HAL open science

A categorization of innovation funnels of companies as a way to better make conscious agility and permeability of innovation processes

Gwenola Bertoluci, Bernard Yannou, Danielle Attias, Emilie Vallet

▶ **To cite this version:**

Gwenola Bertoluci, Bernard Yannou, Danielle Attias, Emilie Vallet. A categorization of innovation funnels of companies as a way to better make conscious agility and permeability of innovation processes. 4th International Conference on Research into Design, ICORD, Jan 2013, Chennai, India. pp.721-734, 10.1007/978-81-322-1050-4_57 . hal-01543728

HAL Id: hal-01543728

https://agroparistech.hal.science/hal-01543728v1

Submitted on 22 Feb 2024

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

Distributed under a Creative Commons Attribution 4.0 International License

Bertoluci G., Yannou B., Attias D., Vallet E., 2013. A categorization of innovation funnels of companies as a way to better make conscious agility and permeability of innovation processes, In ICORD: 4th International Conference on Research into Design, January 7-9, Chennai, India.

A categorization of innovation funnels of companies as a way to better make conscious agility and permeability of innovation processes

Gwenola Bertoluci[1,2], Bernard Yannou[1]*, Danielle Attias[1], Emilie Vallet[3]

[1] Laboratoire Genie Industriel, Ecole Centrale Paris,
Grande Voie des Vignes, 92290 Chatenay-Malabry, France
Tel: +33-(0)1 41 13 15 21
Fax: +33-(0)1 41 13 12 72
email: gwenola.bertoluci@ecp.fr, bernard.yannou@ecp.fr, danielle.attias@ecp.fr

[2] AgroParisTech, 1 avenue des Olympiades, 91744 Massy, France

[3] Logica Business Consulting, Immeuble CB16, 17 place des Reflets, 92400 Courbevoie, France
email: emilie.vallet@logica.com

Abstract: It is common in the Management Science and Design Engineering communities to represent the processes contributing to innovation in companies as a funnel or similar variants. It is assumed it is possible to represent an analogy to the stages of planning and idea generation (the so-called fuzzy front-end), conception generation, as well as idea and concept selection to end up with the very few emerging developed and launched products and services on the market. First, this analogy may feature different innovation process layers, each of them independently as well as the entire set of these innovation process layers. After a review of literature on this funnel representation, we show that this analogy may be meaningful to globally represent and discuss about some properties of the innovation capability of a company at different locations: the R&D process as well as a given NPD process. We further describe a survey carried out within 28 large European technological companies through 48 detailed face-to-face interviews. Our questionnaire has allowed us to observe some characteristic patterns in the innovation funnels. We finally propose a model of five innovation funnels varying by their shape, permeability of emerging ideas and agility in terms of innovation management. We also hypothesize that these 5 funnels evolve in a sequential and cyclic way and that our cyclic model may be used as a questioning tool for the continuous improvement of the innovation management.

Keywords: Innovation funnel, development funnel, product development, design process, innovation management

* Corresponding author

1 Introduction to funnel representations

Looking for ideas for an individual or group to document the resolution of a problem implements a cognitive process [1] of divergence and convergence. This is in this divergence part of ideation that creativity tools are solicited. This second convergence part is often represented as a synthesis funnel (see [2] and Figure 1) in which ideas are selected, recombined or eliminated to result in the very few selected ideas that merit to be further detailed.

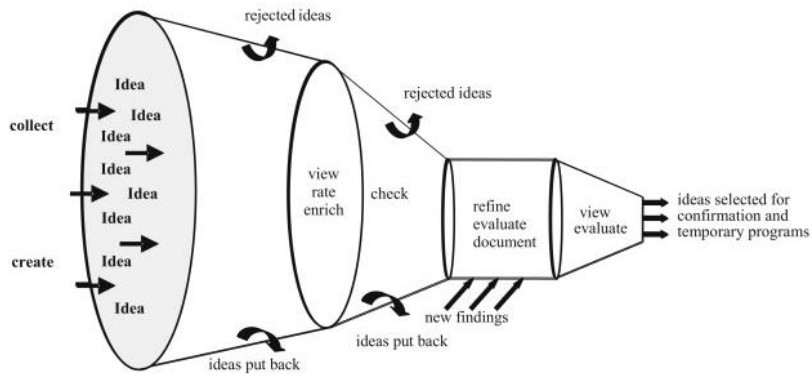


Figure 1. Idea Funnel [2]

Design exploration process is an important part of design creativity and novelty [3]. The design activities in conceptual design are contained in two kinds of steps: divergent and convergent [4-6]. Cross [4] thought of the conceptual design process as mostly being convergent with the necessity to contain a deliberate divergence in the search for novel ideas (see Figure 2).

