Using Knowledge Networks to support Innovation

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Verklaring

Deur hierdie tesis elektronies in te lewer, verklaar ek dat die geheel van die werk hierin vervat, my eie, oorspronklike werk is, dat ek die outeursregeienaar daarvan is (behalwe tot die mate uitdruklik anders aangedui) en dat ek dit nie vantevore, in die geheel of gedeeltelik, ter verkryging van enige kwalifikasie aangebied het nie.

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Declaration

By submitting this thesis electronically, I declare that the entirety of the work contained therein is my own, original work, that I am the owner of the copyright thereof (unless to the extent explicitly otherwise stated) and that I have not previously in its entirety or in part submitted it for obtaining any qualification.

Date:......................................

Opsomming

Innoveringsvermoë is 'n kritiese eienskap vir organisasies wat poog om in 'n moderne ekonomie te oorleef en te groei. Innovasie word egter gereeld misverstaan en gevolglik wanbestuur. Algemene wanopvattings sluit in dat Innovasie slegs 'n oomblik van inspirasie behels en daarom slegs van individue of 'n enkele departement binne die organisasie afhang. In realiteit word die Innovasieproses deur 'n definitiewe lewenssikuls gekenmerk en neem 'n wye verskeidenheid rolspelers daaraan deel.

Effektiewe Innovasiebestuur maak tot 'n groot mate op doeltreffende samewerking tussen bogenoemde rolspelers staat. Hierdie samewerking strek egter verder as kollaboratiewe organisasiestrukture, bilaterale ooreenkomste en gevestigde vennootskappe. Rolspelers in die Innovasieproses vorm 'n Kennisvoorsieningsketting en moet verbind word op 'n wyse wat die uitruil van kennis tussen hulle bevorder.

Daar is verskeie moderne benaderings tot Kennisbestuur, maar weinig van hierdie strategieë spreek die volle kompleksiteit van Innovasie aan. 'n Wye verskeidenheid kennisbronne en –formate bestaan tussen 'n groep rolspelers soos dié wat in die Innovasieproses betrokke is. Die ideale Kennisbestuurstrategie om die Innovasieproses te vergesel moet daarom 'n holistiese uitkyk op kennis bied en terselfdertyd die dinamiese aard daarvan in ag neem.

Kennisnetwerke bied dié benadering deur 'n aantal persone en hulpbronne, asook die verhoudinge tussen hulle, te omsluit. Hierdie spelers in die netwerk word toegelaat om kennis onderling vas te vang, oor te dra en te skep met die doel om waarde te genereer. Laasgenoemde Kennisnetwerk word ondersteun deur 'n Kennisnetwerkargitektuur wat uit 'n kombinasie van organisatoriese en inligtingstelselgereedskap bestaan.

Op die organisatoriese front word die Kennisnetwerkargitektuur pasgemaak om oor organisasiegrense te strek. Die kollaboratiewe omgewing wat benodig word om die Innovasieproses te ondersteun, word hierdeur geskep. Deur spelers vanuit verskillende organisasies toe te laat om by die netwerk aan te sluit, word 'n Geïntegreerde Kennisnetwerk gevorm.

Die Inligting- en Kommunikasietegnologie onderafdeling van 'n Kennisnetwerkargitektuur wat die Innovasieproses pas, sluit onder andere 'n aanlyn Inligtingstelsel in. Hierdie Inligtingstelsel gebruik 'n netwerkmodel in sy benadering tot inhoudsbestuur en behoort verder alle kennisoordrag en –skeppingsprosesse binne die Kennisnetwerk te ondersteun.

Hoewel so 'n Inligtingstelsel die 'n enkele toegangspunt tot die netwerk se kennispoel bied, kan dit opgestel word om toegang aan indiwidue vanuit verskillende organisasies te verleen. Hierdie funksionaliteit koppel dit dus aan die behoeftes van 'n Geïntegreerde Kennisnetwerk en verenig die

verskillende onderafdelings van die Kennisnetwerkargitektuur. Die Kennisnetwerkargitektuur vorm gevolglik ‘n oplossingsraamwerk, eerder as ‘n modulêre gereedskapstel.

Om die Innovasieproses volledig binne ‘n Inligtingstelsel te ondersteun verg egter meer as om die onderskeie rolspelers te verbind en kennisbestuur tussen hulle te fasiliteer. Suksesvolle Innovasiebestuur verg begrip vir die volle Innovasielewenssiklus en die gebruik van ‘n omvattende padkaart om innovasieprojekte (wat binne die Geïntegreerge Kennisnetwerk ontwikkel) te lei. Die verlangde Inligtingstelsel fasiliteer dus ‘n Geïntegreerde Kennisnetwerk en ondersteun terselfdertyd die volle lewenssiklus van innovasieprojekte wat uit die netwerk spruit.

Hierdie studie ontwikkel ‘n argitektuurspesifikasie wat die bogenoemde Inligtingstelsel op ‘n funksionele vlak beskryf. Met hierdie argitektuurspesifikasie as riglyn, word die Inligtingstelsel met behulp van ‘n aanlyn inhoudsbestuurgereedskapstel ontwerp en ontwikkel. Ten slotte word die stelsel se funksionaliteit gedemonstreer.

Summary

Innovation capability is undoubtedly an essential attribute for organizations that wish to survive and grow in a modern economy. Innovation is however widely misunderstood and subsequently mismanaged. Common misconceptions include that innovation only consists of a single moment of inspiration, and that it is therefore dependent on a single person or department within the organization. In reality the Innovation Process has a distinct life cycle and involves a wide array of role-players.

Effective innovation management is reliant on efficient cooperation between these role-players. This cooperation however extends beyond collaborative organizational structure, bilateral agreements and partnership contracts. Role-players in the Innovation Process form a Knowledge Supply Chain and should be connected in a way that promotes knowledge exchange between them.

Several modern approaches to Knowledge Management are available, but few grasp the complexity of Innovation. A wide variety of knowledge sources and formats exist within a set of parties like those involved in Innovation. The preferred Knowledge Management strategy to accompany the Innovation Process should therefore take a holistic view on knowledge while embracing its dynamic nature.

Knowledge Networks provide exactly this approach by encompassing a number of people and resources and the relationships between them. These actors within the network are allowed to capture, transfer and create knowledge for the purpose of creating value. This Knowledge Network is supported by a Knowledge Network Architecture consisting of a combination of organizational and information system tools.

On an organizational front, the Knowledge Network Architecture is customized to reach across organizational boundaries, thereby creating the collaborative environment that is needed to support the Innovation Process. By allowing actors from different organizations to join the network, an Integrated Knowledge Network is formed.

The Information and Communication Technology element of a Knowledge Network Architecture that suits the needs of the Innovation Process features an online Information System. This Information System employs a network model in its approach to the handling of content and supports all the knowledge transfer and creation processes within the Knowledge Network.

Although such an Information System provides a single point of entry to the network's knowledge base, it may be configured to allow access to individuals from multiple organizations. This functionality links it to the requirements of an Integrated Knowledge Network, thereby combining the elements of the Knowledge Network Architecture to form a solution framework instead of remaining modular tools.

Fully supporting the Innovation Process within an Information System Architecture does however involve more than simply connecting role-players and facilitating knowledge management between them. Successful Innovation Management requires an understanding of the full Innovation Life Cycle, and ensuring that a comprehensive roadmap is followed to guide innovation projects that develop within the Integrated Knowledge Network. The required Information System should therefore facilitate an Integrated Knowledge Network, while providing support for the full life cycle of innovation projects that develop within the network.

This study develops an architecture specification that functionally describes the aforementioned Information System. Using this architecture specification as a guideline, the Information System is subsequently designed and developed with the use of an online content management toolset and a showcase of the system's functionality is provided.

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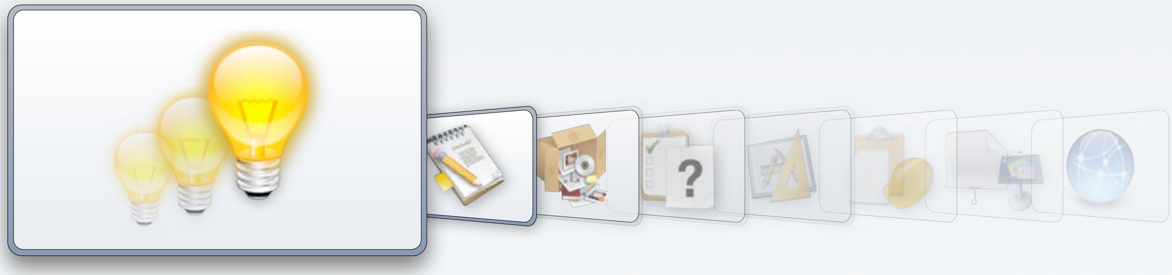
Chapter 1

Introduction

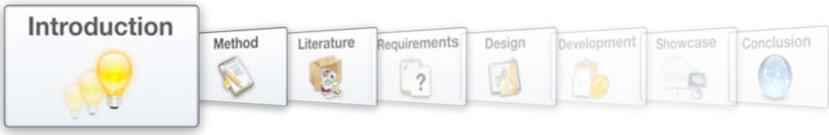


SDLC Step 1: Initiation and System Concept Development

"Begins when a sponsor identifies a need or an opportunity,
upon which a concept proposal is created.
Defines the scope or boundary of the concept."

- Wikipedia

Chapter 1 provides background to the research, proposes an initial problem statement, defines the scope op the project and introduces the structure of the report. The problem statement is refined at the end of Chapter 3.



1.1. Background to the research

Innovation capability is undoubtedly an essential attribute for organizations that wish to survive and grow in a modern economy. Economic magazines annually publish editions especially devoted to listing the year's most innovative companies. Even in times of economic downturn, management teams with a healthy long-term vision for their enterprises will recognize that Innovation is a vital tool for generating value. Many organizations intend to sustain or even increase spending on Innovation in tough economic times.

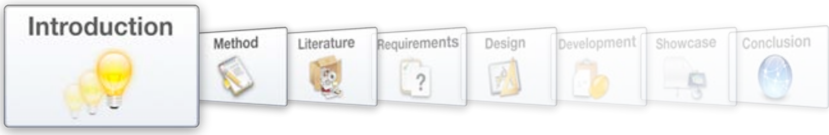
Innovation is however widely misunderstood and subsequently mismanaged (Boston Consulting Group [4]). Common misconceptions include that innovation only consists of a single moment of inspiration, and that it is therefore dependent on a single person or department within the organization. In this sense, Innovation is confused with Invention, which is only one of several stages in the Innovation Process. As will be discussed in Chapter 3, the Innovation Process has a distinct life cycle and involves a wide array of role-players. These role-players span the pre-competitive and competitive domains and include a variety of entities, ranging from academia, government, industry (including competitors and suppliers) as well as the market.

Effective Innovation Management is reliant on efficient cooperation between these role-players. This cooperation however extends beyond collaborative organizational structure, bilateral agreements and partnership contracts. Role-players in the Innovation Process should be connected in a way that promotes knowledge exchange between them.

Several modern approaches to Knowledge Management are available, but few grasp the complexity of Innovation. A wide variety of knowledge sources and formats exist within a set of parties like those involved in Innovation. Chapter 3.2.2 highlights that knowledge resides with a range of carriers, and may manifest in both explicit and tacit forms. Collaboration and development of any nature is furthermore constantly augmenting these knowledge objects as knowledge creation or transfer takes place. The preferred Knowledge Management strategy to accompany the Innovation Process should therefore take a holistic view on knowledge while embracing its dynamic nature.

Knowledge Networks are a recent development within the Knowledge Management sphere and provide exactly this holistic approach by encompassing a number of people and resources and the relationships between them. Chapter 3.2.3 elaborates extensively on the way that these actors within the network capture, transfer and create knowledge for the purpose of generating value.

