Cooper and Kleinschmidt (1986) on 123 different firms indicated that success is related not just to addressing these critical success factors, but also how to well these activities are managed. During the later period of NPD research, a study of 86 electronic product pairs in a comparative study for success factors showed the critical need for managerial excellence (Zirger and Maidique, 1990). Overall, these study results abetted a paradigm shift. Within this four year period the direction in the NPD success factor research changed from emphasising operational type activities to stressing the importance of the desired outcome. The results of Zirger and Madique placed managerial excellence as a predictor for success in NPD. Later, Cooper and Kleinschmidt (1993a) published their research findings based on a study with 103 projects in the chemical industry in Europe and North America. In contrast to previous studies, Cooper and Kleinschmidt created a conceptual model combining all product and non-product advantages into a new category, 'The Strategy'. Later, Cooper (1994) analysed 103 new products from 21 different firms to deduce their key success factors. This study resulted in a framework of eleven different criteria for NPD to be profitable. These factors, in contrast to Zirger and Maidique (1990), incorporate and combine both operational and managerial type activities as important for success. The shift from operational importance to an emerging managerial importance, and then to a combination of the both, makes it apparent that these categories should work synergistically with an underscore of quality management overall. After the advent of this NPD structure, a study by Balbontin et al. (1999) showed more progress in the evolution of success factors. Forty-nine companies from the United Kingdom and 38 companies from the USA from key industrial sectors were questioned about their NPD practices with successful and unsuccessful projects. The majority of the results concentrated on management skills. Furthermore, Brentani and Kleinschmidt (2004) found that to achieve outstanding results, senior management and appropriate resources that are committed to NPD must be incorporated. A "NPD" culture must be adopted. The companies that Brentani and Kleinschmidt analysed had a corporate culture that supported their NPD process, i.e. company values were instilled with the importance of the NPD process. The message that was conveyed to management was:

> *"Focus on the softer elements that make up the behavioural environment in order to set the tone of an organization for successful…NPD" (Brentani and Kleinschmidt, 2004, p. 324)*

It is now widely known that management is an issue of major importance. Table 2 presents a table created based on 64 studies on NPD success factors. This table lists the most frequently referenced success factors listed in descending order of most referenced.

Reference Count	Factor	References	Definition
28	User involvement and testing	(Balbontin et al., 1999, Barczak et al., 2009, Bronnenberg and Engelen, 1988, Cooper, 1979, Cooper, 1980, Cooper and Kleinschmidt, 1986, Cooper and Kleinschmidt, 1987b, Cooper and Kleinschmidt, 1987c, Cooper, 1988, Cooper and Kleinschmidt, 1993c, Cooper and Kleinschmidt, 1993b, Cooper, 1994, Cooper and Kleinschmidt,	User involvement and testing refers to the understanding that a new product has to respond to user needs. A frequent interaction with users is required in order to gain all necessary information regarding their needs, to understand what benefits are desired, what superior performance is, what quality means and what the user value depends on. A verification that the product

