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THE COEXISTENCE OF DESIGN THINKING AND STAGE AND GATE IN THE SAME ORGANISATIONAL CONTEXT - CHALLENGES AND NEED FOR INTEGRATION

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Abstract

The current product innovation scenario is facing important changes that require the New Product Development (NPD) process to be adjusted. Despite Stage and Gate (SG) is the most adopted framework, several studies inquired how to overcome its limits; new innovation methods emerged from the practitioners' world, and, among them, Design Thinking (DT). To our knowledge, no research has inquired the coexistence of the two methods inside the same organizational context. This study is based on a single case study of a food company where the two methods co-exist. The aim is to understand if the perceptions of the employees are coherent with the pros and cons of literature and to investigate if the two methods can be compared, integrated or are mutually exclusive. Our study shows that the two methods, as parallel processes, lead to confusion among employees, due to the overlapping of some activities, with a perception of wasted resources. Moreover, emerged an interesting balance among the pros and cons of the two methods, where items have been identified as complementary. Results highlight a call for integration among the two methods with the limits of SG overtaken by the benefits of DT.

Keywords: New product development, Organisation of product development, Design process

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1 INTRODUCTION

In today's fast changing environment, in which products life cycles are dramatically reduced and product development is increasingly complex, is the linear Stage and Gate process still competitive for New Product Development (NPD)? Many scholars are struggling around this question, while companies are trying to adopt different solutions to face this change. Among these solutions, we find the use of different versions of the Stage and Gate process according to project characteristics and the use of hybrid models of Stage-Gate. While Stage and Gate is under review, Design Thinking is gaining momentum as a different approach to innovation, iteratively developing solutions starting from consumers' needs. As a matter of fact, Companies have started to invest significantly on design thinking and to introduce it in their new product development processes along with significant contribution offered by the literature regarding the exploration of design in relation to business performance. As of now, the two approaches were studied in isolation.

The purpose of this article is to research how Stage and Gate and Design Thinking can coexist inside an organization, which are the pros and cons of each approach and to investigate whether there is a benefit in the integration in a hybrid model. To do so, we chose as a case study a multinational Food and Beverage company that has always used the Stage and Gate as NPD process and has recently introduced the Design Thinking approach.

2 THEORY AND GAP

From the 80's, Stage and Gate has affirmed as the most adopted framework for NPD, and its advantages as well as its disadvantages are widely renown. Among the benefits, literature recalls for greater discipline, a better-quality product thanks to upfront homework and to a sharp and early product definition, and increased development speed (Cooper and Kleinschmidt, 1993; O'Connor, 1994; Sommer et al., 2015). On the other side, as a linear product development process, Stage and Gate has been accused of being too rigid and planned, with too structured and too financial-based gates which cannot sustain the iterative cycles required by the today's product development processes (Becker, 2006; Lenfle and Loch, 2010). Moreover, the model has been accused of being too bureaucratic and full with paperwork in its gates-decisions: checklists and non-value-added work hardly matches with reduced product life cycles and increased competition among companies (Becker, 2006; Lenfle and Loch, 2010). Over the years, to overcome the abovementioned limits, companies have experimented with the Stage and Gate process. In some cases, it has been changed and evolved according to the context. An example can be found in Cooper (2014), where the author reports that companies have implemented different versions of the Stage and Gate according to the complexity of the projects and to the context (e.g. how mature is the market, how risky is the project, how impactful is the required development…). A full five stages process can be used to handle projects with high uncertainty and high risk level; a faster version, with three stages and three gates, is used to manage moderate risk projects; finally, an express version, mainly composed of two stages and two gates is used for minor projects (e.g. MacCormack et al., 2012). On the other side, alternative methods to Stage and Gate for NPD recall design as a strategic resource (Ulrich and Eppinger, 2004; Veryzer and Borja de Mozota, 2005; Verganti, 2008). In the last decade, "the growing interest for design amongst managers resonates with the management concept of Design Thinking" (Carlgren et al., 2016:1). Design Thinking (DT) has recently gained popularity and is now affirmed as a NPD framework. Both the practitioners' world (see recent publications in Harvard Business Review, Business Week, or The Economist) and scientific literature (e.g. Johansson et al., 2011) identify Design Thinking as an approach that can obtain more innovative ideas and can implement them faster. Its rapid testing and prototyping approach, its human-centered orientation and its divergent-convergent rhythm (Liedtka, 2015) are said to be the reasons of its advantages. Design Thinking in NPD helps companies to look at the problem-solving equation from different perspectives, in terms of user-centredness and multidisciplinarity, coping with structured ambiguity and following a method maximising the learning momentum throughout the innovation process.

