

HOW DESIGNERS STRATEGICALLY MANAGE PRODUCT PORTFOLIOS

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ABSTRACT

The continuous management of a manufacturing company's product portfolio is a key aspect of successful product development. Managers determine when and which products should be updated or terminated. This process influences inhouse Industrial design teams, thus prompting a range of development strategies they might deploy. In product portfolio management there is a tension between standardisation and customisation. From a marketing perspective this may be addressed through brand DNA, from engineering through modularization. The design perspective (merging those two) has been ill-explored, particularly from professional designers. Previously we proposed a theoretical model describing different industrial design projects and how they influence industrial designers strategic thinking. It was developed through literature reviews and examples found in manufacturing industry. Through a multi-case interview study with 16 participants from five manufacturing companies with strong brands, this article aims to empirically evaluate the proposed model. The results show that the respondents could describe all but one industrial design projects, the cause maybe that they had not been exposed to saving a company by doing a total makeover.

Keywords: Product portfolio management, Case study, Industrial design, Design management

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1 INTRODUCTION

A product never performs in a vacuum; it competes with competitors' products with the goal of "staying ahead of the game". It also competes with other products in the same portfolio, and it even competes with its company's future products. For many companies, this creates pressure to develop new products, regularly update or redesign their existing product portfolio, expand it into new markets, and produce variants in order to increase the company's offering to its customers. A product portfolio is the entire collection of products and services that an organisation offers to its customers (Villamil & Hallstedt, 2018; Ulrich et al., 2020). Product portfolios may be organised into product categories containing several product lines (or ranges) and/or single products (Kapferer, 2014 p.320; Keller et al., 2012 p.563).

The evolution of a product portfolio is a strategic process that is controlled by senior management within a company. According to Cooper et al. (1999) and Simson et al. (2006) the reason for this is that the management team establishes a company's overall product strategy, which then influences how the product portfolio is advanced. They argue that the management of a portfolio is a vital task that needs constant supervision and can generate either great success or great misfortune. Managers have to decide which products need to be updated, revised, or terminated. They constantly need to evaluate which new projects need to be initiated or whether existing development projects should be accelerated to meet a deadline, de-prioritised, or even cancelled in order to relocate resources to other projects. Furthermore, Cooper et al. (1999) state that an important part of management responsibility is to forecast and plan for how the product portfolio should be composed in the future.

At the beginning of the 20th century, industrial designers began to be incorporated into senior management and gained influence in the development of a company's product portfolio. The first was likely Harley Earl, who in 1927 was hired by General Motors president Alfred P. Sloan to lead the new Art and Colour section, a precursor to modern design teams (Gartman, 1994). In recent years, companies such as Johnson & Johnson, Philips, and Apple have appointed chief designers to their boards. These are often called chief design officer (CDO) and one of their tasks is to assist with the development of competitive product portfolios. Industrial design is often used as a strategic tool to create new and often innovative products aimed at achieving recognition (i.e., differentiation from other brands in the same product category) and coherence (i.e., similarity within a branded product portfolio). This means that industrial designers cooperate with several functions (R&D, marketing, brand management, production etc.) within a company to consolidate different requirements into products that are organised into a portfolio. An industrial design perspective on how to develop coherence and recognition has not been fully investigated in the product portfolio management literature. Brand management literature mainly states that there is a need to utilise industrial design in order to achieve differentiation, but does not describe how this should be done, or how it can be managed as part of developing a product portfolio (Keller et al., 2012; Kapferer, 2014). Research has been carried out on how a single product's design features influence a brand (Warell, 2006; Karjalainen & Snelders, 2010; Ranscombe et al., 2012), concluding that a single product design will influence a product portfolio, but so far there is no generic model that describes what industrial design development strategies exist and how they influence the evolution of an existing product portfolio. Hence the following research question is formulated:

RQ: What industrial design strategies exist that can help an existing product portfolio to evolve and how are they utilised by designers?

