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A Framework for Managing the Innovation Process

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Abstract--Successful innovation requires an integrated design process, i.e. integration in the design of the enterprise, the design of the product, as well as the design and implementation of new technologies. Such an integrated design effort requires good collaboration and management of the designs, and should be supported by efficient knowledge management techniques and tools. If innovation is to help a business grow and improve its competitiveness, it is also important to plan the innovation carefully. Though some ideas may just "fall from the sky" or "come out of the blue", an organisation should also have a strategic vision of how the business and the enterprise should develop. The Enterprise should not wait for the innovation to arrive arbitrarily, but rather proactively plan for innovation incorporating market trends, the competitive landscape, new technology availability, and changes in customer preferences and trends in order to create fruitful terroir conducive for innovative thinking. Such an enterprise will also pro-actively manage the knowledge supply chain that supports innovation.

This paper presents a combined convergent and divergent approach for managing innovation within an innovation landscape that contextualise domains, role-players, decision points and knowledge network components . The Innovation management model specifically focuses on the use of roadmapping for planning and deploying innovation within a collaborative deployment environment.

A case study illustrating the use of parts of the framework within the insurance industry is also presented.

I. INTRODUCTION

Innovation is widely recognised by industry and academics as an essential competitive enabler for any enterprise that wants to remain competitive and survive and grow [5],[7]. Surveys such as the annual innovation survey from The Boston Consulting Group [1] however, suggest that although the importance of innovation is fully realised by most enterprises and they continue to spend more and more on innovation, many of these initiatives do not generate satisfactory profit or competitive advantage. The problem does not lie in the invention part or the generation of innovative ideas, but more in the successful management of the innovation process from an idea to a successful product in the market [12], [13], [18]. Booz Allen Hamilton [11] found that a common denominator among successful innovators is "a rigorous process for managing innovation, including a disciplined, stage-by-stage approval process combined with regular measurement of every critical factor, ranging from time and money spent to the success of new products in the market."

This seems to be in stark contrast to the traditional wisdom that inventions cannot be planned, but require innovative and free thinking. Yet even Edison realised that a lot of perspiration is required in balance with the inspiration. Any innovation management framework should thus include a good combination of structure and flexibility in order to successfully deploy all the elements of successful innovation. Fig 1 depicts the process as viewed by the authors.

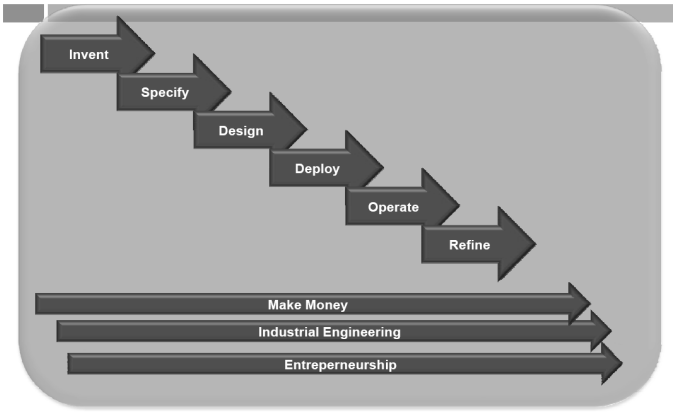

Fig. 1 - Components of the Innovation life cycle

This paper presents an innovation process model developed by combining concepts from various available new product development and innovation process models published in literature and practical experience obtained from various industrial applications. This model is presented as a roadmap to guide users through the innovation process.

The paper introduces different innovation processes as well as new product development models from the literature. Through synthesis important generic characteristics and components of current innovation process models are identified. A new innovation process model (the Fugle model) developed from combined learning from the literature as well as practical experience is then presented. Finally a case study is presented that describes an application and refinement of the model within an insurance company.

II. INNOVATION PROCESS MODELS

An extensive corpus of literature exists on innovation processes describing the management and the phases of the process from idea to commercialized product [17], [16], [14]. The innovation process models have evolved in six generations from simple linear models to increasingly complex interactive models (refer to Table 1).

TABLE 1 - DEVELOPMENT OF INNOVATION MODELS (ADOPTED FROM [14])

Model	Generation	Characteristic
Technology push	First	Simple linear sequential process, emphasis on R&D and science
Market pull	Second	Simple linear sequential process, emphasis on marketing, the market is the source of new ideas for R&D
Coupling model	Third	Recognizing interaction between different elements and feedback loops between them, emphasis on integrating R&D and marketing
Interactive model	Fourth	Combinations of push and pull models, integration within firm, emphasis on external linkages
Network model	Fifth	Emphasis on knowledge accumulation and external linkages, systems integration and extensive networking
Open Innovation	Sixth	Internal and external ideas as well as internal and external paths to market can be combined to advance the development of new technologies

The **first and second generation models** are linear models explaining innovation as either being pulled by market needs, or pushed by technology and science. Fig. 2 illustrates these first and second generation linear models.

The **third generation model** is a coupling model that recognises the influence of technological capabilities and market needs within the framework of the innovating firm (refer to Fig. 3).

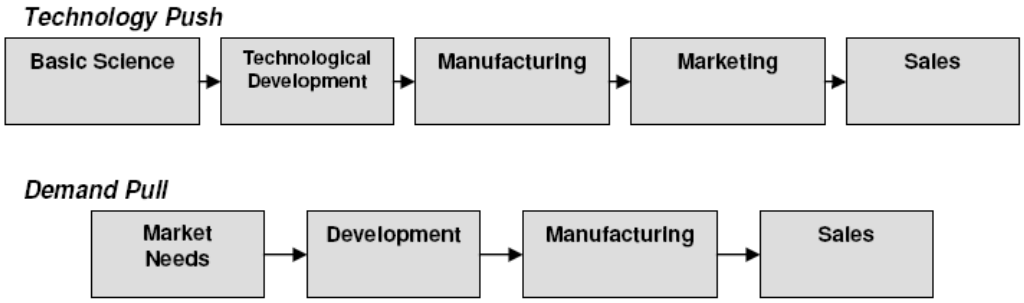

Fig. 2 – First and Second Generation models of the innovation process: Technology Push and Pull [19]