The construction of a Knowledge Network may be approached as the combination of a number of building blocks in a synergetic fashion (refer to Chapter 3.2.3). These building blocks include elements



from several disciplines, including both organizational and information systems tools, management systems and corporate culture. Knowledge flow within the network is often described in terms of the transformation processes that knowledge undergoes, and these processes are a further building block of the Knowledge Network.

Recent technological developments have resulted in an abundance of connectivity within industry. Great advances have been made in online technologies and several open-source projects emerged as pioneers of the modern online content management landscape. These innovative technologies (examples of which are reviewed in Appendix A) are often used as the cornerstone of Knowledge Management strategies aimed at explicit knowledge.

Very few of these technologies have however attempted a holistic approach by facilitating a Knowledge Network. Such a project would aim to connect role-players in an environment that promotes knowledge creation and transfer, as a means of supporting the Innovation Process.

1.2. Problem Statement

Innovation within a globalized economy requires that a wide range of role-players collaborate rapidly. A mechanism that offers this functionality is required.

Insights acquired during the literature study in Chapter 3 lead to a refined problem statement in Chapter 3.3.

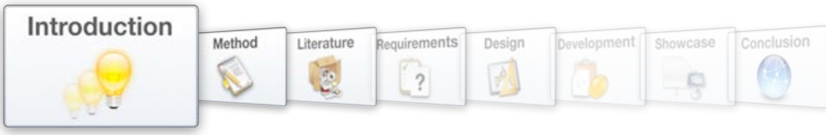
1.3. Structure of the report

This research report employs a navigation structure that fuses the traditional academic report with the Systems Development Life Cycle (SDLC).

From an academic perspective, the research method is stated, followed by a literature study, application of research results and finally drawing some conclusions.

The SDLC however proposes a workflow that includes the following steps (adapted from US DOJ [57]):

1. Initiation and System Concept Development
2. Planning



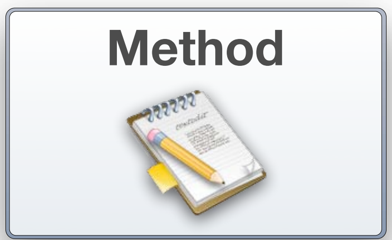
3. Resource Acquisition
4. Requirements Analysis
5. Design
6. Development
7. Integration and Test
8. Implementation
9. Operation and Maintenance
10. Disposition

Considering that the scope of this study extends from a problem statement up to a demonstration of the developed system's functionality, step 7 of the SDLC will be approached with this scope definition in mind. Steps 8, 9 and 10 of the SDLC will not be covered in depth.

Combining academic elements with SDLC produces the following document structure:

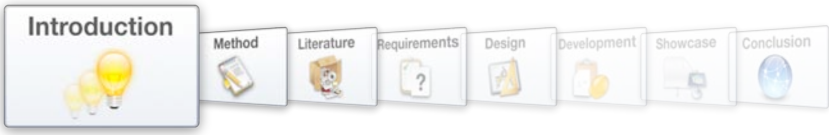
Chapter 1: Introduction

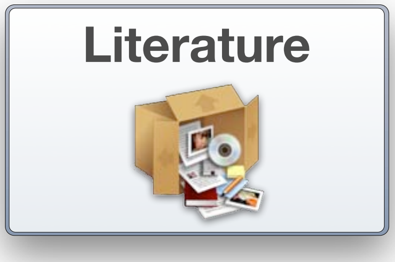
Provides background to the research, proposes an initial problem statement, defines the scope of the project and introduces the structure of the report. Chapter 1 corresponds to the Initiation and System Concept Development stage of the SDLC.



Chapter 2: Method

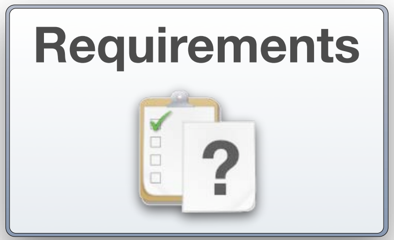
Describes the research method that is implemented and corresponds to the Planning stage of the SDLC.





Chapter 3: Literature

Provides an overview of literature that was studied to gain a greater understanding of the concepts involved in the problem. An overview of relevant technologies accompanies this research overview, and is provided as Appendix A. Insights acquired in the literature study are used to refine the initial problem statement proposed in Chapter 1 and to subsequently define the hypothesis for this research project. Chapter 3 corresponds to the Resource Acquisition stage of the SDLC.



Chapter 4: Requirements

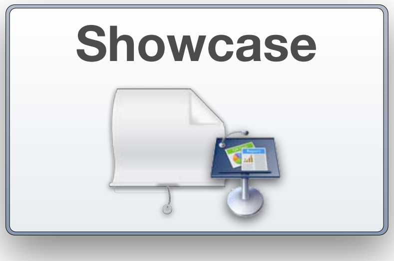
Derives a specification of the proposed solution's functionality in the form of an Information Systems Architecture, and corresponds to the Requirement Analysis stage of the SDLC.

Chapter 5: Design

Uses the Information Systems Architecture derived in Chapter 4 as a guideline for the design of the proposed solution. The technology overview in Appendix A is used as a reference for design decisions. Chapter 5 focuses on how to deliver the required functionality and corresponds to the Design stage of the SDLC

Chapter 6: Development

The detailed system design that was developed in Chapter 5 is converted to a complete information system. Only the approach to the development process is discussed, with some of the details being presented in a series of tutorial videos that are available online at http://www0.sun.ac.za/bingtest/innonet/development. Chapter 6 corresponds to the Development stage of the SDLC.



Chapter 7: Showcase

A demonstration of the functionality of the information system that was developed is used as proof for the hypothesis stated in Chapter 3. Chapter 7 contains elements of the Integration and Test stage of the SDLC.

Chapter 8: Conclusions

Presents a discussion of conclusions that may be drawn from the development process that was followed in the research. Recommendations for further study are made on the basis of knowledge gained in the research. Chapter 8 includes elements of the Implementation, Operation and Maintenance and Disposition stages of the SDLC.

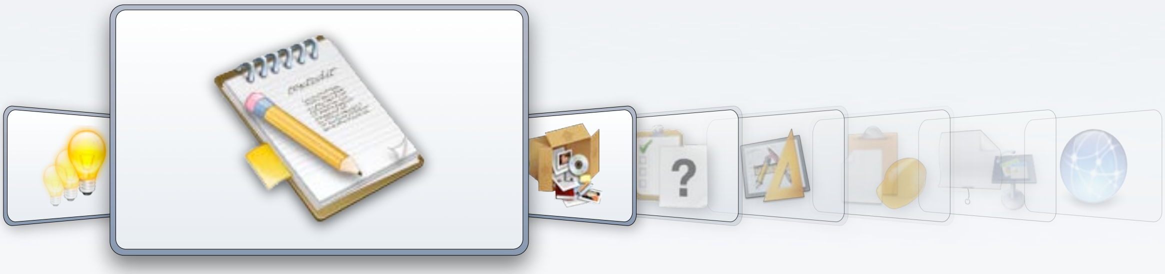
Appendix A: Knowledge Network ICT Architecture Review

Provides an overview of technologies that are relevant to the problem statement, with special focus on Content Management Systems.

Note: The iconic image associated with each chapter in the preceding document structure presentation, will be used throughout in chapter cover pages and page headers to guide the reader through the document and by association, through the SDLC.

Chapter 2

Method



SDLC Step 2: Planning

"Develop a Project Management Plan and other planning documents."

- Wikipedia

Chapter 2 describes the research method that was implemented.

The problem statement, as stated in Chapter 1, reads as follows:

Innovation within a globalized economy requires that a wide range of role-players may collaborate rapidly. A mechanism that offers this functionality is required.

The research method that will be implemented to solve the problem stated above is illustrated in Figure 1.

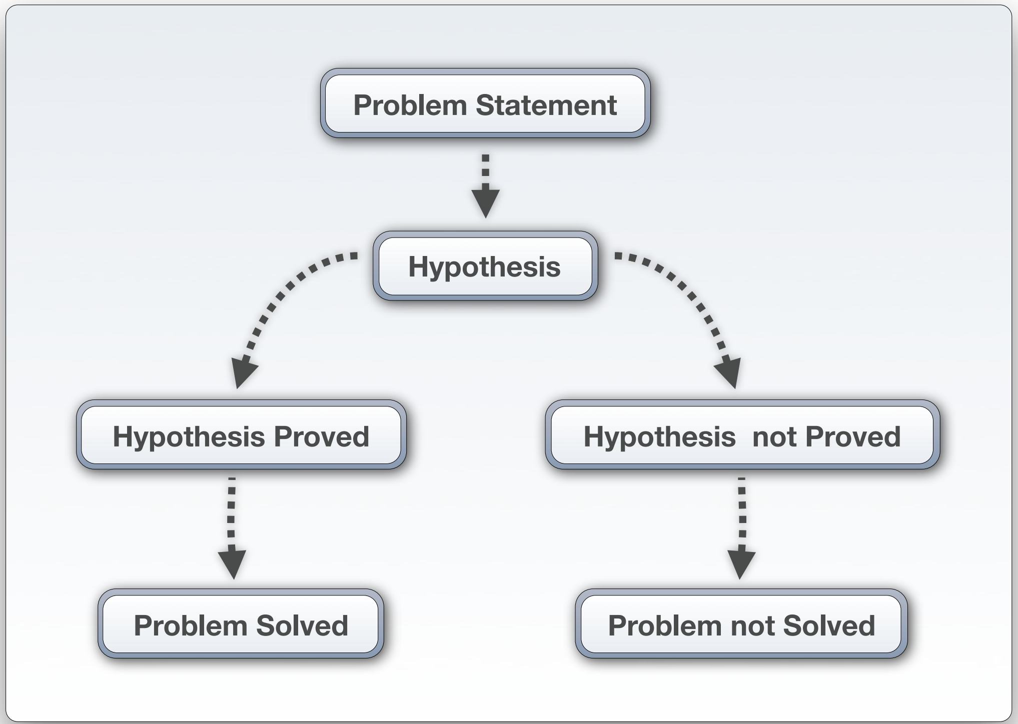


Figure 1 - Research Method

The research method may be described as follows:

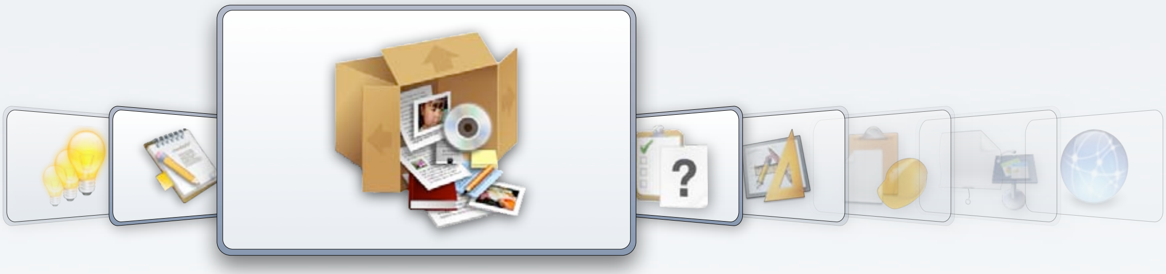
1. The problem is stated
2. A hypothesis is formulated, the proof of which will solve the problem
3. Research and development is performed to substantiate an argument to prove the hypothesis
4. The hypothesis is proved, thereby providing a solution to the problem

The current version of the problem statement is however not specific with regards to the nature of the collaboration that is needed. A hypothesis based on this problem statement will therefore not necessarily be accurate, from which follows that its proof may not solve the problem.

A literature review will therefore be used to shed light on the nature of collaboration that suits the Innovation Process, after which the problem statement will be refined and the hypothesis formulated.

