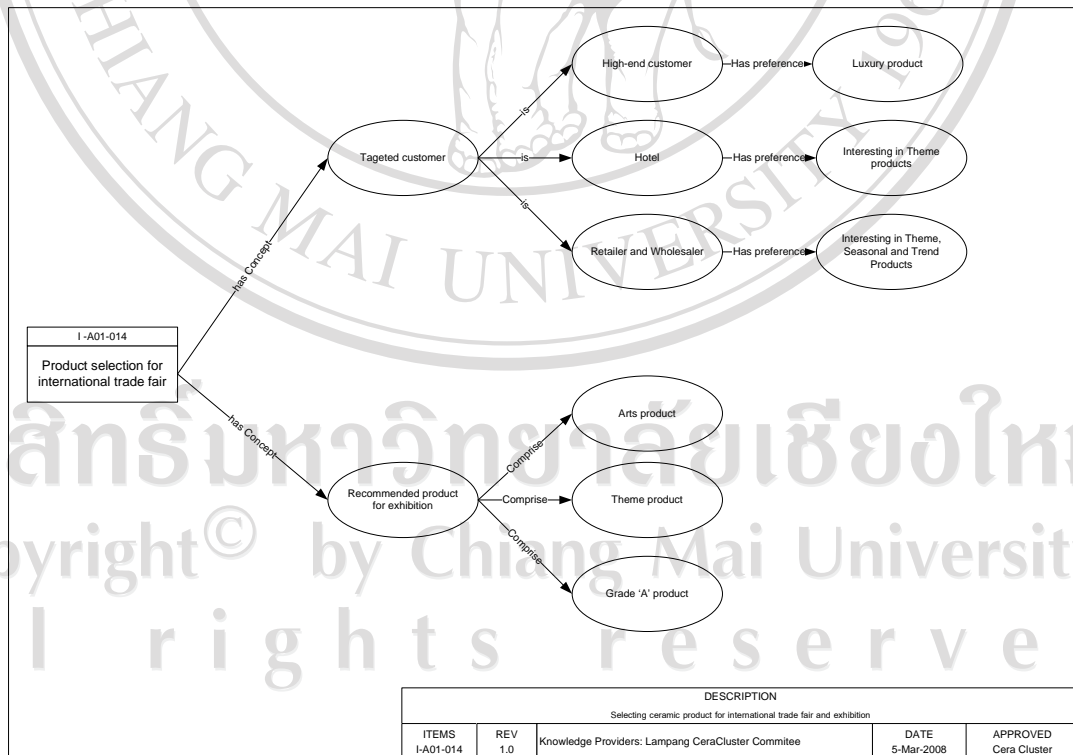
Figure D.2: Product selection for international trade fair (I-A01-014)
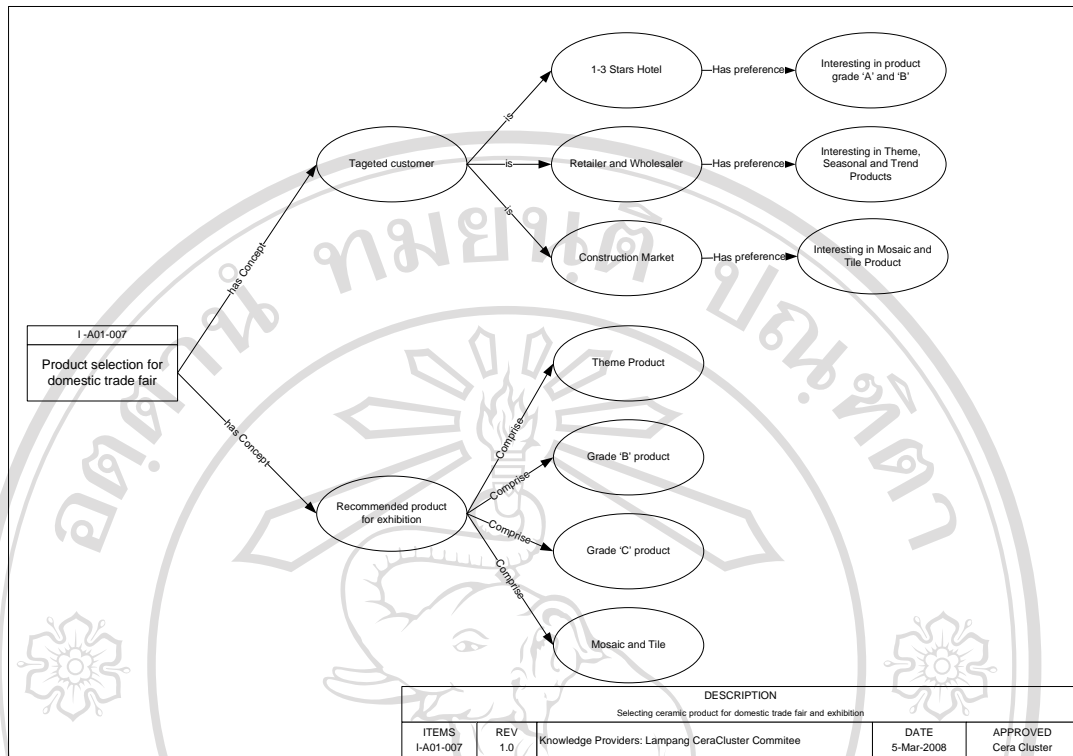
Figure D.3: Product selection for domestic trade fair (I-A01-007)
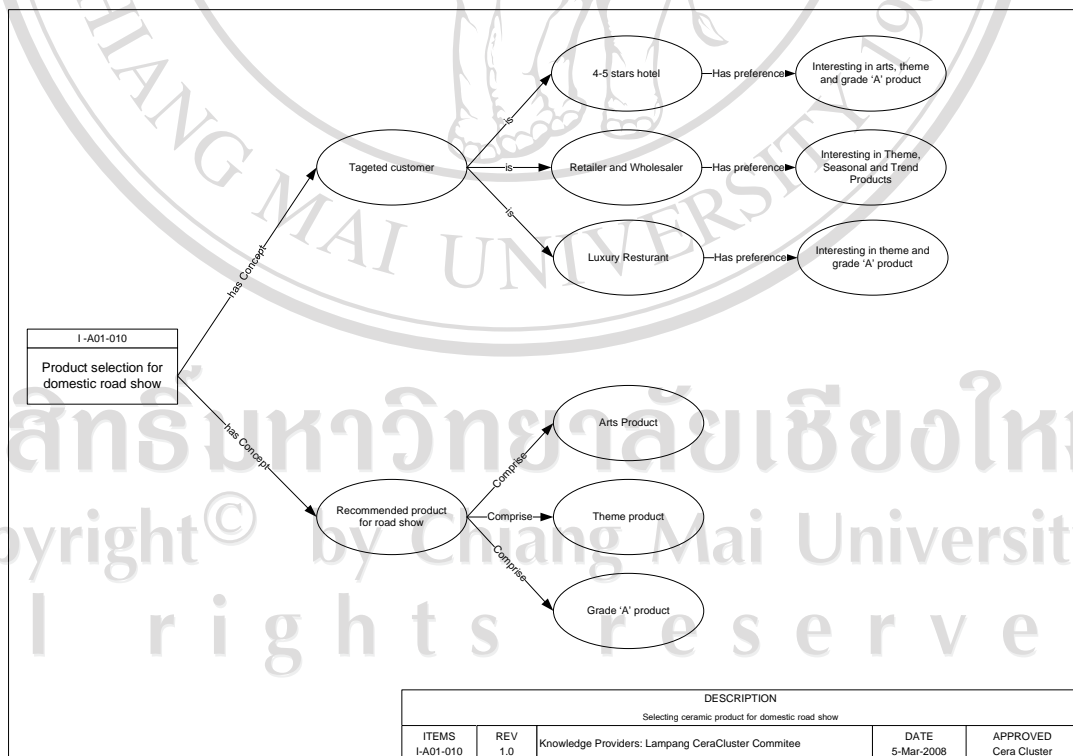
Figure D.4: Product selection for domestic road show (I-A01-010)

Meeting: M2-T-A01

Topic: Lesson learned from international trade fair (case study of UAE)

Template selected:

1. Diagnosis template

Derived Knowledge Model:

Template used	Knowledge Elicitation	Map ID	Map Topic
Diagnosis Template	Lesson learned from international trade fair in UAE	I-A01-004	Lesson learned from international trade fair
	Recommendation for UAE market	I-A01-020	Recommendation for UAE market
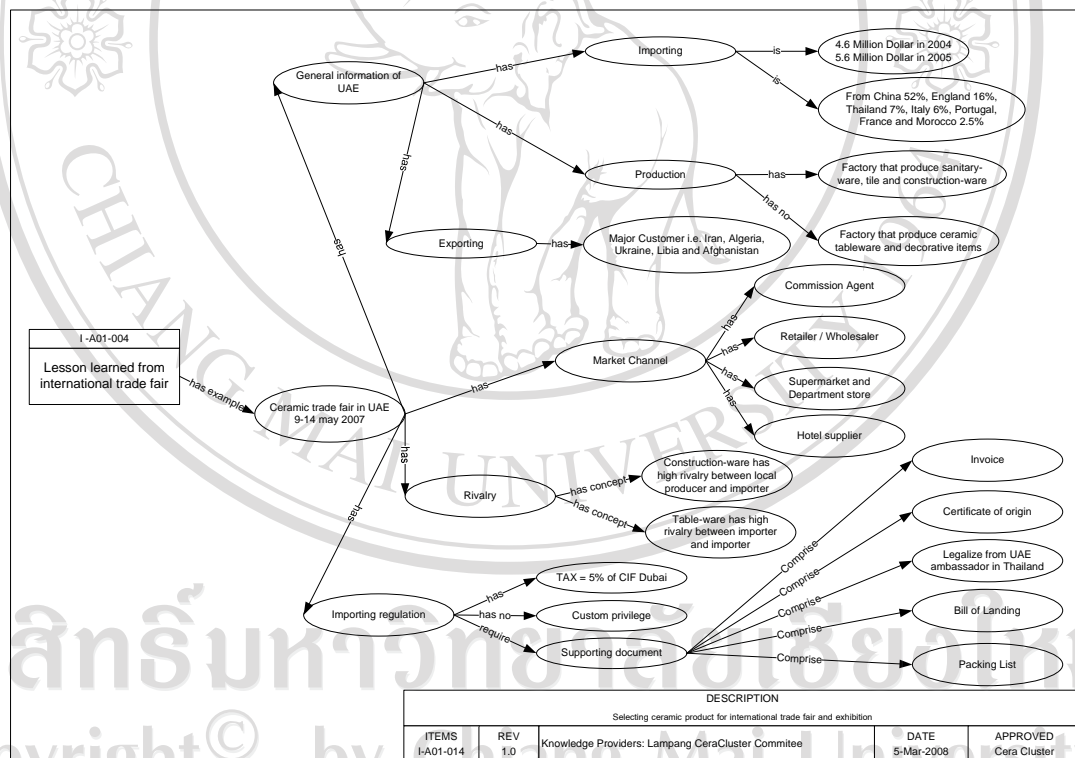
Figure D.5: Lesson learned from international trade fair (I-A01-004)
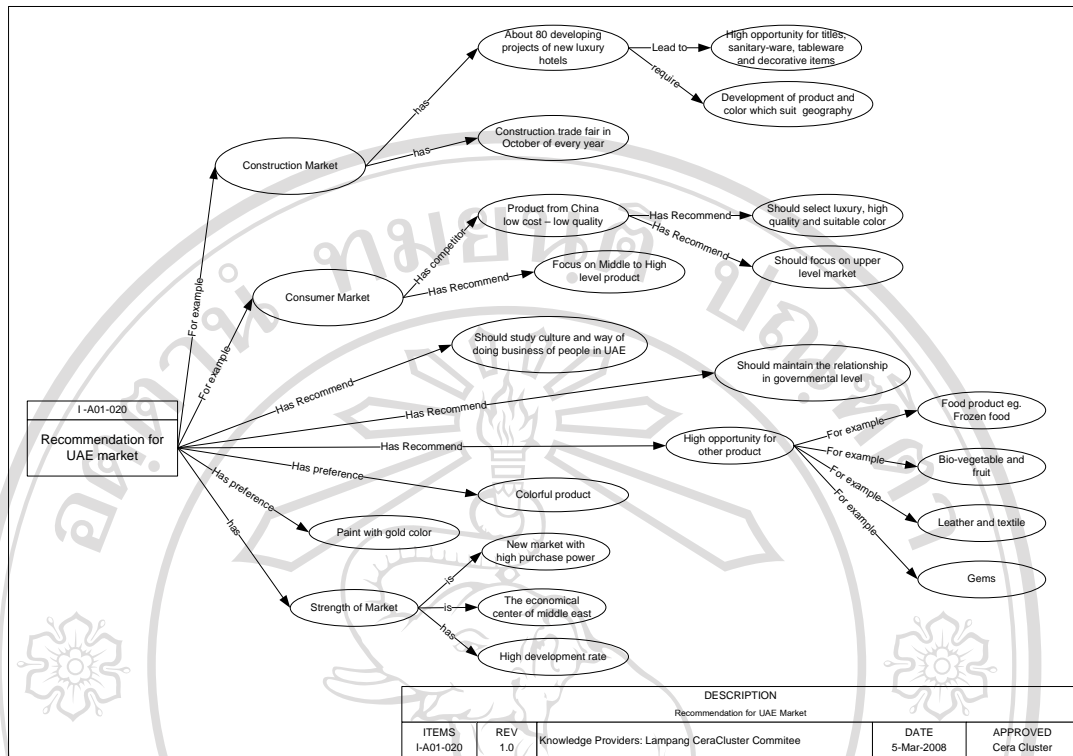
Figure D.6: Recommendation for UAE market (I-A01-020)

Meeting: M3-T-A01

Topic: Acquiring support from the government

Template selected:

1. Classification template
2. Diagnosis template

Derived Knowledge Model:

Template used	Knowledge Elicitation	Map ID	Map Topic
Classification template and Diagnosis template	Acquiring support from the Department of Export Promotion	I-A01-015	Acquiring support from the government
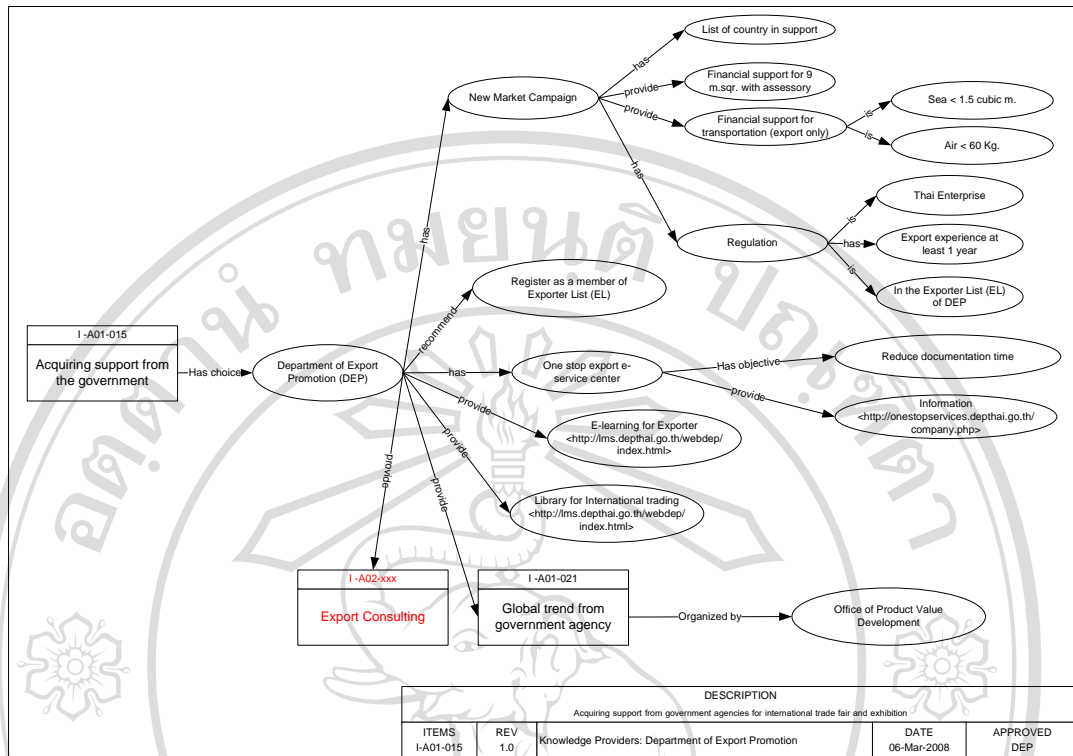
Figure D.7: Acquiring support from the government (I-A01-015)

Meeting: M4-T-A01

Topic: Acquiring support from the government

Template selected:

1. Classification template

Derived Knowledge Model:

Template used	Knowledge Elicitation	Map ID	Map Topic
Classification template	Acquiring global trend from department of export promotion	I-A01-021	Global trend
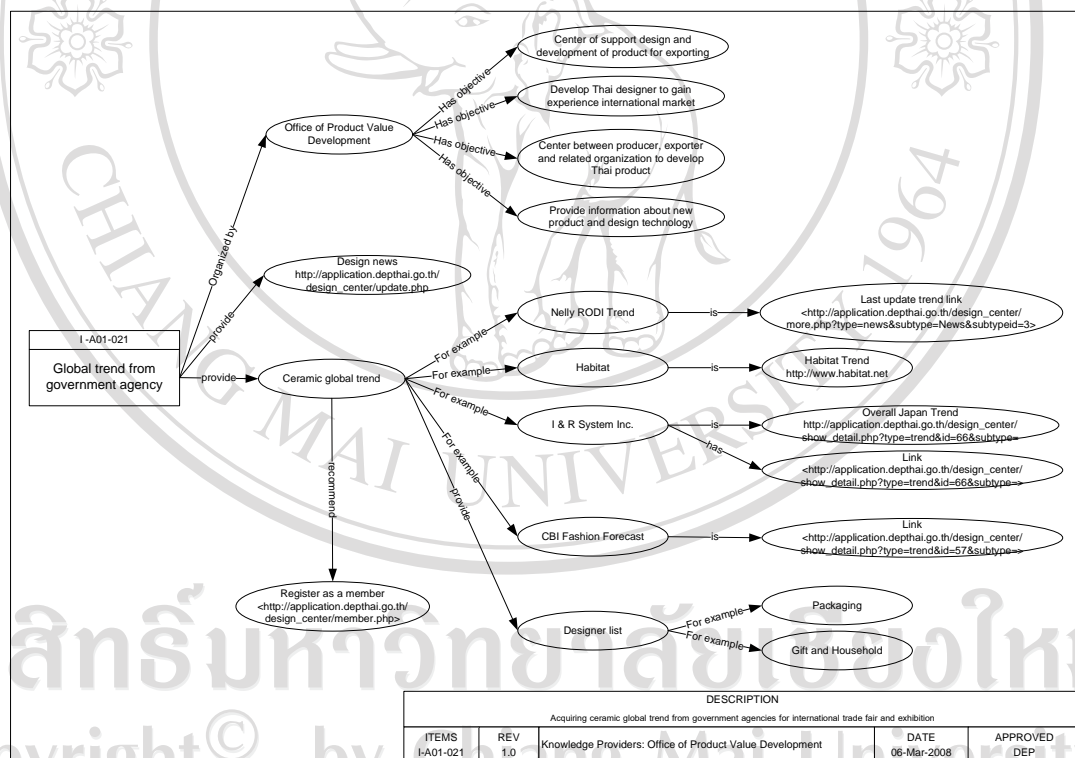
Figure D.8: Global trend (I-A01-021)