Some contributions recognize that NPD methods derived from Design are very different in nature from Stage-and-Gate, and such two different methods can hardly co-exist (e.g. Veryzer and Borja de Mozota, 2005). Hutchins and Muller (2012) declare that this co-existence leads to two distinctive processes inside companies, one innovation process for the front-end innovation (related to users and focused on values), the other for the back-end innovation (more on the economics of product development). The result is

that "*Many companies find that while their front-end innovation process now produces a torrent of fresh new opportunities, the back-end process designed to control the costs of bringing those opportunities to market is still broken!*" (Hutchins and Muller, 2012: 31).
An interesting fact is that Design Thinking appears to be implemented in most of the biggest organisations (Lafley and Charan, 2008; Martin, 2009; Liedtka et al., 2013), and most of those organisations are also adopting Stage and Gate. Two examples above all: Dietmar Bressau explained in an interview that P&G has decided not to change its famous stage and gate process - SIMPL (Cooper, 2014). Despite this, P&G is widely renown for being one of the pioneering in adopting Design Thinking as an innovation process. The same can be said for Hewlett-Packard, who is renown both for its elaboration and evolutions on its internal Stage and Gate (MacCormack et al., 2012) and its workshops, competences and tools related to Design Thinking. We are thus in front of an intriguing phenomenon: the two NPD approaches (Stage and Gate, and Design Thinking) have succeeded in raising the interest of management and design scholars, and in affirming as effective innovation processes. Parallel literatures have developed to describe the two, to improve and adapt them in order to overcome their limits. It is renown how different are Stage and Gate and Design Thinking in their distinctive characteristics, however it seems that most successful organizations are implementing both of them. Despite this observation, to our knowledge no scientific contribution explored the co-existence of the two processes and inquired how to maximize value from their concurrent implementation.
The aim of this paper is to inquire how two different NPD methods such as the Stage and Gate and Design Thinking relate to each other, understanding whether they can co-exist in the same organizational context, and what are the consequences of their concurrent implementation.