Chapter 3

Literature

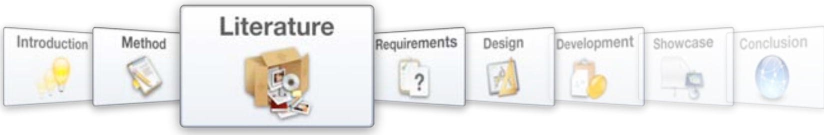


SDLC Step 3: Acquire Resources

"Acquire the resources needed to obtain a solution."

- Wikipedia

Chapter 3 provides an overview of literature that was studied to gain a greater understanding of the concepts involved in the problem. An overview of relevant technologies accompanies this research overview, and is provided as Appendix A. Insights acquired in the literature study are used to refine the initial problem statement proposed in Chapter 1, and to subsequently formulate a hypothesis for solving this problem.



This literature overiew discusses three main research domains:

1. Innovation
2. Knowledge Networks
3. Information and Communication Technologies

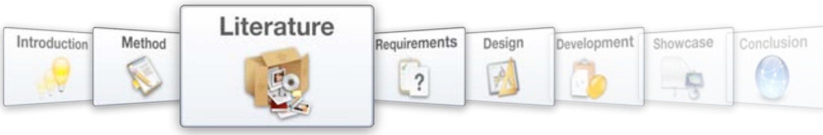
Innovation will be discussed first (Chapter 3.1), as it is the driving force behind the research. The need to optimize Innovation leads to a discussion of its links to knowledge (Chapter 3.1.3), which in turn flows into a review of Knowledge Networks (Chapter 3.2). The support of Knowledge Networks through Information and Communication Technologies is addressed in Chapter 3.2.3.3, and a review of these technologies in terms of a Knowledge Network Architecture is provided in Appendix A.

3.1. Innovation

Innovation is one of the key drivers of the modern economy, and the ability to innovate is considered vital for an enterprise to survive and grow (Drucker [13]). A multitude of definitions for innovation exists and it is a concept that is often misunderstood. Salvendy [49] gives a thorough definition of innovation:

“Innovation is not just one simple act. It is not just a new understanding or the discovery of a new phenomenon, not just a flash of creative invention, not just the development of a new product or manufacturing process; nor is it simply the creation of new capital and markets. Rather innovation involves related creative activity in all these areas. It is a connected process in which many and sufficient creative acts, from research through service, are coupled together in an integrated way for a common goal.”

Although innovation is recognized as an essential competitive enabler, it is often found that even companies that understand innovation do not manage it efficiently or effectively (Boston Consulting Group [4]). This can be attributed to the fact that most innovation management strategies do not pay attention to the complete Innovation Life Cycle, i.e. from an idea to a commercially successful product. An innovation management framework is characterized by structure that provides guidance for the project through the entire life cycle, but also flexibility to not inhibit innovative thinking. Various innovation process models have been developed, all of which may be generalized to include a number of components (refer to Figure 2), which could be interpreted to form the essence of the innovation process (Du Preez [14]).



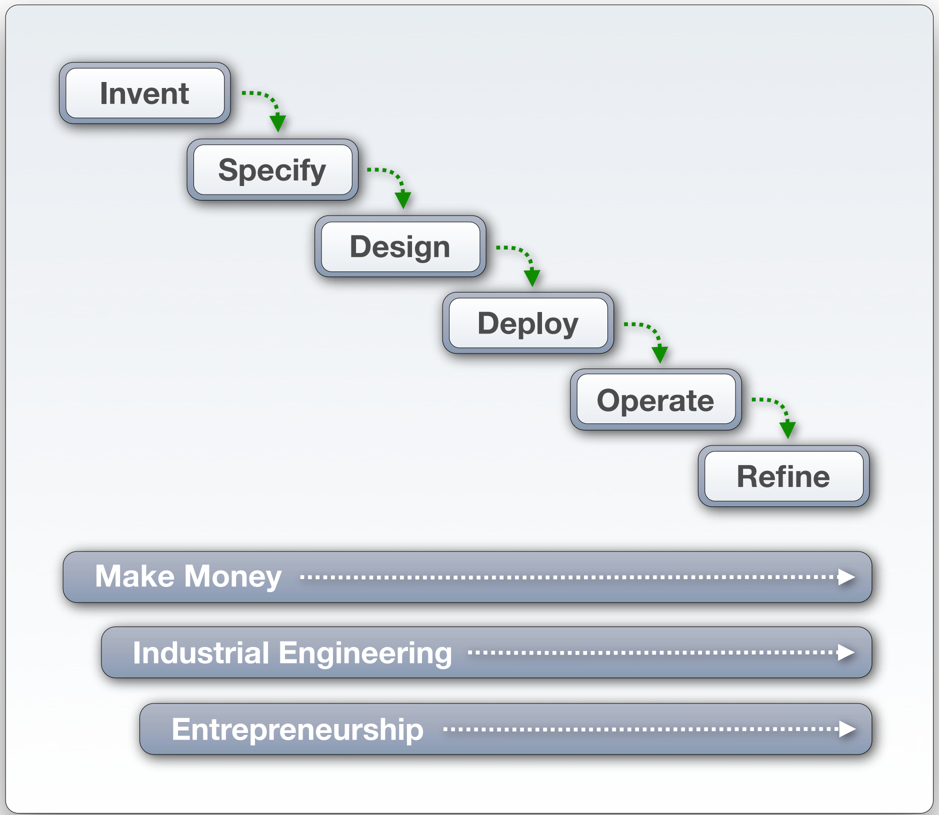


Figure 2 – Components of the Innovation Life Cycle (Du Preez, Louw [14])

3.1.1. Innovation Process Models

Innovation Process Models have evolved in six generations from simple linear models to increasingly complex interactive models (Rothwell [47]).

1. Technology push

   A simple linear model driven by developments in science and technology (refer to Figure 3).

2. Market pull

   A simple linear model driven by marketing and demand (refer to Figure 4).

3. Coupling model

   Sequential model that recognizes interaction between different elements and feedback loops between them. Emphasis is placed on combining research and development with marketing, but limited functional integration is achieved (refer to Figure 5).

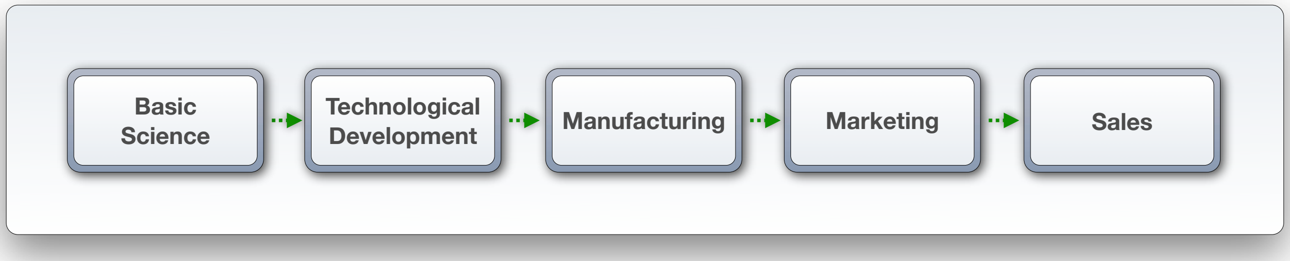


Figure 3 - First generation Innovation Process Model: Technology push (Varjonen [59])

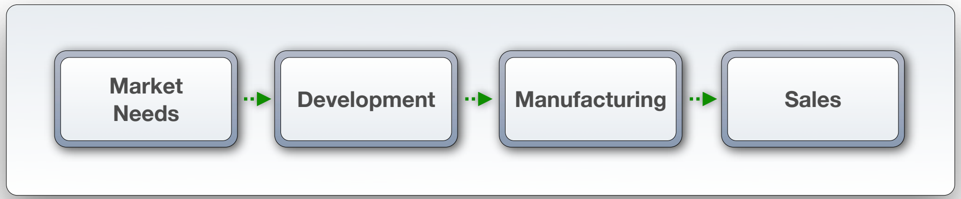


Figure 4 - Second generation Innovation Process Model: Market pull (Varjonen [59])

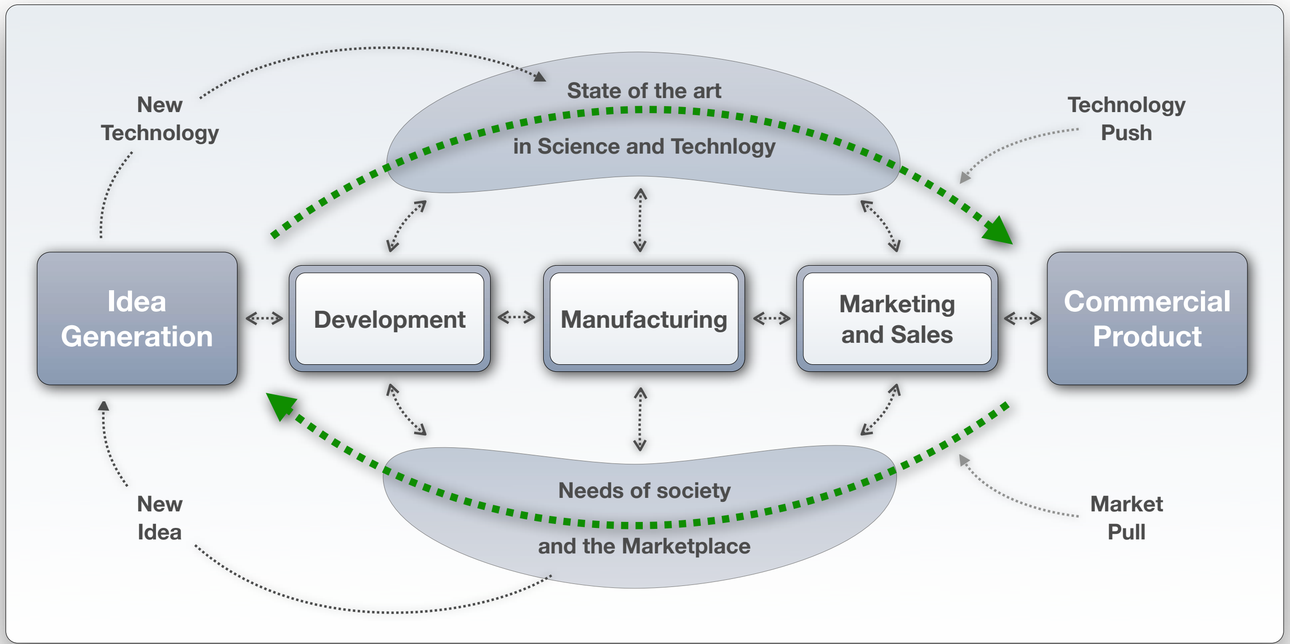


Figure 5 - Third generation Innovation Process Model: Coupling model (Rothwell [47])

4. Interactive model

Characterized by parallel activities across organizational functions and achieves more functional integration than previous models. These interactive models do however not explain the whole innovation process (refer to Figure 6).

