

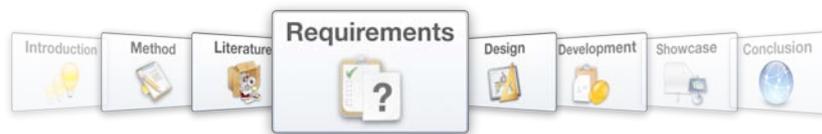
# Using Knowledge Networks to support Innovation

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**Master of Engineering Science**  
at Stellenbosch University



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## 4.2.1. Idea Generation and Identification Stage

A discussion of the Idea Generation and Identification Stage of the FUGLE Innovation Process model may be found in Chapter 3.1.2.1.

### 4.2.1.1. Collect, Categorize and Present Information

This first phase ties in with the development of the network knowledge base, which will be used to stimulate the creation of new knowledge and cradle innovation.

- **Adding of Content**

To collect information, users must be able to externalize their implicit knowledge by adding content in a variety of formats.

**Requirement #7**  
**Adding of Content**

**Required by Chapter:**

- 4.1.2.2
- 4.2.1.1

- **Commenting and forums**

Discussion of topics triggered by, or related to, the externalization process described above serves as socialization mechanisms aimed at the transformation and capture of tacit knowledge. Tacit knowledge, or links to sources thereof, is therefore also collected within the system.

**Requirement #8**  
**Commenting and Forums**

**Required by Chapter:**

- 4.1.2.2
- 4.2.1.1

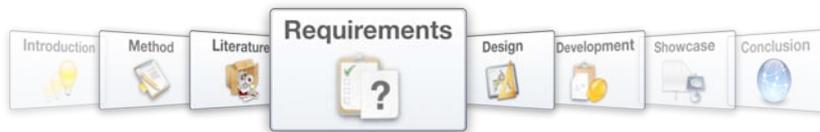
- **Taxonomy**

To categorize information, any contributions to the knowledge base should be incorporated into the knowledge base and filed according to the taxonomy scheme.

**Requirement #10**  
**Taxonomy**

**Required by Chapter:**

- 4.1.2.3
- 4.1.2.4
- 4.2.1.1



- **Navigation and Page Layout**

Ease of access to a well presented, systematized knowledge base will ensure that users browsing through the knowledge network are assisted in the internalization process. Once again, taxonomy, navigation and page design combine to add value.

**Requirement #11**  
**Navigation**

*Required by Chapter:*

- 4.1.2.3
- 4.1.2.4
- 4.2.1.1

**Requirement #13**  
**Page Layout**

*Required by Chapter:*

- 4.1.2.4
- 4.2.1.1

#### 4.2.1.2. Generate and Collect Ideas

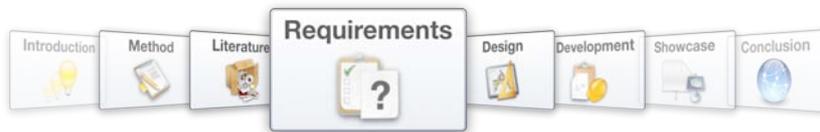
- **Commenting and Forums**

Most of the time, a forum will be a natural, free-flowing discussion on any number of topics at hand. It may however occur that a set of forum discussions is launched to specifically serve as an online idea-generating workshop. These discussions will be triggered by certain facilitating questions that could be aimed at addressing identified opportunities, threats, etc.

**Requirement #8**  
**Commenting and Forums**

*Required by Chapter:*

- 4.1.2.2
- 4.2.1.1
- 4.2.1.2



### 4.2.1.3. Capture Ideas

- **Comprehensive Idea capture form**

Generated ideas must not only be externalized, but should be captured in a comprehensive way to ensure that the full context is recorded. Captured ideas should be integrated with the existing network knowledge base to enrich and develop it, but must also be clearly identifiable for further use in the Innovation Life Cycle.

**Requirement #16**  
**Comprehensive Idea Capture Form**



*Required by Chapter:*

- 4.2.1.3

- **Commenting**

Some initial discussion of the captured idea will help to clarify any uncertainties regarding the content and context.

**Requirement #8**  
**Commenting and Forums**



*Required by Chapter:*

- 4.1.2.2 • 4.2.1.3
- 4.2.1.1
- 4.2.1.2

### 4.2.1.4. Idea Filter

- **Executive Content View**

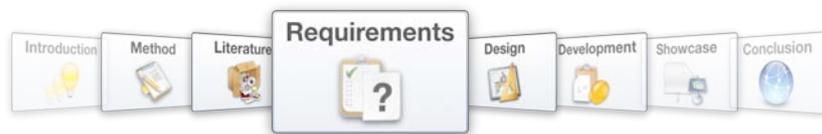
The idea filter involves executive decisions on the possible pursuing of captured ideas and presentation of relevant information is needed to support decision-making. Executive users should therefore have to option to view only knowledge objects that have been tagged as ideas, providing an overview of the options for comparison. Information that could be

**Requirement #17**  
**Executive Content View**



*Required by Chapter:*

- 4.2.1.4



presented in such an executive view includes taxonomy category, author, age, rating and popularity.

- **Development Status Indication**

The result of a review of the idea should be recorded within the knowledge object itself in order to build up a development history. This captures valuable additional metadata on reasons for an idea's success or failure based on context.

**Requirement #18**

**Development Status Indication**

*Required by Chapter:*

- 4.2.1.4

- **Forum discussion**

The executive decisions on which ideas are to be developed further need to be externalized and communicated to other platform users, allowing for constructive discussion.

**Requirement #8**

**Commenting and Forums**

*Required by Chapter:*

- 4.1.2.2 • 4.2.1.3
- 4.2.1.1 • 4.2.1.4
- 4.2.1.2

## 4.2.2. Concept Definition Stage

*A discussion of Concept Definition Stage of the FUGLE Innovation Process model may be found in Chapter 3.1.2.2.*

### 4.2.2.1. Develop, Incubate and Refine Concepts

- **Node Grouping to form Concept**

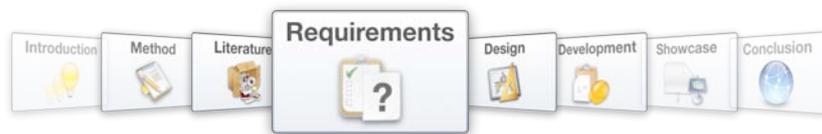
At this stage of the innovation life cycle, several knowledge objects may combine to form a concept. These objects could include ideas, other concepts, people, and industries.

**Requirement #19**

**Node Grouping to form Concept**

*Required by Chapter:*

- 4.2.2.1



To efficiently facilitate the development of this new group of objects toward a feasible concept, it is necessary for them to be bound together to form an informal cluster within the knowledge network. This cluster of nodes is a new example of a knowledge object.

- **Taxonomy**

The newly formed concept should be fed back into the knowledge base and be classified according to the taxonomy scheme so that other users can be exposed to its development. Once again this will allow the concept to be treated as a knowledge object and form part of search results, suggestions of related content, etc.

**Requirement #10**

**Taxonomy**

*Required by Chapter:*

- 4.1.2.3 • 4.2.2.1
- 4.1.2.4
- 4.2.1.1

- **Post contributions into group**

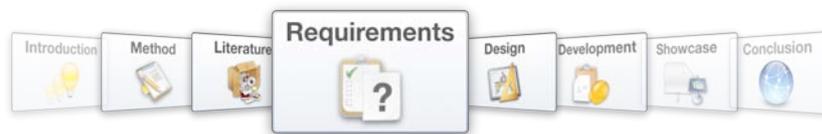
As the concept develops, users may feel the need to externalize implicit knowledge that might not have been relevant before. Although these postings should be directly incorporated into the knowledge base, they should also immediately be linked to the already existing cluster of network nodes that represent the developing concept.

**Requirement #20**

**Post Contributions into Group**

*Required by Chapter:*

- 4.2.2.1



- **Commenting and Forums, Communication**

Allowing users involved with the development of the concept to externalize their implicit knowledge into the development group is only taking advantage of one of several new knowledge networking opportunities that are sparked by the creation of new knowledge. To work together in the development of a concept is one of the best opportunities for socialization and tacit knowledge that is either transferred or transformed should be noted or captured. The platform should support all the necessary communication channels to facilitate this socialization process.

**Requirement #8**  
**Commenting and Forums**

*Required by Chapter:*

- 4.1.2.2 • 4.2.1.3
- 4.2.1.1 • 4.2.1.4
- 4.2.1.2 • 4.2.2.1

**Requirement #5**  
**Communication**

*Required by Chapter:*

- 4.1.2.1
- 4.1.2.4
- 4.2.2.1

#### 4.2.2.2. Concept filter

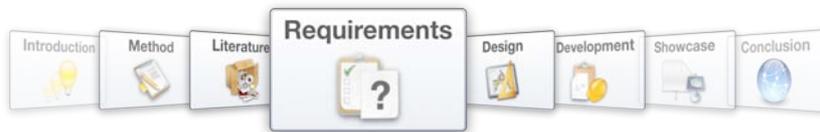
- **Executive Content View**

Similar to the idea filter, the concept filter involves executive decisions on the further development of concepts. Systematized presentation of information is needed to support decision-making, and the platform should therefore be able to extract only knowledge objects of the concept type from the knowledge base. Relevant indicators of potential should be provided, especially those that represent collective opinion, i.e. rating, popularity and development momentum.