Meeting: M5-T-A01

Topic: Booth Decoration and Management

Template selected:

1. Classification template
2. Diagnosis template

Derived Knowledge Model:

Template used	Knowledge Elicitation	Map ID	Map Topic
Diagnosis template	Booth Decoration	I-A01-016	Booth decoration
Classification template	Booth Management	I-A01-017	Booth management
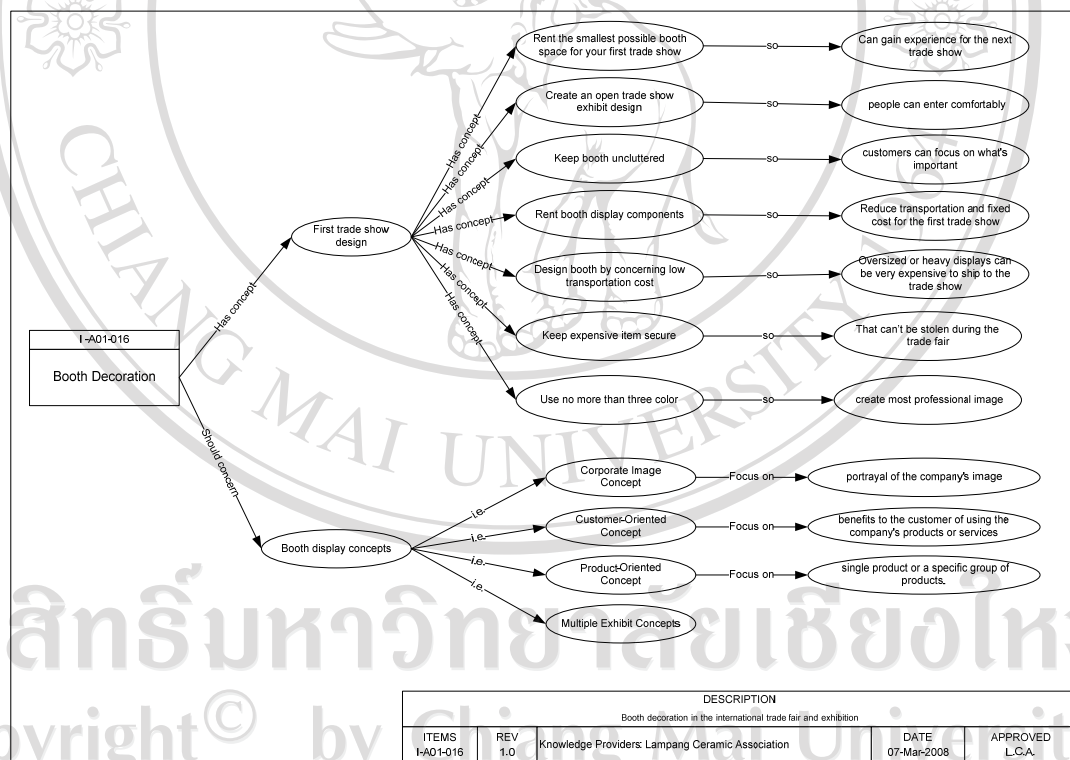
Figure D.9: Booth decoration (I-A01-016)
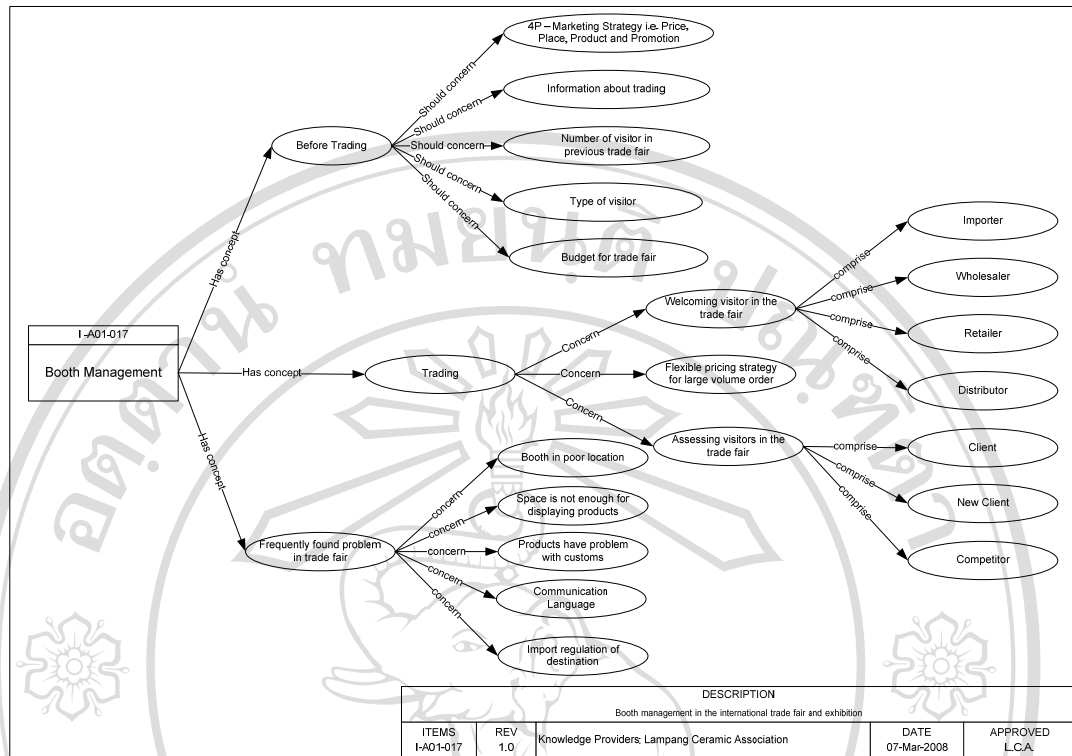
Figure D.10: Booth management (I-A01-017)

Meeting: M6-T-A01

Topic: Acquiring financial support from financial institute

Template selected:

      1. Diagnosis template

Derived Knowledge Model:

Template used	Knowledge Elicitation	Map ID	Map Topic
Diagnosis template	Financial support for trade fair exhibitor	I-A01-019	Acquiring financial support from financial institute
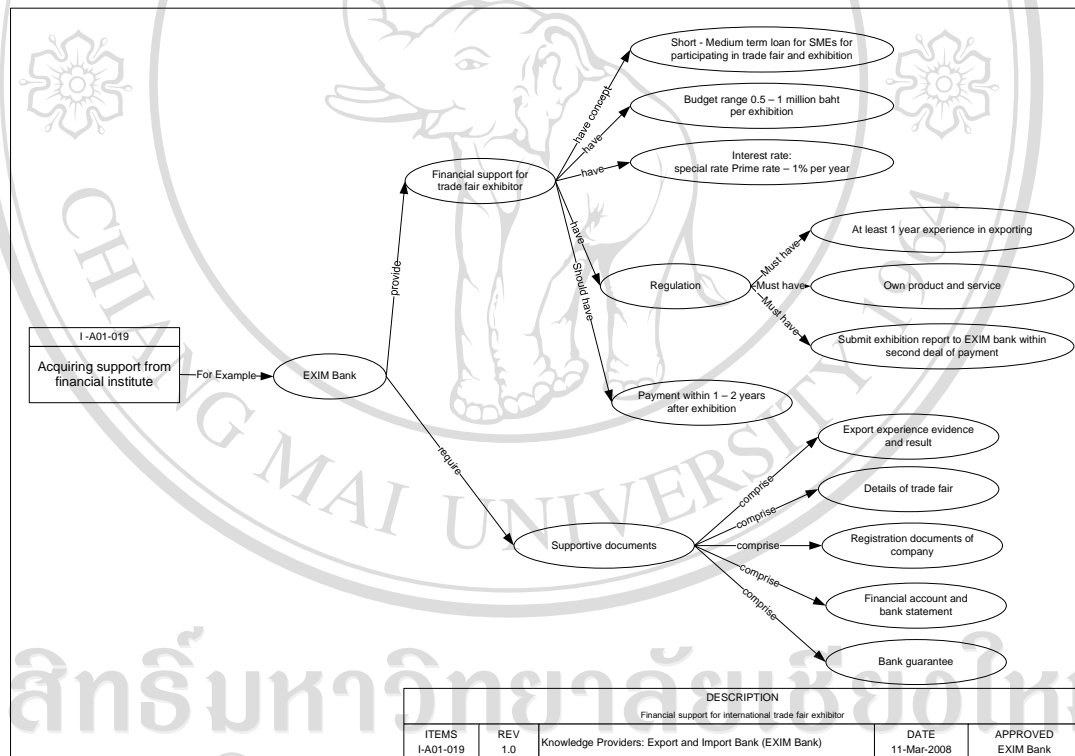
Figure D.11: Acquiring financial support from financial institute (I-A01-019)

Meeting:　　M7-T-A01

Topic:　　Web Marketing / Ceramic Branding

Template selected:

　　　　1.　Diagnosis template

Derived Knowledge Model:

Template used	Knowledge Elicitation	Map ID	Map Topic
Diagnosis template	Web Marketing	I-A01-011	Web Marketing
Diagnosis template	Ceramic Branding	I-A01-012	Ceramic Branding
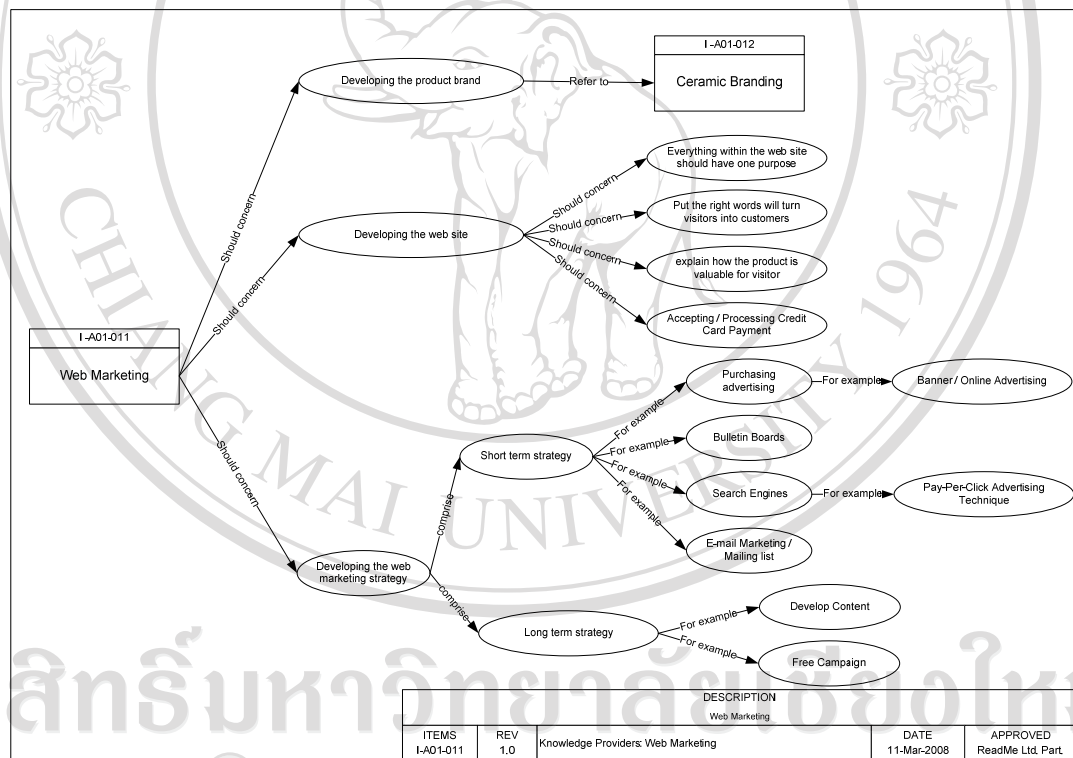
Figure D.13: Web marketing (I-A01-011)
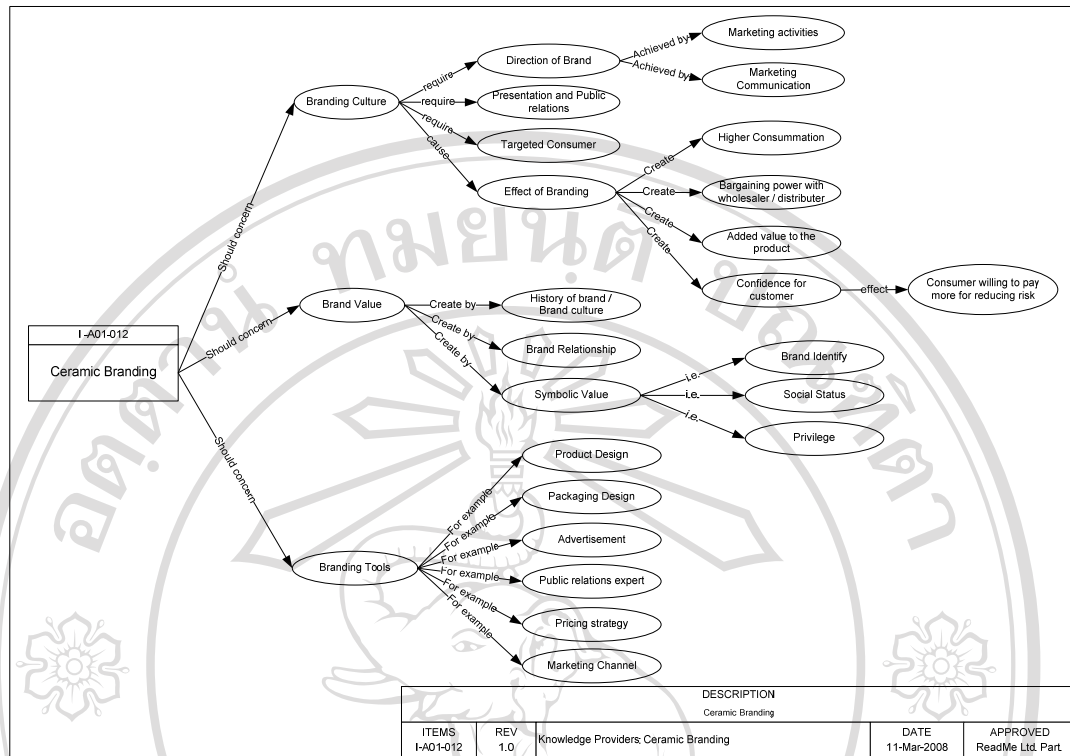
Figure D.14: Ceramic Branding (I-A01-012)

Meeting: M8-T-A01

Topic: Repository and Contacts

Template selected:

1. Classification template

2. Diagnosis template

Derived Knowledge Model:

Template used	Knowledge Elicitation	Map ID	Map Topic
Classification template	International trade fair repository	I-A01-005	Repository
Classification template	International trade fair contacts	I-A01-006	Contacts
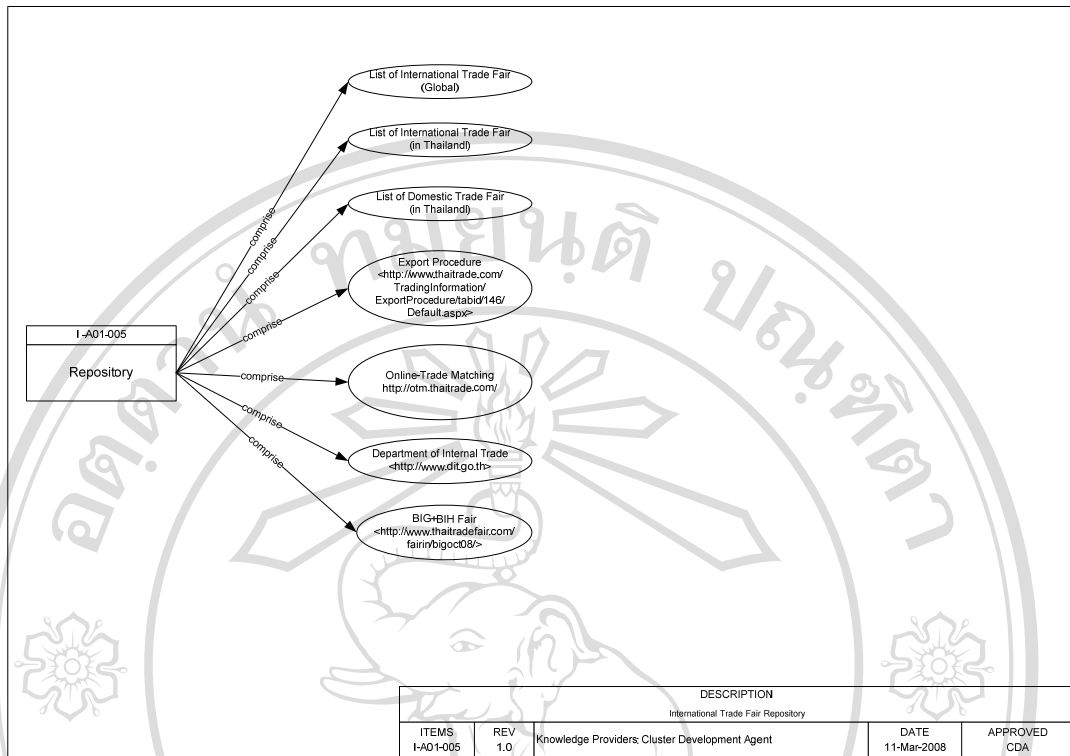
Figure D.15: Repository (I-A01-005)
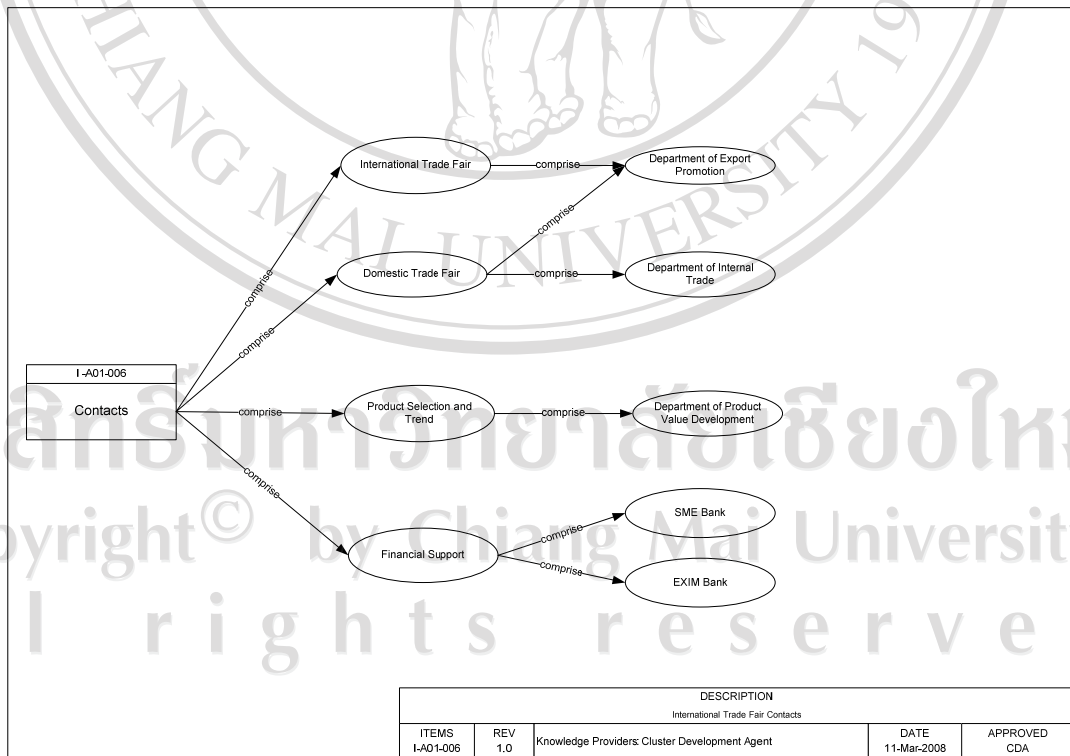
Figure D.16: Contact (I-A01-006)