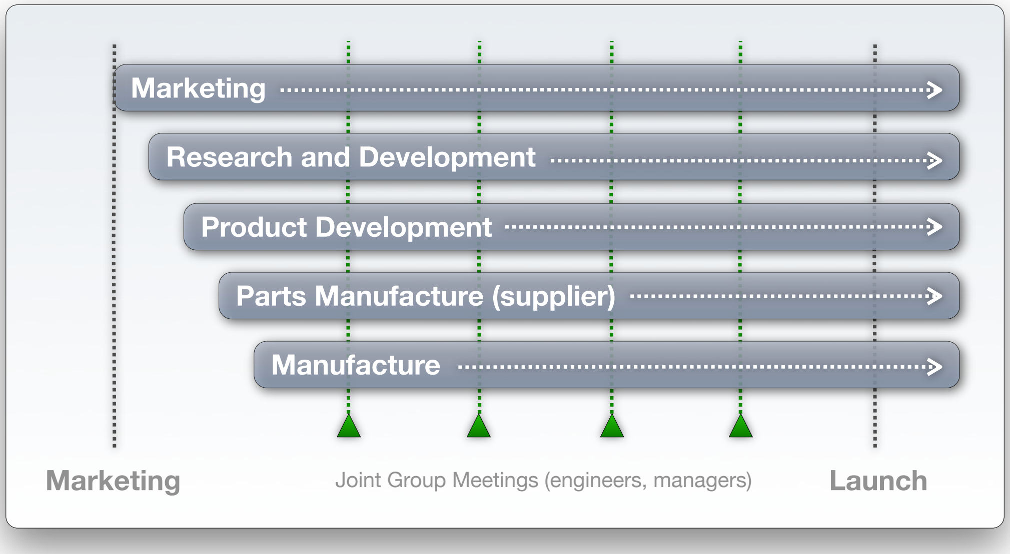


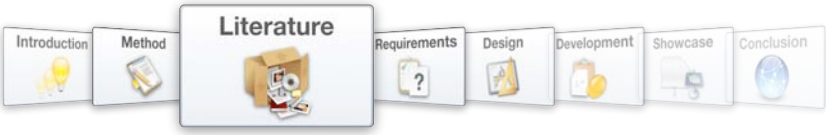
Figure 6 - Fourth generation Innovation Process Model: Interactive model (Rothwell [47])

5. Network model

Network models aim at explaining the complexity associated with the innovation process, including the influence of the external environment (refer to Figure 7). Effective communication with the external environment is also stressed, as a network of stakeholders is usually involved in innovation. However, as illustrated in Figure 8, the innovation process still takes place in closed networks, and innovations are developed and marketed within the firm's own boundaries. External inputs are also not exploited to their full potential.

6. Open innovation

Open innovation takes further advantage of the complexity that network models introduce to the innovation process, while adding a consideration for external influences to the internal focus of previous models. Ideas and paths to market may be contributed by internal and external sources that combine to enhance development through openness and collaboration (refer to Figure 9). The larger base of ideas and technologies that can be utilized drives internal growth while lowering risk by sharing it with fellow network members.



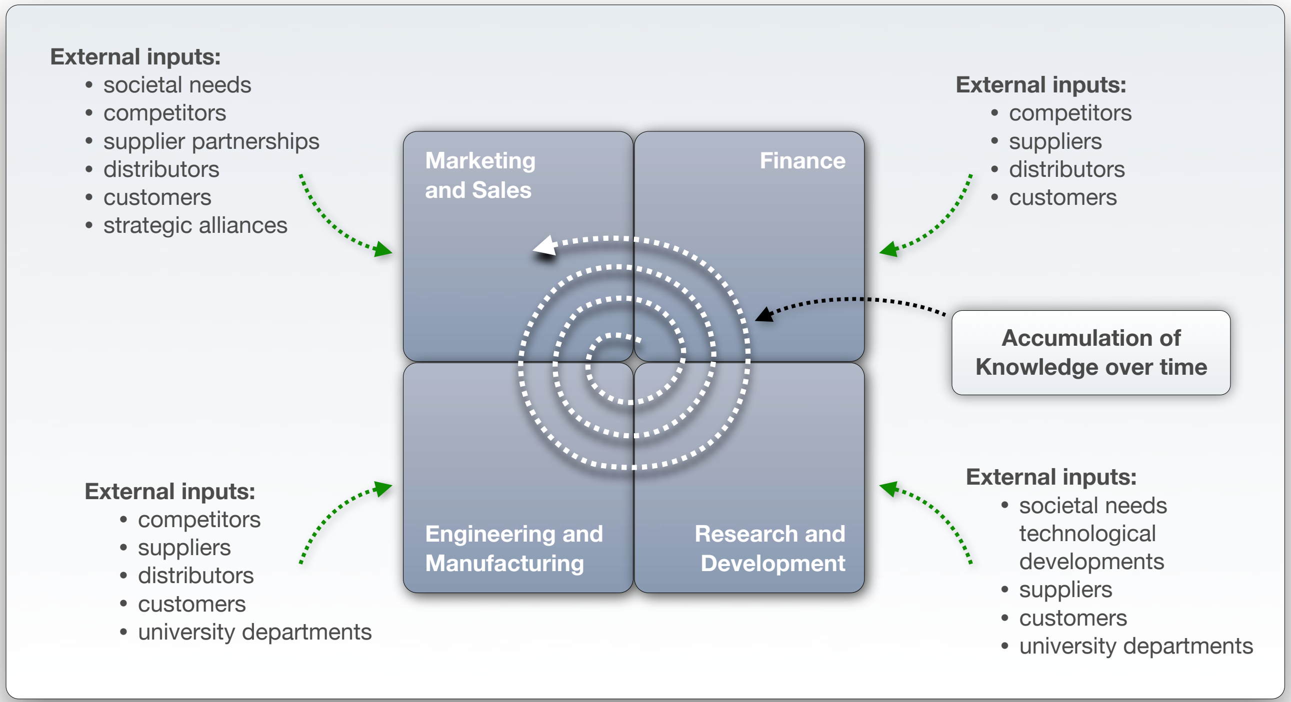


Figure 7 - Fifth generation Network Model depicting external inputs (Trott [56])

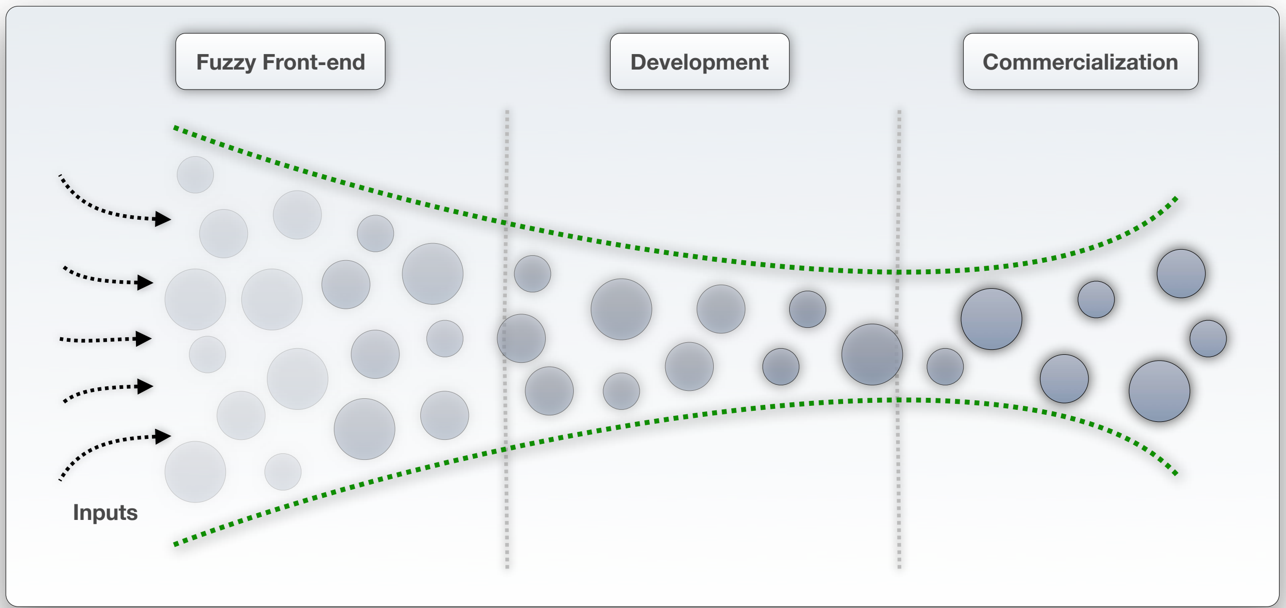


Figure 8 - Fifth generation Network Model depicting external inputs (Docherty)

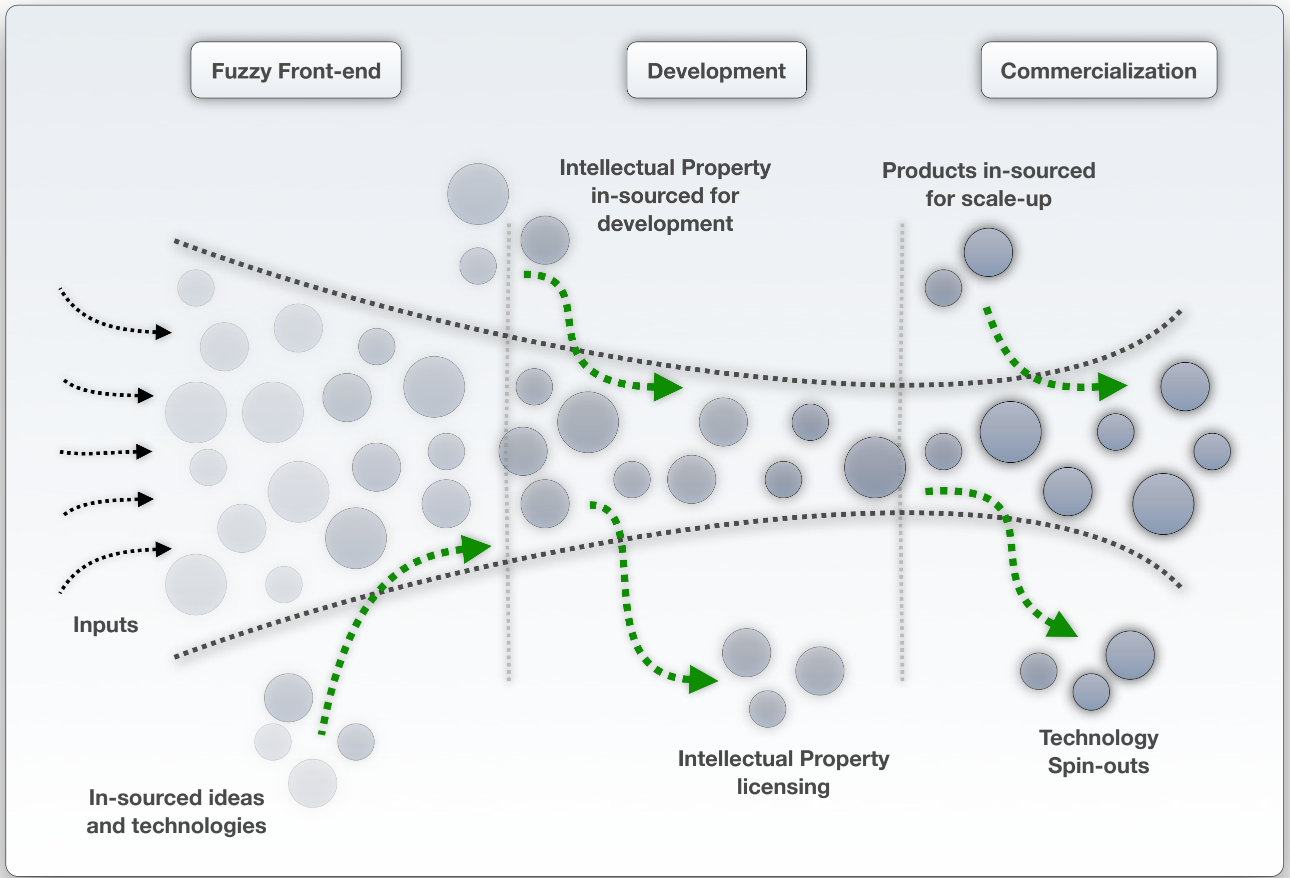


Figure 9 - Sixth generation Innovation Process Model: Open innovation (Docherty [11])

Considering these innovation process model generations, a number of observations that provide insight into the innovation process may be made (Du Preez [14]):

- Most of the innovation models include a sequence of stages: (a) idea generation and identification, (b) concept development, (c) concept evaluation and selection, (d) development and (e) implementation.
- Innovation can be either a market pull or technology push, or a combination.
- Integration between the different functions within the innovation process is of paramount importance and can often be the discriminating factor.
- The latest (open) Innovation Process Models favor a network approach where innovation is not only focused internally, but also externally.