**Requirement #17**  
**Executive Content View**

*Required by Chapter:*

- 4.2.1.4
- 4.2.2.2



- **Development Status Indication**

The result of a review of the concept should be recorded within the knowledge object itself in order to build a development history. This captures valuable additional metadata on reasons for an concept's success or failure based on context, and combined with the development history of the ideas enclosed in the concept, can provide valuable insights into innovation policy and practices.

**Requirement #18**

**Development Status Indication**



*Required by Chapter:*

- 4.2.1.4
- 4.2.2.2

- **Commenting and Forums**

The executive decisions on which concepts are to be developed further need to be externalized and communicated to other platform users, allowing for constructive discussion. This is even more important than in the case of the idea filter, as more users will be aware of the development of concepts than of ideas, mainly because of the participative nature of their development.

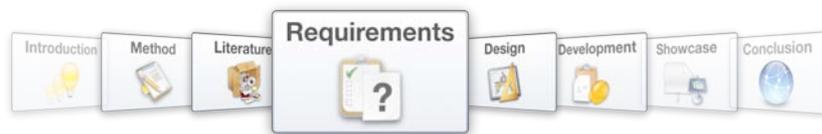
**Requirement #8**

**Commenting and Forums**



*Required by Chapter:*

- 4.1.2.2
- 4.2.1.1
- 4.2.1.2
- 4.2.1.3
- 4.2.1.4
- 4.2.2.1
- 4.2.2.2



### 4.2.3. Concept Feasibility and Refinement Stage

A discussion of the Concept Feasibility and Refinement Stage of the FUGLE Innovation Process model may be found in Chapter 3.1.2.3.

#### 4.2.3.1. Determine Feasibility, Develop Models and Prototypes, Refine

- **Post Contributions into Group**

As in the concept definition stage, externalization needs to be supported, as the users involved in determining the concept's feasibility needs to fill in remaining gaps in the information regarding the concept. This may however also be done by simply tying previously unrelated knowledge objects into the network cluster.

**Requirement #19**

**Node Grouping to form Concept**

*Required by Chapter:*

- 4.2.2.1
- 4.2.3.1

- **Taxonomy**

Any newly externalized knowledge needs to be systematized to ensure that it enriches the body of knowledge. Newly fledged relations between objects should also be reflected. This may involve changing or expanding taxonomy metadata tied to objects.

**Requirement #10**

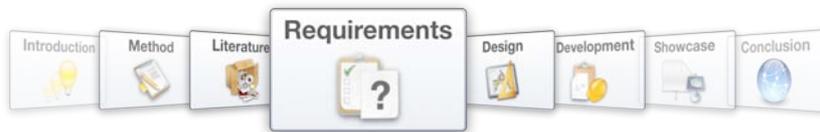
**Taxonomy**

*Required by Chapter:*

- 4.1.2.3    • 4.2.2.1
- 4.1.2.4    • 4.2.3.1
- 4.2.1.1

- **Navigation and Page Layout**

As the concept is one of the most complicated structures within the knowledge network, great care should be taken to present its structure and content in a way that users can understand it. The clear understanding of the concept will assist in more efficiently internalizing any knowledge foreign to them, allowing for more meaningful contributions.



**Requirement #11**  
**Navigation**

 **11**

*Required by Chapter:*

- 4.1.2.3 • 4.2.3.1
- 4.1.2.4
- 4.2.1.1

**Requirement #13**  
**Page Layout**

 **13**

*Required by Chapter:*

- 4.1.2.4
- 4.2.1.1
- 4.2.3.1

- **Comment and Forums, Private Messaging**

The continuing interchange and transformation of knowledge will automatically be linked to discussion. Communal concept development offers excellent opportunities for socialization and transfer of tacit knowledge.

**Requirement #8**  
**Commenting and Forums**

 **8**

*Required by Chapter:*

- 4.1.2.2 • 4.2.1.4
- 4.2.1.1 • 4.2.2.1
- 4.2.1.2 • 4.2.2.2
- 4.2.1.3 • 4.2.3.1

**Requirement #5**  
**Communication**

 **5**

*Required by Chapter:*

- 4.1.2.1 • 4.2.3.1
- 4.1.2.4
- 4.2.2.1

- **Development Status Indication**

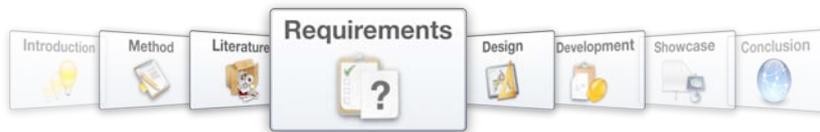
The iterative nature of concept development needs to be supported and the development status of a concept should be clearly communicated to any users involved in the process.

**Requirement #18**  
**Development Status Indication**

 **18**

*Required by Chapter:*

- 4.2.1.4
- 4.2.2.2
- 4.2.3.1



### 4.2.3.2. Funding Gate

- **Executive content view**

As with the idea and concept filters preceding it, systematized presentation of information will aid executive decision-makers in determining which concepts will advance to project status.

**Requirement #17**  
**Executive Content View**

*Required by Chapter:*

- 4.2.1.4
- 4.2.2.2
- 4.2.3.2

- **Commenting and Forums**

Externalization of opinions is needed so that informed decisions are made. Ongoing discussion will further enhance the decision-making process.

**Requirement #8**  
**Commenting and Forums**

*Required by Chapter:*

- 4.1.2.2 • 4.2.2.1
- 4.2.1.1 • 4.2.2.2
- 4.2.1.2 • 4.2.3.1
- 4.2.1.3 • 4.2.3.2
- 4.2.1.4

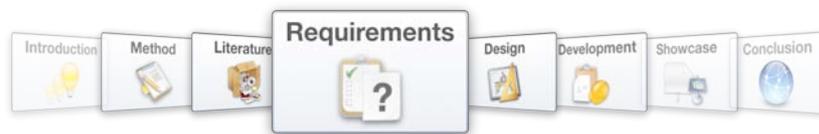
- **Status indication**

Another page in the evolution of the idea to a concept and eventually to a project is written here and all changes to the project status need to be recorded and communicated clearly.

**Requirement #18**  
**Development Status Indication**

*Required by Chapter:*

- 4.2.1.4 • 4.2.3.2
- 4.2.2.2
- 4.2.3.1



#### 4.2.4. Project Stage

*Discussions of the Portfolio, Deployment, Refinement and Formalization and Exploitation stages of the FUGLE Innovation Process model may be found in Chapters 3.1.2.4 to 3.1.2.7.*

The project phase includes all activities following successful passing of the funding gate up to the final exploitation stage (i.e. Portfolio Stage, Deployment, Refinement and Formalization Stage, Exploitation Stage). Through portfolio management, deployment, refinement and formalization and exploitation, the same set of basic knowledge work processes support the necessary information flow. This makes sense, as this part of the Innovation Life Cycle involves project management aimed at achieving commercial gain from the developed concepts, and professional project management software and techniques are used. The role of the platform in this phase therefore narrows back down to its basic goal of knowledge management, and becomes an information hub. It is not only important for the successful management of the project to manage information properly, but is vitally important that innovation projects that arise from work done within the knowledge network are fed back into the network. This enriches the network with new knowledge and allows it to grow.

- **Node Grouping to form Project**

As was the case with concepts, projects will consist out of a number of knowledge objects that combine to form a growing organism. More resources are involved in this phase of the Innovation Life Cycle, thus the governing structure of the group may be more formal than that of its preceding concept. This structure may involve the allocation of responsibility within the group and possibly a different combination of network nodes than those that were involved in the concept phase.

**Requirement #21**

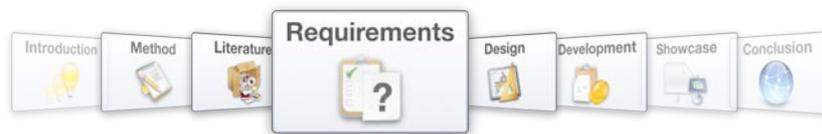
**Node Grouping to form Project**



**21**

*Required by Chapter:*

- 4.2.4



- **Post Contributions into Group**

As progress is made with the project, information such as budgets, design reviews and reports that are deemed fit for public display within the information system, should be entered into the knowledge network. As the project object is the primary audience of these items, they should be linked to it, but should also be integrated with the knowledge base.

**Requirement #20**

**Post Contributions into Group**

*Required by Chapter:*

- 4.2.2.1
- 4.2.4

- **Navigation, Page Layout**

Explicit knowledge objects that form part of the project node cluster should be presented in a user-friendly way. This will not only be advantageous to the mental model of project members, but will enhance the ability of the global network user community to internalize knowledge created and highlighted in the running of the project.