This article will describe what existing product portfolio development strategies can be found in the literature on product portfolio management, product development, brand management and industrial design. The goal is to empirically evaluate a coherent conceptual model, named Industrial Design Product Portfolio management (IDPPM), that includes the most prominent product portfolio management strategies and describe how they impact experienced industrial designers work process. The unvalidated IDPPM model has been presented in different development stages by Andersson & Warell (2015) Andersson (2016; 2021), and Andersson et al. (2021).

2 PRODUCT PORTFOLIOS IN BRAND AND ENGINEERING LITERATURE

Global companies that target different markets with a wide range of product offerings often develop separate organisations and multiple simultaneous product portfolios. From a branding perspective,

[Kapferer \(2014\)](#) states that there are two main ways for a company to reason when developing single or multiple product portfolios; the first is branded house and the second is house of brands. In a branded-house strategy, an industrial designer’s undertaking is to coordinate all design efforts and create a unified communication stream towards the company’s customers along with coherent visual recognition across all of its products. An example of a branded-house company is power-tool manufacturer Hilti ([Hilti, 2020](#)), which has created a unified brand identity and coordinated all its products using a coherent scheme of colours, textures, materials, and recognisable design features.

In a house of brands, on the other hand, a company manages several different brands, each with a unique design expression. This means that, depending on how a company is organised, it can have either one large product portfolio managed by one design function across all brands, or separate design functions managing each product portfolio individually. Thus, the design management strategy focuses on maintaining visual diversity and alignment between the different brands, rather than adopting a communal “house style”. An example of a company employing the house of brands strategy is Unilever, which focuses on several categories of products, including beauty & personal care, food & refreshments, home care, and water purifiers. In the ice-cream market, Unilever has several distinctive product lines, including Ben & Jerry’s, Magnum, and Cornetto ([Unilever, 2020](#)). As illustrated, a product line is a brand consisting of a number of products that are closely related, and in many cases share the same design features, with only slight variations. As [Keller et al. \(2012, p.563\)](#) define it, “a product line (or range) is a group of products within a product category that are closely related because they function in similar manner, are sold to the same customer groups, are marketed through the same type of outlets or fall within a given price range.” The engineering design literature employs a narrower definition of what binds a cluster of products (line or range) together, and has named it a product family ([Simson et al., 2006, p.29](#)). [Meyer and Lehnerd \(1997, p.39\)](#) define this as: “A product family as a set of individual products that share common technology and address a related set of market applications.” The reason for this is that engineers need coherence within a product portfolio, stemming from an ambition to share functions, reduce the number of components, and build modules and platforms that can cater to different categories and product lines (*ibid.*) in order to reduce costs, time to market, and development time ([Ulrich et al., 2020](#)). This means that a product family does not have to follow a product line or product category, thus creating disparate managerial objectives.

3 THE INDUSTRIAL DESIGN PRODUCT PORTFOLIO MODEL

[Andersson & Warell \(2015\)](#), [Andersson \(2016; 2021\)](#), and [Andersson et al. \(2021\)](#) conclude in their research that product portfolio strategies originating from design research, brand management and engineering literature didn’t fully describe what types of development processes industrial designers were exposed to. They found seven different types of design strategies: category extension, product line extension, vertical extension, new-to-the-world, minor updates (facelift), redesign, and revitalization. These were divided into two major themes, expansion and update and how the seven strategies are organised into a generalised model depicting the relations between an example company and its competitor. Table 1 contain a condensed description of the seven strategies, as described by [Andersson \(2021\)](#) and [Andersson et al. \(2021\)](#). In their article (*ibid.*) they elaborate one each strategy, present product examples and describe industrial design tactics.

Table 1. Seven design strategies, the brackets contain alternative names found in literature.

Strategy	References	Description
Category extension (Segment)	Cooper et al., 2004 Keller et al., 2012	The strategy is when a company extends its portfolio into an area that is, for the company, a new category of products, where competing products already exist.
Product line (Range)	Keller et al., 2012 Ulrich et al. 2020	Product line is created when the various products within a brand are developed into a series of versions that share several commonalities: design features, parts, modules, functions, and brand values.