- Most of the models ignore the exploitation of the new innovation within the market. Exploitation is the only mechanism to competitiveness and financial survival, and should therefore be included in the framework.

3.1.2. The FUGLE Innovation Process model

The observations made in the previous section were taken into account by Louw and Du Preez (Du Preez [14]) in the development of the FUGLE Innovation Process model (refer to Figure 10).

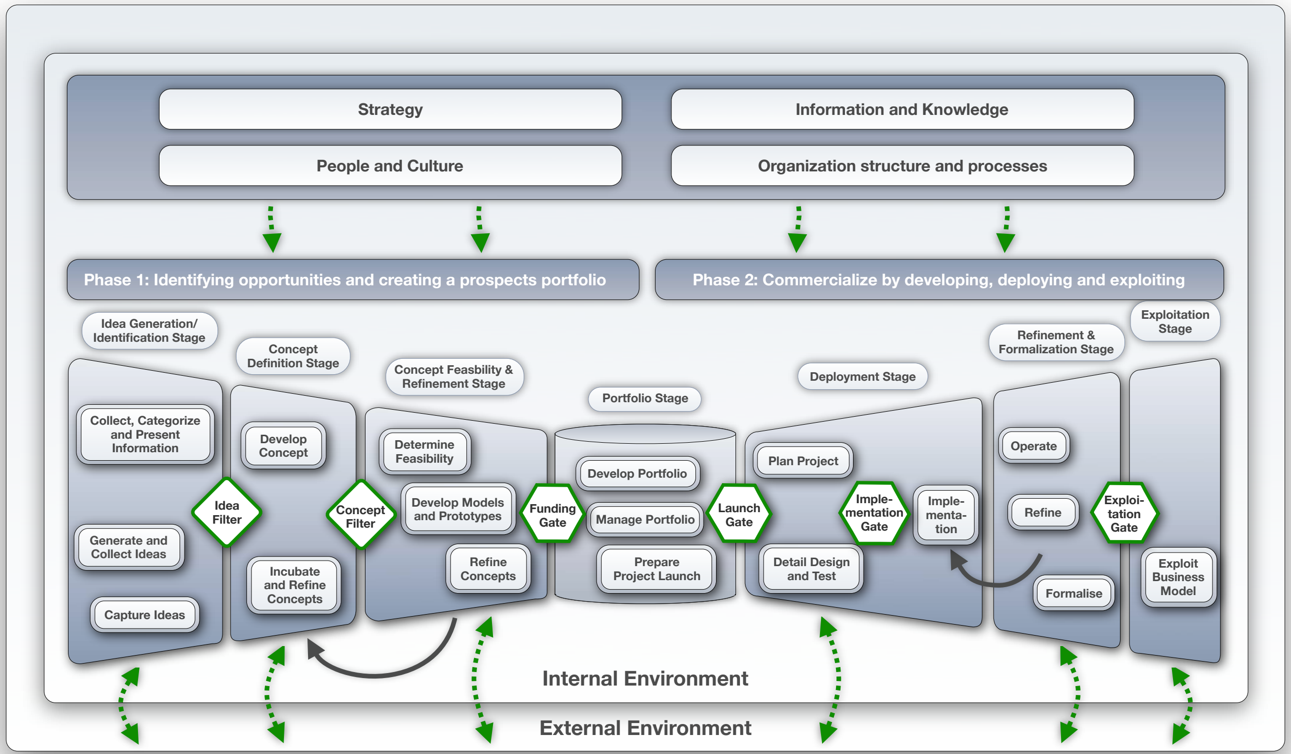


Figure 10 - The FUGLE Innovation Process model

The model is centered on a generic innovation process roadmap and combines the convergent innovation front-end or funnel (refer to Figure 11) with the divergent deployment and exploitation elements, thereby representing the entire Innovation Life Cycle (refer to Figure 12). This divergent phase is described as the "bugle".

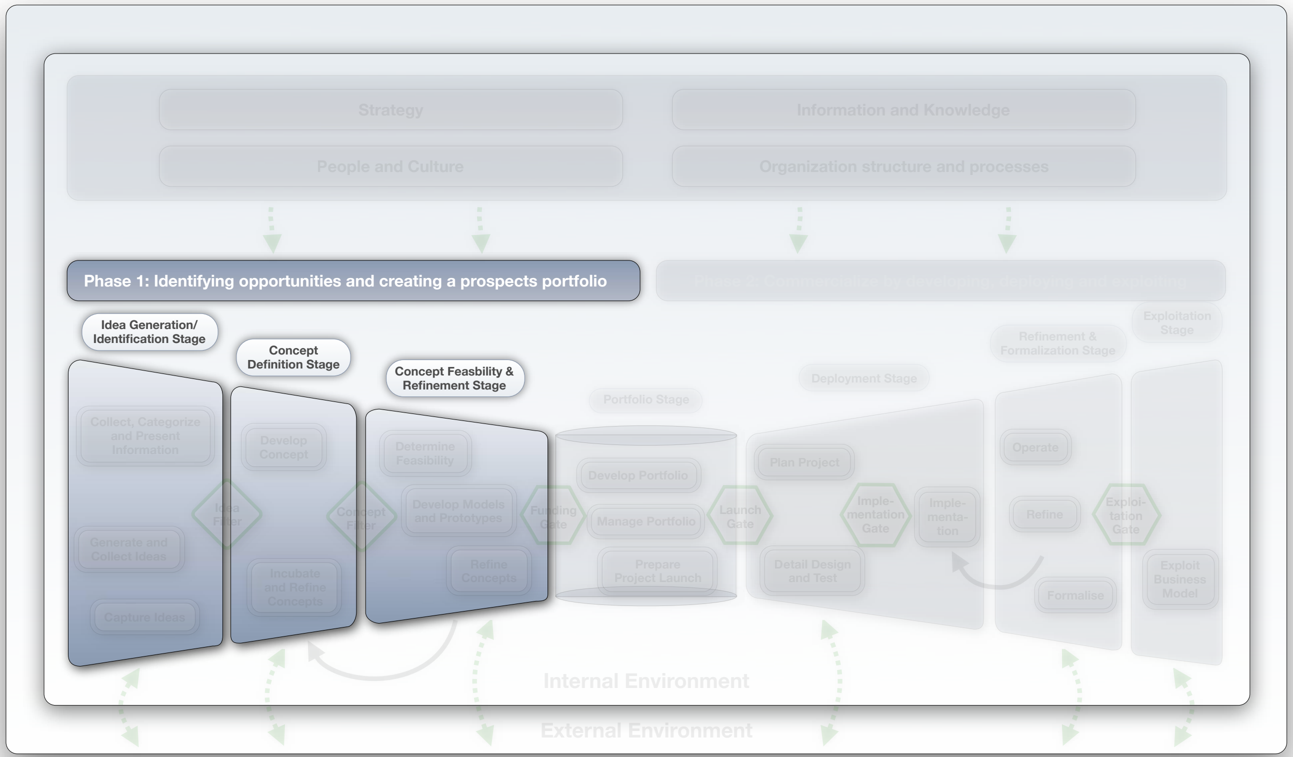


Figure 11 - The convergent innovation "funnel" of the FUGLE Innovation Process model

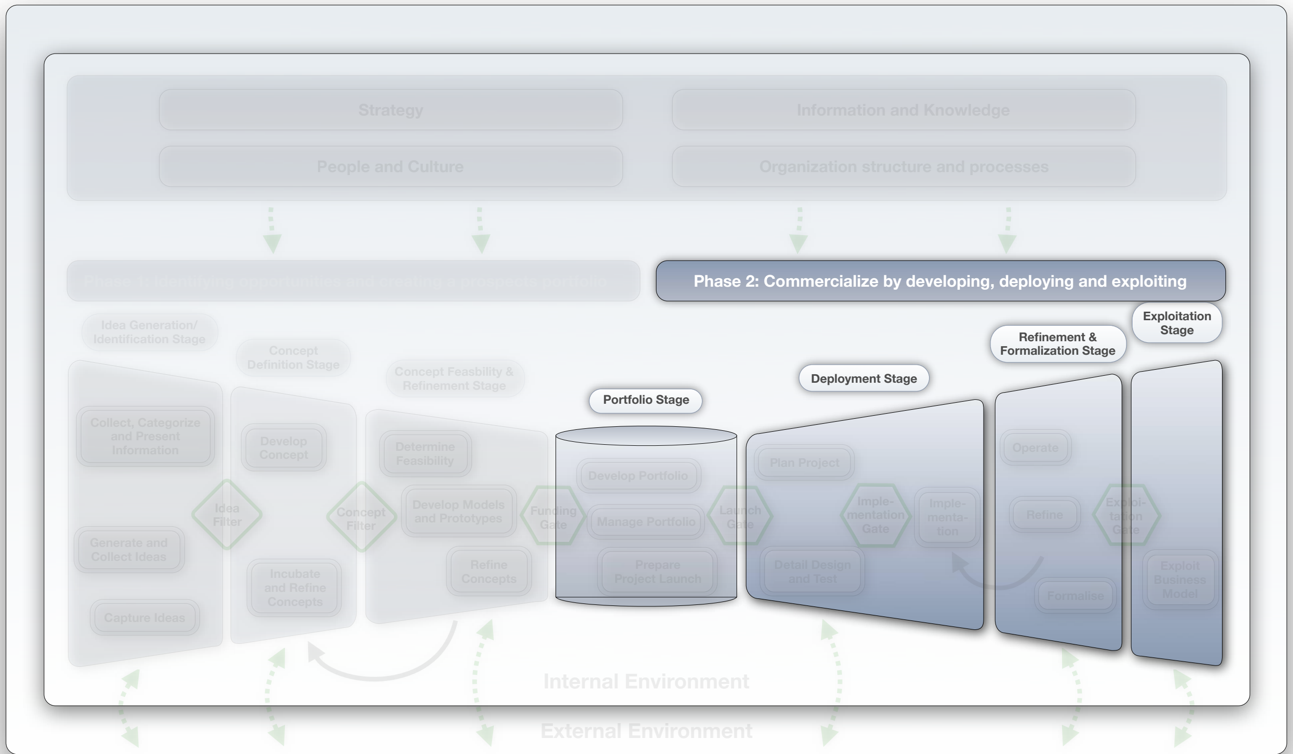


Figure 12 - The divergent deployment and exploitation "bugle" of the FUGLE Innovation Process model

