



Barriers and opportunities of implementing design thinking in product development process of a business to business company

Downloaded from: <https://research.chalmers.se>, 2025-12-04 23:07 UTC

Citation for the original published paper (version of record):

Ramanujam, H., Ravichandran, B., Nilsson, S. et al (2021). Barriers and opportunities of implementing design thinking in product development process of a business to business company. *Proceedings of the Design Society*, 1: 551-560.
<http://dx.doi.org/10.1017/pds.2021.55>

N.B. When citing this work, cite the original published paper.

BARRIERS AND OPPORTUNITIES OF IMPLEMENTING DESIGN THINKING IN PRODUCT DEVELOPMENT PROCESS OF A BUSINESS TO BUSINESS COMPANY

Ramanujam, Harshavardhan (1);
Ravichandran, Balachandar (1);
Nilsson, Susanne (1);
Ivansen, Lars (2)

1: KTH Royal Institute of Technology;
2: Chalmers University of Technology

ABSTRACT

Customer centricity is described as placing value creation for customers at the core of business decisions and organizational practices and is progressively regarded as a foundation of sustainable competitive advantage by companies. Hence in recent years, there is a shift from companies being product-centric to them adapting customer-centric practices as a practice to create balanced and sustainable businesses. Although there are several methods and processes that can help companies become customer-centric; Design Thinking (DT) is championed by many practitioners and academics alike as being effective in introducing customer-centricity in organizations. Despite being a highly researched topic in the last decade, the bulk of the research is focused on success stories or one-off cases of using design thinking in Business to Customer (B2C) environments. This paper is based on a qualitative study performed at a high-tech Swedish electronics company and focuses on highlighting the barriers and opportunities of adapting DT in Business to Business (B2B) companies with established product development processes. The barriers we identified can help companies to address the impediments and will make the DT implementation easier for companies

Keywords: Design Thinking, Business to Business, Integrated product development, Innovation, Design methodology

Contact:

Ramanujam, Harshavardhan
KTH Royal Institute of Technology
Integrated Product Development and Design
Sweden
harshavardhanstramanujam@gmail.com

Cite this article: Ramanujam, H., Ravichandran, B., Nilsson, S., Ivansen, L. (2021) 'Barriers and Opportunities of Implementing Design Thinking in Product Development Process of a Business to Business Company', in *Proceedings of the International Conference on Engineering Design (ICED21)*, Gothenburg, Sweden, 16-20 August 2021. DOI:10.1017/pds.2021.55

1 INTRODUCTION

Customer-centricity is described as placing value creation for customers at the core of business decisions and organizational practices and is increasingly regarded as a foundation for companies to achieve a sustainable competitive advantage (Hemel & Rademakers, 2016). Around 30% of Fortune 500 firms such as Dell, Intel, IBM, and American Express have recently taken steps to adapt a customer-centric organizational structure for these reasons. Although evidence indicates that customer-centricity helps companies to segment themselves and deliver the right value to their customers, organizations such as Xerox and Cisco have seen poor results when adapting this ideology (Lee et al., 2015). Customer-centricity is even painted as an antithesis to product-centricity (Galbraith, 2005; Shah et al., 2006). This, combined, with the long wait for customer-centricity to bear fruit, makes companies less encouraged to adopt it (Carlgren et al., 2016). These challenges have led companies to search for a middle ground that will help them be customer- and product-centric at the same time. Design thinking (DT) is pitched as one way to accomplish this, through a process that can help companies balance customers' desires against the technical feasibility and business viability of a product (T. Brown & Katz, 2011). Design thinking has emerged as a human-centric yet goal-oriented approach to innovation that prompts innovators to adapt the ways designers think and work (Carlgren et al., 2016). The existing literature on DT is, however, centered on business-to-customer (B2C) companies or one-off case studies of how companies used DT to solve specific problems. There is hence a lack of clarity on how business-to-business (B2B) companies could benefit from DT if they were to adapt DT into their existing product development process (PDP). One standout advantage of implementing DT in a B2B company is the potential to co-create with customers who are experts in their fields (Liedtka et al., 2013). Due to this lack of clarity in the literature, we conducted a study to look for the barriers to, and opportunities for, implementing DT in a B2B company producing high-tech products.