**Requirement #11**

**Navigation**

*Required by Chapter:*

- 4.1.2.3   • 4.2.3.1
- 4.1.2.4   • 4.2.4
- 4.2.1.1

**Requirement #13**

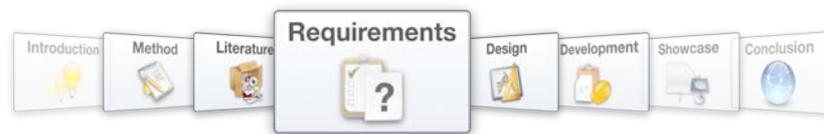
**Page Layout**

*Required by Chapter:*

- 4.1.2.4   • 4.2.4
- 4.2.1.1
- 4.2.3.1

- **Comment, Forum, Messaging**

Project development offers immense possibilities for collaboration and the sharing of experience, best practices, etc. Socialization and tacit knowledge transfer should be supported through communication facilities.



**Requirement #8**  
**Commenting and Forums**

**8**

*Required by Chapter:*

- 4.1.2.2 • 4.2.2.1
- 4.2.1.1 • 4.2.2.2
- 4.2.1.2 • 4.2.3.1
- 4.2.1.3 • 4.2.3.2
- 4.2.1.4 • 4.2.4

**Requirement #5**  
**Communication**

**5**

*Required by Chapter:*

- 4.1.2.1 • 4.2.3.1
- 4.1.2.4 • 4.2.4
- 4.2.2.1

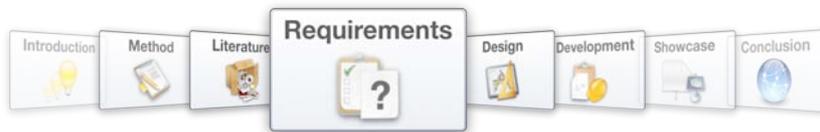
#### 4.2.5. Innovation Life Cycle Segmentation

After examining the system architecture requirements put forward by the Innovation Life Cycle it can be concluded that innovation does not require an information system architecture much different than the requirements for implementation of a knowledge network. Adequate support of Knowledge Work Processes should therefore combine to form a platform that complies with nearly all the requirements for online innovation management.

A new requirement that is evident is the need for the support of custom dynamic network activity that morphs through the innovation life cycle. As the generic innovation roadmap as proposed by the FUGLE model is followed, sustained and controlled information propagation is needed. This involves the ability for network nodes (knowledge objects) to combine to form new knowledge objects or node clusters within the network. These new objects are not homogeneous and should have an organic nature.

Information propagation through the Innovation Life Cycle does not only create the requirement for custom knowledge objects. It also provides an indication of the scope of use of these individual objects. A single knowledge object to manage ideas can satisfy all information needs up to and including the Idea Filter (refer to Chapter 4.2.1). A new object is however needed for concept management during the Concept Definition, Concept Feasibility and Funding Gate stages (refer to Chapters 4.2.1 and 4.2.2). Given the scope of project management included in the proposed Information System Architecture, a third knowledge object will be able to satisfy all information propagation needs from the Portfolio stage to the Exploitation stage (refer to Chapter 4.2.4).

Considering the Innovation Life Cycle as presented by the FUGLE model from the viewpoint of the custom knowledge objects, the innovation process may be divided into three distinct phases: the Idea



Phase, the Concept Phase and the Project Phase (refer to Figure 37). These three custom knowledge objects may now be designed with their scope in mind.

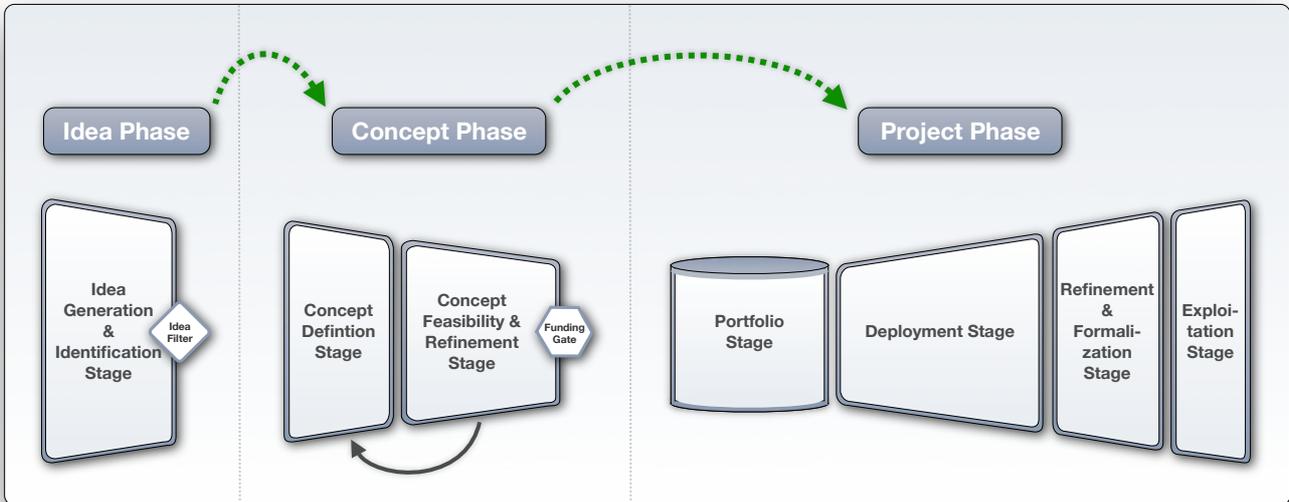


Figure 37 - The Innovation Life Cycle is divided into three phases based on information management requirements

#### 4.2.5.1. Knowledge Object to support the Idea phase: Idea Object

For a full description of the requirements for the Idea Object based on usage in specific stages of the innovation process, refer to Chapter 4.2.1.

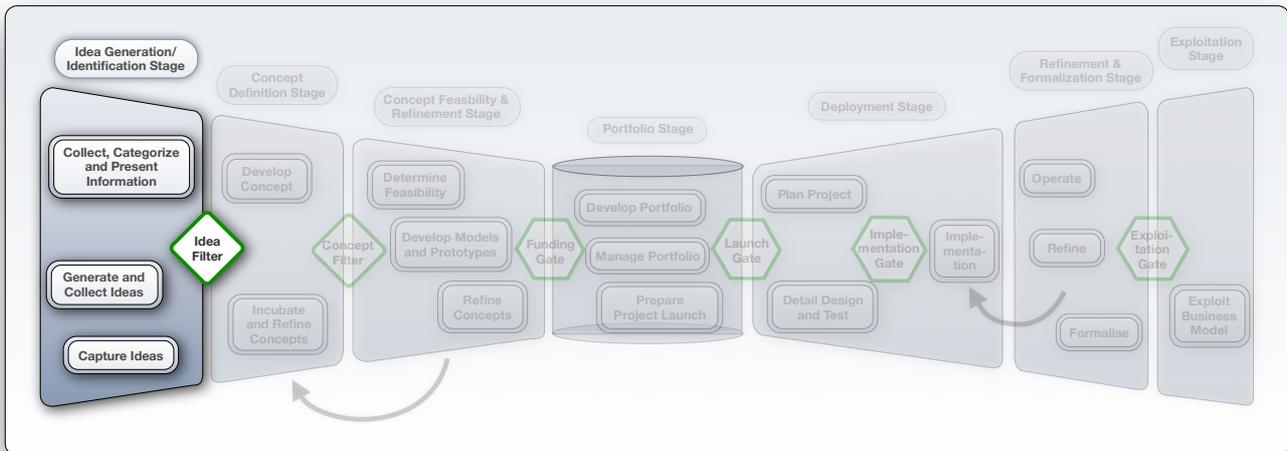
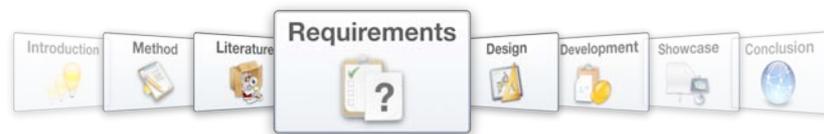
The first phase of the innovation life cycle is concerned with presentation of information and then capturing ideas that are inspired by this exposure to knowledge. As the development and commercialization of an idea might take some time, information on the idea might be sparse shortly after it has been captured. It is only when the idea is combined with other ideas or contexts that it becomes more complex. A single knowledge object type should be able to capture and propagate information on the idea from the start of the innovation life cycle up to successful passing through the idea filter (refer to Figure 38).

**Requirement #22**

**Idea Object**

*Required by Chapter:*

- 4.2.5.1



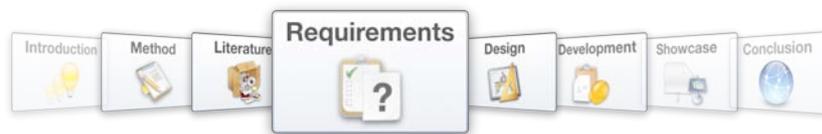
**Figure 38 - The Idea phase of the Innovation Life Cycle**

The created knowledge object should be able to capture sufficient information about the idea to ensure completeness of content, but also to indicate the context of the idea. Adequate space in a media-rich environment must be provided for the author to express and convey his or her idea. Over and above the opportunity to embed images, video and audio in the posting concerning the idea, attachments must also be supported. Possible metadata might include elements regarding the identity of the author and any other related users, specific knowledge sources that may have contributed to the formulation of the idea, and date of submission.