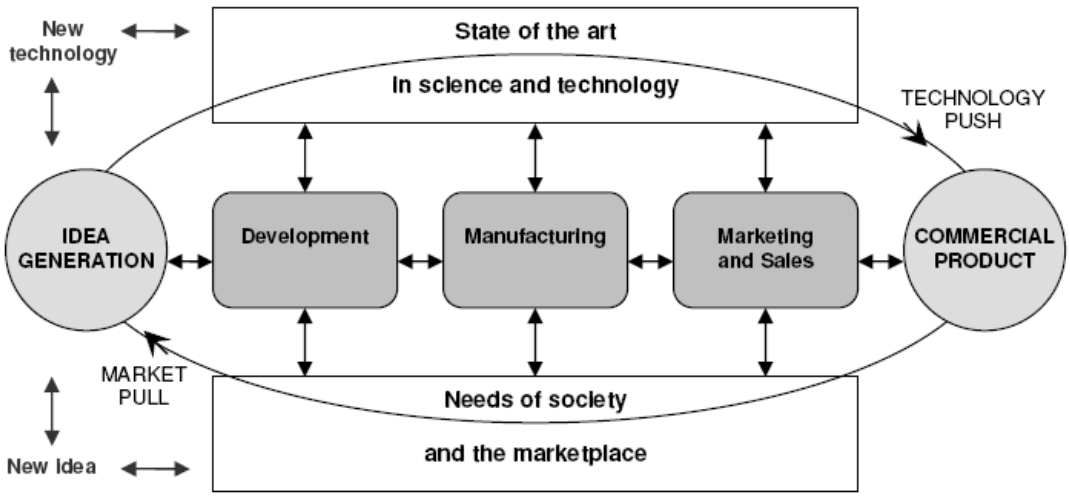

Fig. 3 – Third Generation Coupling Model of Innovation [15]

Although the coupling approach contains feedback loops it is essentially a sequential model with limited functional integration. One of the most well known sequential or linear innovation process models is the Stage-Gate model from Cooper [3]. This model divides the product innovation process into stages with defined gates acting as decision points between the stages (Refer to Fig. 4).

At the end of each stage is a stage gate, which consists of a phase review to evaluate whether the previous phase or stage was successfully completed. If the project is reviewed positively, work proceeds to the next phase. If not, then work continues or iterates within that phase until it can successfully pass the gate.

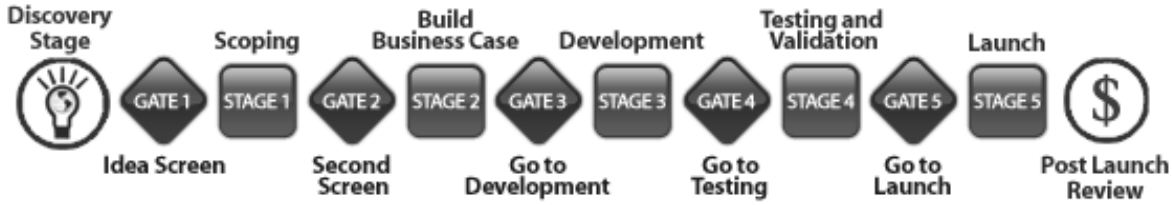

Fig. 4 – Stage Gate Process [3]

The advantage of the stage gate process is that it ensures better quality in the innovation process. The gates also help to ensure comprehensiveness, i.e. no critical activities have been omitted. A disadvantage of this model could be that the gates are too rigorous, especially in the early stages of idea and concept generation. Another critique is also that it is a linear or sequential process. Although such a sequential approach with evaluation gates enhances the effectiveness and efficiency of incremental innovation processes, for more radical innovations characterised by high uncertainty a flexible, learning-based approach is appropriate.

More iterative loops may be required between idea generation and concept definition, based on learning obtained through modelling and prototyping. Also, this model does not address the post launch refinement, optimization and exploitation of the new innovation.

Another interesting **third generation coupling innovation process** model is the Collaborative Innovation (CI) process that has been developed at United Technologies Research Centre (UTRC) [21]. This model is focused on the conceptual design phase of product innovation. It uses a quality function deployment approach with strong focus on modelling the value needs of the different stakeholders, as well as the innovation focus using problem-formulation (PF) modelling from TRIZ (refer to Fig. 5). Although this model is very comprehensive regarding the conceptual stage, it lacks the details for the further development and deployment of the innovation.

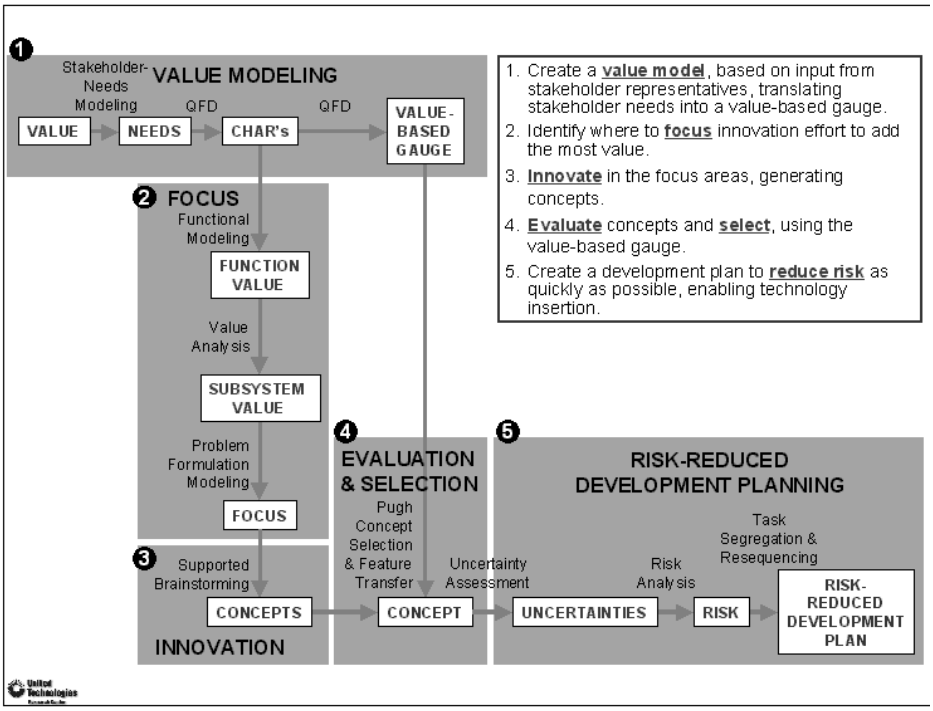

Fig. 5 – The Collaborative Innovation Process [21]

To improve the lack of functional integration in the linear models, **the fourth generation innovation process model**, the interactive approach, was developed [15]. This approach views the innovation process as parallel activities across organisational functions (refer to Fig. 6). These interactive models however do not explain the whole innovation process. For example, the pressure to yield more effective and efficient product development processes has led to an increase in:

- horizontal strategic alliances and collaborative R&D consortia;
- strategic vertical relationships, especially at the supplier interface;
- innovative SMEs forging external relationships with both large and small firms;
- greater emphasis in the development of cross-functional and parallel integration within firms to gain greater potential from higher real-time information processing.