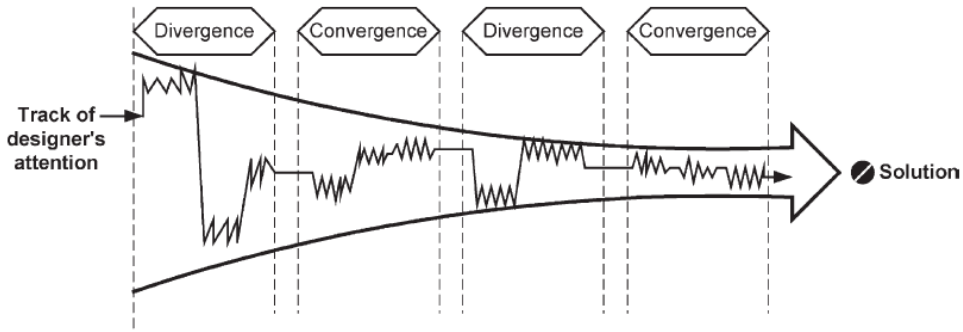


Figure 2. The conceptual design process defined by Cross [4]

Pugh's model [5] for conceptual design and the definition of the convergence and divergence activities can be represented as on Figure 3. Pugh mentioned that it is essential to carry out concept generation and evaluation in a progressive and disciplined manner so as to generate better designs. This progressive and disciplined manner is illustrated as an iterative, repeated divergent and convergent process with the number of solutions gradually decreased (see [7]).

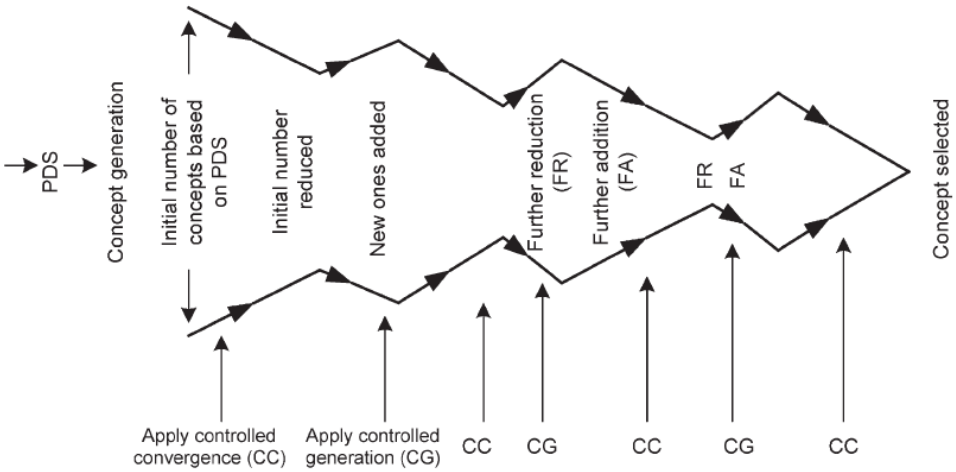
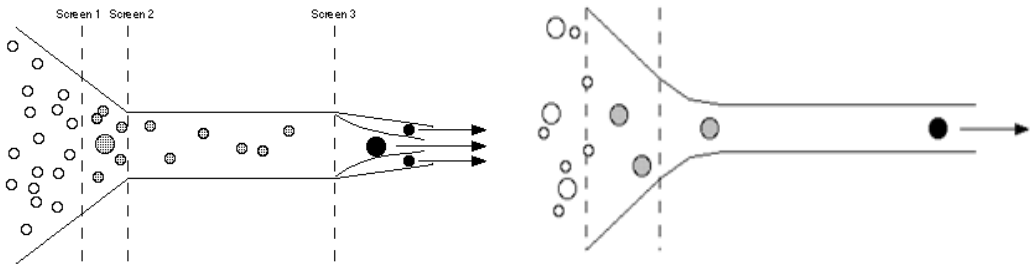


Figure 3. Pugh's conceptual design process [5]

This representation of the progressive reduction of the possible design space has been extended by various authors [8; 9] to take into account the development of new technologies whenever a new technology is a key lever of innovation. Wheelwright *et al.* note that the companies that supply these funnels by R & D (Figure 4a) on technologies, processes and products also extend the scope of the funnel to bottom-up uses (Figure 4b) to identify and filter out new ideas from a strategic market analysis.