It is important that the interface that is used to capture ideas, is easily accessible and easy to use. Users may have ideas when navigating through the explicit knowledge base, or while they are taking part in a forum discussion that is specifically aimed at generating ideas. In both cases links to the idea capture form should be close at hand.

Any idea postings should immediately be categorized for integration with the global knowledge base. This enriches the knowledge base, as brand new knowledge is now made accessible to users of the knowledge network. New knowledge will most likely be the objects in the network that get the most attention, and therefore users should be allowed to comment on newly posted ideas as soon as the author is satisfied that the idea is presented properly. The ensuing discussion may lead the author to edit his or her idea and this should be supported by the information system. The author should be able to indicate when he or she feels that the idea is ready to be evaluated in the idea filter stage.

As the Idea Object is being used to propagate information through the innovation life cycle up to completion of the idea filter, and it should be designed with this full scope of use in mind. When scrutinized during the idea filter stage, only promising ideas that are in line with the global innovation



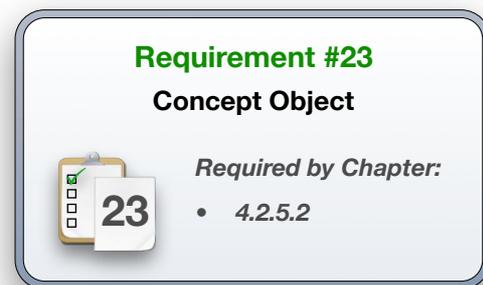
strategy will progress to become concepts earmarked for further development. This is a decision that can be made in a number of ways, but is usually influenced by executive users. They should therefore be presented with information on the idea pool that will aid their decisions. This information may represent a summary of the idea content, the collective opinion of the network user community in the form of ratings. Popularity indications in terms of total number of hits of comments, information on context within the knowledge base and filtering history (for older ideas) may also prove useful.

#### 4.2.5.2. Knowledge Object to support the Concept phase: Concept Object

*For a full description of the requirements for the Concept Object based on usage in specific stages of the innovation process, refer to Chapters 4.2.2 and 4.2.3.*

Once an idea has successfully passed through the idea filter, it is considered to be in line with global innovation strategies and objectives, and is worth exploring. This entails the development of the concept in terms of formal definition, feasibility studies and refinement.

Concepts are however often the result of the combination of a number of knowledge objects. The simple carrier knowledge object created to store ideas in the initial phase of the innovation life cycle, will not be sufficient anymore. The requirements for a knowledge object that represents a concept do however stay constant from the initialization of the concept all the way to the funding gate, where a concept is granted funding for further development as a prospective project (refer to Figure 39). A new, single knowledge object type can therefore be designed for this phase of the innovation life cycle.



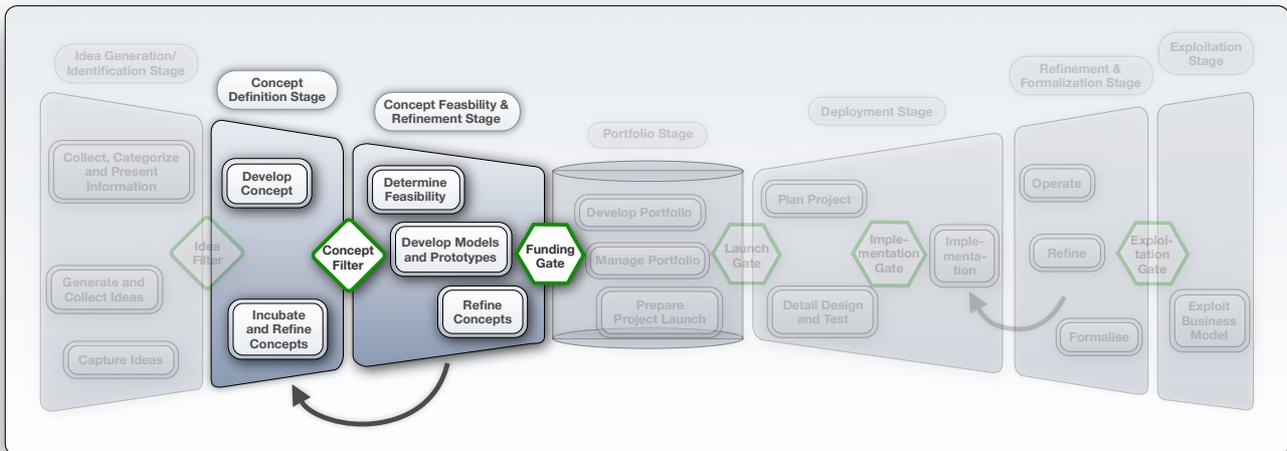
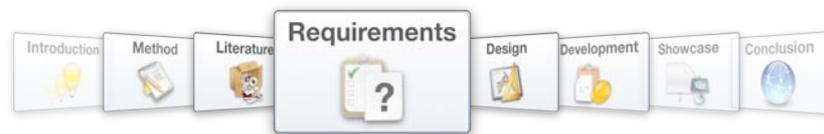
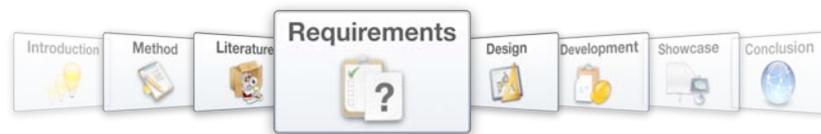


Figure 39 - The Concept phase of the Innovation Life Cycle

Concepts are substantially more complex than ideas. Concepts may be a combination of several ideas, but even considering the concept in terms of its idea components will not reveal its full complexity. However, concepts are not simply a combination of ideas, but a combination of a host of knowledge objects that together form the concept definition. These knowledge objects may include people, documents, resources, competition, etc. The development of a concept can be seen as a change in the combining knowledge objects as well as the way that these knowledge objects combine.

The Concept Object should therefore be able to represent a cluster of knowledge network nodes. These cluster associations should not be rigid, as objects may join or leave the cluster during the development of the concept. Changes in the combining objects themselves should also be accessible to the developing concept. Object relationships should thus be maintained on a real-time basis. Knowledge objects should also be allowed to form a part of several concept clusters at once, e.g. in the case of an engineer that is involved in the development of several concepts at once. Users should be able to voluntarily associate themselves with the development cluster – either as an active participant, or as a passive, learning member, subjecting themselves to internalization and socialization.

Concept Objects should be compliant to integration with the global knowledge base, as was the case with idea objects. Similarly, concepts represent newly created knowledge that should be used to enrich the knowledge base. Capability to integrate with the knowledge base involves that the concepts should be categorizable. The concept objects could indicate the knowledge categories represented by the knowledge objects that combine to form the concept, but need not necessarily be



a part of those categories themselves. The anatomy of the concept object is complex, and the design of the online interface that presents the information to the user should be designed in a way that is easy to understand. It should be clear which separate objects are combining to form the concept, but the concept should also be presented as a unit.

Development of the concept may motivate users to externalize some of their implicit knowledge. As with the standard externalization process, this new explicit knowledge should be integrated with the knowledge base. This may be specifically relevant to the concept under development, and the externalizer should have the option to designate the concept node cluster as a specific target for the new knowledge object. The externalizer is therefore binding the new knowledge object into the concept cluster upon creation.

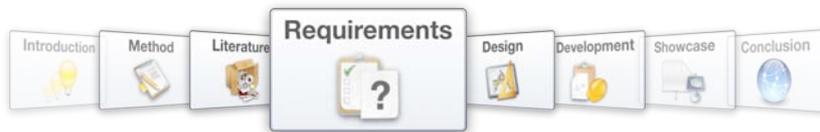
Users involved in the development of the concept may want to comment on the comprising knowledge objects or on the concept object itself and this requirement should be supported. A dedicated forum discussion will also prove useful to manage communication specifically related to the concept.

As the concept is developed, progress is made in stages. When the concept's current development status is indicated, it will aid users in keeping track of progress and to work towards completing the concept development. This progress tracker should be specifically designed to indicate progress in terms of the idea filter and the funding gate, as these are the two main evaluations that the concept will undergo during its development.

As was the case with ideas in the idea filter, the concept filter evaluates all the ideas currently being developed on the online platform. If the concept seems promising, enough resources may be allocated to support feasibility studies, modeling or prototyping. To aid the executive users in choosing these most promising concepts, the relevant information should be made available in a value-adding format. This information will include an overview of the concept topic, knowledge category, development history and popularity.

If the concept successfully passes through the concept filter, results of feasibility studies, models and prototypes also need to be entered into the knowledge base as knowledge objects. These knowledge objects should immediately be integrated into the concept node cluster. If the concept does however not pass the concept filter, it is not discarded, but simply fed back into the development stream for rework. This result and ensuing action should also be reflected in the development progress indicator linked to the concept.

The concept's last examination is during the funding gate, and once again an executive decision regarding the allocation of more resources needs to be taken. Key information on successfully



developed concepts should be presented, with the successful concepts being converted into the next type of knowledge object – the project.