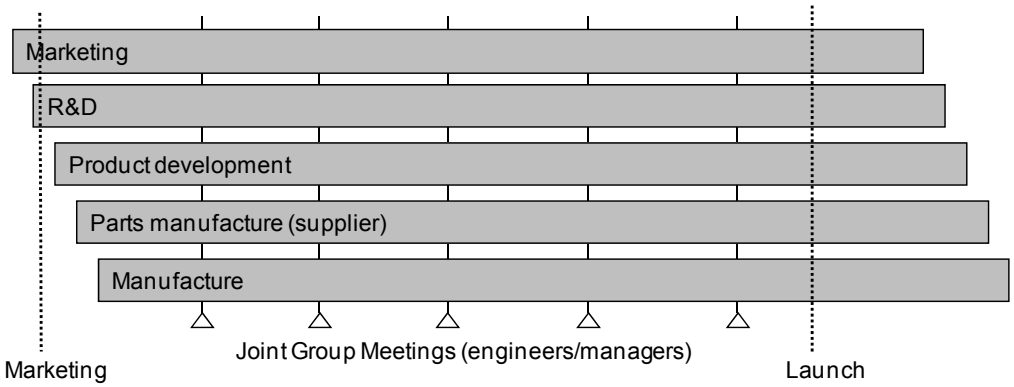

Fig. 6 – Fourth Generation Interactive Model [15]

A well known model that can be classified as a fourth generation model is the Minnesota Innovation Research Program (MIRP) model developed during the 1980s [10]. The MIRP model explains the sequence of core characteristics that are reflected as an innovative idea is transformed and implemented into a concrete reality. Each cycle comprises three successive periods: an initiation period, a development period and an implementation period. Each of these periods are distinguished from each other on the basis of specific process characteristics (refer to Table 2).

It is important to note that there are no clear-cut boundaries between these three periods. In many cases there are overlaps between the development period and the implementation period since many innovations are developed through interaction between innovation teams and the market. A limitation of this model is that it stops the innovation process prior to implementation. However, introduction into the marketplace, adoption, and continued improvement should be part of the innovation process.

TABLE 2 – CHARACTERISTICS OF THE MIRP MODEL'S PERIODS [10]

	Initiation	**Development**	**Implementation**
Generic innovation process characteristics	1. Gestation 2. Resource acquirement 3. Shocks	4. Proliferation 5. Setbacks 6. Diverging and changing success criteria 7. Fluid participation of personnel 8. Involvement of investors and top managers 9. Relationship building 10. Creation of social infrastructure to support innovation	11. Integrating the new with the old 12. Attributions about innovation success and failure.

The **fifth generation or network models** originated in the 1990's and attempt to explain the complexity of the innovation process. Major characteristics of the network model are the influence of external environment and the effective communication with external environment. Innovation happens within a network of internal and external stakeholders. Important therefore is to establish links between all the role-players. An example of such a model is given by Trott [17] (refer to Fig. 7).

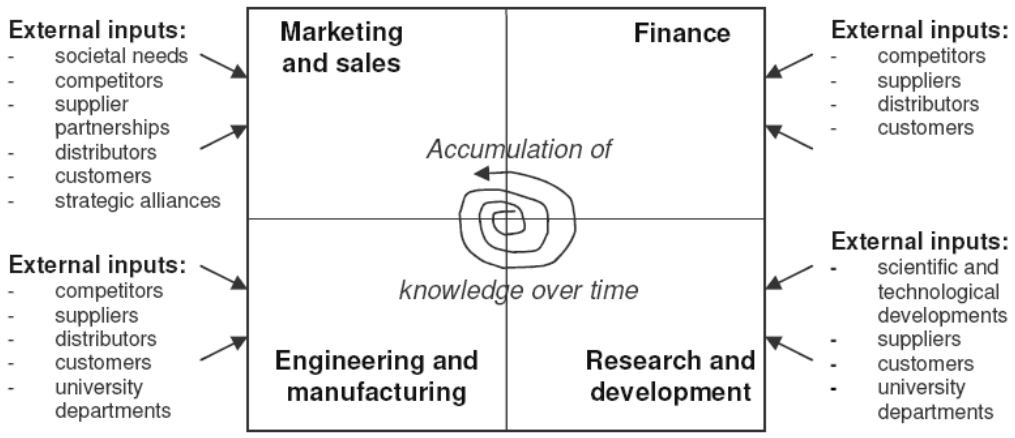

Fig. 7 - A network model of Innovation [17]

A very comprehensive model of such an integrated and networked fifth generation innovation process model is given by Galanakis [8]. He proposes an innovation process description using a systems thinking approach (which he terms the "the creative factory concept") (refer to Fig. 8). This model has at its centre the firm (enterprise), which is the generator and promoter of innovations in the market, the industrial sector and the nation. The model's overall innovation process is constructed of three main innovation processes:

1. the knowledge creation process from public or industrial research;
2. the new product development process, which transforms knowledge into a new product, and
3. the product success in the market, which depends on the product's functional competencies and the organisational competencies of the firm to produce it at a reasonable price and quality and place it adequately in the market.

This process is affected by internal factors of the firm (e.g. corporate strategy, organisational structure, etc.), as well as by external factors in the National Innovation Environment (e.g. regulations, national infrastructure, etc.).