(a) Funnel of technology push (b) Funnel of market bottom up

Figure 4. Funnel representations of Wheelwright [9]

The two situations of convergent part of an ideation process (innovative process) and technology push or market pull representations (strategic innovation management) are very different. Whether one refers to very general models such as the Chain Linked of Kline and Rosenberg [10] and the Stage and Gates of Cooper [11], or more detailed and structuring processes proposed in design engineering [12-15; 9], this analogy of forward selection and progressive shrinking of the design space appears to be a highly interpretative task. However, it is very well illustrated by Wheelwright and Clark [9] who clearly associate it with the product planning stage preceding that of product development (Figure 5).

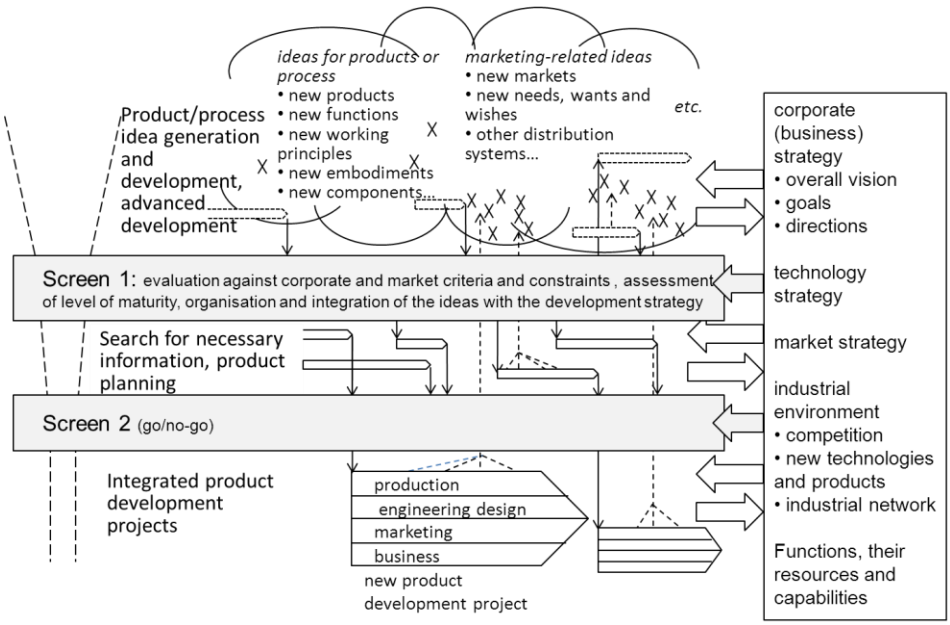


Figure 5. The funnel development process of Motte *et al.* [16], adapted from Wheelwright and Clark [9]

These representations in funnels do not aim to facilitate the structuring of a process of innovation but to illustrate how an organization has the means to open and close its creative space and thus its products space. In this sense, to interrogate the businesses associated with the innovation process on how they actually process opens or closes to integration of new ideas and new opportunities, throughout a development process, is a way to identify how this funnel is actually generated. It is a question asked on the innovative organization behind that could lead to a continuous improvement of the innovation management. The objective of this paper is to propose a tool for the continuous improvement of the innovation management in companies based on a funnel categorization obtained after an innovation survey in 28 large companies.

2 Survey on innovation in large companies and lessons learned

In a recent survey of 28 large European companies in the industry, we investigated the state of practice in innovation and innovative organizational models in large companies. This survey has provided qualitative and quantitative results which have been reported in a book [17]. We interviewed 48 R & D or innovation directors by asking them to self-diagnose their business practices according to the five management areas that contribute to value creation: strategy and business intelligence, organization of R & D, management of innovation processes, innovation culture and management of human resources and R & D, measurement of innovation performance. Our learning are numerous and sometimes surprising. We report hereafter just a few of them to contribute to this paper.