2 DESIGN THINKING

Umbrella construct is a phrase used to include and account for a set of different phenomena (Hirsch & Levin, 1999) with the aim of assimilating a large body of seemingly unrelated discoveries (Astley, 1985). DT, by its nature, fits into the definition of an umbrella construct, as there are significant discrepancies in the ways its proponents and critics—whether researchers or practitioners—understand its meaning and potential use cases (Micheli et al., 2019). At the very core of the DT construct are the concepts of divergent and convergent thinking, visualization, and empathy (T. Brown & Katz, 2011). The idea of DT has been publicized and communicated to practitioners as a fuel with generic descriptions of ideation and concept development, because of which an inherent assumption has developed that DT practice is always the same (Carlgren et al., 2016). However, researchers have found that this is not the case, as some companies that implement DT view it as a set of processes and tools to help with innovation, while other companies see it as a set of principles and a mindset to help the people work better with innovations (T. Brown & Katz, 2011; Carlgren et al., 2016; Ingle, 2013; Mootee, 2011). The conceptual model developed by Carlgren et al. (2016) was meant to help managers communicate DT to their peers and help introduce, implement, plan, and evaluate DT into their organizations. If managers are to communicate the concept of DT, they must understand the core principles and try to develop techniques that will, in turn, help others achieve the right mindset to practice DT effectively. Despite this vagueness in how companies use DT in real-world applications, several renowned universities around the world, including the University of Toronto's Rotman School of Management and Stanford University, have introduced academic courses and programs that aim to educate students in the principles of DT. The d.school at Stanford, which has been partly credited with developing and spreading DT to industries, has developed an iterative framework with five steps that are performed in sequence, namely,

1. *Empathize*. Data collection phase for understanding the needs of customers using tools such as ethnographic studies.
2. *Define*. Data analysis phase for gaining a refined understanding of the problem. This phase is also referred to as the redefine phase.
3. *Ideate*. Idea generation phase for solving the problem through interdisciplinary collaboration.
4. *Prototype*. Phase to come up with tangible prototypes that are representations of selected ideas from the previous phase that can be experienced.
5. *Test*. The validation phase to show the developed prototype to users and obtain feedback.

These five phases are, to some extent, considered to constitute a linear process, starting with a problem and ending with a defined product ready for development.

However, challenges arise when companies try to adapt DT. [Liedtka et al. \(2013\)](#) and [Mootee \(2013\)](#) acknowledge these challenges and note that “preaching the gospel of DT” and asking people to adapt its principles is the least effective way to implement DT in an organization. Employee buy-in is one of the three important factors that impact the implementation of any innovation process in an organization ([Liedtka, 2018](#)). The other two factors are the ability of the process to deliver superior solutions and lower the cost of the risks of change. Hence, implementing and legitimizing DT needs several supporting steps for it to be successful. For instance, DT should be introduced with proper structures in place, since using DT involves changing people’s behavior. It must be started with a lot of structures in place to help people not think about it a lot. Over time, these clear guardrails will make the use of DT habitual and a part of an organization’s culture. This point correlates with the framework proposed by [Carlgren et al. \(2016\)](#) to help managers introduce DT to an organization.

3 RESEARCH APPROACH

This article is based on study in a Swedish high-tech B2B company. The scope was defined by the authors based on the following.

- The company had recently conducted a survey indicating that their customer satisfaction rating was not in line with their ambitions.
- Internal company surveys indicated a low understanding of internal stakeholder needs.
- The backlog of product issues reported by end customers had not gotten the attention it needed.