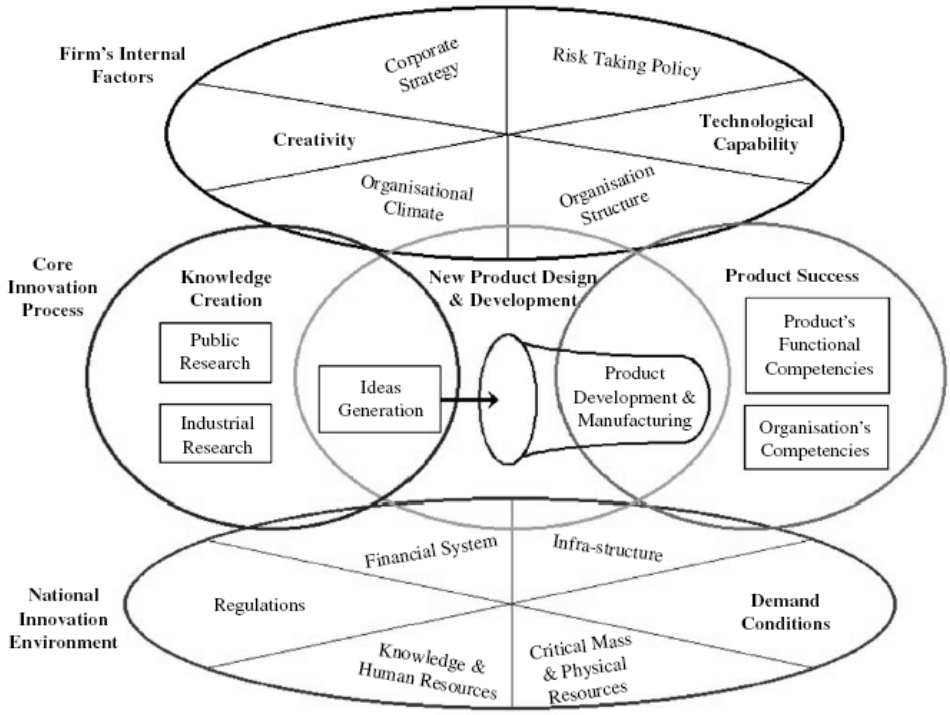

Fig. 8 – The Creative Factory Systems Innovation Model [8]

These **fifth generation models** are mainly closed networks of innovation. Traditionally, new business development processes and the marketing of new products took place within the firm boundaries (refer to Fig. 9). In closed innovation systems, employees within the organisation develop the ideas internally and in secrecy.

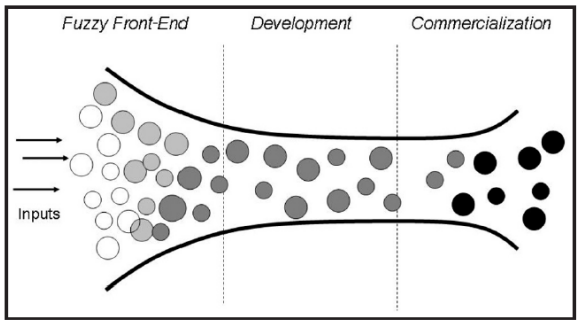

Fig. 9 – Closed Innovation Model [4]

A new **sixth generation** of innovation models can be called open innovation models. These are also network models of the innovation process, but instead of being only focused on internal idea generation and development, internal and external ideas as well as internal and external paths to market can be combined to advance the development of new technologies (refer to Fig. 10).

The concept of open innovation was first termed by Chesbrough [2]. One of the most obvious benefits of open innovation is the much larger base of ideas and technologies from which to draw to drive internal growth. But beyond that, leading companies also recognize open innovation as a strategic tool to explore new growth opportunities at a lower risk [4]. The innovation environment has changed through networking and collaboration. Open innovations call for a new logic, which put openness and collaboration at its centre. Networked or web communities are the open and agile tools to put into practice the open innovation concept.

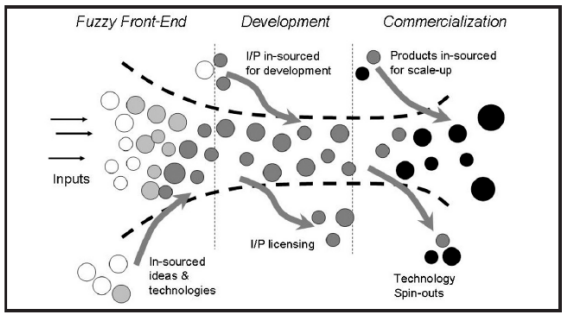

Fig. 10 - Open Innovation Model [4]

To fully exploit all concepts of open innovation, enterprises should develop Integrated Knowledge Networks to support the Innovation Knowledge Supply Chain depicted in Fig. 11. [6].

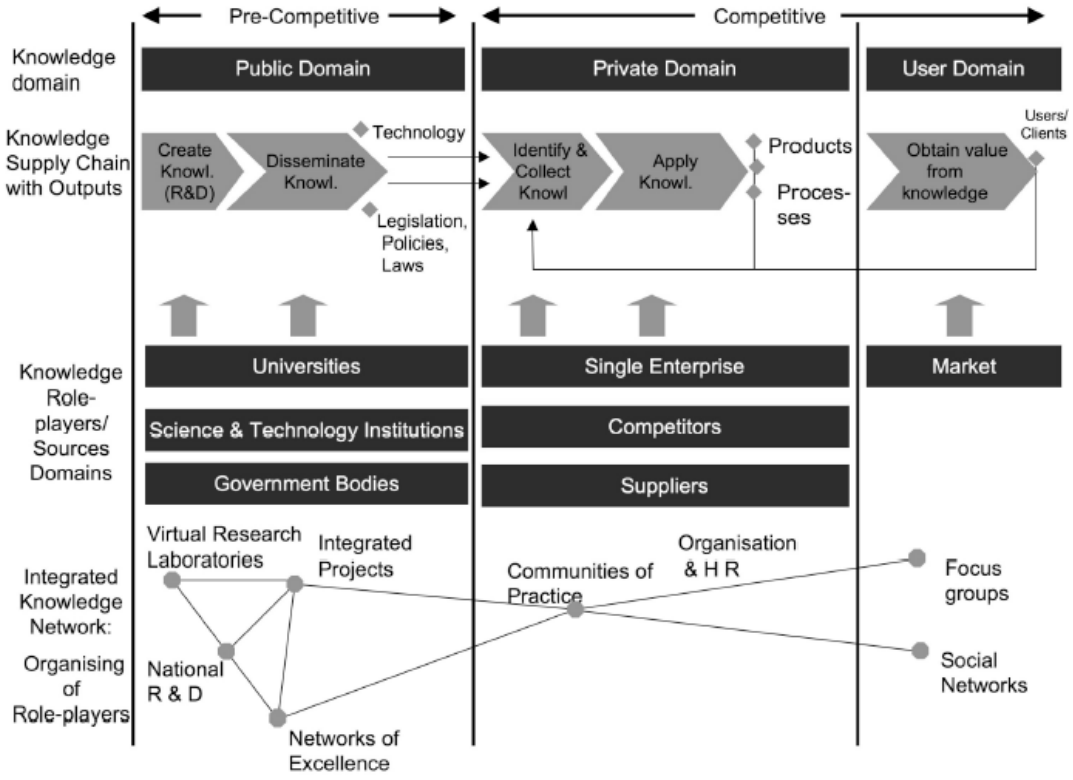

Fig. 11 - The Innovation landscape with integrated knowledge network components supporting the Innovation Knowledge Value Chain [6]

To summarize, the innovation environment has changed through networking and collaboration from simple linear models to the more complex integrated network models. Open innovations call for a new logic, prescribing openness and collaboration at its centre. Networked or webbed communities are the open and agile vehicles to pragmatically deploy open innovation concepts. In the new networked paradigm it is possible to exploit the linear and coupling processes in combination depending on the requirements.