Two thirds of respondents reported having profoundly transformed or reorganized their R & D over the past three years. For reasons to support the international expansion, pooling and centralization of research upstream, location in the business unit of applied

research and development or reorganization of the development process and resource allocation of R & D. These reorganizations are made in trial and error mode (no apparent method) and reflect a search for greater innovation performance. Indeed, companies face a real difficulty in measuring performance and the benefits of innovation, investment in research that results often lately by the market launch of innovative products and services. Management indicators of innovation or value creation are often of "rear-view mirror" type like the number of patents rather than of “looking ahead” type (able to monitor the value increasing).

Finally, the companies say that the upstream processes of ideas management are poorly organized. Indeed, 47% of companies do not use a methodology for generating ideas. The methods used are the idea boxes and idea contests without, in most cases, budget for the exploitation of good ideas that emerge. Also appalling, the only methods of generating ideas and driving innovation that are sometimes referred by high-level managers are TRIZ and Design to Cost and Objectives.

The companies surveyed acknowledge the fact that the so-called “innovation process” of a company is actually a series of strata or four processes (see Figure 6 which is our own representation) with interconnections but acting at different times, with specific strategies, roadmaps and different but interdependent budgets. These four processes are:

1. The process of ideas generating on products, technologies, processes or organization,
2. That of research or technology management
3. That of product lines or programs management or planning
4. The very activity of project management of New Product Development (NPD), which supplies the market with new offers and contributes largely to the creation of business value.

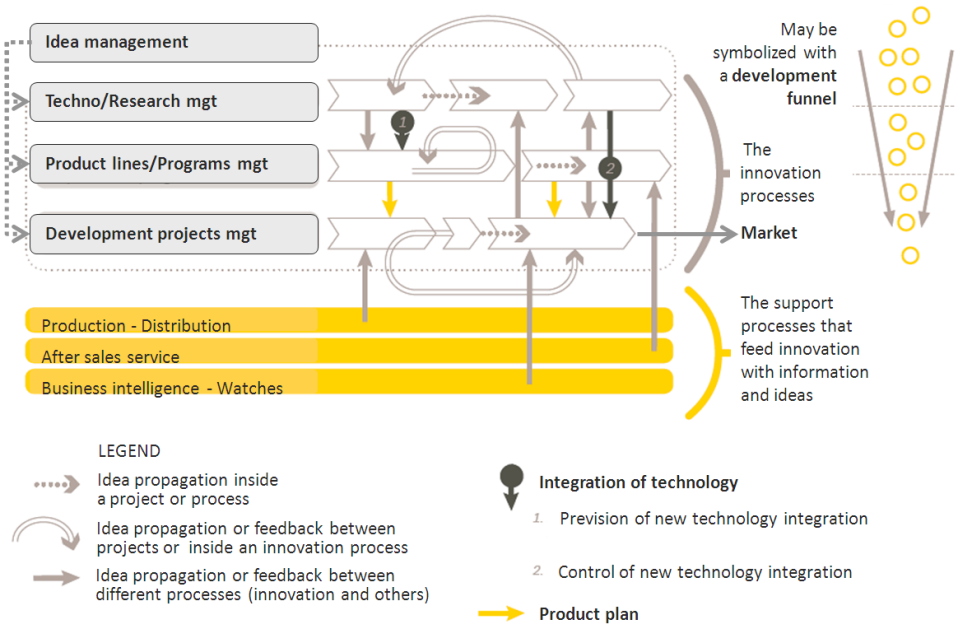


Figure 6. Modeling innovation or value creation processes in companies

It may be noted that a number of business support processes such as marketing, customer relations, after sales service, purchasing and competitive intelligence also

contribute more indirectly to the increased degree of effective innovation of the company's products. Note also that according to the ideas (nature, size, maturity), process #1 of Ideas Management can feed processes #2, #3 and #4. All this must necessarily be organized within the company with the collection process of ideas and transfer of ideas within mature roadmap that invest and plan their development and their deployment in research, product lines or project development. However, these transfer processes are currently poorly organized and coordinated so that the process of generating and collecting ideas as we have seen. But there are organized and standardized processes within the company such as product development. These are step by step processes with intermediate outcomes expected, so-called "stage and gate". It turns out that these processes are as well necessary to ensure a minimum quality and coordinate development activity on a complex project, as sometimes too rigid and not very permeable to new ideas and opportunities that would upset too much a strategic positioning or that would appear during the project.