Appendix E:

KMS Specification

E.1. Requirement Specification

User Requirement Specification for the Cluster Knowledge Management System

RS-1   **Support Knowledge Creation**
    RS-1.1   **Provide opportunity**   *(Refer to FS-1.2 and FS-5.3)*

- *Add new event on collaborative calendar*
- *Add new news on the push/pull news system*

    RS-1.2   **Create knowledge card**   (Refer to FS-2.1)

- *Add new knowledge card to CK-Card system*

    RS-1.3   **Add contact**   *(Refer to FS-1.1)*

- *Add new user to the cluster map*

RS-2   **Support Knowledge Sharing**
    RS-2.1   **Push/Pull news system**   *(Refer to FS-4)*

- *Manage news system*
- *Push news to subscribers/users/user groups*

    RS-2.2   **Collaborative calendar system**   *(Refer to FS-5.1 and FS-5.2)*

- *Display events from the calendar*

    RS-2.3   **Display collaborative knowledge card**   *(Refer to FS-2.1 and FS-2.2)*

- *Display selected knowledge card*
- *Browse over the knowledge card*
- *Search knowledge card from the keyword*

    RS-2.4   **Display cluster map**   *(Refer to FS-3.1)*

- *Visualize cluster map*

RS-3   **Support Knowledge Reuse**
    RS-3.1   **Search opportunity**   *(Refer to FS-4, FS-5.1 and FS-5.2)*

- *Display events from C-Calendar*
- *Display news*
- *Display knowledge map*

    RS-3.2   **Search knowledge card**   *(Refer to FS-2.2 and FS-10)*

- *Knowledge card search*
- *Advanced knowledge search over the knowledge card*

    RS-3.3   **Search contact**   *(Refer to FS-3.2)*

- *Search contact in the cluster map*

RS-4   **Support information storage**   *(Refer to FS-1)*

- *Cluster map database*
- *C-Calendar database*
- *Push/Pull news database*
- *Knowledge card database*

RS-5   **Support Communication**
    RS-5.1   **Text communication**   *(Refer to FS-6)*

- *Live chat system (asynchronous)*

    RS-5.2   **Voice and video communication**   *(Refer to FS-7)*

- *Video conferencing system (synchronous)*

    RS-5.3   **Support mobile device integration**   *(Refer to FS-8)*

- *Voice over Internet Protocol (VoIP) system*

RS-6   **Support Users' Personalization**   *(Refer to FS-9.1, FS-9.2 and FS-9.3)*

- *Customizable knowledge map search*
- *Customizable news view*
- *Customizable calendar view*

RS-7   **Support Users' Visualization**   *(Refer to FS-9.4 and FS-9.5)*

- *Customizable cluster map view*
- *Customizable collaborative system*

PS-8   **Support Knowledge System Management**   *(Refer to FS-1)*
- *Manage user information*
- *Mange user group*
- *Manage user's VoIP account*

E.2. Functional Specification

Functional Specification for cluster knowledge management system

FS-1   **Administrative Functions**
    FS-1.1   **Manage User:** Cluster map manipulation
- *Manage user information*
- *Manage user group*
- *Manage user VoIP account*

    FS-1.2   **Manage News:** Push/Pull information
- *Add/Delete news subscribers*
- *Mange push/pull news*

    FS-1.3   **Manage Opportunity:** Collaborative calendar
- *Manage events*
- *Manage events categories*

    FS-1.4   **Manage Virtual Collaboration:** Collaborative platform
- *Enable/Disable collaborative system*

FS-2   **Collaborative Knowledge Card Functions:**
    FS-2.1   **Collaborative Knowledge Card**
- *Knowledge card metadata*
- *Semantic Knowledge map*
- *Wiki content*
- *Knowledge card links*

    FS-2.2   **Knowledge Map Search**
- *Knowledge card search*
- *Wiki content search*

FS-3   **Cluster Map Functions:** Collaborative platform
    FS-3.1   **Cluster Map Visualization**
- *Display User by group*

    FS-3.2   **Cluster Map Visualization**
- *Search User in the cluster map*

FS-4   **Push/Pull News Functions:** Display news and events from the news database
- *Display news topic*
- *Display news content and image (if available)*

FS-5   **Collaborative Calendar Functions:** Display list of events from c-calendar
    FS-5.1   **Display Week calendar**
- *Display only this week event for displaying on the portal page*

    FS-5.2   **Display Month Calendar:** display on the calendar page
- *Display all events in the selected month for displaying on the calendar page*

    FS-5.3   **Add New Event to Calendar**
- *Add a new event to the calendar system*

FS-6   **Live Chat Functions:** Allow user to send text message to online users

- *Display online users on the KMS*
- *Send text message to all users who is online on the KMS*
- *Send personal text message to a user who is online on the KMS*
- *Send text message to admin (CDA)*

FS-7   Video Conference Functions: Allow user to create virtual meeting room
    FS-7.1   Broadcast audio to online users
- *Enable/Disable audio broadcasting*
    FS-7.2   Broadcast video to online users
- *Enable/Disable video broadcasting*
- *Display video from users' webcam (if enabled)*
    FS-7.3   Display online users in the conference room
- *Show list of online users*

FS-8   Voice over Internet Protocol (VoIP) Functions: Allow use to communicate to mobile devices
    FS-8.1   Web-based VoIP Phone
- *VoIP phone (web service)*
    FS-8.2   VoIP Server
- *Manage users VoIP account*
- *Allow connection to PSTN (Public Switched Telephone Network)*
- *Handle all VoIP connections*

FS-9   Widget Functions: Allow user to personalize information from the KMS
    FS-9.1   Customizable knowledge map search
- *Search engine connection: allow user to connect to advanced search engine on the KMS from their client application.*
- *Customizable search result*
    FS-9.2   Customizable news view
- *Display news by (all new / today / this week / this month)*
    FS-9.3   Customizable calendar view
- *Display events by (today / this week / this month)*
- *Display events by category*
    FS-9.4   Customizable cluster map view
- *Display contact by group of user*
- *Display online/offline contact*
    FS-9.5   Customizable collaborative system
- *Enable live chat function on client application*
- *Enable video conference function on client application*
- *Enable VoIP function on client application*

FS-10   Advanced Search Functions: Allow user to search over the collaborative knowledge card system
    FS-10.1   Knowledge card search
- *Search knowledge card name which match with the search keyword*
    FS-10.2   Wiki content search
- *Search wiki content which contains the search keyword*
    FS-10.3   Forward inference search
- *Search domain knowledge which related with the search keyword*
    FS-10.4   Backward inference search
- *Search domain knowledge which related with the search keyword*

E.3. Design Specification

Design Specification for the Cluster Knowledge Management System
DS-1   **Area Level 0: Global Level**
     DS-1.1   **Top Menu Frame**
- *Home*
- *Cluster Map*
- *Calendar*

     DS-1.2   **Main Content Frame**
- **Portal**: display week calendar, push/pull news and subscribing box *(Refer to RS-2:FS-3)*
- **Cluster Map:** display visualized cluster map and provide XML feed for cluster contact or contact list *(Refer to RS-2:FS-3)*
- **Calendar:** display events within the selected month and represent by categories. *(Refer to RS-2:FS-5)*

DS-2   **Area Level 1: Cluster Level**
     DS-2.1   **Top Menu Frame**
- *Home*
- *Cluster Map*
- *Calendar*
- *Knowledge Card*
- *Advanced Search*

     DS-2.2   **Main Content Frame** *(Extended from DS-1.2)*
- **Knowledge Card:** display knowledge card and enable knowledge card browsing *(Refer to RS-1.2:FS-2)*
- **Advance Search:** display knowledge card search input box and represent search result in format of list or map *(Refer to RS-3.2:FS-10)*

DS-3   **Area Level 2: CoP Level**
     DS-3.1   **Top Menu Frame**
- *Home*
- *Cluster Map*
- *Calendar*
- *Knowledge Card*
- *Advanced Search*

     DS-3.2   **Main Content Frame** *(Extended from DS-2.2)*
- **CoP Knowledge Card:** display knowledge card for particular community of practice *(Refer to RS-2.3:FS-2)*

     DS-3.3   **Widget**
- **Search:** allow customizable search *(Refer to RS-6 and RS-7:FS-9.1)*
- **News:** allow customizable news display *(Refer to RS-6:FS-9.2)*
- **Events:** allow customizable events display *(Refer to RS-6:FS-9.3)*
- **Knowledge Card:** allow user to view knowledge card from client application *(Refer to RS-7:FS2)*
- **Collaborative System:** allow customizable collaborative platform *(Refer to RS-5.1 and RS-5.2:FS-7 and FS-8)*
- **VoIP Phone:** allow user to connect to VoIP server via client application *(Refer to RS-5.3:FS-8)*

DS-4   **Area Level 3: Administrator Level**
     DS-4.1   **Top Menu Frame**
- *Home*
- *Cluster Map*
- *Calendar*
- *Knowledge Card*
- *Advanced Search*
- *Administrator Control Panel*