This will however require new ways of collaboration between enterprises whilst also competing concurrently

III. SYNTHESIS FROM INNOVATION PROCESS MODELS IN THE LITERATURE

The previous section presented a selection of innovation models from the literature. These models all have their advantages and disadvantages, and no model can claim to be fully comprehensive, covering all different views for all application areas. The opposite is true. There are just too many variables impacting on the innovation and design processes for one framework to provide a "one size fits all" solution.

A synthesis of the innovation process models from the literature suggests the following:

1. Most of the innovation process models involve a pattern of the following steps or stages: (a) idea generation and identification, (b) concept development, (c) concept evaluation and selection, (d) development, and (e) implementation.
2. Innovation can either be a market pull or technology push, or even a combination.
3. Integration between the different functions within the innovation process is of paramount importance and can often be the discriminating factor.
4. The latest (open) innovation process models favour a network approach where innovation is not only focused internally, but also externally.
5. 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.

IV. THE FUGLE INNOVATION PROCESS MODEL

Most innovation process models evaluated focus mainly on the funnel part of the innovation process (i.e. identifying and filtering new ideas and concepts). Further, they mostly address product innovation as opposed to service companies that have less tangible products (e.g. insurance companies).

These models also neglect or totally exclude the exploitation part of a new innovation, i.e. to successfully exploit the innovation in different markets and application areas (including exploitation of different business models for the enterprise). This is important since an innovation should at the end generate more value to the company than the cost that it is associated with.

This section presents a new innovation framework called the Fugle model which was developed and applied within an insurance company. It was generalised to make it applicable to product as well as service companies.

The aim of the model is to help businesses to identify, evaluate, develop, implement and exploit new products and services more efficiently and effectively. Fig. 12 presents a cause and effect diagram that illustrates the business value that the model tries to address. The diagram reads from the bottom: if the lower block is true, then the block on the next higher level is achieved.

The model is centred on a generic innovation process that combines the convergent innovation front-end or funnels (identification and evaluation) with the divergent deployment and exploitation of the innovation (termed in this the paper the innovation bugle). Fig. 13 presents a diagram of the Fugle model's complete high level innovation process. Fig. 14 and Fig. 15 highlight the funnel and bugle components of this model. The innovation process (the funnel and the bugle) operates internally in the firm, but all the stages of the process are linked to the external environment. This emphasises the innovation network aspect, as well as the open innovation concept – all the stages could have external influence, or even outsourced externally. The complete innovation process is guided and supported at the top by the firm's strategies, its people and culture, organisational structure and processes, as well as information and knowledge.

Although the model has distinguishable stages with gates and filters, the activities within the stages can overlap. 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. The model therefore combines the linear and spiral innovation process concepts.

Gates and filters are used as decision points between certain activities and stages. During the idea generation and concept definition and evaluation stages these decision points are called filters. This illustrates the fact that less harsh go/ no go decisions are required during these beginning uncertain stages. Filters are used to sift the attractive and less attractive ideas and concepts. The less attractive ideas and concepts should however still be documented and stored for future revisit and evaluation (because circumstance may for example be more favourable for these ideas in the future).

The various activities that take place in the different stages of the Fugle model are described in more detail in the following sub-sections.