In our book [17] we have thus classified the 28 surveyed companies into 5 categories of innovation funnels (there are 6 companies per category in average), considering the characteristics of the whole 4-layer innovation process of Figure 6 after the three general properties of *shape*, *permeability* to emerging ideas along the process and process *agility*. This classification has been made by us, the 10 researchers having contributed to interview the company managers.

We have baptized them: the funnel "standard, but infertile", the funnel "standardized with high attrition", the "heroes' mode" funnel, the funnel "mixed (or dual device)", the funnel "agile and permeable". We have also graphically represented them in simple and expressive pictorials with small circles for ideas and contours for the shape (see Figure 7).

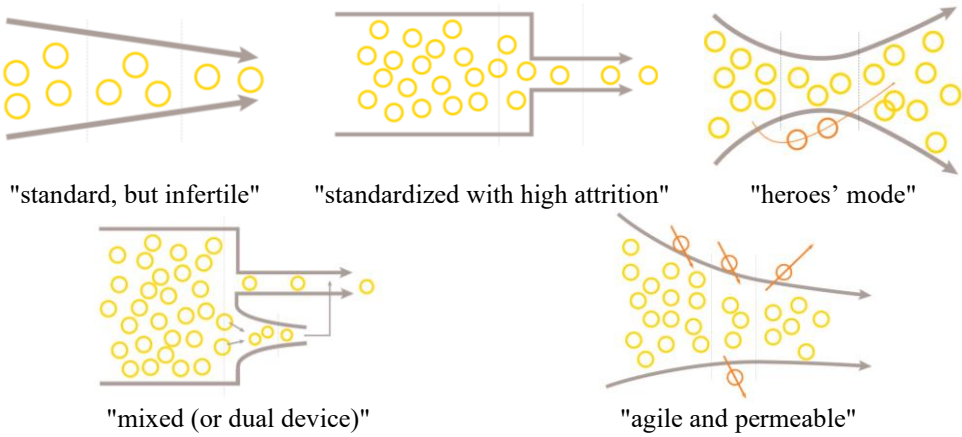


Figure 7. Our model of five innovation funnels

3 Definition of 5-funnel model and correlations with company features

3.1 The "standard, but infertile" funnel

For this funnel, few ideas and innovative proposals are selected upstream. The process R & D is classical and relatively heavy. It usually results in a limited number of development projects that generally go until the completion; it is not very selective. This

model is found in sectors such as aeronautics, submitted to severe constraints of technical reliability in operation and intense capital investments. It can also be found in the energy sector, a sector where a R & D Director said: "*Today the results will kill creativity; R & D is today is a super design department*".

The main characteristic of firms adopting this funnel is to have a limited number of ideas in the sequence generation / collection. However, the steps of selection / maturation and launch / development are well standardized and instrumented (Stage & Gate, TRL-Technology Readiness Levels - project mode...). Despite a cumbersome process, the dropout rate of development projects is low, once the concept validated and the decision to develop the product made.

These companies are mainly technology companies where the product renewal period is long (more than 10 years) and where the type of innovation is "product" dominant. However, some companies doing predominantly "product" innovation may refer to other funnel models.

The competitive intensity corresponds to relatively oligopolistic markets which, even if they evolve with new entrants, do not change they belong to the exclusive club of leaders in their field.

3.2 The "standardized with high attrition" funnel

Here, the process Research and Development (TRL, Stage & Gate) is unique, classic and relatively heavy, with progressive selection and strong attrition of the proposals. In this model, it is difficult to stop the projects launched once they have passed the stage - gate – of product development. This funnel is found in sectors such as pharmacy or mass retailing where the selection of ideas for innovation is strong before starting the process of development itself.

In this model, many ideas are killed as they pass upstream phase (vision / selection / feasibility of innovation concepts), sometimes despite an abundance of leads and ideas for innovation in this phase. For the transition phase in product development phase, the company takes the minimum possible risk and projects that pass this stage are then under control. But as explained by a Director of Research, Technology and Innovation, "*Risk reduction is the anti-innovation. The goal is not to reduce risks, but to manage them. The difficulty comes from people who want to reduce the risks*".

However, the development projects initiated are not arrested or very little even when they no longer meet the original expectations: "*I have a project in mind. When I arrived ten years ago, people said "It's been ten years since we talk of it", it's still there!* ".