DS-4.2   **Main Content Frame (Extended from DS-3.2)**
- **News Management:** allow admin to add new news and distribute information to users *(Refer to RS-1.1:FS-1.2)*
- **Subscriber Management:** allow admin to manage news subscribers *(Refer to RS-1.1:FS-1.2)*
- **Cluster Map Management:** allow admin to mange users information and cluster map *(Refer to RS-1.3:FS-1.1)*
- **Collaborative Platform Management:** allow admin to enable/disable live chat and conference room *(Refer to RS-8:FS-1.4)*

E.4. System Specification

System Specification for the Cluster Knowledge Management System

SS-1   **Hardware Specification**
    SS-1.1 Server Specification
- Processor: Intel Pentium4 3.0 GHz minimum
- Memory (RAM): 2048 MB recommended
- Hard drive space: minimum 50 MB
- Network Interface Card 100 Mbit/sec

    SS-1.2 Client Specification
- Processor: Intel Pentium4 1.0 GHz minimum
- Memory (RAM): 512 MB recommended
- Hard drive space: minimum 20 MB
- Network Interface Card 100 Mbit/sec

SS-2   **Network Specification**
- Wired or Wireless Network
- Domain Controller Service
- Fixed IP address

SS-3   **Software Specification**
    SS-3.1   **Server Specification**
        SS-3.1.1 KMS Server (Linux distribution Debian)
- Apache Web Server
- MySQL
- PHP 5.0
- Red5 flash server

        SS-3.1.2 VoIP Server (Linux distribution Debian)
- Apache Web Server
- PHP 5.0
- Asterisk 1.4.0 or compatible
- Festival TTS
- Mbrola TTS Voice Pack

    SS-3.2 Client Specification
- Microsoft Internet Explorer 6.0 or Mozilla Firefox 3.0
- Adobe Flash Player 9.0 plug-in
- Adobe AIR Installer

E.5. Test Specification

Test Specification for the Cluster Knowledge Management System

E.5.1. Demonstration Test Specification

Test No. DT-01
2. Test Name: Demonstration Test
3. Test Description:
- Demonstration by ceramic Anonymous user, support cluster, core cluster and cluster development agent.

4. Assumption:
- Attendants are experts who have domain knowledge about case study.

5. Test Case Examples: Exporting ceramic product

6. Feed Back:

Issue	Proper	Fair	Poor	Comment
DT-1 Anonymous user				
View events				
View push/pull news				
Subscribe news				
View cluster map				
DT-2 Support cluster member				
View events				
View push/pull news				
Subscribe news				
View cluster map				
Browse knowledge card				
Search knowledge card				
DT-3 Core cluster member				
View events				
View push/pull news				
Subscribe news				
View cluster map				
Browse knowledge card				
Search knowledge card				
Search knowledge from widget				
View news from widget				
View events from widget				
View knowledge card from widget				
Collaborate via text, voice and video from widget				
Call user mobile device via VoIP server from widget				
DT-4 Cluster development agent				
Add new news to system				
Distribute news to all/selected users				
Manage subscriber list				
Manage user information				
Manage collaboration platform				

7. Questions: N/A
8. Logging System: Video Recorder

E.5.2. Functional Test Specification

1. Test No.: FT-01
2. Test Name: Functional Test
3. Test Description:
- Functional Test done by administrator, core cluster and support cluster

4. Assumption:
- Attendants are expert and decision maker for ceramic cluster

5. Test Case Examples:
  Functional Specification Testing

6. Feed Back:

Issue	Proper	Fair	Poor	Comment
FS-1 Administrative Functions				
FS-1.1 Manage User				
FS-1.2 Manage News				
FS-1.3 Manage Opportunity				
FS-1.4 Manage Virtual Collaboration				
FS-2 Collaborative Knowledge Card Func.				
FS-2.1 Collaborative Knowledge Card				
FS-2.2 Knowledge Map Search				
FS-3 Cluster Map Functions				
FS-3.1 Cluster Map Visualization				
FS-3.2 Cluster Map Visualization				
FS-4 Push/Pull News Functions				
FS-4.1 Display news				
FS-5 Collaborative Calendar				
FS-5.1 Display Week calendar				
FS-5.2 Display Month Calendar				
FS-5.3 Add New Event to Calendar				
FS-6 Live Chat Functions				
FS-6.1 Live Chat				
FS-7 Video Conference				
FS-7.1 Broadcast audio to online users				
FS-7.2 Broadcast video to online users				
FS-7.3 Display online users in the conference room				
FS-8 Voice over Internet Protocol (VoIP) Functions				
FS-8. Web-based VoIP Phone				
FS-8.2 VoIP Server				
FS-9 Widget Functions				
FS-9.1 Customizable knowledge search				
FS-9.2 Customizable news view				
FS-9.3 Customizable calendar view				
FS-9.4 Customizable cluster map view				
FS-9.5 Customizable collaborative system				
FS-10 Advanced Search Functions				
FS-10.1 Knowledge card search				
FS-10.2 Wiki content search				
FS-10.3 Forward inference search				
FS-10.4 Backward inference search				

7. Questions: N/A

8. Logging System: Video Recorder

E.5.3. Operational Test Specification

1. Test No.: OT-01
2. Test Name: Operational Test
3. Test Description:
- Operational Test done by cluster members on real environment.

4. Assumption:
- Attendants are CDA, Expert and Knowledge worker who participated in each activity.

5. Test Case Examples:
    Ceramic trade faire exhibition
- Pre-trade faire Preparation (Preparation, Meeting, Follow up)
- Problem solving during trade faire (Preparation, Meeting, Follow up)
- Post-trade faire meeting (Decision, Problem Solving)

(*Follows the sequence diagram*)

6. Feed Back:

Issue	Proper	Fair	Poor	Comment
OT-1 Pre-trade faire preparation				
…				
OT-2 Problem solving during trade faire				
…				
OT-3 Post-trade faire meeting				
…				

7. Questions: N/A
8. Logging System: Video Recorder

Appendix F:

Technologies

F.1. Flex-based application

In the technological point of view, the knowledge management system in this study relied on three major technologies i.e. Adobe Flex, PHP and AJAX. Flex is a useful tool which allows the knowledge system developer to create the Rich Internet Applications. It also provides an ability to design and implement human-centered user interface without worrying about browser limitation [AFCS 09]. Flex application is based on MXML and ActionScript language. MXML is an XML-based markup language that is primarily used to layout application display elements and GUI. ActionScript is an ECMAScript-compliant object-oriented programming language that is primarily used for application logic. The generic concept of Flex application was shown in figure F.1.
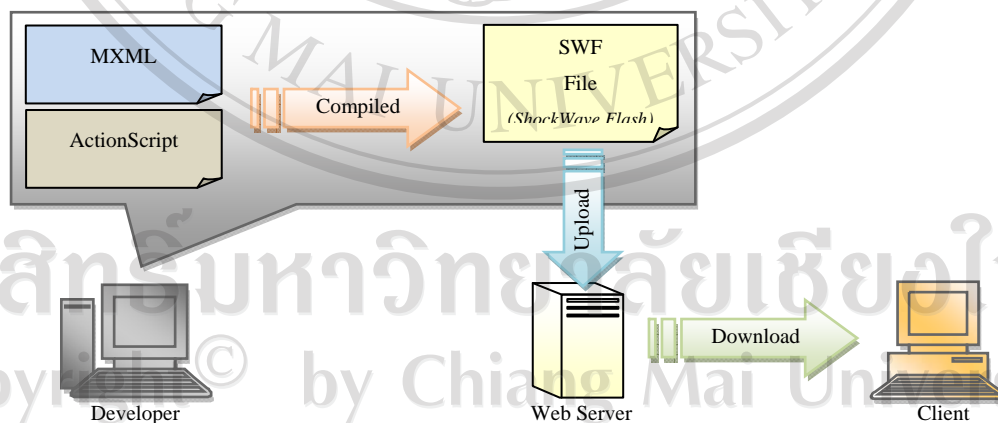
Figure F.1: The concept of Flex-based application implementation [AFCS 09]

The diagram implied that Flex is a client-side technology that is rendered by Flash Player or Adobe AIR. Flex can also work with JavaScript on the client machine. However, for communicating with the server, Flex requires a server-side technology (like ColdFusion, LiveCycle Data Services, Java, ASP.NET or PHP) to provide it

with real-time data. In this study, PHP which is a core technology of KMS server was taken into account for interfacing between Flex application and web server. PHP is an interpreted scripting language that allows a web server to create dynamic web pages or web services. It is one of the most well-known back-end server technologies. With PHP, both application logic and layout execute on the server, which returns HTML to the browser. Another advantage of PHP to Flex-based application is PHP can talk directly with a database server, and therefore can be used to write web services. Flex does not communicate with the database directly; however, it can consume data from a web service and display it. Figure F.2 show the interfacing between PHP and Flex.
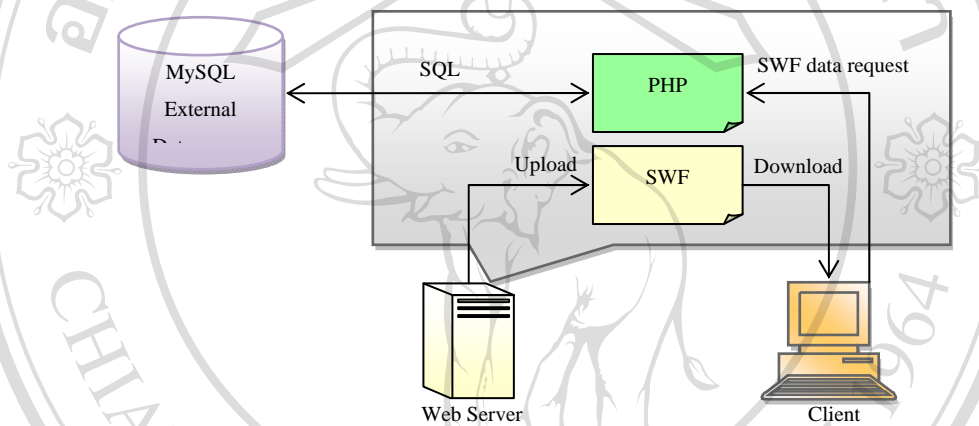
Figure F.2: The interfacing between PHP and Flex [AFCS 09]

Finally, AJAX (Asynchronous Javascript And XML) was integrated in KMS in order to retrieve data from web server asynchronously in background without interfering with display or behavior of the existing page. It allows application to use *XMLHttpRequest* which is widely used in many dynamic base applications such as Google Maps, Windows' Live, or Facebook.