3 METHODOLOGY, DATA COLLECTION AND DATA ANALYSIS

To study this issue, we have select a company who implemented both the Stage and Gate and the Design Thinking, with a high product development ratio. The Company is a global leader and belongs to the Food and Beverage Industry. It has been using the classical Stage and Gate process for R&D processes in the last decades to support its products launches on the market, and has recently introduced Design Thinking as a reference method for NPD. In the last 2 years, the company went through internal investments to set up an internal area that is entirely dedicated to the expression of Design Thinking, a full time dedicated team dedicated to the area with new roles ("Design Thinking Head" and "Design Thinking Coach") and design thinking projects developed in several forms. Most of the projects developed in the area have been successfully inserted in the Company Strategic Global lines for further development. On the other side, also Stage and Gate has a formal head and a dedicated team and it has clearly defined processes, with official steps, associated teams and top-management gate keepers that assess the pre-established gates documents when the team is ready to submit the request of advancement. This submission can be undertaken monthly. Shorter options of Stage and Gates are in place in case of limited changes to existing products or different scales of investments.
To inquire how the two methods relate to each other in this context, we selected 5 internal projects. We avoid the projects related to Service innovation, and – among the NPD projects developed in the last 2 years - we considered the ones who have been processed using the two R&D methods. We have selected 5 projects. All of them are related to innovations in their main product lines and were started in 2015 and 2016: 3 in Italy, 1 in USA, 1 in Sweden. The authors also analyzed the projects documentation as internal reports from the R&D department. For each project, we have collected the significant documents (intermediate reports of project development of the two processes). Those reports were also used as conversation triggers and as examples the interviewees could refer to with shared artifacts, to recall passages of the NPD process. Authors performed a series of interviews aiming at understanding what are the perceived pros and cons of the two methods, how are settled nowadays in the company, and what are the relations among them. To a better comprehension about how the two methods are implemented into the company, the interviewees were asked to explain the activities that are undertaken in each stage of the two methods (e.g. for the Stage and Gate which are the gates and who are the gatekeepers that attend to each gates, as well as how the clients and final users are involved in the process; for the Design Thinking what are the objectives of the different phases and how the assumptions, prototyping activities and users testing). Respondents were also asked to collocate where the Design Thinking has been placed inside the NPD process to investigate whether the two methods can be compared, can be integrated or are mutually exclusive. Interviewees roles are manager (informant 3,5,7,8,9), BU director (informant 1,

6), and Senior Manager (informant 2,4), and the interviews' average length is 46 minutes. Each semi-structured interview was verbally transcribed and coded by the authors. Open codes aimed at identifying the perceived characteristics of the two methods, with codes like "completeness", "process-oriented",etc. Each code had attached a characteristic to highlight if the interviewee mentioned it with a positive or negative value.

4 RESULTS

4.1 Stage and Gate and Design Thinking inside the company

Stage and Gate and Design Thinking co-exist in a concurrent way inside the company. All the interviewees had a clear view and aligned answers about what are the activities and objectives of the two NPD processes.

The Stage and Gate is the "official" framework for NPD processes in the company and, no matters how detailed the Design Thinking result is, employees need to go through the Stage and Gate process to obtain a go-to-market feedback from the top management. The Stage and Gate has two main versions that are used according to the level of risk, the complexity and the investment required by the projects. The first one, is a full-five stages process used to handle important innovation projects and the second one, faster and lighter, used for incremental innovations.

An analysis of the Stage and Gate was conducted in terms of how the idea is developed and transformed into the product that is launched at the end of the process (a representation of the path of a generic Stage and Gate project is represented in Figure 1). Stage 0 is the idea generation, which means that the idea of a new product development project can results - for example - from a market analysis or from a research program of the R&D function. If the idea gets approved, it is integrated into the master plan, which means that enters the stage 1, preliminary assessment phase, and a product design strategy (PDS, definition of a set of attributes that describe the product, its packaging, its ingredients, etc.) along with some pre-prototypes are developed. In this stage, there is also the need to show the business potential of the idea. Between two stages there is always a gate in which the gatekeepers approve or reject the progress of the project. When all the activities of a stage are completed and the development team receives from the gatekeepers the order to enter the next phase, the project can move forward. In stage 2 (the detailed assessment phase) the product design strategy is validated and cannot be modified. Here, economic and financial activities are conducted in order to deepen the development of the project. Everything that has been defined in the product design strategy is executed in stage 3 (development), which means that industrial tests are conducted to validate all the attributes of the product design strategy. The last stage prior to launch is the validation stage (stage 4), during which there is the setup of the production line and all the product and process standards are defined in order to launch the product. The final stage is the post launch review in which tests are run in order to check that the standards defined in the prior stage are verified.

The Design Thinking projects are projects undertaken by a multidisciplinary and multifunctional team. So far, the company used that method to very ambiguous and uncertain areas of opportunities, for example to exploit a trend to develop new products, to find a way to deliver a new technology to the users, to develop a new business opportunity.