		1995c, Cooper et al., 2002, Cooper and Edgett, 2008, Edgett et al., 1992, Gemünden et al., 1992, Huang et al., 2002, Jervis, 1975, Johne and Snelson, 1988, Lilien and Yoon, 1989, Mishra et al., 1996, Pinto and Slevin, 1987, Rochford and Rudelius, 1997, Rothwell et al., 1974, Rubenstein et al., 1976, Song and Parry, 1997a, Utterback et al., 1976)	responds to the customers' needs and the customer acceptance is obtained through testing the product or prototype before the full scale launch or development. Hereby, testing can refer to the technical inspection in a lab or under controlled conditions or field trials in collaboration with the end users.
26	Cross-functional project teams	(Balbontin et al., 1999, Barczak et al., 2009, Barczak, 1995, Cheng and Shiu, 2008, Cooper and Kleinschmidt, 1993d, Cooper, 1994, Cooper and Kleinschmidt, 1995b, Cooper and Kleinschmidt, 1995a, Cooper and Kleinschmidt, 1995c, Cooper and Kleinschmidt, 2007, Cooper and Edgett, 2008, Ebadi and Utterback, 1984, Hopkins, 1981, Jervis, 1975, Johne and Snelson, 1988, Lilien and Yoon, 1989, Pinto and Slevin, 1987, Pinto and Pinto, 1990, Rothwell et al., 1974, Song and Parry, 1997a, Song and Parry, 1997b, Szakasits, 1974, Verworn, 2009, Voss, 1985, Yap and Souder, 1994, Zirger and Maidique, 1990)	Cross-functional project teams refers to having a core project team with members from different functions within the company. This cross-functional team is committed to and accountable for the project from the beginning to the end and all team members have an overall business understanding. Good internal communications within the cross-functional teams are essential to ensure the close interaction between the different team members and functions within the company. It is suggested to install adequate and formal communication channels just as feedback mechanism and regular meetings to ensure high quality interdepartmental coordination and cooperation.
21	Top management	(Baker et al., 1986, Balbontin et al., 1999, Barczak et al., 2009, Brentani and Kleinschmidt, 2004, Cooper and Kleinschmidt, 1987a, Cooper and Kleinschmidt, 1993d, Cooper, 1994, Cooper and Kleinschmidt, 1995b, Cooper and Kleinschmidt, 1995a, Cooper and Kleinschmidt, 2007, Cooper and Edgett, 2008, Hopkins, 1981, Johne and Snelson, 1988, Kleinschmidt et al., 2007, Lilien and Yoon, 1989, Maidique and Zirger, 1984, Pinto and Slevin, 1987, Rubenstein et al., 1976, Utterback et al., 1976, Yap and Souder, 1994, Zirger and Maidique, 1990)	The factor top management refers to the strong involvement of the top management in the NPD process with a high level of support from the beginning to the end. By involving the top management which is accountable for the project outcome it is ensured that all necessary resources are committed to the project and that it receives the necessary support for a successful product launch.
20	Market research	(Barczak et al., 2009, Cooper, 1984a, Cooper and Kleinschmidt, 1986, Cooper, 1988, Cooper and Kleinschmidt, 1993c, Cooper and Kleinschmidt, 1993a, Cooper and Kleinschmidt, 1993b, Cooper, 1994, Cooper and Kleinschmidt, 1995b, Cooper and Kleinschmidt, 1995c, Cooper and Edgett, 2008, Edgett et al., 1992, Hopkins, 1981, Huang et al., 2002, Maidique and Zirger, 1984, Mishra et al., 1996, Rothwell et al., 1974, Rubenstein et al., 1976, Szakasits, 1974, Zirger and Maidique, 1990)	Market research refers to undertaking a detailed assessment of the market. Aim of market research is to obtain a qualitative and quantitative understanding of the market, the customer needs and wants and the competitive situation.
16	Preliminary technical assessment	(Cooper and Kleinschmidt, 1986, Cooper, 1988, Cooper and Kleinschmidt, 1993c, Cooper, 1994, Cooper and Kleinschmidt, 1995b, Cooper and Kleinschmidt, 1995c, Cooper and Edgett, 2008, Dwyer and Mellor, 1991a, Dwyer and Mellor, 1991b, Hopkins, 1981, Huang et al., 2002, Pinto and Slevin, 1987, Rochford and Rudelius, 1997, Song and Parry, 1997a, Szakasits, 1974, Verworn, 2009)	Preliminary technical assessment precedes the development phase of the new product idea. It is concerned about the technical feasibility of the proposed product to eliminate technical problems and uncertainties before development and manufacturing. Key questions of the assessment are: Can it be developed? What technical solutions are required? At what costs? Can it be manufactured?
15	Preliminary financial analysis	(Barczak et al., 2009, Cooper and Kleinschmidt, 1986, Cooper, 1988, Cooper and Kleinschmidt, 1993b, Cooper and Kleinschmidt, 1993c, Cooper, 1994, Cooper and Kleinschmidt, 1995b, Cooper and Kleinschmidt, 1995c, Cooper and Edgett, 2008, Dwyer and Mellor, 1991a, Hopkins, 1981, Huang et al., 2002, Rochford and Rudelius, 1997, Song and Parry, 1997a, Szakasits, 1974)	Preliminary financial analysis refers to the activity of developing an economical plan and budget for the new product. Costs, a sales forecast, a potential return on investment and the payback period are assessed. This analysis is typically performed before the development stage and thereafter repeatedly performed to adjust to changed circumstances.
15	New product strategy	(Barczak, 1995, Barczak et al., 2009, Cooper, 1984b, Cooper and Kleinschmidt, 1993a, Cooper and Kleinschmidt, 1993d, Cooper, 1994, Cooper and Kleinschmidt, 1995a, Cooper and Kleinschmidt, 1995b, Cooper and Kleinschmidt, 1995c, Cooper, 2000, Cooper and Kleinschmidt, 2007, Johne and Snelson, 1988, Meyer and Roberts, 1986, Pinto and Slevin, 1987, Zirger and Maidique, 1990)	New product strategy refers to the development of an appropriate strategy for the new product. This strategy is defined early on in the development process and sets out the new product goals and objectives, the target market and the product concept. This strategy has to be aligned to the company strategy and defines how the new product contributes to achieving the company objectives. Furthermore, the new product strategy describes the new product and non-product advantages to be achieved.
15	Product champion	(Barczak, 1995, Barczak et al., 2009, Chakrabarti, 1974, Cooper and Kleinschmidt,	Product champion refers to the leader of the cross-functional NPD teams. This individual leads and drives