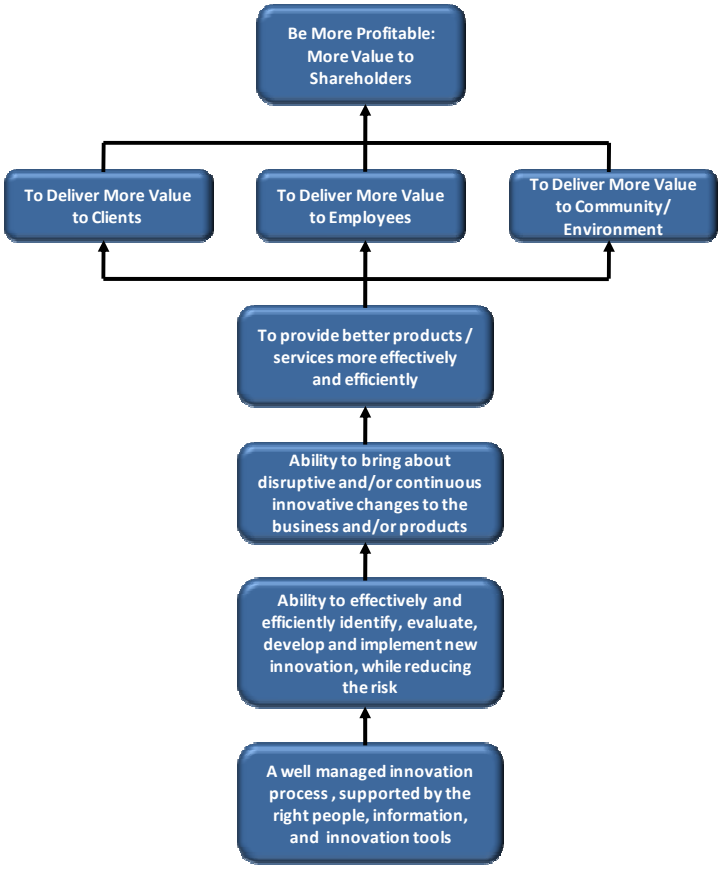

Fig. 12: The Business Value of an Innovation Process Model

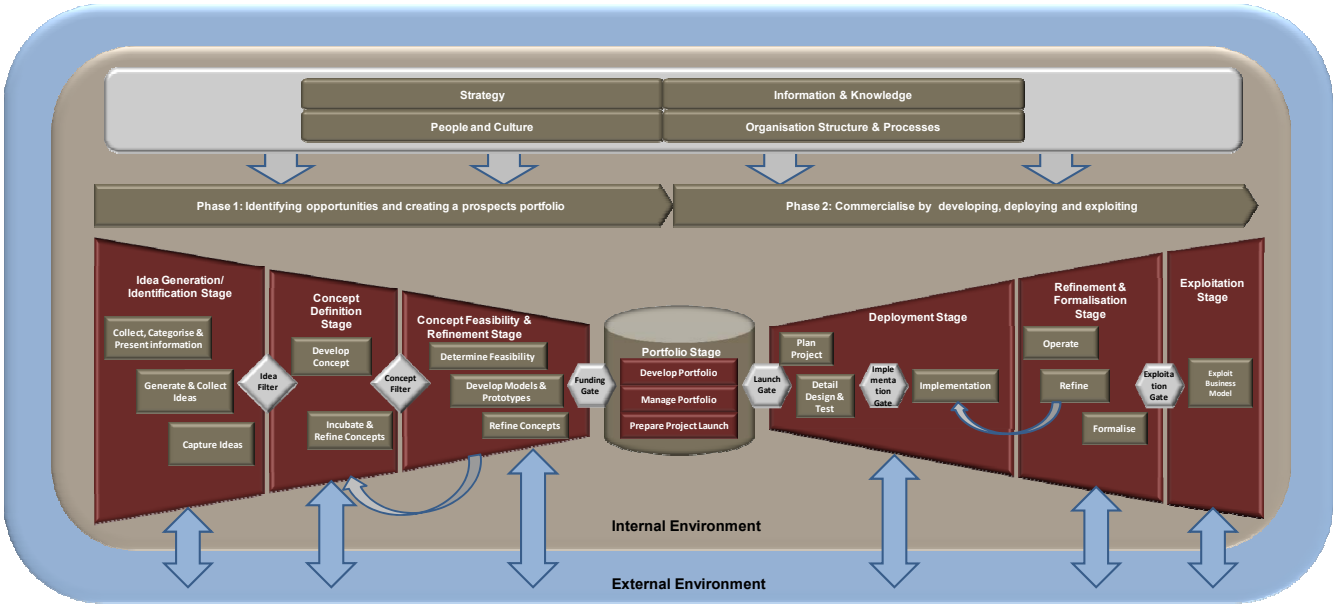

Fig. 13: The Fugle Innovation Process

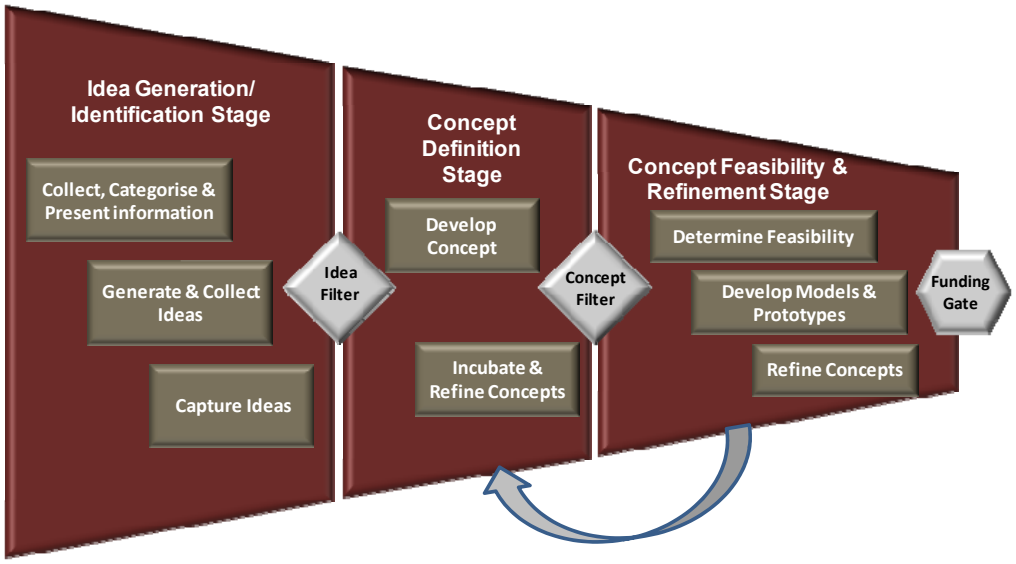

Fig. 14 – The Fugle Model's Innovation Funnel

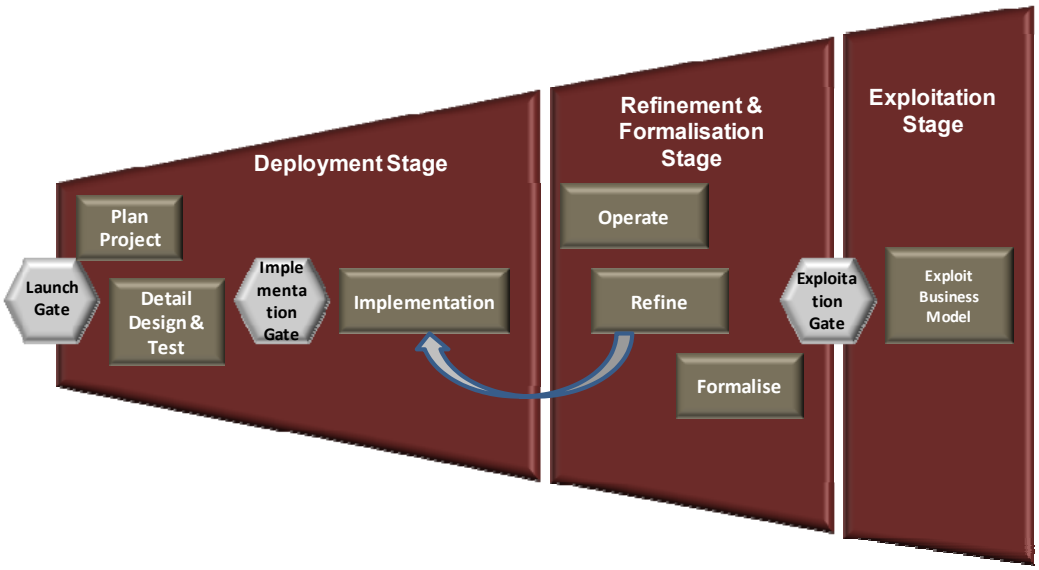

Fig. 15 - The Fugle Model's Innovation Bugle

A. Idea Generation/ Identification Stage

This is the creative stage where new ideas are generated and/or new opportunities identified. New ideas can come from various internal (e.g. employees) or external (e.g. customers and suppliers) sources. Ideas can come by chance, or they can be the result of focused workshops and brainstorming sessions. Using an agricultural metaphor, the aim of this stage is to pro-actively provide the seeds and fertiliser for new ideas to grow, and then to harvest, filter and store these ideas for further development into workable concepts.