The Design Thinking projects follows the double diamond schema in a sequence of two divergent-convergent cycles that are composed into four main phases: Understand, Define, Explore and Create. Thus, after the Kick-off meeting, the development team start a divergent phase, the Understand Phase, which aim is to understand and to establish more familiarity with the context of the research and the potential users, along with their needs, relevant technologies and competitive products. Through an initial benchmarking (desk research, observations and first face to face interviews) the team should understand what is relevant inside the context, get a general understanding of the market, on what insights can be gathered, what trends are observed and which could be the unmet needs. The Design Thinking projects, then, enter the Define Phase, that is a convergent phase in which the aim is to investigate the needs discovered in order to re-define the initial problem. A preliminary phase of prototyping, called prototyping, is useful to reach a deeper level of interaction with the user. Building some prototypes and test them with the customers and users allows the team to fully investigate the needs discovered previously. Then it follows the Exploration phase, which is an ideation stage in which the team generates ideas and develop them into concepts, prototypes, and cycles of testing, building, failing, refining the prototypes to explore better the solutions' space. The final convergent phase is the

Creation phase. Once the concept has been defined the team needs to proof it is valid. Through an additional cycle of build-test-refine with the customers and final users, the team defines more and more the specifications and features of the solution. This last phase aims at understanding if the concept that the team created, when delivered to the users, matches their needs. If not, the prototype is modified according to the users' feedback.

4.2 How the two methods are perceived by the employees

Perceived distinctive properties of the two NPD methods. Some of the challenges claimed by several authors in literature (Becker, 2006; Lenfle and Loch, 2010) about using the Stage and Gate model as NPD process have emerged during our interviews. Besides several benefits of having different customized versions of the Stage and Gate that are used according to the level of risk, the complexity and the investment required by the project, the process is still perceived as slow and too bureaucratic. The reasons of these complaints depend on the fact that the gates meetings are held once a month and, to attend to a meeting, each development team must present different documents, specific for each gate. Getting to the point of having all the necessary forms filled and ready for the presentation is particularly challenging, since the fulfilment of the documents requires the contribution of different actors belonging to different functions. These people usually follow simultaneously several projects, so it is not always possible to have all the forms needed before the meeting day. Thus, the necessity expressed by the majority of the interviewees to have a dedicated team which would work full time on one or maybe two innovation projects at a time, so that the project can move faster through all the stages.

In addition, the interviewees highlighted the need of having cross functional teams from the very beginning of the ideation phase, rather than engaging people of different business function only when they are needed. Indeed, this later engagement usually leads to rework and it is often very costly in both terms of money and time (Hutchins and Muller, 2012); not to mention the loss of all the diverse inputs that come from the different perspective that people of different functions have and that can bring the project to a new radical innovation level.

Another theme that emerged from every interviewee is the influence of the organizational culture on the Stage and Gate process. Nowadays the company's culture is oriented towards the launch of the products, which affected the NPD process in two opposite ways. From one side, it results into a company with a high product development ratio, which is obviously positive and could be interpreted as an efficient and productive process. However, zooming on the path that a single project does through the Stage and Gate, can be seen that everything enters the Stage and Gate, usually arrives to the launch, with very few exceptions. Thus, if we think at the traditional Stage and Gate process concept: the original function of the gates was to help the company in prioritize and select only valuable project (Cooper, 1990). According to Informant 1, is very difficult to see a kill decision during the gates, rather the project is strictly selected before entering the Stage and Gate and once they are in the process they move from stage to stage till the end. Informant 1 also complained about the fact that process does not support people to think about the problems that they are trying to fix, but make them run into the development on an idea generated internally without a real understanding about the users' needs that this solution aim to fulfil. *'The Stage and Gate has become a fixed course rather than a funnel towards the launch! In 22 years I have seen very few kill decisions[…] R&D people are amazing in ideating solutions, but the problem is trying to understand the upstream need. – The solution I am developing is relevant for the user? How this solution will be experienced by the user? – Design Thinking has been fundamental to start to understand that we are able to develop beautiful solutions, however they not always match user's needs'* (Informant #1).