#### 4.2.5.3. Knowledge Object to support Project phase: Project Object

For a full description of the requirements for the Project Object based on usage in specific stages of the innovation process, refer to Chapter 4.2.4.

The requirements for a knowledge object that can store and propagate information from the portfolio stage of the innovation life cycle onwards (refer to Figure 40) are much the same as those specified for the concept phase. Projects do however pose new and unique challenges and creating a new knowledge object type allows for more custom solutions to these challenges. A generic project object type will be designed that meets all the requirements of the proposed information system architecture up to the exploitation stage.

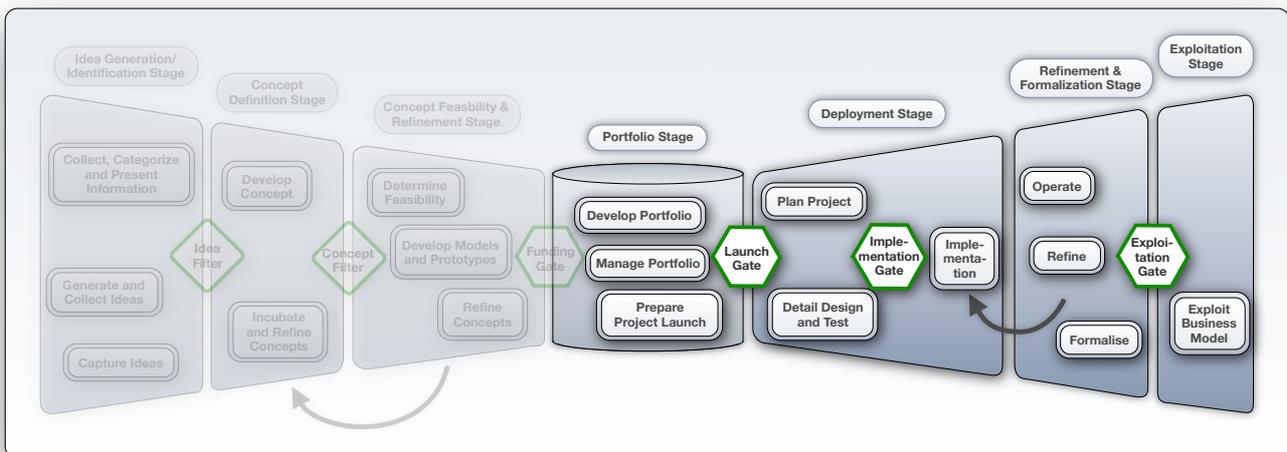
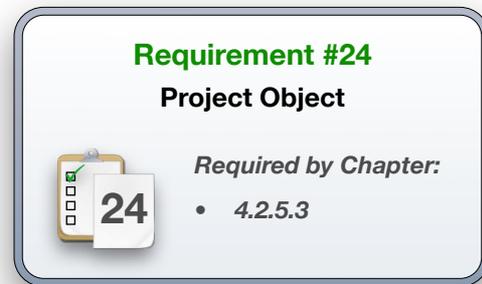
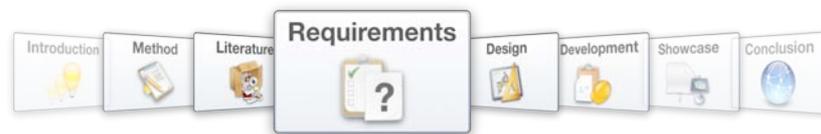


Figure 40 - The Project phase of the Innovation Life Cycle



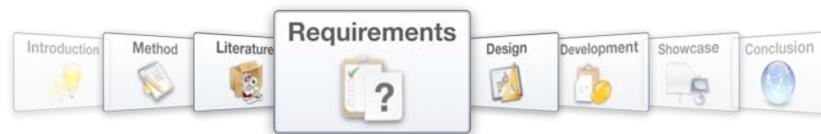
Most of the information management that is done in the project phase of the Innovation Life Cycle will be conducted in specialized project management software. The design of an information system that handles online project management detail falls outside the scope of this study. The information system architecture that this requirement specification section is proposing, will therefore only aim to act as knowledge hub during the project management phase. It is however vital to see projects from a knowledge network perspective.

Projects that develop from ideas and concepts that were developed by using the knowledge network, are valuable knowledge sources themselves. It is important for these projects to be integrated in the network and to thereby enrich the knowledge base by completing innovation life cycles that were started in the network. These projects will not only contribute explicit knowledge in the form of reports, designs, etc. but also offer some of the best opportunities for the support of socialization between users of the platform.

Project objects should be representative of a cluster of network nodes, as was the case with concept objects. It is to be expected that access to the contents of the clusters or even joining the cluster might be more secure and formalized than with concepts, which mostly represent free collaboration. Although these security constraints will differ from project to project and will be determined by management, it is important that provision for security requirements should be made in the design of the project objects.

A requirement that was touched on earlier, is the need to add knowledge objects to the network while immediately earmarking them for inclusion in a specific project cluster and it is in this sense that the project objects become knowledge hubs. Objects that are posted directly into the project cluster may contain design specifications, financial reports or schedules. Once again, security constraints should be taken into account when designing access controls to these potentially sensitive nodes. All nodes should however be able to integrate with the network knowledge base as their security controls may relax over time. Some knowledge objects may be related to projects but have no security restrictions and these knowledge objects should immediately be available for presentation along with other explicit knowledge objects in the knowledge base.

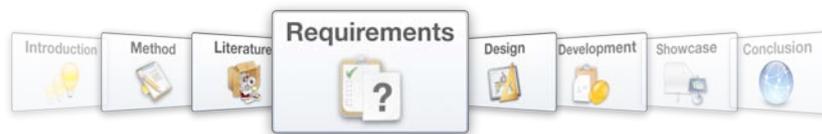
Considering that project objects represent complex clusters of nodes within the knowledge network, platform and page design should play a role in ensuring a constant mental model for users. Users should be able to tell the difference between different knowledge objects that are involved in the cluster, but also be able to see the project as a unit working together towards a common goal. Modern online information system platforms' support for media-rich content should be exploited in order to present project members with an interface that is easy to use and understand, while offering sophisticated information presentation.



As projects offer an ideal platform for interaction and tacit knowledge interchange, a complete set of communication tools should be embedded in the project object interface. These should include forum discussions, private messaging between project members and commenting facilities on posted objects. It is important to assist users in managing their platform communication by binding as many of the communication facilities as possible to the project object, thereby also enriching the functionality thereof.

The project object should clearly indicate its own development status as an innovation project. These status indications should reflect the entire range of states that an innovation project can be classified in, from the portfolio stage through to the exploitation stage.

During its development, the innovation project is subjected to a number of executive evaluations (e.g. the launch gate and the implementation gate). In each case an executive overview of the developing project within the knowledge network should be provided to assist in decision-making. Project objects should be designed to store the relevant information on the projects they represent for use by executives in these filter stages.

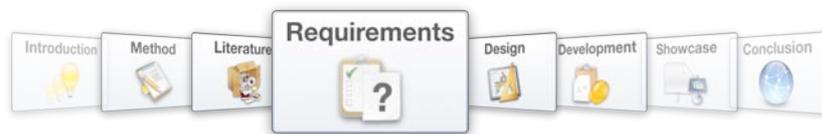


### 4.3. Consolidated Information System Architecture

Combining the requirements identified in this chapter produces the following Information System Architecture specification:

Requirement	Requirement Number	Requirement origins (Chapters)
Online Environment	0	4.1.1
Holistic approach to Knowledge	1	4.1.1.1
Knowledge Object support	2	4.1.1.2
Inter-organizational Flexibility	3	4.1.1.3
Interaction and Teamwork	4	4.1.2.1
Communication	5	4.1.2.1, 4.1.2.4, 4.2.2.1, 4.2.3.1, 4.2.4
User Profiles	6	4.1.2.1
Adding of Content	7	4.1.2.2, 4.2.1.1
Commenting and Forums	8	4.1.2.2, 4.2.1.1, 4.2.1.2, 4.2.1.3, 4.2.1.4, 4.2.2.1, 4.2.2.2, 4.2.3.1, 4.2.3.2, 4.2.4
Rating of Content	9	4.1.2.2
Taxonomy	10	4.1.2.3, 4.1.2.4, 4.2.1.1, 4.2.2.1, 4.2.3.1
Navigation	11	4.1.2.3, 4.1.2.4, 4.2.1.1, 4.2.3.1, 4.2.4
Search Function	12	4.1.2.3
Page Layout	13	4.1.2.4, 4.2.1.1, 4.2.3.1, 4.2.4
Featured Content	14	4.1.2.4
User Subscription Alerts	15	4.1.2.4
Comprehensive Idea Capture Form	16	4.2.1.3
Executive Content View	17	4.2.1.4, 4.2.2.2, 4.2.3.2
Development Status Indication	18	4.2.1.4, 4.2.2.2, 4.2.3.1, 4.2.3.2
Node Grouping to form Concept	19	4.2.2.1, 4.2.3.1
Post Contributions into Group	20	4.2.2.1, 4.2.4
Node Grouping to form Project	21	4.2.4
Idea Object	22	4.2.5.1
Concept Object	23	4.2.5.2
Project Object	24	4.2.5.3

Figure 41 - Information System Architecture requirements



## 4.4. Refined Information System Architecture

The consolidated set of Information System Architecture requirements presented in Figure 41 (Table 1) represents a wide variety of functionality. Grouping the requirements according to function provides the following refined Information System Architecture specification:

### 4.4.1. Online Environment

Online Environment		
Functionality	Requirement(s) Addressed	Reference Chapters
Online Environment	0	4.1.1

Figure 42 - First layer of Information System Architecture: Online Environment

A web-based staging environment for the Information System, allows ease of access from anywhere in the world. By developing the system to be accessed with any standard web browser software, the need for specialized client software is eliminated, thereby making the Information System even more accessible.