Vertical extension (Differentiation)	Aaker, 1997 Keller et al., 2012 Meyer & Lehnerd, 1997	The strategy is used to create a value range within an existing line of products. Two types of differentiation have been identified in the literature. The first is where a company decides to create a high-tech or a low-end product alongside its existing products. The second type is a strategy whereby a company simultaneously creates three or more value levels of the same product: basic (low performance), low mid-range, high mid-range, and premium (high performance).
New-to-the-world (Blue ocean, disruptive, fundamentally new products)	Cooper et al., 2004 Kim & Mauborgne, 2005 Ulrich et al., 2020	This strategy focuses on the creation of products that have not previously appeared on the market.
Minor design update (Facelift)	Gartman, 1994 Cooper et al., 2004 Ulrich et al., 2020	The strategy can be seen as the careful maintenance of existing products in order to create a feeling of newness, to adapt to new trends in the market, or to showcase non-visual updates, such as technical and software improvements.
Redesign	Tovey, 1992 Warell, 2006 Keller et al. 2012, Ranscombe 2012	This strategy focus on making larger changes to the product design and technology and, if necessary, also making minor changes to the brand values of a company's existing product [P3], or to an entire product line [P2].
Revitalisation (Rejuvenation)	Kapferer, 2014, p.387 Keller et al., 2012, Karjalainen & Snelder, 2010	The strategy is a version of redesign, but with the difference that it also includes a more profound change to a company's design DNA. This strategy is employed when there is a vital need to create new positive associations and changes to the entire brand.

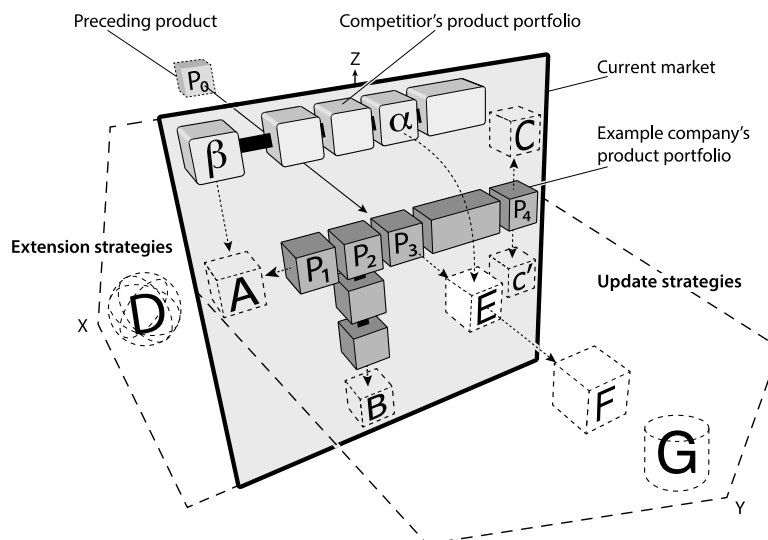


Figure 1. The industrial design product portfolio management model illustrates how extension and redesign strategies may be utilised to expand or update an existing portfolio (Andersson, 2021; Andersson et al., 2021).

In the model (Figure 1) the letters A to G represent the identified product portfolio development strategies: A = Category extension, B = Product line extension, C = Vertical extension, D = New-to-the-world, E = Minor design update (facelift) F = Redesign, and G = Revitalisation. They are all

visualized as dotted cubes, a sphere or cylinder to represent that they are future products. Light grey cubes marked [alpha] and [beta] represent a competitor's existing products in its portfolio, while the cubes marked [P1-4] represent the example company's existing products. [P0] represent the example company's proceeding products, i.e. historical products DNA that is no longer part of the current market but may influence future product designs. The Industrial design product portfolio model (IDPPM) consists of a ZX-plane (in grey), illustrating an existing market at a given point in time, where two companies are competing with their product portfolios, i.e. the example company and its competitor. The second arrow-plane (XY-plane), illustrate update strategies, [E-G], where the existing company portfolio is utilized in the change process to accommodate new designs.