The primary aim of the study was to obtain a deeper understanding of different use cases of DT and the various barriers and opportunities involved with trying to adapt DT principles to a B2B company with a well-developed product development process (PDP). Thus, the research methodology used in the thesis study was exploratory instead of explanatory. This exploratory deep dive helped identify some surprising aspects of the DT umbrella construct ([Hirsch & Levin, 1999](#)).

A single case study approach was chosen as a way to understand the dynamics of this theoretical setting, and the data collection was done mainly through semi-structured qualitative interviews. The authors considered the guidelines set by [Yin \(2009\)](#) for research questions, units of analysis, and the criteria for interpreting the findings. The authors also followed a highly iterative process between data collection and data analysis, as prescribed by [Eisenhardt \(1989\)](#) for case study-based research. The interview guide consisted of four sections, and a total of 25 interviews, each about 60-75 minutes long, were conducted. All the interviews were conducted by video conferencing in Microsoft Teams (due to the global pandemic at the time the interviews were conducted). The interviewees were chosen based on their level of involvement in the PDP and came from different hierarchical levels and different departments. All the interviews were recorded, after getting permission from the interviewees, and were transcribed to help with the quality of the analysis ([Fejes & Thornberg, 2009](#)). The authors analyzed the coded interviews by converting each coded transcript into a mind map to visualize the PDP and the issues mentioned by the interviewees. The whole PDP was observed and the issues that the interviewees highlighted were identified and mapped to DT principles and referenced to the DT literature. Based in the analysis, the authors determined the barriers to and opportunities for implementing DT in a B2B company and described them in the results section.

4 RESULTS

Our results show that when a B2B company intends to introduce DT into its PDP, it needs to consider nine barriers in total that can be grouped into three major areas:

1. Mindset and Organizational Culture
2. Organizational Structures and Processes
3. Customers

4.1 Barriers related to Mindset and Organizational Culture

We identified four assumptions about how DT will negatively affect the PDP that can be critical barriers linked to the culture in the company.

Assumption 1: DT might reduce R&D productivity. Several of the respondents pointed out that DT principles might not be compatible with the processes they were already working with (stage-gate, scrum, etc.). They mentioned that they were engaged with their responsibilities throughout the workday and highlighted the significant switching costs they had to account for in juggling the different projects they work on simultaneously. From their perspective, DT appeared to be a tedious and unserious way to go about doing their work. Some respondents who had experience with DT projects in the past even considered DT to not be their regular way of working. From their point of view, DT appeared frivolous, and they felt uncomfortable participating in DT projects. Some respondents even suggested that their customers might consider them unprofessional if they used DT techniques such as ethnographic studies or mind maps to understand the customer's voice.

Assumption 2: It is not important to interact with customers. Many interviewees assumed that it was not necessary to interact with customers in order to develop good products. They ascribed to this sentiment for two primary reasons. The first was that customers ask for specific solutions to their problems right from the start of a project because of the designers' expertise in the field. This negates the need to interact with customers during the development process, and many designers stated that they did not see the value in understanding customer needs. They assumed there was no need to challenge and reframe problems and hence see no value in using DT or any other innovation process to do so. The second reason designers mentioned is that they felt customers would not have anything new to tell them. This was particularly the case with designers working in cutting-edge high-tech development. We also found that people who worked in these areas also struggled to find ways to communicate their work to customers so they could get meaningful feedback.

Assumption 3: Only large projects need customer interaction. A unique trend we observed during the investigation was that although the process demanded a thorough preliminary study phase to understand the expressed and implicit needs of customers at the start of a development project, not all development projects included this preliminary phase. Almost all the larger projects had a detailed preliminary study phase, but smaller projects followed a slightly shorter pipeline, with a shorter preliminary study phase. This discrepancy or deviation from PDP appears to be arbitrary, and when we asked developers about the underlying reasons why smaller projects did not include a thorough preliminary study phase as prescribed in the company's PDP, they mentioned factors such as quicker deliveries, better resource management, or in certain cases developers' better understanding of the customers' actual needs from the outset. The case study examined a company where significant resources are allocated to incremental projects, and there was thus a significant lack of communication with customers. This means that implementing DT (which depends on customer interaction for effectiveness) was futile.