These companies face a double problem. First, how to reduce the number of tracks to explore and to evaluate in upstream stage - which has a cost - to focus on the most promising? Then, how to accept anyway to take risks, knowing that establishing sales forecasts of innovation on the market is both a delicate task and a choke point? In other words, how not to "sterilize" automatically waiving any idea if its business case is not solid in terms of apparent ROI, given that the expected revenue is often not accurate?

3.3 The "heroes' mode" funnel

The "heroes' mode" funnel makes coexisting a standardized funnel with a heroic mode. It is a R & D process (Stage & Gate) classic that can turn out to be cumbersome with a progressive selection of ideas and difficulty to kill the projects once they started. It is

characterized by a weak support to potential innovations proposed by the field and which have failed to take the step of selecting initial ideas. The innovations are defended by tenacious individuals with strong personalities that sometimes succeed to make their ideas acknowledged by others and to put them into an official project portfolio.

Companies in this scheme feed well the funnel in ideas in the upstream phase. But there may be two reasons for not ensuring a good transfer from upstream phase to downstream phase: 1) A R & D process too cumbersome, judged too bureaucratic and procedural or 2) conversely, a lack of a real ideas selection process.

Innovations that pass this barrier are supported for some literally "overreach" by the holders of ideas, which we called the "heroes" and who, with tenacity and by using their internal network, particularly among the bosses of business units, manage to insert their idea into the mainstream product development.

3.4 The "mixed (or dual device)" funnel

As its name suggests, this funnel combines two processes. On the one hand, a conventional process of Research and Development (TRL type, stage & gate...) works, but it can be cumbersome. It is often keyed to the yearly budget. Once the candidate ideas issued, it works more in "top down" mode. Its main features are a progressive selection and difficulty to kill projects launched. On the other hand, the process is light, but institutionalized, organized and resourced to capture the ideas and proposals. It is "bottom up", which gives real resources to support potential innovations, giving the possibility to impact the official portfolio of research and development projects.

This funnel consists in putting another competing device in parallel of the standard R & D process (standardized funnel). This parallel process encourages the expression and development of ideas, if possible "out of the box". It is light, rather “bottom up”, but well processed and sequenced. It is generally funded fairly "light".

Conditions to help ideas holders are implemented effectively, albeit on a modest scale in comparison with the official process. They can take different forms: a department dedicated to breakthrough projects and exploration of new growth territories, small committees with financial resources which support the evolution and development of the idea, fund dedicated to disruptive innovation... In the best case, an idea supported and emerging from this parallel device may reinstate the traditional process, or even take the place of a program or development project already in the portfolio.

These models are very new in the organizations we met. Some have produced tangible results, that is to say that ideas have been supported and reintegrated into the process of a traditional project. However, none has yet succeeded in bringing an innovation project standalone, ready to integrate the portfolio of projects issued from the official planning.

3.5 The "agile and permeable" funnel

Here, the innovation process is instrumented and institutionalized to generate and capture ideas constantly. The whole organization - not only the functions dedicated to Research and Development - and its culture are adapted to support the ideas and give them means. The permeability of the funnel acts both for "input" and "output": stopping of the project, outsourcing of a part of the cycle, selling the idea and the first results obtained for continuing the development by a third party, etc.. The engagement process

of the projects is disconnected from the annual budget process for more flexibility while roughly maintaining the budgets allocated to them.

This funnel that one can qualify of "ideal" is pretty close to the previous. When the "dual device" opens a new avenue for innovation, this funnel seeks to open innovation to all disciplines (research, engineering, marketing, design, sociology, risk management, regulatory watch...) and to external partners, from the upstream stage of the process (exploration of innovation fields).

4 Let us hypothesize an evolution law in a 5-funnel cycle

4.1 An evolution law of companies in a 5-funnel cycle

We have also observed that these different forms of funnel tend to be on a sequential series which is even cyclic. Indeed, the surveyed companies described their 3 to 5 years past and were entitled too to describe their idealized future in terms of innovation management. Therefore, we experimentally hypothesize that there is a natural law of evolution like it exists in TRIZ theory for technical systems [18; 19].