Table 1. Distinctive properties of the Stage and Gate process

Perceived distinctive properties of the Stage and Gate
(+) the process looks complete as it validates the product in terms of economic and technical feasibility, user acceptance, ecc.. '*The process per se, tells you everything you need to do...the process is complete!'* [informant #2] **Selected label: <Completeness>**
(+) method to have every Business Units aligned on the project's development **Selected label: <Follow up>**
(+) "Safe side" of innovation [informant: #1, #2, #4] **Selected label: <Comfort-zone>**
(-) too rigid. [informant: #1, #5, #4: *'one of the limits is the rigidity of the fixed gates meeting'*] **Selected label: <Rigidity>**
(-) gates are too financial based [informant: #1, #5] (-) "forced-go" stage and gate '*In the early stages, you work with evaluation of datas, which limit the possibility to research paths that are more expansive but on which you could probably have a greater return in terms of tests with customer.'* [informant #5] **Selected label: <Go/kill decision>**
(-) gates-based process, not learning-oriented process *'Sometimes you lose 2 or 3 months because of bureaucratic things rather than effective activities related on the development of the idea into the product'* [informant: #5] *"To overcome a gate, we need to have positive evaluations along all the elements of the gates decision. If we have a red element, we can't go on, and the result is that the group continue to re-iterate minor modification until every element takes a green. This is not a real innovation path, it's rather a hurdle race toward the launch".* [informant #1, #7] **Selected label: <Process oriented mindset>**
(-) time-consuming process/ too slow. [informant #1, #2, #7] **Selected label: <Too slow>**
(-) risk-averse: limits potential breakthrough innovation and the possibility to explore. [informant #2, #4, #5] **Selected label: <Risk-adverse>**
(-) Culture influence the focus of the SG on the process and the solution [informant: #1, #2] **Selected label: <Culture>**

According to the interviewees, Design Thinking activities have been relevant to understand that there is no need to rush into the development of all the idea generated from the R&D activities. Rather, the Design thinking is being used as a tool to make people aware about the problem that they are trying to solve, to shift from the focus on the project to the focus on the users and their needs. Moreover, one of the most appreciate aspects that the Design Thinking introduced is the direct contact with the consumer even in the early stages. Informant #4 highlights how the continuous contact and collaboration with the final user help the team to achieve, in a very short time, the same results and insights that are generally achieved with a marketing analysis: *'The results achieved by the three months DT projects, with very limited resources, were the same that we achieved with a 6 month research with unlimited resources, if compared to those of the DT project, and structured customer tests that took us infinite time'.*