Appendix G:

Database and Class Models

G.1. Database Models
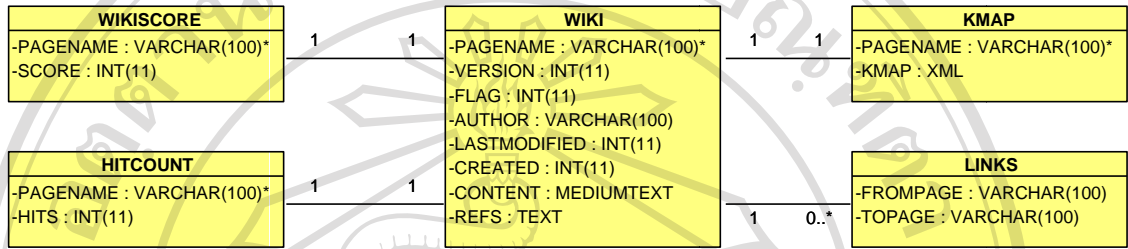
Figure G.1: Knowledge card's data model
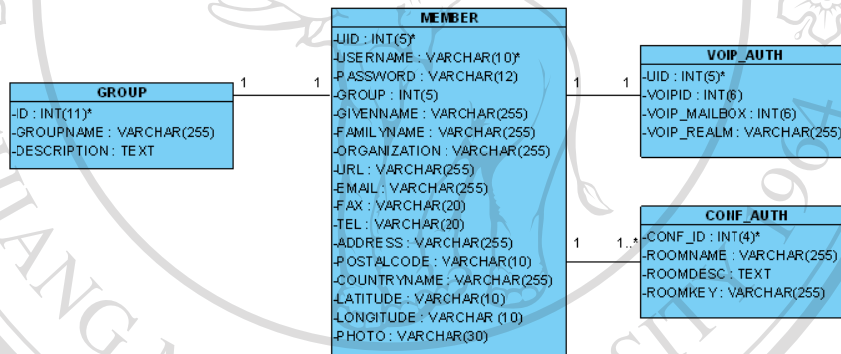
Figure G.2: Cluster map's data model
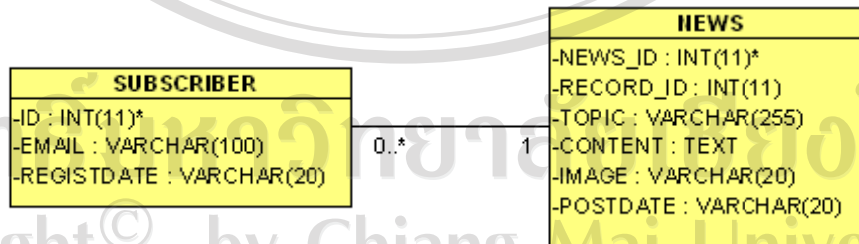
Figure G.3 Push/Pull News' data model
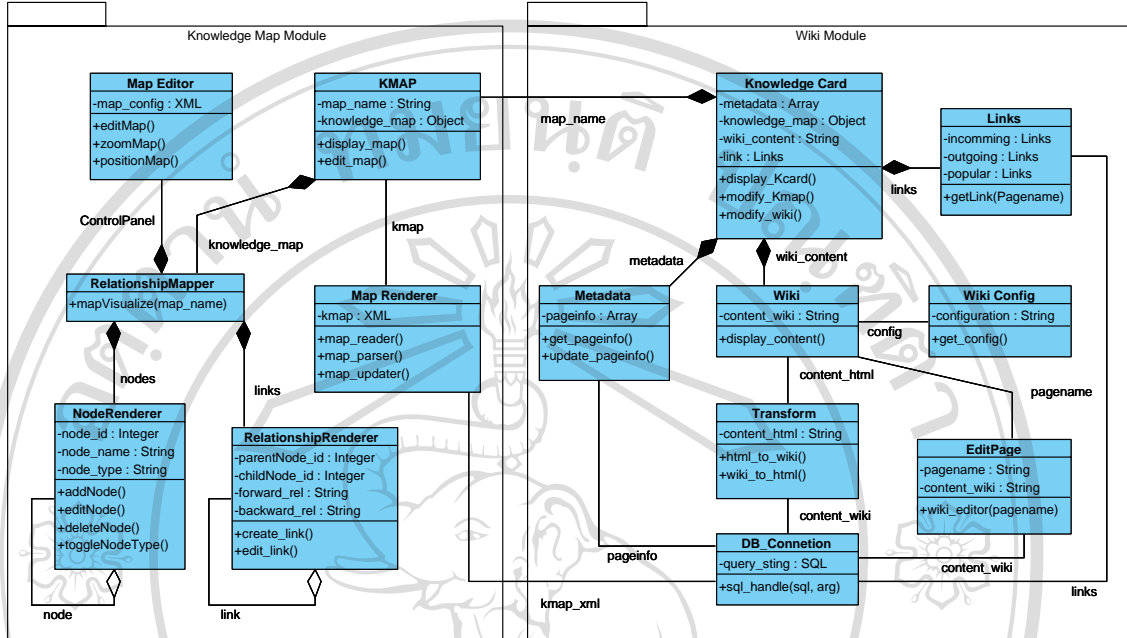
G.2. Class models

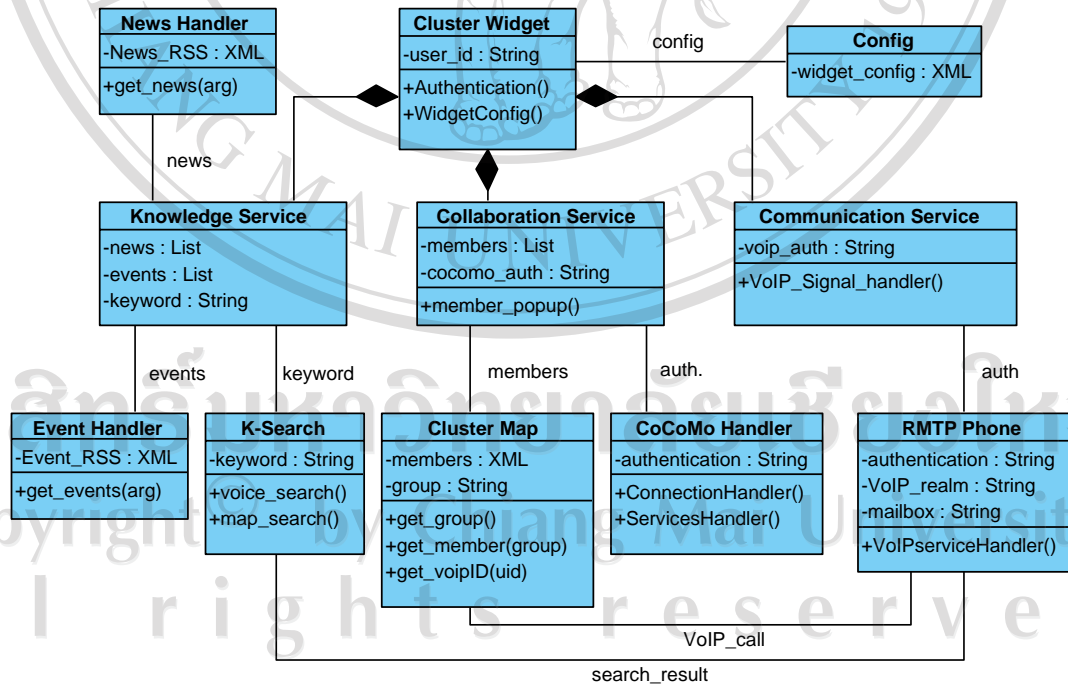Figure G.4: Knowledge map's class model
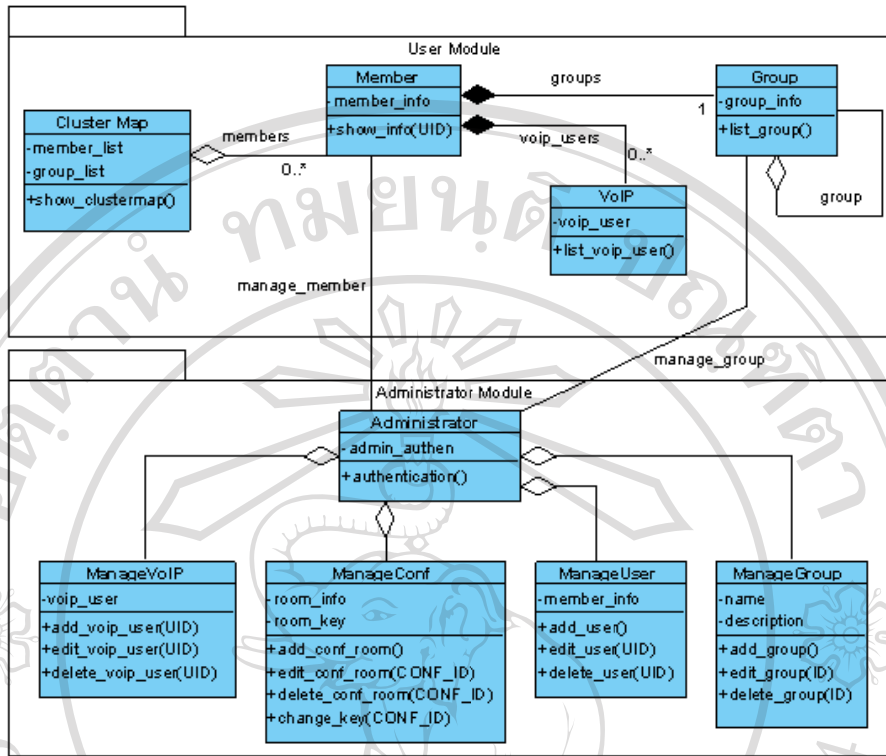