The online environment furthermore allows it to be accessed with ease by users from a number of different organizations from around the globe, thereby enabling Integrated Knowledge Network support.

### 4.4.2. Network Model

Implementing a network model approach to content management is the base of the entire platform, as all subsequent design will be done relative to how this requirement is met.

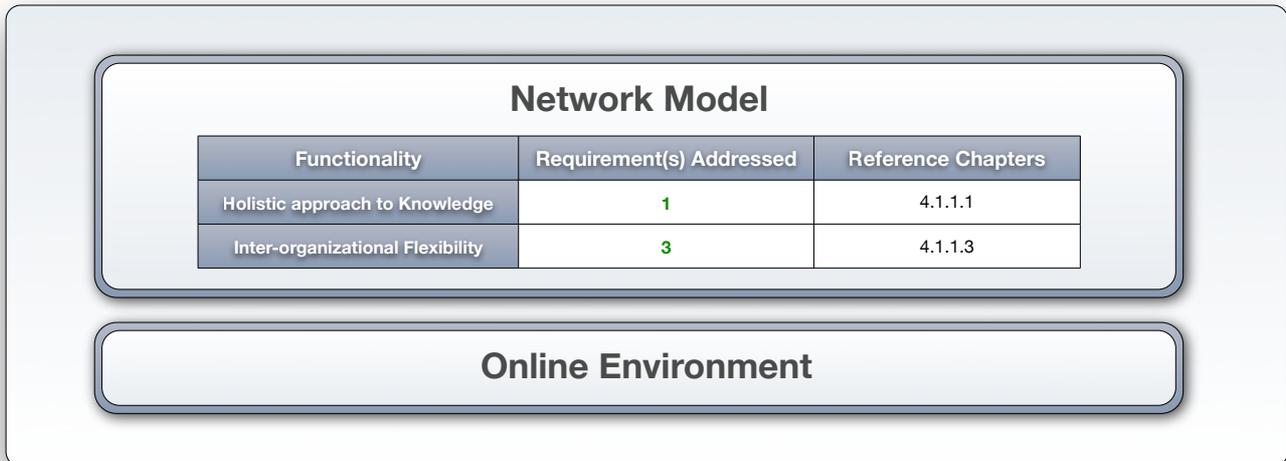
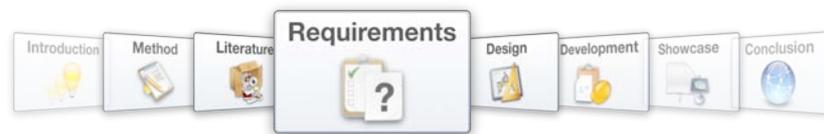


Figure 43 - Second layer of Information System Architecture: Network Model

#### 4.4.2.1. Holistic approach to knowledge

Designing the network model with consideration for explicit, implicit and tacit knowledge requires the handling of different types of knowledge objects within the network. Knowledge objects will therefore become the nodes of the network.

#### 4.4.2.2. Inter-organizational Flexibility

Using a network design as the base of the system enables the system to take advantage of the positive attributes associated with networks, e.g. spanning across organizational boundaries as in the case of an Integrated Knowledge Network.. The network should furthermore be allowed to grow organically, link with other networks and connect nodes without any unnecessary interference.

#### 4.4.3. Knowledge Object support

Knowledge objects form the nodes of the knowledge network and it is essential for the successful implementation of the network model that different knowledge object types are handled elegantly. This implies that users, documents, content posts, ideas, concepts, projects and discussions should all be treated as peers on a data structure level.

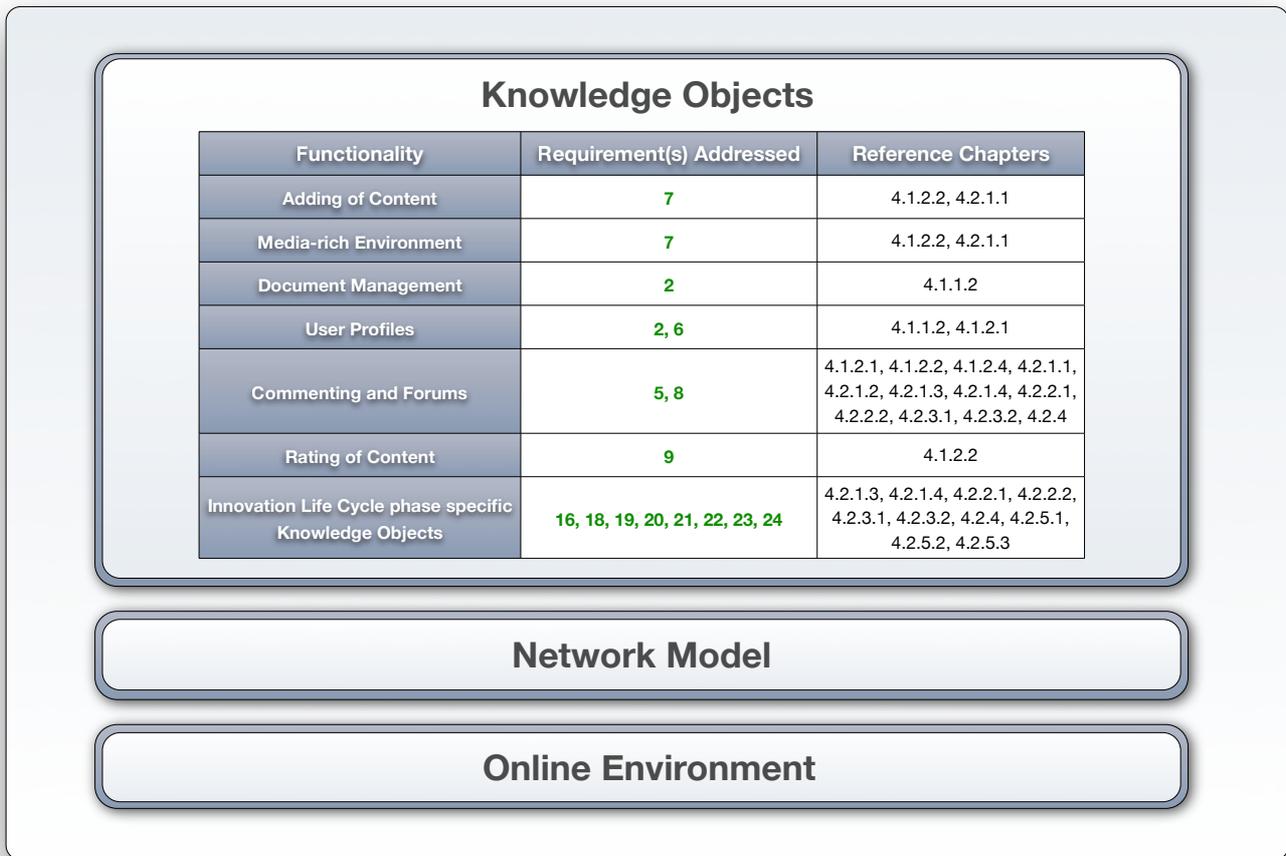


Figure 44 - Third layer of Information System Architecture: Knowledge Objects

**4.4.3.1. Adding of content**

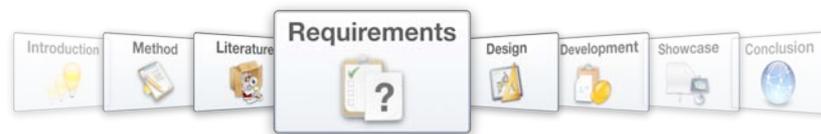
Knowledge objects are crucially important to the functioning of the system and it must be easy to add them to the network. A variety of options should be available to contributors to store the knowledge they want to externalize.

**4.4.3.2. Media-rich environment**

A media-rich environment is necessary to allow users freedom of expression. This implies that users should be able to embed images, audio and video in their contributions and have the option to attach files to nodes as well.

**4.4.3.3. Document management**

Documents are key knowledge objects in knowledge networks and should be able to form autonomous nodes within the proposed network model. This will create a repository of explicit knowledge that needs to be integrated with the knowledge base.



#### **4.4.3.4. User profiles**

Users should be able to join easily and maintain their profiles and biographies, thereby creating and updating their own nodes in the network. Users will also be able to use their accounts to manage their communication and alerts within the network.