		1993d, Cooper, 1994, Cooper and Kleinschmidt, 1995b, Cooper and Kleinschmidt, 1995c, Cooper and Edgett, 2008, Hopkins, 1981, Keller, 2004, Rothwell et al., 1974, Rubenstein et al., 1976, Voss, 1985, Yap and Souder, 1994, Zirger and Maidique, 1990)	the new product development from the beginning to the end of the project. He has sufficient authority and power to efficiently coordinate the different involved parties and to integrate them into a continuous process. He typically possesses technical competence and a deep knowledge about the company and market.
12	Preliminary market analysis	(Cooper and Kleinschmidt, 1986, Cooper, 1988, Cooper and Kleinschmidt, 1993c, Cooper, 1994, Cooper and Kleinschmidt, 1995b, Cooper and Kleinschmidt, 1995c, Cooper and Edgett, 2008, Dwyer and Mellor, 1991a, Dwyer and Mellor, 1991b, Huang et al., 2002, Song and Parry, 1997a, Zirger and Maidique, 1990)	Preliminary market analysis refers to the activity of undertaking a first and quick assessment of the market to gain initial insights about the market size and potential, customer interest and needs, requirements and value, and the competitive situation. The scope of this analysis is limited and makes use of e.g. focus groups, key customers and experts.

Table 2: NPD success factors

ANALYSIS

The NPD success factor literature review revealed a range of main points to be considered for the development and innovation process. The key points were:

- Develop a strategy and implement this into your business
- Follow a structured process
- Get up-front work right
- Involve your users
- Allocate sufficient resources
- Create an innovation culture

Defining a strategy for the new product is a recurring topic throughout the literature. This strategy needs to be defined early in the development process and defines the target market, product concept, positioning, benefits and features of the new product. This strategy not only guides the NPD process but also defines how the new product contributes to achieving the company objectives (e.g. Cooper and Kleinschmidt, 1993d, Kahn et al., 2006, Pinto and Slevin, 1987). Once a strategy has been established, it becomes important to implement a rigorously structured and complete process to increase the likelihood of succeeding in the NPD efforts (Utterback et al., 1976). This formalised process is designed to take the product through all necessary development stages. It focuses on the completeness of the process and on the quality of execution of the different stages, which in particular includes the up-front work leading to the definition of the product (e.g. Cooper and Kleinschmidt, 1995a, Hopkins, 1981). Another salient point is that the up-front work before the actual new product development should receive much attention. High quality execution of these factors is required as it determines the product definition and all following steps in the development or innovation process (e.g. Cooper and Kleinschmidt, 1987a). This includes all work which has to be undertaken to be able to establish a detailed product definition e.g. idea generation, idea screening, preliminary assessments, market research and detailed user tests (e.g. Cooper, 1988). A dominant recurring topic in the literature is user involvement and customer focused new product development. It has been found to be critical to involve users throughout the process, especially at the beginning in order to gain vital information about perceived value, wants, needs and quality for the new product (e.g. Cooper et al., 2002, Cooper and Kleinschmidt, 1995c, Gemünden et al., 1992, Pinto and Slevin, 1987). Furthermore, it is important to allocate a sufficient amount of resources to each project to ensure that all NPD

efforts can be carried out sufficiently. This encompasses not only resources in the form of materials and budgets, but also an allocation of adequately skilled human resources (e.g. Cooper and Kleinschmidt, 1995a, Cooper and Kleinschmidt, 2007, Kleinschmidt et al., 2007). These efforts can be enhanced by creating an innovation culture within the company which rewards creativity and innovation. This is achieved by giving the employees freedom to work on their own creative projects and offering conferences and workshops.