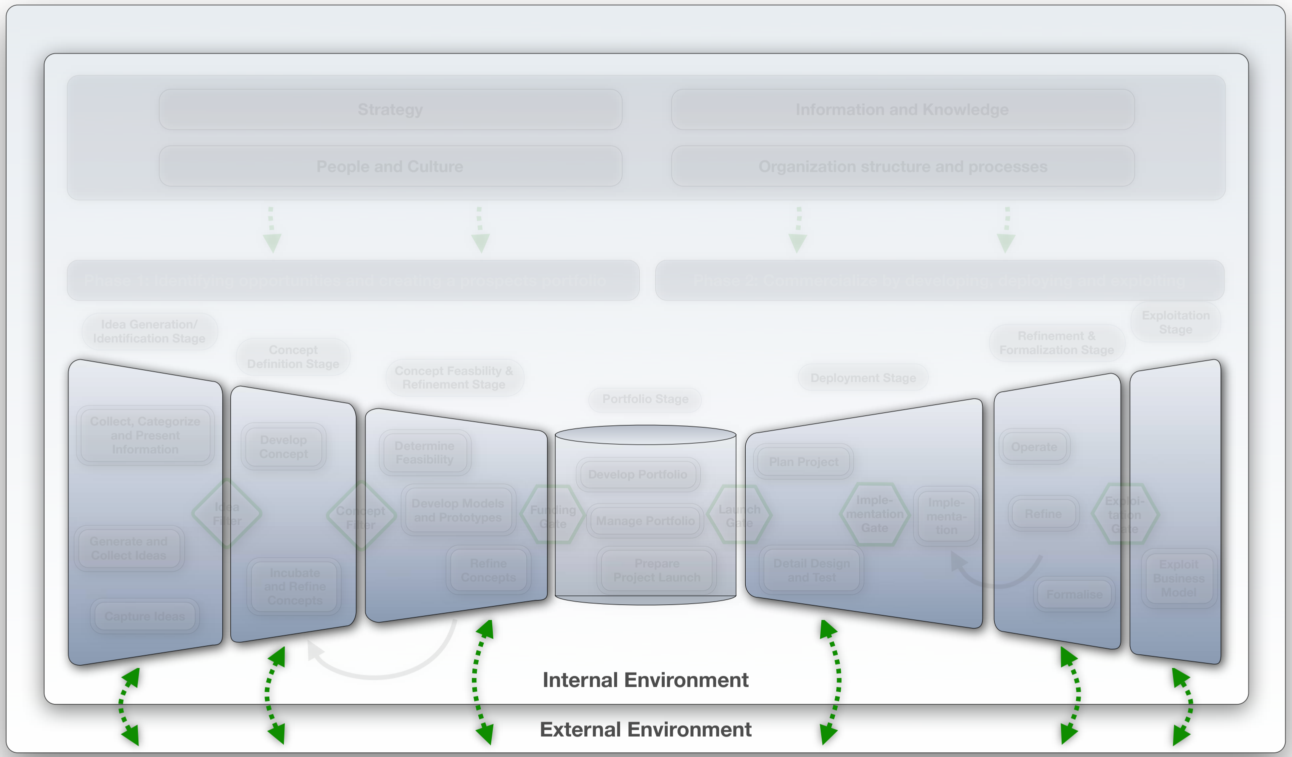


Figure 13 - Activities within the funnel and bugle are linked to the External Environment

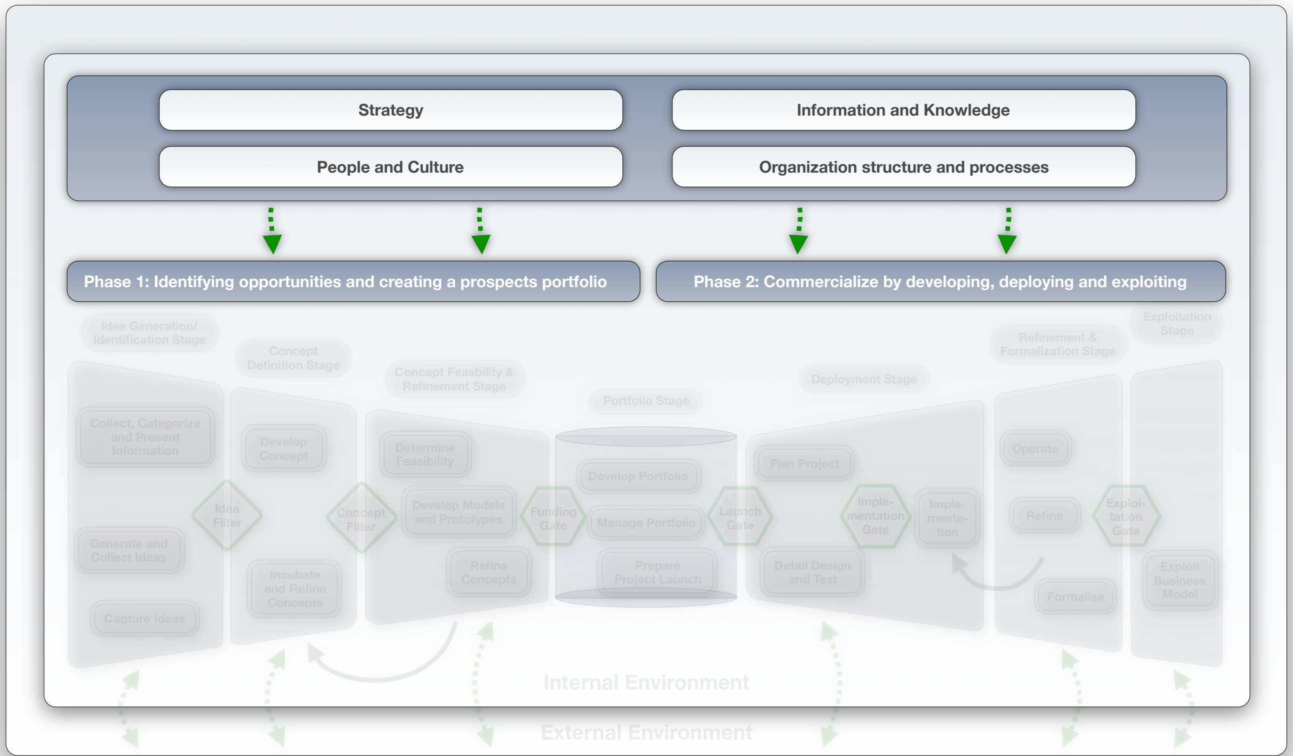


Figure 14 – Strategy, People and Culture, Information and Knowledge and Organizational Structure governs the Innovation Process

The innovation process (the funnel and bugle) operates internally in the firm, but all the stages of the process are linked to the external environment (refer to Figure 13). This emphasizes the network aspect of innovation, as well as the open innovation trend to incorporate external inputs in the process. These inputs could influence any stage of the process, even up to the point of outsourcing. The complete process is guided and supported by the enterprise's strategies, people and culture, organizational structure and processes, as well as information and knowledge (refer to Figure 14).

The FUGLE (a concatenation of "funnel" and "bugle") model consists of a number of stages with gates and filters. The model is however flexible and allows for activities to overlap between stages. Iterative loops are possible between the concept definition and concept feasibility stages, as well as between the deployment and refinement stages. Iterative loops are also possible within the stages.

Gates and filters are used as decision points between certain activities and stages. During the idea generation stage and concept definition and evaluation stages these decision points are called filters. This illustrates the less rigid approach that should be applied during these initial development stages. Filters are used to sift the promising and less promising ideas and concepts. The less promising ideas and concepts should however still be documented along with their full context and stored for future revisit and evaluation, as circumstances may be more favorable for these ideas and concepts in the future.

The various activities that take place in the different stages can be described as follows:

3.1.2.1. Idea Generation / Identification Stage

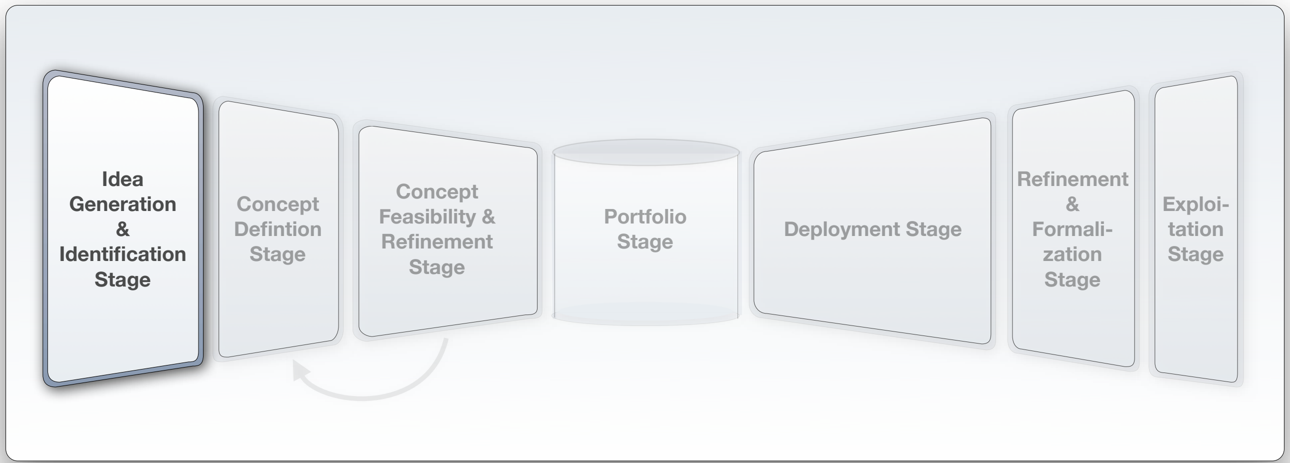


Figure 15 - Idea Generation Identification Stage of the FUGLE Innovation Process Model

This is the creative stage where new ideas are generated and/or new opportunities identified. As the model embraces the open innovation paradigm, these new ideas can come from internal or external sources.

By efficiently and effectively identifying, capturing, classifying and presenting information, information can act as a constructive stimulus for idea generation. This information may be about problems, competitors, clients and markets, technologies or strategies that are available to the business.

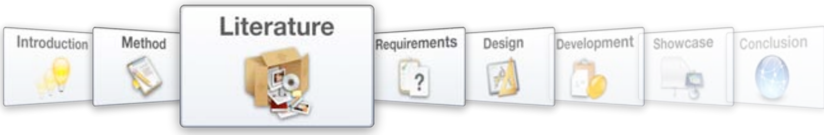
Although ideas are often the result of moments of inspiration, idea generation can be proactively encouraged and facilitated in workshops and brainstorming sessions. By properly managing a formalized Knowledge Supply Chain (Du Preez [15]), the right information can be made available to the right people in the right manner, thereby helping to trigger new and innovative ideas.

Irrespective of the process that was followed to generate an idea, it is important to capture the idea in a fashion that allows for it to be communicated to others and to be developed further as a concept (Gaynor [19]). All ideas should be captured, as even ideas that do not seem promising at first may prove valuable if the business context changes over time. The idea capturing mechanism should include as much metadata as possible, including any available context in terms of development life cycle, team members that were involved and any external considerations or influences.

Ideas should be evaluated against a company's strategic objectives, and those that are clearly not in line may be rejected. This leaves only promising ideas that are in line with objectives as candidates for further development, thereby ensuring that resources dedicated to the development of these ideas have a good chance on generating returns. Rejected ideas should not be removed from the system, as a change in future circumstance may render them more promising and relevant.

3.1.2.2. Concept Definition Stage

The focus of this stage is to transform the idea into a workable concept. Concepts are often developed by combining different ideas. Once the initial concept definition is done, some time should be provided to share the concept with different people in order for the concept to incubate. If necessary, this may lead to refinement of some of the ideas followed by another filtering process to select the concepts that are most promising for further evaluation in order to determine their feasibility.