Table 2. Distinctive properties of the Design Thinking process

Perceived distinctive properties of the Design Thinking
(+) Focus on the user, his/her daily activities and what influences his/her purchase choices *'What I find very interesting is the full immersion of few days in the target's lives[...]understand people's behaviour is what gives us real added value [...] we usually interview who is responsible of the purchase, which is, for us, the mum. But we do not have the opportunity to understand how kids' decisions affect and influence mum's choices during the purchase.'* [informant: #1, #2, #5] (+) Direct contact with the user from the beginning *'DT unlock in a fast way the initial contact with the customer'* [informant #1,#5, #4] **Selected label: <User focus>**
(+) Focus on the problem rather than on the solutions *'DT highlights an important issue, which is to know first of all the needs of our users, not run into the development of the solution, because our R&D is amazing in doing so, however, the problem is to understand which is the need we are referring to.'* [informant #1] *'DT often puts back the initial idea into the discussion and force you to refine your idea, this allow you to have a disruptive output.'* [informant #2] **Selected label: <Problem framing>**
(+) Prototyping as a tool to get in front of the stakeholder with something tangible and real. [informant #2] **Selected label: <Visualization>**
(+) Multifunctional collaboration *"I noticed we are recently appreciating what it means to work with colleagues from other functions. In other conditions we would never meet them"* [informant: #1] (+) Easy knowledge sharing *"I love to have multiple perspectives while we design. Being influenced by other functions is enriching and effective. We should always work together. On the contrary, when we don't work with Design Thinking, , I meet Supply Chain employees only after 3 prototypes, and it's possible that I need to start all-over again."* [informant: #1, #3] **Selected label: <Diversity>**
(+) Co-creation with the customer *'What we do now is internal idea generation and external co-design. We should do the contrary! We should co-create with customer and user or design experts in order to bring some fresh ideas, If we keep on doing internal idea generation we will always end up with the things that we already know.'* [informant: #1, #2, #4, #5, #9] (+) prototyping *'What I liked about DT is the prototyping phase'* [informant #8, #4] **Selected label: <Experimentation>**
(-) Lack the economical [informant: #4] and technical [informant: #2] feasibility analysis (-) Lack quantitative validation *'If the Design Thinking is only used for idea generation, its way of working with a limited number of people is ok, but when it comes to the development phase you need to have 75, or 100 people that validate your product, unless the variability is too high..'* [informant #2, #8, #9] **Selected label: <Completeness>**
(-) The DT tangible output let people believe that the project is in an advanced stage of the process in which the product is mostly defined. **Selected label: <Uncertainty of the process>**

4.3 Overlapping activities from the two NPD processes.

Data analysis from the interviewees and the documentation show that the two methods' coexistence asks for double activities from the employees, creating confusion and frustration among them.

The two methods are managed in a separated way, and nowadays most of the results gained by the Design Thinking teams need to go through the Stage and Gate process from its very beginning. For example, both the interviewees and the documentation analysis show that the output of the Design thinking project #3 and #4 represented a clear and satisfactory preliminary product design strategy (Gate 1 after phase 1), but those projects were asked to restart from Stage 0 of the Stage and Gate. Similarly, the Design thinking team of project #1 defined the product in its very final packaging and recipe, with the pilot plant involvement (phase 2 of the Stage and Gate), but that project was asked to start from Stage 0 as well as project #3 and #4.

This scenario is perceived by the employees and managers in a multi-faceted way. From one side, employee feel protected and in their comfort zone, they don't need to take any risks and they don't need to expose themselves out of the "usual" product development process.

From the other side, these requirements are perceived to be a rework which creates confusion and frustration. '*Our challenge now is to find a way to transform the DT projects results into valuable data for consumer understanding, in order to start directly with the Stage and Gate process without a re-screening session of the initial concept. This would allow to avoid to do the same activities twice'* (Informant #4). From the already reported citation, it is clear the need to integrate the two methods in order to reduce the rework, from one side, and not to lose the benefits derived from both methods, on the other side.

Recently, the company has moved steps towards a possible integration of the two methods. Indeed, the Design Thinking project #5 achieved similar results to project #1: a product made in the pilot plant with a well-defined recipe and a final packaging (stage 1: preliminary assessment). Therefore, the company decided to attach to these results the 'definition of economics range' and ask the approval to enter the Stage and Gate at Stage 2: Detailed Assessment (shown in Table 3).

Table 3. Connection of design thinking process with Stage and Gate process

Project	Status
#1	Through Stage and Gate -Entered in Stage 0
#2	A 2nd Design Thinking project has been opened in another city.
#3	Through Stage and Gate -Entered in Stage 0. Informant #4 comments that the results achieved with the DT project are similar to those achieved with a market research.
#4	Through Stage and Gate -Entered in Stage 0. Informant #4 comments that the results of the DT could be used to enter the Stage and Gate at phase 2.
#5	Through Stage and Gate -Entered in Stage 2. Informant #2 comments that he attached to the DT output the economic evaluation of the concept and ask to enter the SG in stage 2. *'DT is an alternative way to arrive to Stage 2'*

All the interviewees strongly supported this finding, both the ones who were involved at an operational level in the projects, and the ones who had a managerial perspective with a higher view of the process. It is interesting that the confusion and frustration arise not only when the Design Thinking project results enter into the Stage and Gate from stage 0 ("*So are we saying this has no value*?"), but also when they enter in more advanced stages, as reworks and "*incoherent efforts*" are still required.