Figure G.5: Knowledge Widget's class model

Figure G.6: Cluster map's class model

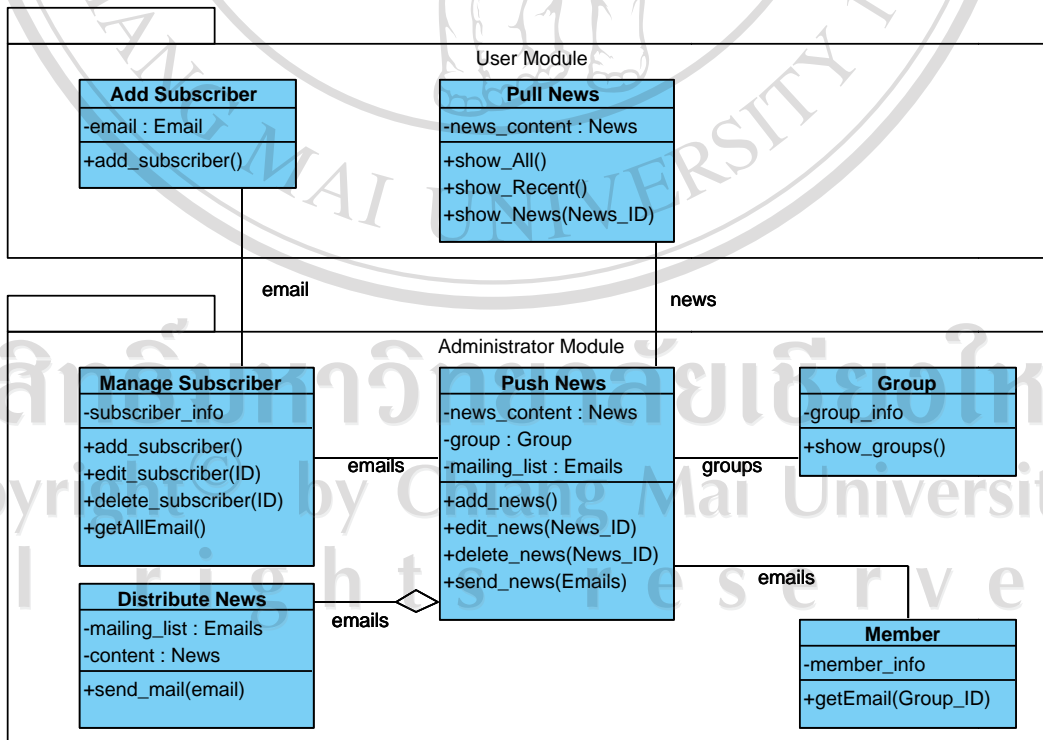Figure G.7: Push/Pull News' class model

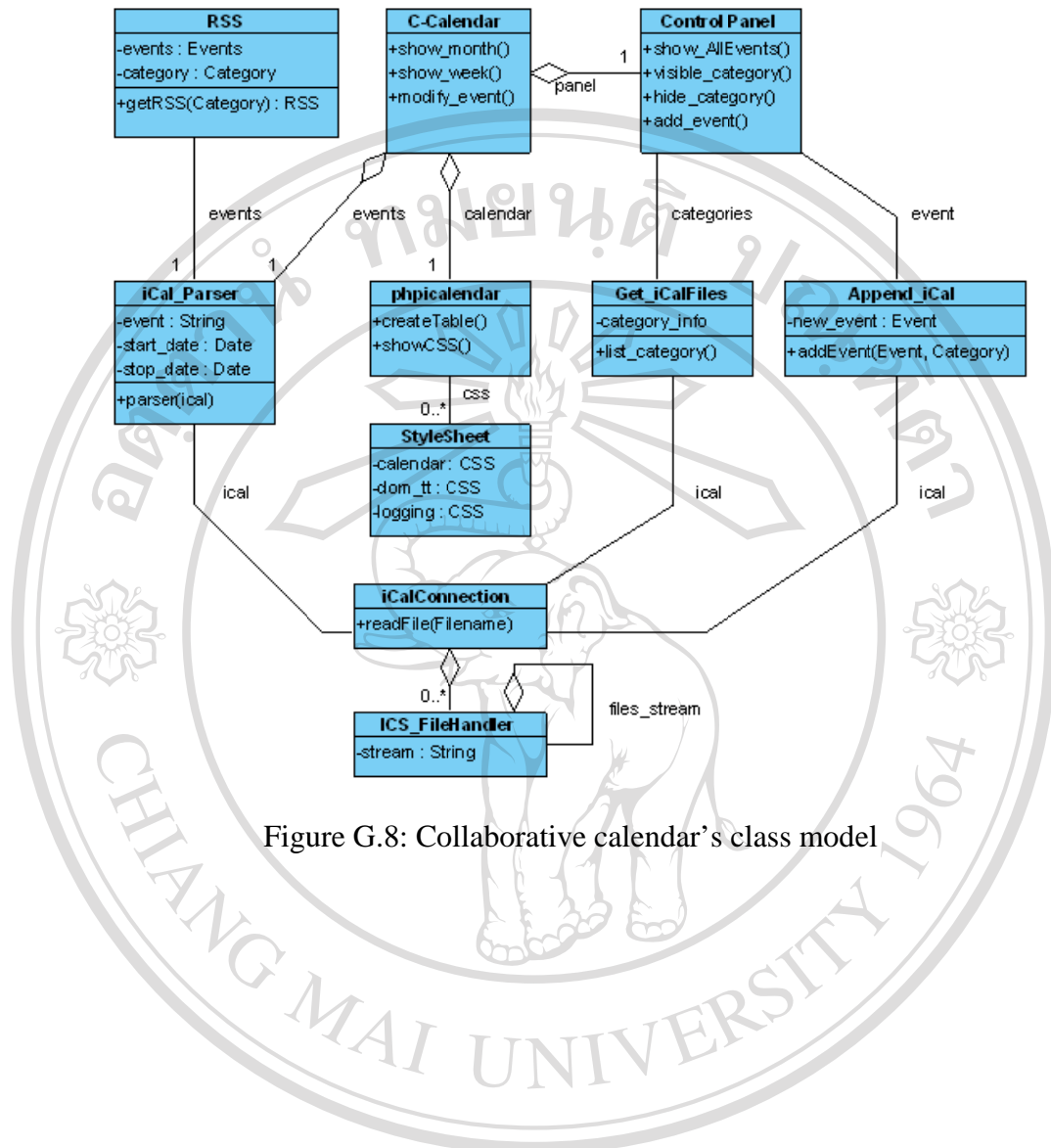Figure G.8: Collaborative calendar's class model

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International Conferences

P. SUREEPHONG, Y. OUZROUT, N. CHAKPITAK, A. BOURAS, "Collaborative Knowledge Representation and Acquisition: a case study of industry cluster", International conference on Software Knowledge Information Management and Applications (SKIMA 2009), Fez, Morocco, October 2009. (Accepted)

P. SUREEPHONG, Y. OUZROUT, A. BOURAS, "A Knowledge Management System Architecture for Clusters: a Thai ceramic cluster case study", 8th International Industrial Engineering Conference, Bagnères-de-Bigorre, France, pp.65, June 2009.

P. SUREEPHONG, N. CHAKPITAK, L. BUZON, A. BOURAS, "Cluster Development and Knowledge Exchange in Supply Chain", International conference on Software Knowledge Information Management and Applications (SKIMA 2008), Katmandu, Nepal, pp.210-215, March 2008.

P. SUREEPHONG, N. CHAKPITAK, Y. OUZROUT, A. BOURAS, "An Ontology-based Knowledge Management System for Industry Clusters", International Conference on Advanced Design and Manufacture (ICADAM 2008), Sanya, China, pp.333-342, January 2008.

P. SUREEPHONG, N. CHAKPITAK, Y. OUZROUT, G. NEUBERT, A. BOURAS, "Knowledge Engineering Technique for Cluster Development", Second International Conference on Knowledge Science, Engineering and Management, Melbourne, Australia, pp.661-666, November 2007.

P. SUREEPHONG, N. CHAKPITAK, Y. OUZROUT, G. NEUBERT, A. BOURAS, "Knowledge Management System Architecture for the Industry Cluster", : IEEE International Conference on Industrial Engineering and Engineering Management (IEEM 2007), Singapore, pp.1970-1974, December 2007.

P. SUREEPHONG, Y. OUZROUT, G. NEUBERT, and A. BOURAS, "Knowledge Management System for Cluster Development in Small and Medium Enterprises", International Conference on Software, Knowledge, Information Management and Applications (SKIMA 2006), Chiang Mai, Thailand, pp.39-44, December 2006

National Journal

P. SUREEPHONG and S. SRIBOONCHITR "Stock Analysis by Fuzzy Logic", Economic Journal of Chiang Mai University, Chiang Mai, Thailand, pp: 31-35, June 2005

National Conference

P. SUREEPHONG, Y.OUZROUT and A. BOURAS, "La gestion de connaissance dans les chaînes logistiques: Application au cas des «clusters»", 1er Colloque National sur: La Chaine Logistique au Maroc, Pratiques, enjeux et perspectives, Fez, Morocco 2008