#### **4.4.3.5. Commenting and Forums**

The platform should allow users the option to comment on knowledge objects within the network. These comments should be linked to the objects themselves, as discussion on an object enriches the object. It may also happen that discussion develops without it being based on a specific node in the network, but is rather stimulated by a topic outline – in this case the discussion becomes an object in itself in the form of a forum discussion.

#### **4.4.3.6. Rating of Content**

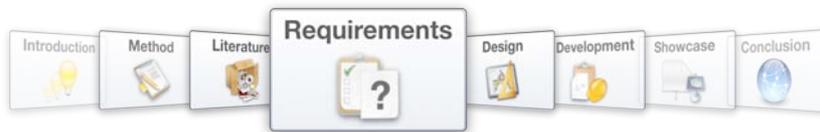
Allowing users to rate content gives them the opportunity to express their opinion on knowledge objects in a quantitative fashion. Rating should not only be permitted on written content, but should be extended to documents, ideas, concepts, etc.

#### **4.4.3.7. Innovation Life Cycle phase specific Knowledge Objects**

Ideas, concepts and projects should be represented as knowledge objects within the network, thereby integrating them with the knowledge that was used to generate them. Each phase of the Innovation Life Cycle also has specific information needs and custom knowledge objects must be designed for this purpose.

The knowledge objects that are designed to represent concepts and projects during the Innovation Life Cycle should not only be singular objects. The needs of these phases of the life cycle are of such a nature that a group of network nodes should be combined in a dynamic and organic way, with a central node being used to bind them together.

Throughout the Innovation Life Cycle, all knowledge objects that represent ideas, concepts or projects should clearly indicate their current development status. This will help to guide development along the generic innovation roadmap.



#### 4.4.4. Taxonomy

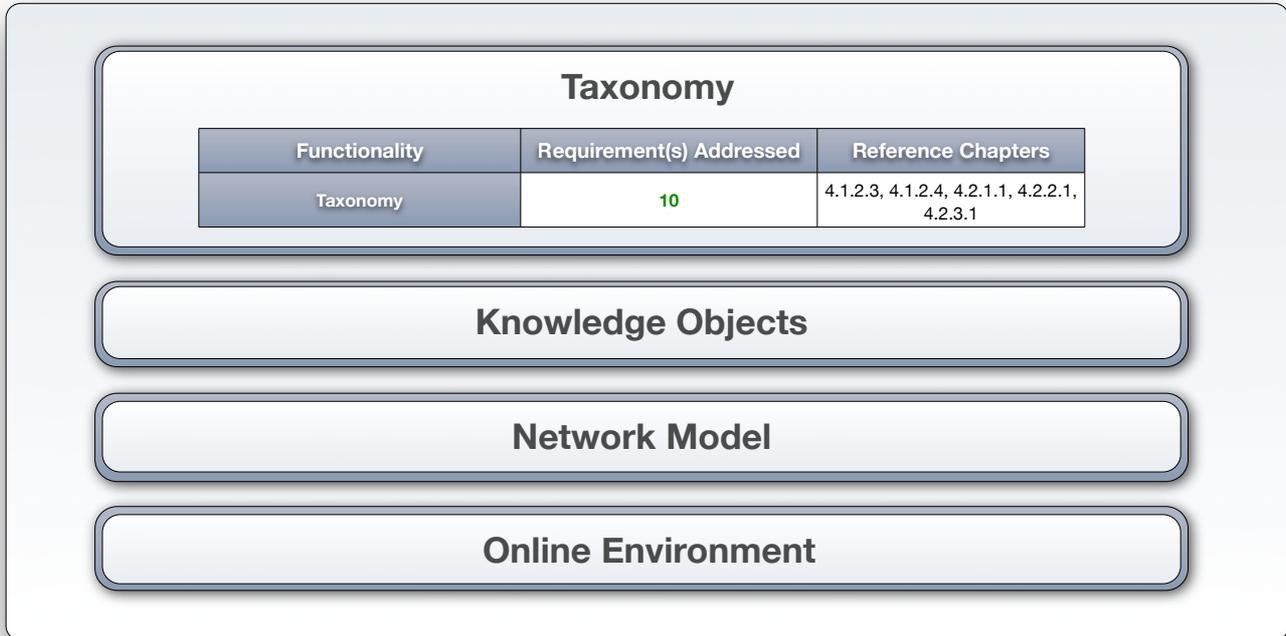
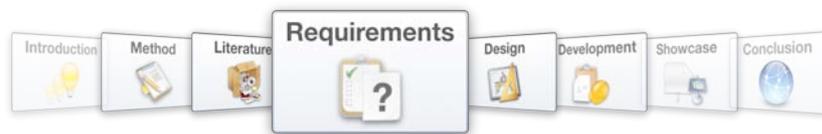


Figure 45 - Fourth layer of Information System Architecture: Taxonomy

##### 4.4.4.1. Classify content

To generate the maximum amount of value from the knowledge network, nodes should be systematized. This entails creating categories in which to classify objects, as well as including the functionality to tag objects with keywords. These tags will be used to determine relevance between nodes (proximity within the network) and provide suggestions to users when they are navigating the knowledge base. Navigation of the knowledge base via the taxonomy should be made as simple and intuitive as possible.



#### 4.4.5. Querying

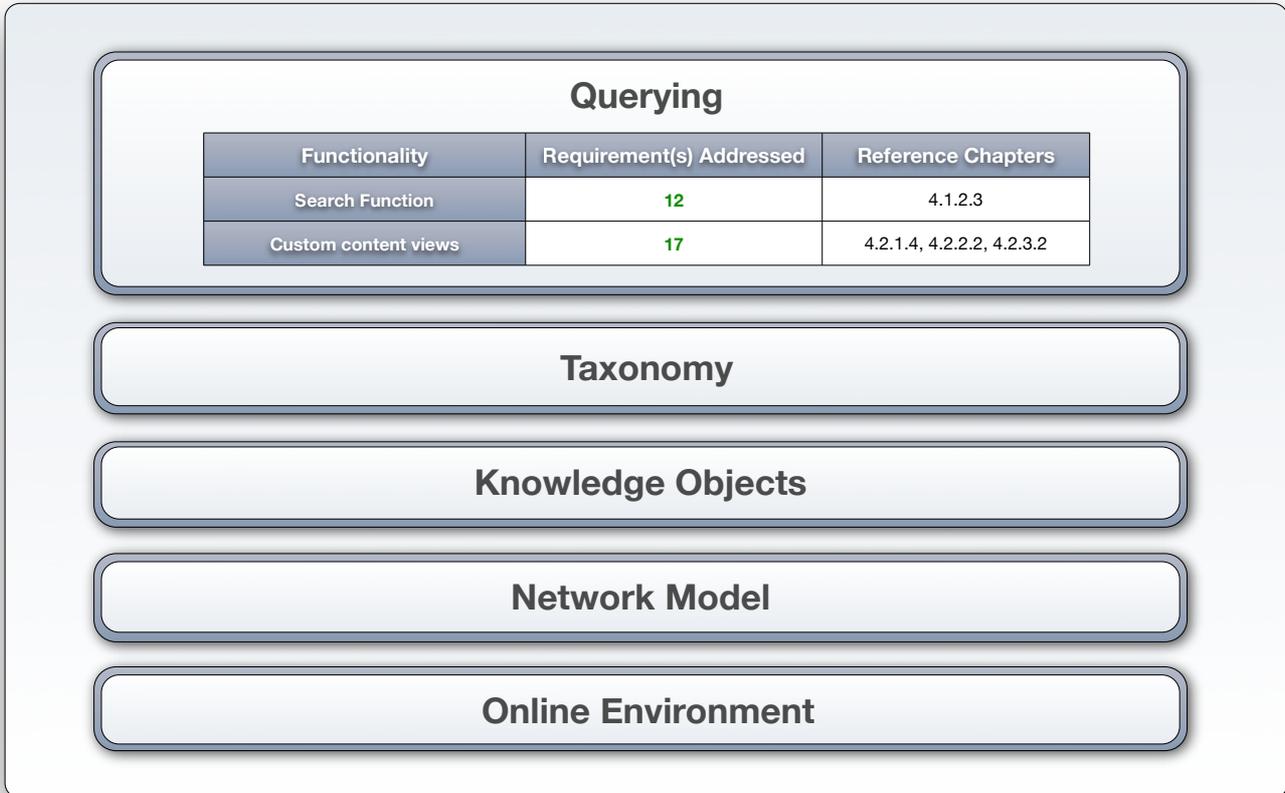


Figure 46 - Fifth layer of Information System Architecture: Querying

##### 4.4.5.1. Extract custom user views of content

The implementation of knowledge objects results in all network nodes being treated as peers on a data structure level. Categorizing and tagging these objects provides a rich knowledge base from which custom queries can be made. These queries can be used to enhance the user experience or to play an important role in the Innovation Life Cycle, e.g. generating a view of all concepts that have been identified as being “refined” for consideration in the funding gate.

##### 4.4.5.2. Search function

Along with being able to navigate through the taxonomy with ease, users should be able to search for terms throughout the network and receive full results. The implementation of knowledge objects will result in users, documents, posts, ideas, concepts and projects as possible output as search results.