We define these five stages of evolution of a company in terms of innovation management maturity as:

- The start-up, spontaneously permeable and agile
- The growing company that tends to standardize processes
- The healthy reaction to the normalization: the heroes that defend innovations
- The awareness of the need to establish mechanisms that promote innovation "out of the box"
- The organization of agility

In more details, the 5 stages are:

1. **Stage 1**: At the beginning of a company, at the stage of start-up, the involvement of the founders, the small size of teams and the low volume of activities make that an oral culture is adequate. The whole company is spontaneously committed, led by leaders heavily involved at the operational level, to ensure the output of innovations. The funnel is naturally agile and permeable (or "ideal") without the need for formal processes.
2. **Stage 2**: The growing company creates specialized functions and provide them with dedicated resources. The implementation of processes, operating rules, management tools is needed to control the volume of activity and resource use. The company becomes "technocratic" and sometimes "bureaucratic". A standardized funnel is then implemented. Depending on the types of innovation practiced and sectors concerned, the standardized funnel can be "infertile" (number of ideas for innovation low, often linked to highly technical products and processes and to their renewal duration) or, on the contrary, can be of "high attrition".
3. **Stage 3**: To fight against the negative effects of this form of selection, heroes appear, which personally defend innovative ideas that have failed to pass the formal selection process and eventually turn into real success stories.
4. **Stage 4**: Companies capitalizing on these successes and eventually recognizing the value of one or more parallel channels to the formal and standardized

selection process, finally put in place a dual system by putting them in competition and, at best, in making them cooperate and exploiting synergies.

5. **Stage 5**: At the ultimate stage, companies are able to merge all the channels of innovation in addressing innovation transversely to functions, approaching it from a multidisciplinary perspective, identifying and exploiting at best external sources of innovation or the value of their Research and Development. They manage to implement, on an industrial scale, an ideal, organized and equipped, agile and permeable funnel, returning to the virtues of roots. In practice, companies in our study [17] are almost all in stages 1 to 4; only a few have some characteristics of the ultimate stage 5. This clearly reveals how much progress still to implement a process for ideas and projects management that is not too rigid while being sufficiently organized. The challenge, in our opinion, for the company that wants to be fully innovative is to get to stage 5, at least for innovations that are not strictly incremental. To be truly innovative as it grows, the company must recover the dynamics and virtues of its beginning as illustrated by Figure 8 of the evolutionary cycle of the five funnels.

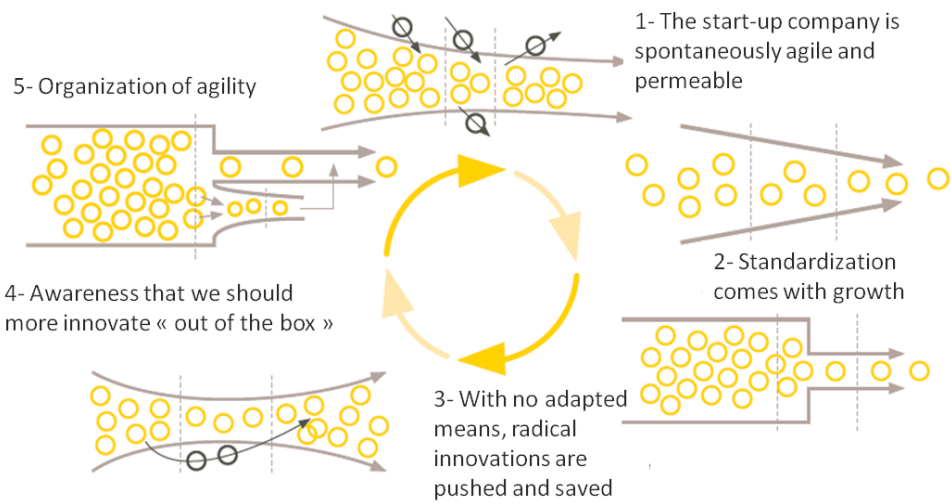


Figure 8. The evolutionary cycle of the five funnels

4.2 How to find the agility and creativity of the origins?

It is not mandatory at all to evolve towards the next stage of innovation funnel for a company. But one believes that, like the TRIZ evolution laws of technical systems [18; 19], making people conscious of the innovation funnel their company is likely to be close to is already fruitful for them to visualize their company process and start discussions about what today contributes to the funnel *shape*, *permeability* and *agility*. Each people can also try to imagine how to personally interpret this innovation funnel.

In the case where the company is not satisfied with innovation management and performance, we propose to use the previous evolution law as a tool for continuous improvement. A creative workshop can be organized as follows:

- Gather a short-list of some players representing the ideas and projects management processes in the company (generation, selection, development, managers).
- Make them positioning their business on the 5-funnel cycle. Make them express the reasons to be at a given location and try to result in a consensus for the whole company.
- Then, lead a brainstorming session on how to move from the present company funnel to the next stage.
- Work to a strategic and operational roadmap.