4 VALIDATION OF THE THEORETICALLY DESCRIBED DESIGN STRATEGIES IN THE IDPPM MODEL

In order to validate the found theoretical design strategies and obtain more insights into how they affect industrial design practice, an empiric multi-case study was proposed focusing on senior industrial designers and studio engineers working inhouse at Swedish manufacturing companies. Dane and Pratt (2009) recommend that when doing field research with professionals the most practical way of capturing processes and events is to do retrospective interview studies. This is in-line with what Yin (2014) and Miles et.al (2014) describe as the premises for case study or qualitative research. Eisenhardt (1989) and Miles et.al. (2014) recommends that to get a more rigours data sample multiple case companies should be studied. The general layout of a multi-case analysis is; within-case, cross-case analysis, data display and drawing of conclusions.

4.1 The case companies

In assessing aspirant case companies, we started by examining our own experience of the design field and list known Swedish OEM companies with design functions. The motivation for targeting this type of companies was that according to Buxton (2008, p.79), Johansson and Holm-Svengren (2008), and Micheli et.al. (2018), they had a greater incentive to create a fruitful interactive environment between industrial designers and other company functions. The next step was to review two public industry guides containing industrial design companies, Swedish Industrial Design Foundation (SVID) and Form Design Center (FDC), Google search, and the business director Eniro.se to find additional companies. The found companies were scrutinised by their size, type of product portfolio and whether they had an integrated industrial design function. Several multinational companies were identified and the largest and most prominent once was contacted. Chief Designers, Design VPs and Head of Design from five companies responded positively to participate in the study, see table 2. To get a wider data sample the contacted persons were asked to recommend senior team members within the design organisation or closely related to the function, in total 16 persons were interviewed.

Table 2. Details of case sectors and interviewees.

Case	sector	Employees	Interviewees
I	Automotive	50,000 – 100,000	VP design director, Senior design engineer.
II	MedTech	1000 – 10,000	Chief designer, senior designer.
III	Consumer goods	50,000 – 100,000	Global design director (interviewed twice), Senior design manager, two design managers, Portfolio manager.
IV	Commercial vehicles	10,000 – 50,000	Chief designer, design manager exterior design, senior ergonomics manager, design engineer manager.
V	Material handling	1000 – 10,000	Chief design, senior engineer, surface designer.

4.2 Data collection

Prior to the interviews the researchers selected, or were recommended by the contacted chief designers, prominent company products. These were used as a visual mediating tool during the interviews. The pictures of the chosen products where printed on A4 papers and showed the products

from different angles. The pictures were then used as a means for the respondents to illustrate their thoughts of prominent design features and the design rationale behind them. In addition to the product pictures the respondents also got markers in order to draw features on the pictures and make comments. This was done during the interviews as a way of getting additional data types. The interview guide was semi-structured, and the questions focused on making the respondents describe their own and the teams design process and how it impacted the design of their product portfolio. The interviews were conducted face-to-face in the company's own facilities, they lasted between 60 and 90 minutes, they were audio-recorded and later transcribed. In line with recommendations for interview studies, supplementary field notes were taken during the interviews (Miles et. al, 2014). The interview guide is available from the authors upon request.