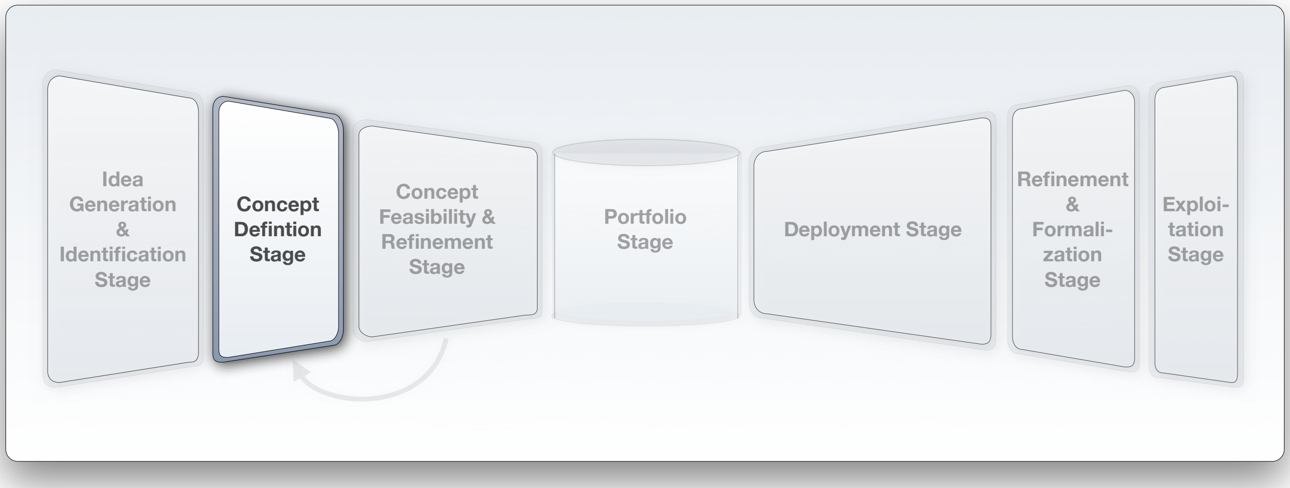


Figure 16 - Concept Definition Stage of the FUGLE Innovation Process model

3.1.2.3. Concept Feasibility and Refinement Stage

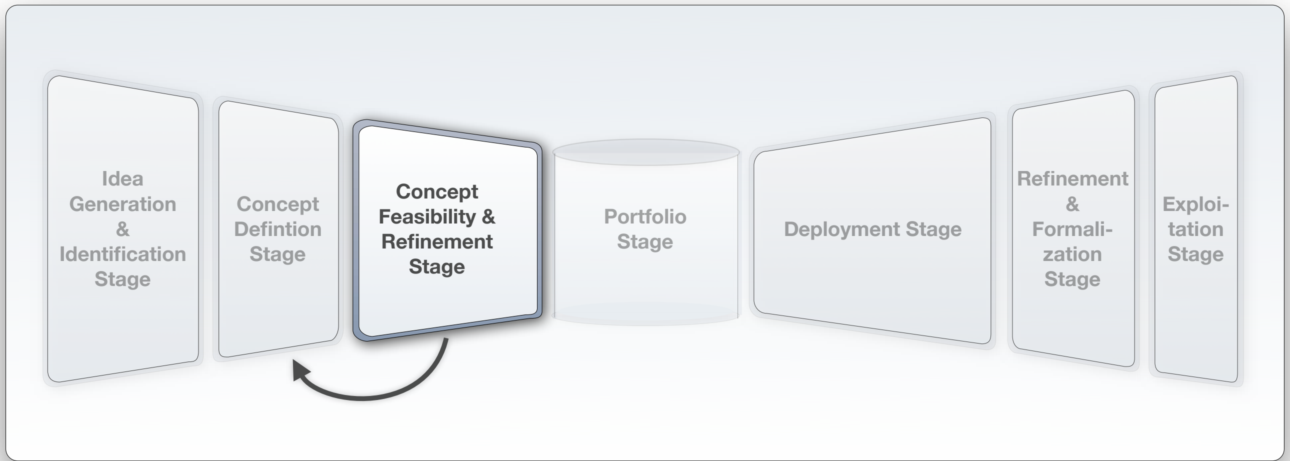


Figure 17 - Concept Feasibility and Refinement Stage of the FUGLE Innovation Process model

The concept feasibility stage is about further investigation of the concept and collecting additional information to compliment the potentially limited information that was available during the definition stage. Modeling and prototyping also provides valuable information on concept feasibility. Iterative loops of concept refinement and evaluation will typically occur, and should be used as a learning experience. It is better and more cost effective to fail at this stage than later during the deployment stage. The funding gate at the end of the stage is used to make decisions on which concepts should be resourced and developed further, thereby producing a list of prospective innovation projects as the stage output.

3.1.2.4. Portfolio Stage

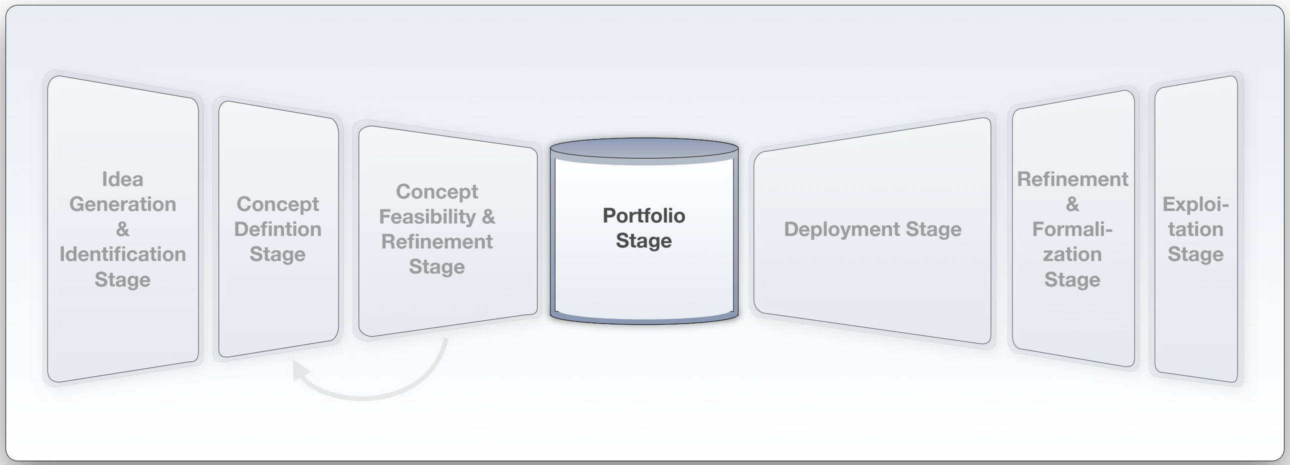


Figure 18 - Portfolio Stage of the FUGLE Innovation Process model

Innovation Portfolio Management entails the holistic management of the enterprise's innovation initiatives and includes prioritization, scheduling and alignment of prospective innovation projects. Resource allocation is also considered during this stage, along with assignment of responsibility. Innovation initiatives should be continuously monitored to understand the aggregate effect of the innovation portfolio on the strategic objectives of the enterprise. Innovation projects progress towards deployment by determining a launch date for each individual project.

3.1.2.5. Deployment Stage

The innovation solutions that were identified, conceptualized and approved during the previous stages are now designed, implemented and tested. This includes the detail project planning and management of the design and implementation projects. An implementation gate is used after the detail design is completed to serve as a final design review before implementation. Implementation of the design involves the development and deployment of the new innovation.

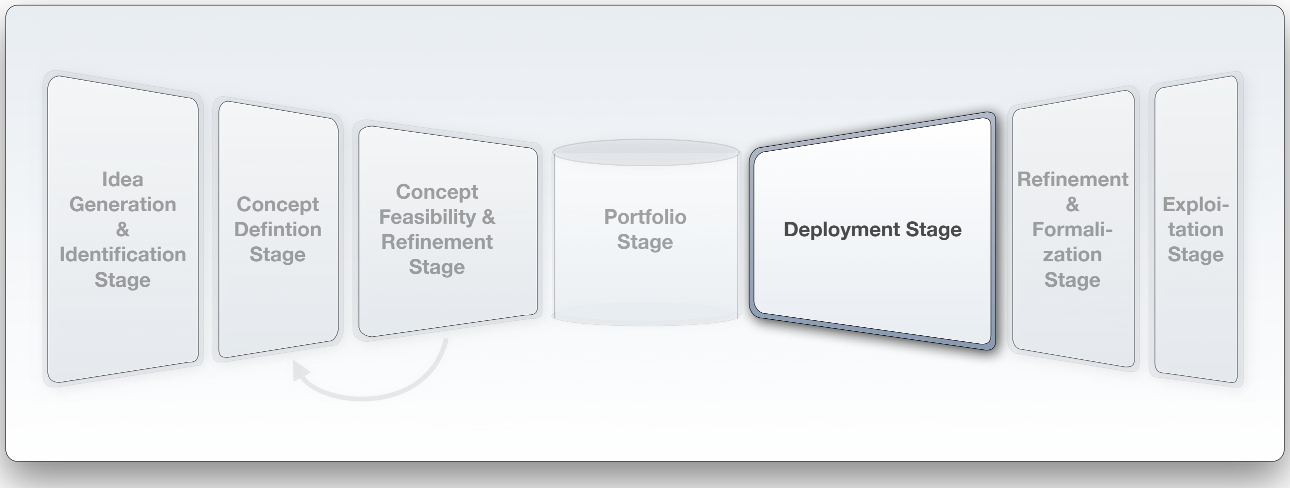


Figure 19 - Deployment Stage of the FUGLE Innovation Process model

3.1.2.6. Refinement and Formalization Stage

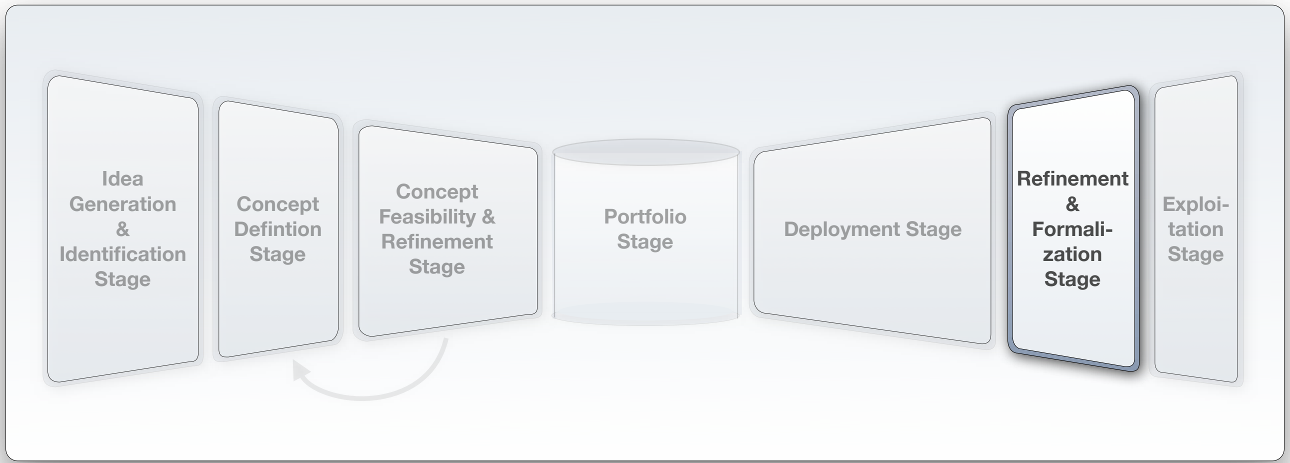


Figure 20 - Refinement and Formalization Stage of the FUGLE Innovation Process model

After initial deployment the innovation project is in operation, but will most likely not function optimally. The progress of the project should therefore be monitored, measured, evaluated and refined until it functions satisfactorily according to specifications. Once the solution is performing satisfactorily it can be formalized in terms of operational documentation.