4.4 Emergence of Complementary regarding the properties of the two methods

When asked to reflect about the two processes, interviewees identified different pros and cons. All the interviewees agree upon the fact that the two processes are both valuable and, we can say, they have complementary features. One quote above all is from informant #4, who said: '*I perceive Design Thinking and Stage and Gate as two complementary models, one doesn't exclude the other: the Design Thinking unlock, in a fast way and early in the process, the contact with the final user, the Stage and Gate instead starts to operate the more industrial part of feasibility and costs. Stage and Gate is less for dreamers and more for implementers. However, the two methods talk to each other and should be used in a complementary way. Which is this way? I don't already know.'*
What emerge from data is a scenario of two NPD processes that reinforce each other in their reciprocal limits, by leveraging on their distinctive strengths. Table 4 below summarizes this complementarity by reporting the simultaneous limits and strengths of the two methods.

Table 4. Comparison of Limits and strengths of the two NPD methods

Perceived distinctive properties of the Stage and Gate	**Perceived distinctive properties of the Design Thinking**
Method as a safe scaffolding process for innovation	
(+) the process looks complete as it validates the product in terms of economic and technical feasibility, user acceptance. (+) "Safe side" of innovation **<Comfort-zone>**	(-) Missing economical viability. (-) Soft technical feasibility. Quantitative validation **<Uncomplete process>** (-) The DT tangible output let people believe that the project is in an advanced stage of the process in which the product is mostly defined. **<Uncertainty of the process>**
Method as a learning process for innovation	
(-) gates-based process, not learning-oriented process. (-) risk-averse: limits potential breakthrough innovation and the possibility to explore. (-) Culture influence the focus of the SG on the process and the solution **<process oriented mindset>/ / <culture>** (-) gates are too financial based. (-) "forced-go" stage and gate **<Go/kill decision>**	(+) Focus on the user, his/her daily activities and what influences his/her purchase choices. (+) Direct contact with the user from the beginning. (+) Focus on the problem rather than on the solutions **<user focus> / <problem framing> / <risk-adverse>** (+) Co-creation with the customer (+) prototyping (+) Multifunctional collaboration (+) Easy knowledge sharing **<Diversity> / <visualization> / <Experimentation>**

5 DISCUSSION OF RESULTS

How the two methods are perceived by the interviewees is aligned with most of the current characteristics identified from the literature. Design thinking is identified as a User-centered innovation method, accented by the empathy-theme (Liedka, 2015). Learning-as-an-objective is what drives the process (Leifer and Steinert, 2011; Beckman and Barry, 2007), also defined Experimentation-oriented (Carlren et al., 2016), with its continuous iteration and testing, divergent and convergent sessions, and prototypes as a practice to learn. Problem framing and extreme collaboration are present as well. Similarly, the completeness and clear structure of the Stage and Gate is present in all its perception, and its affirmed role in the company makes it the "comfort zone" area of R&D. Its drawbacks are present, from its implementation as a process pushing a pure analytical and reliability thinking, to a difficult interaction among groups.