#### 4.4.6. Messaging

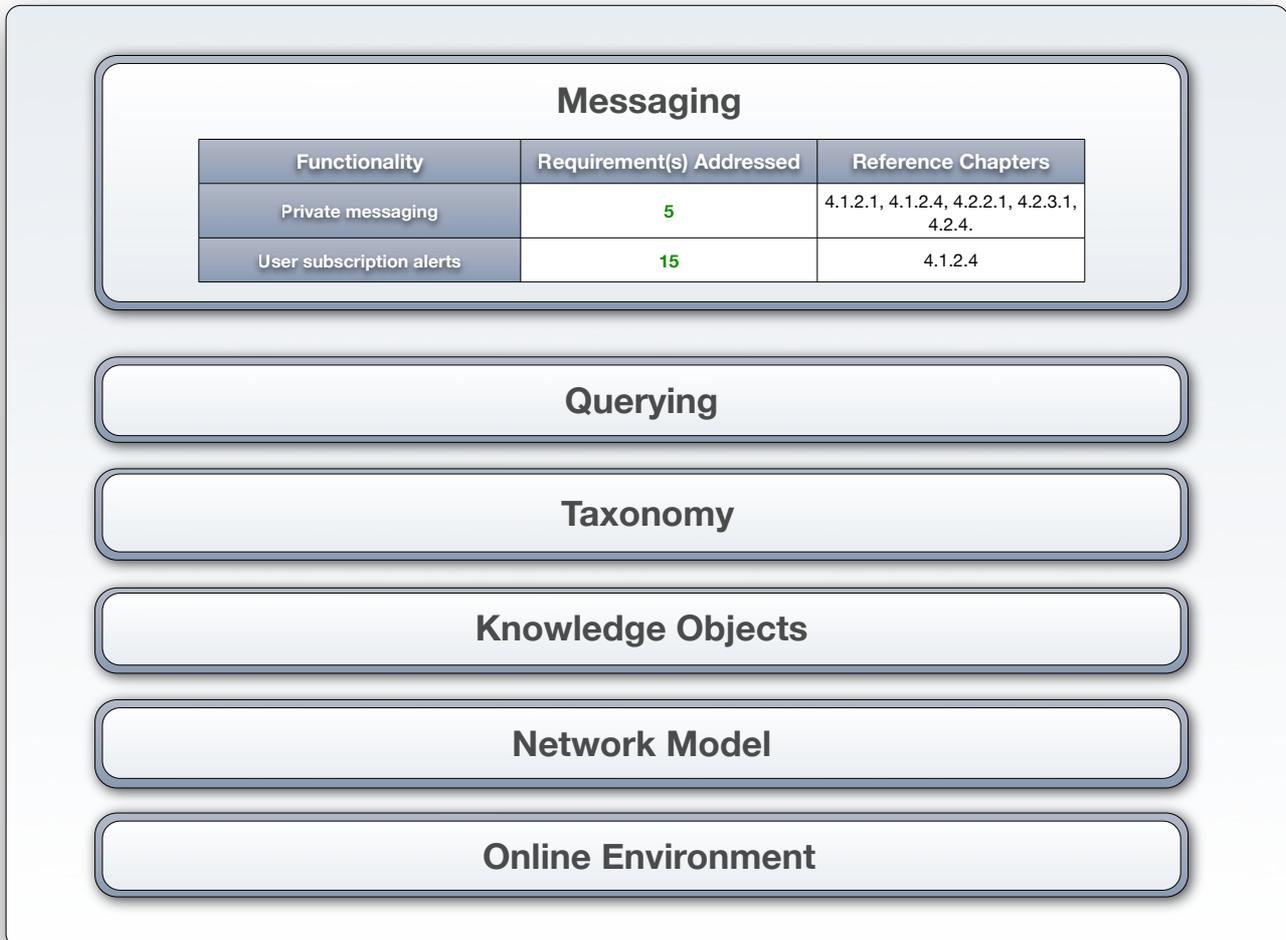


Figure 47 - Sixth layer of Information System Architecture: Messaging

##### 4.4.6.1. Private messaging

Communication has been highlighted as an important requirement for the proposed platform solution, especially for enabling social networking on the platform and promoting the smooth execution of the Innovation Life Cycle. Private messaging and contact forms that send an e-mail to users should be included to provide an efficient communication system throughout the platform. These functions will compliment the support for discussion that is created by employing commenting and forums.

##### 4.4.6.2. User alerts

Users should be able to subscribe to alerts that are triggered by activity within the network. This could be a new comment in a certain thread, a new post being classified in a certain knowledge category, or a favorite user making a new contribution to the network.

#### 4.4.7. Navigation, Layout and Theme

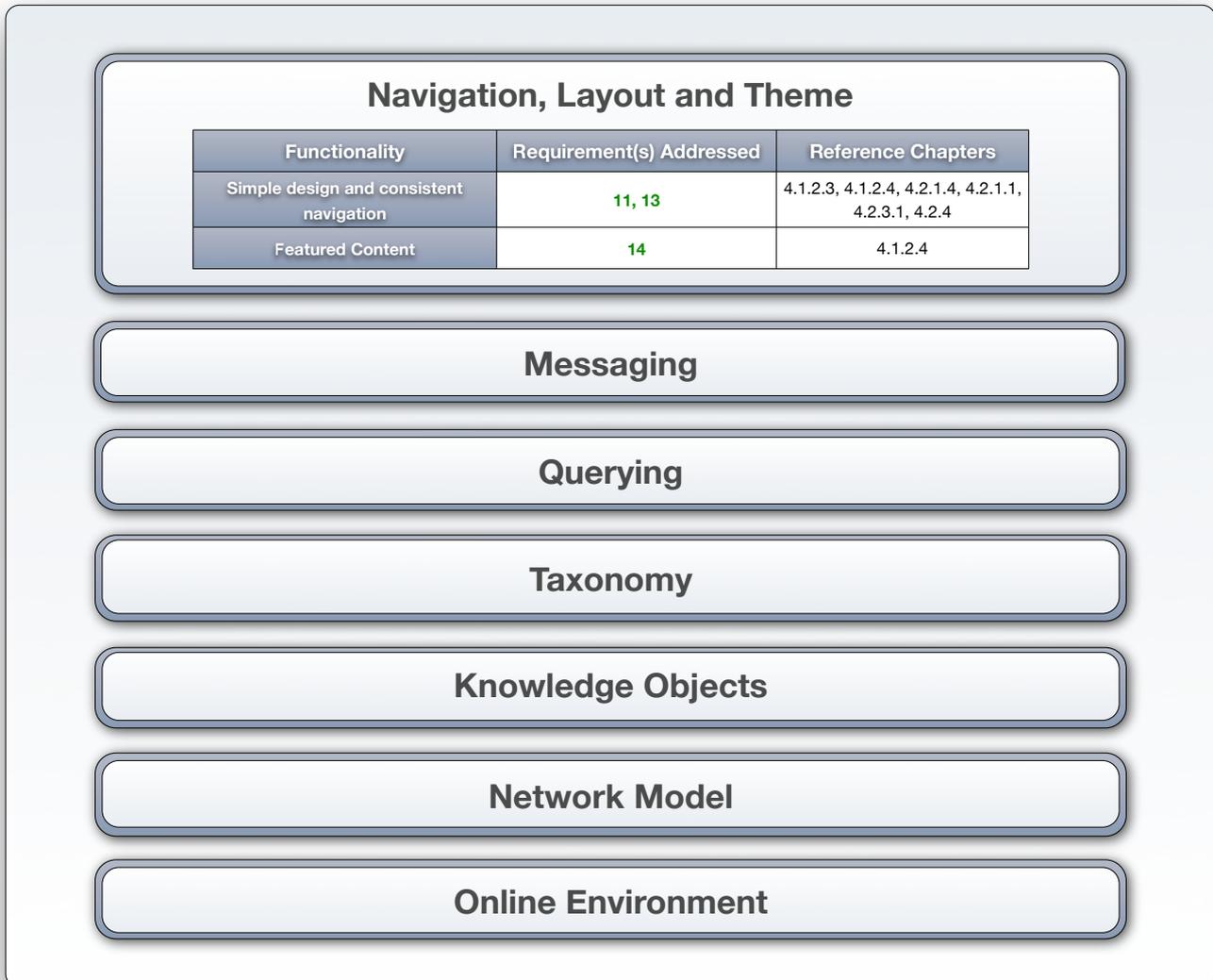


Figure 48 - Seventh layer of Information System Architecture: Navigation, Layout and Theme

##### 4.4.7.1. Simple design and consistent navigation

The knowledge network that must be implemented is a rather complex structure of knowledge objects, relationships, communication functions, etc. It is therefore imperative that the platform has a look-and-feel that is simple and easy to use and understand. The presentation of information should be done in a way that is comprehensive, but at the same time relevant. Correct contextual use of menus and information blocks will ensure that the right information is shown to the right users at the right time.

##### 4.4.7.2. Featured content

To ensure that newly contributed knowledge object are noticed by users browsing the platform, content should be ordered with the latest items at the top of lists, unless otherwise specified by the