3.1.2.7. Exploitation Stage

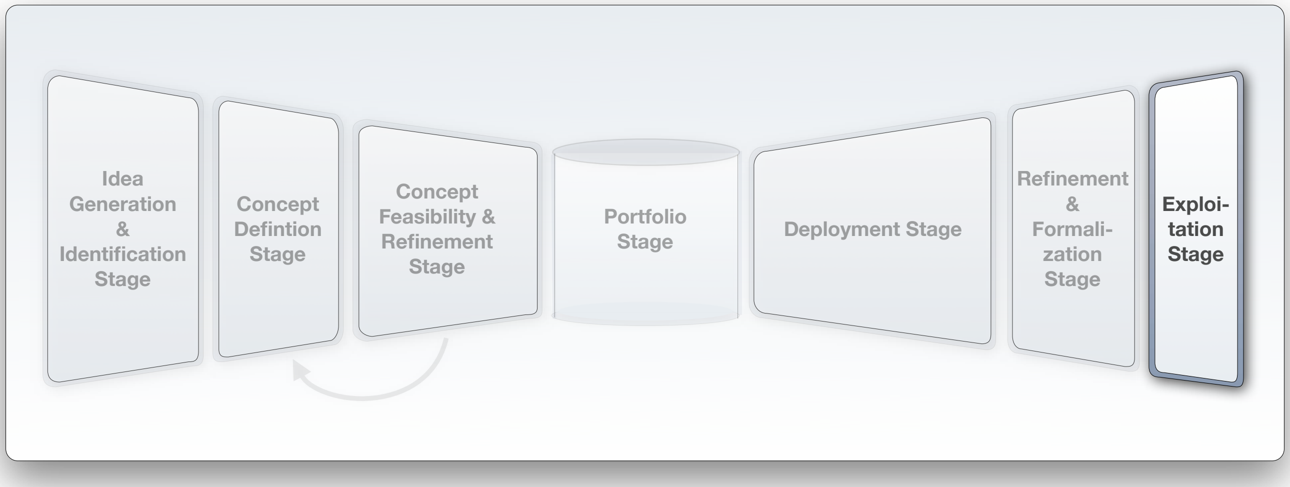


Figure 21 - Exploitation Stage of the FUGLE Innovation Process model

Once the solution has been formalized, a final stage is reached where the solution is further exploited through new business models and markets, thereby generating more value from the innovation project. An exploitation gate is however used to determine which projects should advance to this stage.

Although this innovation process model appears to have a linear structure, several iterative loops and overlaps exist between the stages. Many of the tasks in the process also occur concurrently, e.g. idea generation and idea capturing. Activities such as portfolio management and the managing of information occur throughout the process.

Application of the FUGLE Innovation Model will be discussed and illustrated in Chapter 4.2.

3.1.3. Innovation and the Knowledge Supply Chain

If innovation is seen as a source of sustainable competitive advantage in a modern economy, a logical step to follow a company's alignment to embrace innovation is a move toward efficient and effective innovation management. Research is increasingly highlighting the fact that knowledge management is a key requirement for effective innovation management. How knowledge is used, spread and stored by an organization's employees determines whether this organization has a culture of stimulating or restraining innovation (Schutte [50]).

Innovation is a product of the novel exploitation of existing internal and/or external knowledge. In order to innovate effectively and sustainably, existing knowledge should not only be captured, but also shared and integrated in context. As the global innovation rate accelerates, companies are however starting to understand that most innovation targets are not reachable as an isolated organization. Collaboration is needed within the knowledge environment and this means that knowledge sharing activities should no longer be limited by organizational boundaries. Understanding the Knowledge Supply Chain provides insight into the way that organizations may collaborate to facilitate rapid innovation within the material supply chain. (Du Preez [15])

The Material Supply Chain relates to the product development process and shows how engineering, manufacturing and customer value are linked throughout the product development life cycle. These development partners are involved in the continuous flow of related information and knowledge about the product, its manufacturing and its utilization. A similar supply chain could be depicted for services and logistics.

The Knowledge Supply Chain is equivalent to a knowledge generation value chain. It indicates how discovering new knowledge, making the knowledge transferable, transferring that knowledge through documentation and from person to person, and finally applying that knowledge, all support the material supply chain (refer to Figure 22) (Du Preez [15]). This may be interpreted as an indication of the way in which information and knowledge supports the innovation process.

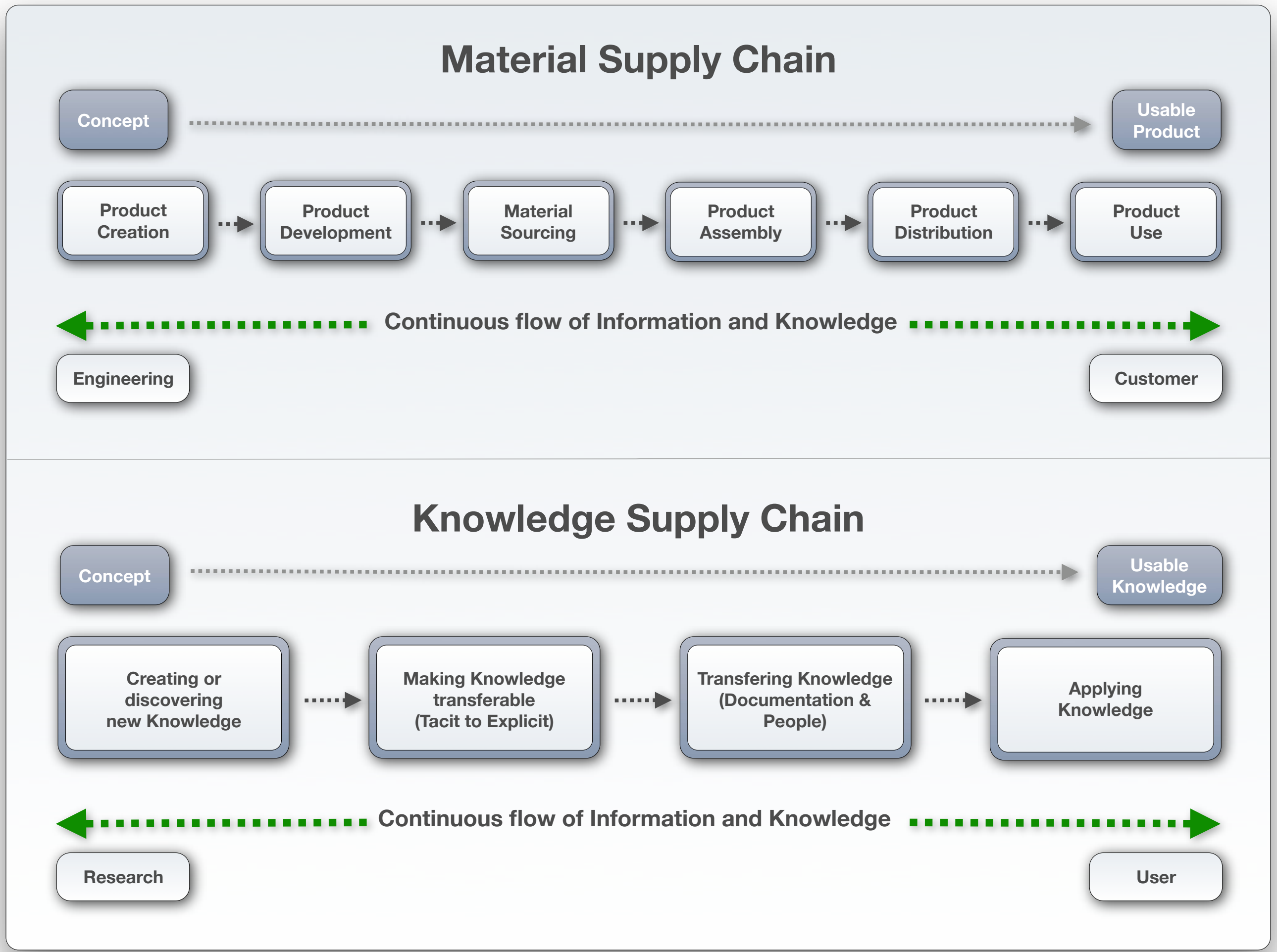


Figure 22 - The Material Supply Chain and the Knowledge Supply Chain (NGM Group [33])

Refining the Knowledge Supply Chain provides insight in the knowledge life cycle (refer to Figure 23):

- Role-players in the Knowledge Supply Chain include universities, technology and science institutes, government, enterprises, competitors, suppliers and markets.
- Interrelated role-players in the Knowledge Supply Chain span the public and private knowledge domains, and are often connected in overlapping networks.
- Knowledge that is created in the public domain is utilized in the private and user domains, thereby linking the pre-competitive and competitive domains.
- Role-players in the Knowledge Supply Chain are linked through abundant connectivity, which is increasing as information and communication technologies are reaching maturity.
- Knowledge is mostly created by teams executing projects.
- Knowledge is contextualized by the life cycle of the project in which it was created.

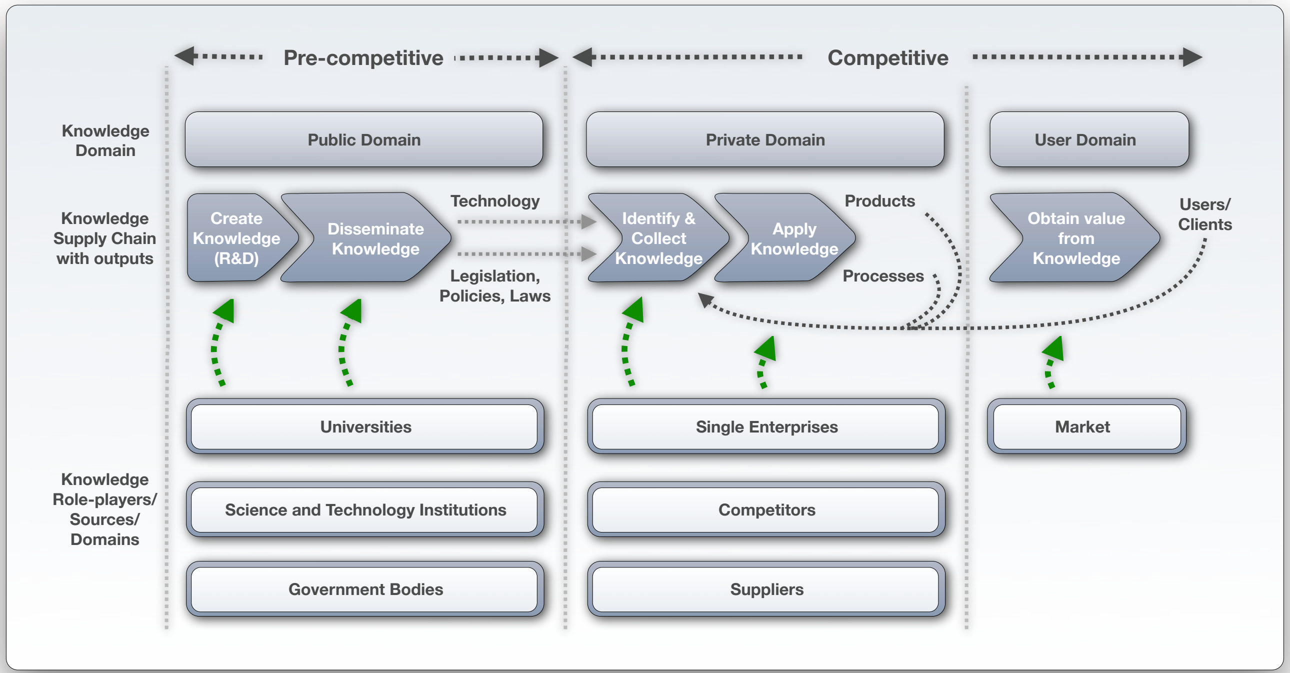


Figure 23 - A refined Knowledge Supply Chain showing Role-players (Du Preez [15])

3.1.4. Managing the Knowledge Supply Chain through Knowledge Networks

Considering the wide array of knowledge sources and formats involved in the Knowledge Supply Chain, a major challenge is to enable improved communication and collaboration throughout the chain. The knowledge available within the system is also at no point static, as personal learning, experiences, insights and ideas are continually augmenting the knowledge component that is contained in the minds of individuals.

By enabling individuals to better communicate and collaborate within a team, across teams, within and across organizations, even more significant new knowledge, insights and ideas will be created, transferred, shared, absorbed and leveraged at a much faster rate, thus promoting innovation rates. (Du Preez [14])

Seufert [54] define a Knowledge Network as “a number of people, resources and relationships among them, who are assembled in order to accumulate and use knowledge primarily by means of knowledge creation and transfer processes, for the purpose of creating value”. Knowledge Networks can therefore be seen as the organizational environment within which knowledge processes related to the Knowledge Supply Chain take place in order to achieve innovation.