Collect, Categorise and Present Information

The very crucial "seed and fertiliser" for the idea generation stage is information:

- information about current problems or problem areas in the business,
- information about competitors,
- information about clients and markets,
- information about technologies,
- information about company strategies and objectives

By efficiently and effectively identifying, capturing, categorising or classifying, and presenting information, information can act as an important stimulus for the generation of new ideas.

Generate and Collect Ideas

Although many ideas will be a spur of the moment thought, ideas can also be purposefully generated in

workshops or brainstorming sessions. An idea, however, needs hard thinking to determine its significance. By making the right information available to the right people in the right manner, this can help to trigger new or innovative ideas. Thus a formalised Knowledge Supply Chain significantly improves and support innovation.

Capture Ideas

Whether the idea was a spur of the moment thought or created in a brainstorming session, it is important to capture or frame the idea in some acceptable manner so that it can be communicated to others and developed further into a concept [9]. Capturing ideas is also important in order to keep a history of new ideas, since many times ideas that are rejected due to current circumstances, can become more viable in the future. It is also important to capture the ideas in context with the development life cycle, the relevant team members and the external considerations.

Idea Filter

A company's strategies should help to act as a guide for filtering new ideas. Ideas that are clearly out of line with company strategies can be rejected at this stage. Since it takes time and resources to develop new ideas into concepts and evaluate their feasibility, the trick is to intelligently filter new ideas while decreasing the probability of rejecting good ideas. Careful thinking should therefore go into developing a filtering process and criteria. Rejected ideas should however be captured along with the reasons for their rejection

B. Concept Definition Stage

The focus of this stage is to transform the idea into a workable concept. A concept could be developed from different combinations of different ideas. Once a concept has been defined and documented, some time should be provided to share the concept with different people in order for the concept to incubate and maybe refine some of the ideas. At the end of the definition stage another filtering process occurs to select those ideas that are most promising and require further evaluation in order to determine its feasibility.

C. Concept Feasibility and Refinement Stage

At the concept definition stage, information about the concept might be limited. The concept feasibility stage is about further investigation of the concept by collecting additional information, as well as modelling and prototyping in order to determine its feasibility. The concept to be applied is to "fail fast and smart" [20]. The concept evaluation 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. Iterative loops of concept refinement and evaluation will typically occur. At the end of this stage a funding gate is used to make the decision which concepts should be resourced and further developed. The outcome of this stage is therefore a list of prospective innovation projects.

D. Portfolio Stage

Innovation Portfolio Management entails the holistic management of the enterprise's innovation initiatives. The activity utilises the outputs the Concept Feasibility and Refinement Stage as the basis for the prioritisation, scheduling and alignment of the innovation project initiatives. Furthermore, Innovation Portfolio Management constitutes the allocation of resources, assignment of responsibility and the continuous monitoring of the initiatives, understanding the aggregate effect thereof, to ensure that the strategic objectives of the enterprise are achieved. It also entails making the decision of when to launch a specific innovation project.

E. Deployment Stage

The deployment stage involves the design, implementation, and testing of the innovation solution as identified, conceptualised and decided upon during the previous stages. It includes the detail project planning and management of the design and implementation projects. After the detail design, an implementation gate is used as a final design review before implementation. Implementation of the design involves the development and roll-out of the new innovation.

F. Refinement & Formalisation Stage

After the roll-out, the new innovation is in operation. Initially the new implemented solution will not function optimally. This stage is bout monitoring, measuring, evaluating and refining the solution until it functions satisfactorily according to specifications. Once the solution is performing satisfactorily it can then be formalised in terms of operational documentation.

G. Exploitation Stage

Once the solution has been formalised, this is final stage is reached where the solution is further exploited through new business models and markets. The aim is therefore to generate more value from the solution. Before this stage is entered, an exploitation gate needs to be passed where decisions are made regarding which solutions can and should be further exploited.

Although this innovation process model appears to be a linear staged process, there are many iterative loops and overlaps between the steps within the different stages. Many of these steps (e.g. idea generation and idea capturing) also occur concurrently. Activities such as portfolio management and the managing of information occur throughout the process.

This section served as a high level introduction to the Fugle model. The next section presents a case study implementation within the insurance industry where some of the concepts are elaborated.

V. CASE STUDY IMPLEMENTATION IN THE INSURANCE INDUSTRY

This case study focuses on the innovation funnel, or phase 1 of the Fugle model (idea identification and concept development). It describes an implementation at an insurance company. This implementation is currently still in progress. Only initial lessons learned are therefore discussed.

A. Case Study Description

This case study focuses on the first phase of the innovation process, i.e. generating ideas and concepts and taking those concepts all the way to a portfolio of innovation projects. The company was established as a new business unit of a larger insurance company. The aim is to develop and sell innovative insurance products through new and innovative distribution channels (e.g. using mobile phones). The target market is the lower income market. Due to fierce competition in this sector, they need to be able to quickly develop and sell new innovative products.

The company have no formal innovation management process in place yet for managing their innovation funnel. There is no shortage of new ideas, yet they find it difficult to effectively develop these ideas into concepts, and then to select the most appropriate concepts for further investigation and final development. Currently a more structured innovation management process based on the Fugle model is being developed.

One of the concepts from the Fugle model currently being implemented is a staged innovation funnel consisting of filters and gates. In order to better manage the development of new product concepts, different categories of ideas were defined:

- Market – ideas around new markets to target
- Marketing – ideas around new ways of marketing the product
- Partner – ideas around new partners for distributing the product
- Product – ideas around new product
- Technology – ideas around new technologies for supporting various insurance value chain processes

New ideas are classified as belonging to one of the above categories. New concepts are then defined by combining ideas from the different idea categories. A concept is only completely defined when all the above mentioned idea categories have been described, e.g. the product, which market, what marketing process to be used in marketing the product, which partner(s) to be used in distributing the product, and what technologies to be used where in the insurance value chain. Standard templates are used to ensure concepts are captured effectively and efficiently. By combining ideas from the different idea categories, various new concepts can be defined. This process helps to ensure that a new concept is properly defined and thought through before more investigations are performed to evaluate the concept's feasibility. An idea management software tool can be used to capture and manage ideas coming from either internally or externally to the business. Scheduled workshops or brainstorming sessions can be used to generate complete concepts from these ideas.