It's interesting that the Design Thinking process is perceived as lacking a strong technical feasibility and, most of all, of a strong viability. Design Thinking should be, by definition, at the intersection of Desirability, Feasibility and Viability (e.g. Leifer and Steinert, 2011). Indeed, the analyzed documents show that the viability component was completely ignored, while the feasibility component was considered but not stressed. The company pilot plans were involved in the advanced prototyping efforts, but detailed recipes and functional information derived from pilot plans were not even reported in the final documents. This is probably the logical conclusion of a biased use of Design thinking that the company has adopted, pushing the desirability element of the process, and leaving other viable consideration for a second moment, to the Stage and Gate process. This distortion is confirmed by three interviewees reporting that they didn't want to care about economics at this stage with the team, as this would have probably killed the learning process, "*since when we talk about economics, we enter in a go/kill decision mode*".

An interesting contribution lies in the identification of overlapping activities from the two NPD processes, given that the coexistence of the two models generates rework, symptom of confusion and frustration from the employees. This result seems to hide a recommendation for practitioners, as well as a suggestion for scholars.

In our case study, overlapping activities exist both when the design thinking project result enters from phase 0 of the Stage and Gate, and when it enters in later phases, and this seems to be both an inefficient use of resources, as well as a cause of employees' frustration.

We inject this alert into the current debate related to the role of Design Thinking in NPD processes. Given an organizational context that has assimilated both methods, what model should host the two methods? Should Design Thinking be a pure front-end innovation method - that has an impact only in the first phases of NPD as most of the company use it today (Hutchin and Muller, 2012; Carlgren et al., 2016)? Or is it a fuzzy front-end innovation method that has deep connections with the other innovations (NPD included) (e.g. Oliveira et al., 2010)? Or is it a method that balances exploration and exploitation, and in its practical application should be considered as a third way of thinking the innovation process (Martin, 2010; Leavy, 2010)?

With this result, we understand that the use of Design Thinking as a method that drives ideas that will be later processed with the classical Stage and Gate not only is a model that fails to balance exploration and exploitation (Martin, 2010), but also creates an inefficient use of resources and internal tensions among employees.

This finding calls for studies that can understand what type of models let the two methods coexist, maximizing the value of both, without creating internal negative tensions.

The reclassification of perceptions in Table 4 identifies the emergence of complementarity regarding the properties of the two methods. Instead of comparing two approaches as standardized vs flexible or as front-end vs back-end (e.g. Hutchins and Muller, 2012), we compare the perception of the employees throughout two elements: elements of the methods that scaffold innovation as a process being reliable; elements of the methods that scaffold innovation as a process supporting a learning process. This re-classification helps us seeing a possible line of thoughts for an integration of the two methods. Indeed, while design thinking perceptions seems to define it as a method that supports innovation as a learning process but fails to be a reliable process, the Stage and Gate seems to be extremely reliable in its rules and steps, but weak in a real support of learning for the R&D team.

One possible line of thoughts could thus start from how some phases of Design Thinking can be imported into the Stage and Gate. In this way, Stage and Gate – that is recognized by management in its procedural forms – would be the scaffolding under which injecting the innovation brought by Design Thinking.
Among the element to import, our coding mention user-centeredness, problem exploration, prototyping to learn, experimentation and radical collaboration. At present, literature presents some interesting suggestions that could help in the path for studying a possible integration of the two frameworks. For example, in Cooper (2014) an example of sequential iterative prototypes brought to users during the Stage and Gate process is described. In this case, users' feedback incorporation in the Stage and Gate is mentioned, and, although this is far from being a process that - to cite Hutchins and Muller (2012) - "*re-conceive [the Stage and Gate] as an assumption-driven process centered on learning, rather than simply a sequence of activities marching towards a pre-determined outcome*" (:32), this is an interesting attempt that scaffolds a prototyping-to-learn-effort into the Stage and Gate process.
With our case study, we identify a new inspiring research path, with a very high impact regarding managerial implications, as they show that Stage and Gate could gain advantages if hybridized with Design Thinking, as well as Design Thinking could improve its performances and could scale up in the company if integrated with Stage and Gate. We leave to future research a theoretical and an empirical study aiming at describing Stage and Gate and Design Thinking interaction.

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