4.3 Data analysis and conclusion drawing

All respondents' responses from a company were treated as a single case meaning that all the data, transcribed interviews, fieldnotes, and annotated product pictures, connected to it were analysed simultaneously. This was done in order to get a coherent understanding of how each inhouse design team operated. The transcripts were deductively analysed by adapting Miles et. al (2014) coding process for qualitative research. The process started by extracting relevant quotes and passages that described how the respondents designed products, decisions they made regarding the designs, and how they described other company functions influence on their process. The quotes and passages were noted with comments and a premier coding of the data was organized in Excel spreadsheets. The annotated product pictures were used as an aid in the text analysis in order to better understand how and why they had made certain strategic design decisions during the development process of the products. Next an inductive analysis was conducted on each collected case where the focus lay in finding evidence of design strategies linked to the IDPPM model. Conclusions were drawn by comparing all the findings from the respondents within each design strategy, inferring whether and in what way findings supported the design strategies. By doing so the researchers aims at establishing an empirical link between professional design practice and the theoretical findings described in [Andersson \(2016; 2021\)](#) and [Andersson et al. \(2021\)](#).

5 FINDINGS

Findings present an empirical connection between the respondents' responses and six out of the seven design strategies described in the IDPPM model ([Andersson, 2021](#); [Andersson et al., 2021](#)). No trace was found of the revitalisation strategy in the collected data, see Table 3. Proceeding products, or predecessors, is not a strategy perse but were added to the findings due to that it was mentioned by several respondents and is part of the IDPPM model (P0). In the table the number represents both direct and indirect quotes found within the collected data. The quotes were traced and coded by the main author and the result were evaluated by the co-authors.

Table 3. Number of direct and indirect quotes found in the collected data corresponding to each of the seven strategies and predecessors (P0) ([Andersson et al., 2021](#)).

Strategies	Quotes	Strategies	Quotes
P0 – Predecessors (part of strategies E-G & A)	17	D – New to the world	38
A – Category extension	58	E – Minor update	74
B – Line extension	69	F – Redesign	61
C – Vertical extension	68	G – Revitalisation	0

Table 3 demonstrate that findings presented below (5.1-5.8) originates from a large sample of empiric data which not only corroborate the theoretical design strategies but also give new insights into industrial design practice in large manufacturing companies. The findings are presented in a descriptive manner accordance to [Yin \(2014\)](#) and Miles et al.'s (2014) recommendations of how to present qualitative data. In addition, each design strategy is presented with representative respondent quotes.

5.1 P0 - Predecessors

Respondents from most of the case companies mentioned the need to account for preceding products when updating (strategies E - G) or designing a new category of products (A). They described that they not only looked at predecessors from their case company's product history but also at historic design features from the product category in order to create a bond towards the new design. The rationale behind this is that utilising design historicity aids in the building of a design DNA and brand identity. Two respondents (case II and IV) stated that this was not always the case, as designers they sometimes had to decide whether existing design features should be used or whether new ones should be created instead.

What prior products have we had (in our portfolio), what (design) do we want to bring a long, and in what (design) direction do want to go. Quote: senior designer, case company III

5.2 A - category extension

According to the respondents (case companies I-V) a category extension can either be part of a strategic plan from management or an unauthorised project, *skunkwork*, from the design team. According to a senior engineer at case company I, planned category extensions usually have strategic needs such as *"we miss or need this"* in or product portfolio. Respondents from company III describe skunkwork circumstances where they have found undeveloped product categories, created design proposals, and then got permission from management to proceed to develop the new category design. One respondent from the same company stated that the company also had utilised original design manufacturing (ODM) companies by purchasing and rebranding "blank" products in order to quickly expand into an existing product category. The rebranding was done through aligning the ODM products with the company's existing colour, material and graphic layout schemes.

We identified an opportunity to do a great product with a strong design, then we could (be the first company to) lift the product category. Senior design manager, case company III

5.3 B - Line extension

Respondents from all case companies described that they had knowledge of creating versions (line extension) of existing products. The process of creating line extensions were either part of product planning or occurred during the design process. Planned extensions derived from performance needs such as vacuum cleaners aimed at allergy and pet owners or trucks that were altered into fire trucks, garbage trucks, and mining trucks. The line extensions were made by designing a few new parts, changing the colour or material schemes, and create new product names. This was done in order to distinguish different performances in the line products. Case company IV had developed its design into a modular architecture, meaning that they had constructed a library of designed parts that were used to create different sizes of the same design. The design library meant that they could rapidly make several product versions and easily customise its products to consumer needs. Case company II described that during the initial design research phase a new user group was found that they determined needed its own product version. This was accommodated for in the product development process and through a few technical adaptations, new colours, materials and graphic layout, and a different graphical user interface (GUI) they created two products.