Once new product concepts have been defined, a concept filter is used to decide which concepts are the most promising and should be further evaluated. This filter acts as a concept review where concepts are discussed and evaluated against pre-defined criteria. This is necessary since it takes time and resources to effectively evaluate a concept's feasibility. Since time and resources are scarce, not all concepts can be evaluated in more detail.

Fig. 16 illustrates this idea and concept management process being implemented.

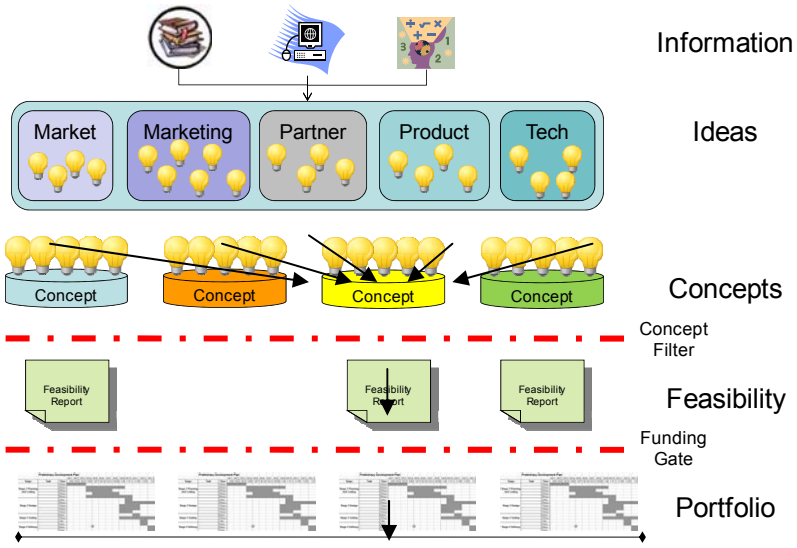

Fig. 16 – Idea and Concept Management Process

In evaluating different concepts' feasibility, modelling (e.g. financial, actuarial and process (simulation) modelling) as well as mock-ups and prototypes are used. This facilitates the rapid evaluation of the concepts. Potential problems are identified early by experimenting (making mistakes) early on in the process. It is very important is to learn from these mistakes and document the lessons learned as soon as possible.

A feasibility report is then generated for each concept evaluated, which is used during a funding gate process to decide which concepts should be further developed. Approved concepts are specified as projects and made part of a project portfolio. This involves developing a project plan for each project and prioritising the project. This portfolio should be managed to ensure that a good balance of high, medium, and low risk projects are obtained (this project mix should be in line with the company's strategies).

B. Lessons Learned

As mentioned before, the funnel implementation of the Fugle model is currently still in progress. Early observations on completed sections of the Fugle methodology are the following:

- In order to improve the innovation management process, it is wise to break the whole process into smaller stages of activity. This helps to guide and focus activities, especially the information generation and collection activities. A staged approach therefore simplifies the management of the innovation process by providing clear management decision points. This ensures better control of the process in terms of time and quality.
- The quality of the innovation product (which can be either a physical product or a process) strongly depends on the quality of the process used to develop and implement the innovation. The process itself is only as effective as the decisions made within it, and as efficient as the speed with which the information required for each decision is made available. Stage-gate frameworks help to ensure quality by enforcing decisions at review gates. Basically, the gates are examinations of a composition of pre-defined quality criteria which must be fulfilled to continue from one project stage to the next. Quality checks at these gates ensure increased focus through phase-specific checklists, minimise project risk, ensure direct feedback from the process (and the quality of execution) to the current project/product stage, reduce the development time by "doing it right the first time", and ensure a project/product that meets customer requirements.
- Having a formal development stage in the process in which there are also several 'build-test-feedback-revise' loops (as in spiral development) can be effective while remaining consistent with Stage-Gate principles. A stage need not be a narrow list of serial deliverables but should consist of whatever activities make sense in advance of the next business checkpoint or gate.
- Due to the "fuzziness", possible information overload, and a large number of ideas and concepts during the initial stages of the innovation process, the innovation process needs some direction or focus. Conceptual design teams need to know where to focus their innovation efforts, strategically, to add the most value. Innovation for innovation's sake alone is not valuable. Company objectives and strategies should therefore be important criteria when filtering or screening ideas.
- A holistic approach driven by cross functional teams is required. In cross-functional teams, individuals from different backgrounds draw upon their pools of tacit, as well as explicit knowledge, to contribute. The tacit dimensions of their knowledge bases make such individuals especially valuable contributors to innovation projects. Cross-functional teams provides a mean to establish a closer link between functions, which ensures an integrated innovation process as well as smoother transition between the various phases of the innovation process.
- Innovation cannot happen in isolation. A network approach is required. An internal and external approach is therefore required. Especially in this case study information about partners play a very important role in defining the product concepts. A critical success factor of innovation is to bring many differing people, interests and perspective into an innovation process, while still focusing on the end client or customer.
- Information plays a very important role throughout the innovation process, especially during the initial identification and concept stage where new opportunities need to be identified and important decisions made. At the early stages of the innovation process, there is more uncertainty and higher risks due to a lack of information. By having better information in context, this uncertainty can be reduced which leads to better and speedier business decisions. Efficiency and speed are derived mainly from the information efficiency of the process and from continuous communication across the innovation network.

VI. CONCLUSION

Innovation has come a long way since it was first defined and identified as a prime survival priority. Many instances of innovation can be cited from the early days starting with Eve convicting Adam to experiment with a new business model about knowledge.

As many other evolutions, it has become abundantly clear that enterprises have to collaborate to be able to compete. Sharing ideas and exploiting opportunities demands integration of effort and structure within some flexibility. This paper presented an integrated approach that combines the concepts of a collection of previously proposed models. It also provided a partial deployment of the framework within one application. Significant further research and development is required to fully exploit the potential of this framework.

However, it provides some new scope for managing and exploiting engineering management and technology concepts.

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