5 Conclusion

It is common in the Management Science and Design Engineering communities to represent the processes contributing to innovation in companies as a funnel pictorial. We noticed that it could be used in several situations: representing the ideation process, as well as more strategic innovation processes. We propose to use the funnel representation as a holistic representation of the 4-layer processes that well model innovation or value creation processes in companies (see Figure 6).

Our survey on innovation practices in 28 large companies [17] has led to the observation that the innovation funnels of these companies can be categorized into 5 funnel types differentiated by their shape, permeability to ideas and process agility, and that they could be easily sketched as meaningful pictorials (see Figure 7). Our surveyed companies also learnt us that the past or the expected future of the companies let us think that the 5 funnel types follow a sequential and cyclic evolution law, as in TRIZ theory.

We finally propose to use the 5-funnel model as an inspiring tool for making people conscious of the innovation processes of their company and discussing of it. In addition, they can use it in a creativity workshop to imagine a strategic and operational roadmap for making their company evolving from one funnel stage to the next. These tools are being tested in companies and they truly appear insightful.

References

[1] De Brabandere L., Mikolajczak A., "Le plaisir des idées. Libérer, gérer et entrainer la créativité au sein des organisations", Dunod, ISBN 210040847, Paris, 2002.

[2] Deschamps J.P., Nayak P.R., "Product juggernauts - How companies mobilize to generate a stream of market winners", Harvard Business School Press, Arthur D. Little, Inc., ISBN-10: 0875843417, Boston, 1995.

[3] Gero J.S., Kazakov V., "An exploration based evolutionary model of a generative design process", Microcomputers in Civil Engineering, vol. 11, 1996, pp. 209-216.

[4] Cross N., "Engineering Design Methods - Strategies for product design", John Wiley & Sons, Chichester, 1994.

[5] Pugh S., "Total Design: Integrated methods for successful product engineers", Addison Wesley, New-York, 1990.

[6] Roozenburg N.F., Eekels J., "Product Design: Fundamentals and Methods", John Wiley & Sons, Chichester, 1995.

[7] Liu Y.C., Chakrabarti A., Bligh T., "Towards and 'ideal' approach for concept generation", Design Studies, vol. 24(4), 2003, pp. 341-355.

[8] Brem A., Voigt K.-I., "Integration of market pull and technology push in the corporate front end and innovation management - Insights from German Software industry", Technovation, vol. 29(5), 2009, pp. 351-367.

[9] Wheelwright S.C., Clark K.B., "Revolutionizing Product Development", Free Press, 1992.

[10] Kline S.J., Rosenberg N., "An overview on innovation, in the positive sum strategy", ed. Landau R. , Rosenberg N., National Academy Press, Washington, DC, 1986.

[11] Cooper R.G., "Stage-gate system: A new tool for managing new products", Business Horizons, vol. May-June, 1990, pp. 44-55.

[12] Cooper R.G., "A process model for industrial new product development", IEEE Trans Eng Manag, vol. 30, 1983, pp. 2-11.

[13] Cooper R.G., "Predevelopment activities determine new product success", Industrial Marketing Management, vol. 17, 1988, pp. 237-248.

[14] Pahl G., Beitz W., "Engineering Design". The Design Council, Springer, London, 1984.

[15] Ulrich K.T., Eppinger S.D., "Product Design and Development", McGraw-Hill, New York, 1995.

[16] Motte D., Bjärnemo R., Yannou B., "On the interaction between the engineering design and development process models - Part I: Elaborate Elaborations on the generally accepted process models", Proceedings of ICoRD: 3rd International Conference on Research into Design, January 10-12, Bangalore, India, 2011.

[17] Cuisinier C., Vallet E., Bertoluci G., Attias D., Yannou B., "Un nouveau regard sur l'innovation - Un état des pratiques et des modèles organisationnels dans les grandes entreprises", Techniques de l'Ingénieur, ISBN 978-2-85059-130-3, Paris, 2012.

[18] Petrov V., "The laws of system evolutions", The TRIZ journal, March 2002, paper #2, see http://www.triz-journal.com/archives/2002/03/b/index.htm.

[19] Savransky S.D., "Engineering of creativity - Introduction to TRIZ Methodology of Inventive Problem Solving", CRC Press, 2000.