This (second design) should be displayed in the product, even in the software (GUI), we had to manage both visual identities at the same time. Senior designer, case company II

(Design) modularisation is our way of creating a cost-efficient way to make small, large, and prolonged truck cabins accommodating all configurations on the frame and axles. Chief designer, case comp. IV

5.4 C - vertical extension

Vertical extension strategies were described by respondents from all case companies except case V. Respondents from case company I and III described that they utilised four vertical steps: premium, high mid-range, low mid-range and basic. Respondents from the other two describe a dual differentiation, case company II expressed an aim at developing a basic version of their bestselling product and a respondent from case company IV stated that they had developed a premium version. The main differentiating factors are price, digital services, and functionality. It is achieved through changes in the design primarily through assigning each level with its own set of colour variants,

materials, finish, GUI, design elements and features, and functional performance. Premium levels have more expensive natural materials (metals, leather, wood), intricate patterns, paint, lacquered and gloss finish, high-performance technical parts, GUI and internet-of-things (IoT) services. The basic level has cheaper materials (plastic, cast metals, printed patterns emulating materials), no or few paint schemes, matt or a natural finish, knobs, handles and analogue dials instead of GUI and digital services. Respondents from case companies I and III describe that they combine line extension and vertical extension to create a larger customer offer. Case company I and III are global companies with several brands, targeting different markets and geographical areas in the world. To accommodate all these brands and maintain a cost-efficient production, the products are separated through different brand identities, i.e. separate colour and material schemes, graphic layout, GUI, and a few design elements.

You can choose if you want (your car) to be super cool, cool, low-key, or exclusive.

Senior studio engineer, case company I

Prize. On expensive premium products is it obviously; better performance, features, GUI, spin-speed, energy consumption, customer experience, more lighting, more glass, more metals, larger vegetable box (in refrigerators). Senior design manager, case company III

5.5 D - New-to-the-world

Respondents from Case companies I, III, IV explicitly described that their companies had made new-to-the-world products or components. Through analysing historical products from the remaining two companies (II and V) it was inferred that they had created products that at the time were cutting-edge. The strategy has many similarities with category extension, that it can be either part of a planned innovation process or a skunk-work where one or a few employees develop a concept that then is approved by management. From a visual design perspective, the main difference is that there are no predecessors to utilise in the new design. Respondents from case company III described that technology and consumer readiness is vital for success, they had developed new products that were too early and had to be scrapped. Approximately 15 years later, when the consumers were ready and technology had matured, they reanimated the products.

We were first on the market with a robot vacuum-cleaner, it was at least 14 to 15 years ago, but we were too early. Senior design manager, case company III

5.6 E - Minor update/facelift

The update/facelift strategy was mentioned by respondents from all of the five case companies. Minor updates and facelifts were described as either part of product planning and changed regularly every 3-4 years or part of an ongoing improvement process. In the planned product changes the goal was to make as few alterations on the form as possible, instead only focus on changing the colours, material, finish, GUI and services. Changes to the form was made primarily on visible and design intensive components, to get as much "bang for the buck" as possible. The goal was to update older products so that they had some design features in common with the newest products in the portfolio. Unscheduled technical improvements were bundled with design updates to create a package, this could then be marketed and generate a rationale for consumers to invest.

We could modernise textiles, new colours, and materials but it was very unusual to do updates that required changes to existing tools or the need for new tools. Senior studio engineer, case company I

(The strategy is to make) incremental changes all the time. We bundle improvements (with a facelift) so that it creates a new year-model. Chief designer, company V

5.7 F - Redesign

Just as with minor updates, a redesign can be either a generation plan or a more sporadic occurrence. Case companies I and III described that redesign of products in the company's portfolio was planned to occur every 6 to 8 year. Case companies II, IV and V described a need-based decision process where a redesign was initiated due to competitors advancements, new customer needs, technical advancements, managers think a product looks old or want to advance the entire product portfolio into a premium level.