The NPD success factors have been studied and peer reviewed extensively; however, the DM Staircase model is still in its infancy. Still, in comparing the definitions of the Staircase model factors against the definitions of the NPD success factors, a wide range of similarities are found. However, there is no direct match between the two sets of factors due to differences in the definitions and numbers of factors. The only two factors which can be seen in both datasets are "planning" and the NPD success factor "new product strategy". Both factors are described as defining a strategy. The factor planning refers to outlining a design strategy for design whereas the factor new product strategy refers to a product strategy. However, considering that DM is the "management portion" of the NPD process that functions under the consideration of design principles, they both refer to the same principle, but in different contexts (Hesselmann et al., 2011). Furthermore, both NPD and the Staircase Model set out that the definitions and objectives of the item to be developed must be established and not only be aligned to the overall corporate strategy, but contribute to it as well.

Partial overlap can be found between the Staircase "awareness of benefits" and the NPD "top management". In both, the attitude that the management reflects is a crucial role. It is important that the management is convinced and supportive of the NPD and design process. However, it appears that the Staircase factor "awareness of benefits" acts on a slightly different level. The Staircase Model contains a taught awareness that results in the necessary support for the design process while the NPD factor "top management" simply refers to the involvement, commitment and support of top management to ensure a smooth process.

The Staircase factor "resources" is not reflected in the presented most referenced NPD success factors (Table 2). It has been excluded from the list due to an insufficient amount of references. However, this should not result in a complete mismatch as both different factors are defined as the same with the only difference that the Staircase factor is more clearly defined. Both request the allocation of sufficient resources to ensure the best possible project outcome and include assessing and budgeting the available resources before the start of the project.

The Staircase factor "expertise" is also not reflected in the listed NPD success factors. However, the NPD factor "product champion" includes limited information about a necessary skill set and level of expertise.

The definition for the Staircase factor "process" outlines the necessity to follow a structured, formalised and implemented process for innovation and development activities. This factor is

not reflected in any single factor of the listed NPD success factors. However, every single listed NPD factor represents one step of an innovation or development process.

CONCLUSION

The Staircase model provides a valuable tool for businesses and academics alike, establishing a DM assessment model that can be used to refine and discover research areas, enabling company self-evaluation. It offers a simple and effective way for companies to discover their own weaknesses and obstacles that prevent them from implementing design in their management structures whilst also highlighting strong areas and increasing the awareness of DM and company capabilities.

The nine NPD success factors derived from the literature are not exclusive to the NPD process but are considered as the most important factors. A wide range of additional factors have to be considered to establish a complete NPD process, such as the allocation of sufficient resources, creating an innovation culture or an initial screening of new product ideas. However, as shown in the previous section, the five Staircase factors are not exclusive. It is clear that these Staircase factors are defined on a broader level than the NPD success factors. Whilst the NPD factors naturally describe in detail which factors are the most prominent for the NPD process, the Staircase factors are defined on a superordinate level. Instead of describing the required process in detail, the Staircase factor "process" only states that a professional and effective design management process which is embedded in core business processes must be followed. Evidently, the Staircase model is using a much wider approach than the process oriented NPD factors. It can be concluded that aside from some similarities and overlap in the definitions to the NPD success factors, the Staircase factors have their own unique discipline. However, it is premature to negate that the Staircase factors do not reference the crucial points of NPD. The literature review of the NPD success factor research over the past 40 has revealed that all five factors of the Staircase model are still covering key points in the NPD literature, though not the most crucial ones.

Next, the authors intend to examine the questionnaire that is used to calculate the Staircase scores. This step will be necessary to analyse how appropriate the choice of questions for the provision of insights into the five factors is. In particular, the questions informing the Staircase factor process will undergo a rigorous investigation to examine the extent the NPD factors are reflected in these questions.

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