This has resulted in several products from company II have not been redesigned for 15 to 20 years and it took 10 years for company IV to redesign its modular design system.

We have a generation plan, products that were launched 2012 were replaced in 2018. It's usually six- to eight-year cycles between each product. Global design manager, case company III.
The design team has the market team as a powerful partner, when they do their product planning and market analysis, they can state that: "Ok, this needs to be done". chief designer, case company IV

5.8 G - Revitalisation

No comments or traces of revitalisation could be found in the collected data or in the product history of the selected case companies. An example of revitalising a company outside our data sample is the British clothing company Burberry. During the 1990s, the brand unintentionally became a favourite of British soccer hooligans. The young hooligans, or "chavs", wore their clothes as a uniform creating a negative association for Burberry leading to a decline of the brand. Through repositioning towards high fashion, discontinuing mass-market products, and reducing the use of its check design feature (a camel, red, and black check) on the new designs the company managed to turn the tide. ([The Economist, 2011](#); [Keller et al., 2012](#), pp.739–740).

6 DISCUSSION AND CONCLUSION

In this paper a semi-structured interview process, where designers and studio engineers elaborated on their work processes, rendered diverse information that allowed for a more comprehensive understanding of the seven strategies: category extension, product line extension, vertical extension, new-to-the-world, minor updates (facelift), redesign, and revitalization.

The interviews were conducted at five manufacturing companies and focused on investigating what strategies were used when managing their product portfolios. For each case company there were at least one interviewee with more than 15 years of strategic design experience. All interviews were carried out in Sweden (and in Swedish as it was the native language of all participants) with six companies from different market segments. However, the companies are all fairly homogenous, characterised by high-tech and complex products, with a solid form, modularized architecture, and a mature organization, making the qualitative data analysis compatible. Conversely, the narrow scope renders it less efficient to draw general conclusions where design consultant agencies, other market segments, and novice designers are included. Also, the focus on Swedish design teams decries the cultural influence on the design processes.

The RQ raised in the beginning of the paper, i.e. "What industrial design strategies exist and how are they used?" has been addressed, and it has been concluded that professional experienced inhouse designers utilise at least six out of the seven described design strategies described by [Andersson et al. \(2021\)](#), see Table 3. The seventh (revitalisation) is validated through literature, the lack of findings may indicate that it is not a common strategy for inhouse designers. The large number of found quotes per strategy strengthen the findings described in this paper and validate that they are known strategies in the industrial design profession. The findings showed that several strategies [A, B, D] were utilised both proactively, "skunkworks", by the design team and as commissions from management. Vertical extension and facelift seem to be management strategies that had been adopted by designers. The respondent's description of the six strategies corroborate the notions that they are part of the basic practice of industrial design. [Cooper et al. \(2004\)](#) conclude that incremental and major product revisions constitute more than half of all development projects in a company. New-to-the-world strategy was the least discussed strategy by the respondents (Table 3), that may correlate with [Cooper et al.'s \(2004\)](#) data showing that the strategy is known but only constitutes 10.2% of all product development projects.

The seven strategies have been individually evaluated by professionals but not as a correlating system depicted in the IDPPM model (Figure 1). This means that new understandings and associations may occur if the figure is evaluated by professionals. They may find additional combinations of strategies, such as the combination of product line and vertical extensions described by respondents in [C], or even new strategies not previously described. The IDPPM model have been presented to researchers within the field of design and students studying design and design engineering. Initial reactions have been that it renders an "aha moment" and a realisation that product development is more diverse than the development processes described by [Ulrich et al. \(2021\)](#). Unfortunately, these reactions have not been recorded or evaluated, but future studies aim to address this issue.

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