Assumption 4: Internal customers are the real customers. One interesting phenomenon we observed was that many internal stakeholders who identify needs, design solutions, and manufacture and sell the products do not themselves use the company's products. In addition, since the case study company produces high-tech products, the knowledge needed to develop products is situated in different spheres of science. For example, a single product from the company involves the work of people from different engineering fields, such as optics, mechatronics, pneumatics, and so on. This product complexity has led to the evolution of a culture where a designer or developer considers their chunk of development to be the product itself. For instance, an optical engineer at the company only makes sure that the lenses she develops fit the operational parameters specified the person before her in the development flow. To her, the people interfacing with the optics area are her end customers. In some cases, employees view the internal case-handling software (e.g., JIRA) as their customers. Admittedly, viewing their work as isolated tasks to be completed helps the company to make on-time deliveries, but it also removes a certain emotional connection between employees and those tasks. In such a task-based environment, DT is burdensome to adopt, as it puts a heavy demand on employees to not just listen to the end customer but also empathize with their problems and needs before commencing product development.

4.2 Barriers related to organizational structure and processes.

The company's current organizational structure and division of labor and knowledge, along with its well-defined PDP processes, were identified as barriers to the effective implementation of DT.

Assumption 1: Division of Labor and Knowledge Silos. One observation we made after analyzing the qualitative interviews was that the division of labor was a natural by-product of the company's well-developed PDP. Although this is not an inherently bad thing, this division of labor meant that over the years the company has developed knowledge silos within its different functions. This led to significant variation in internal stakeholders' views of customer requirements and customer values—and in some cases even who the customer is—depending on their role and area of product development.

Assumption 2: Structured PDP allows less time for customer interaction. Following a well-structured PDP means that R&D has to keep up with milestones, timelines, and periodic audits. Interviewees mentioned these features of a well-developed PDP as drawbacks for designers, who faced significant time constraints when developing products through collaborating with stakeholders and co-creating with customers. In the case study company, designers and other internal stakeholders worked on multiple projects of varying complexity simultaneously. Some respondents highlighted that even productive interruptions such as meetings pulled them away from their design work and imposed serious switching costs on their development project deliverables. Internal stakeholders seemed to be engaged in some activity during about 90% of their available workday. This situation meant that only specific stakeholders such as sales managers and product managers had time to interact with customers. In this situation, implementing DT in its traditional form—i.e., by holding a workshop for each development project—would require a complete reworking of the existing development model and would mean companies would need to allow additional time for all relevant stakeholders (including designers) to interact with customers.

4.3 Customer-related barriers

Assumption 1: Customers solve their problems or ask for specific solutions instead of presenting problems to be solved. Interviewees mentioned that customers in a B2B setting have the technical knowledge and are generally experts in their relevant fields. They highlighted this fact to illustrate how B2B companies have opportunities to leverage customer knowledge to develop the right kinds of products. This circumstance, however, also presents one glaring drawback. Because customers are experts in using the products, they tend to solve their own problems without reporting them to the supplier. This means that the supplier company receives less information on issues with existing products and limited feedback from customers on how to solve these issues for future generations of their products. Customers thus ask the supplier for specific solutions or product requirements instead of simply presenting their needs and issues in general terms, a fact that makes the initial states of innovation less effective. The researchers found that if customers are reluctant in presenting their needs to designers, the value of DT in seeking continued validation of customer needs might be redundant. Hence, customers' expertise and ability to solve their own problems are barriers to implementing DT in an organization.

Assumption 2: Closed-off customers unwilling to interact with the company. The case study company has a global customer base, and many of the respondents commented that their customers were closed off for different reasons. One respondent mentioned reasons that included language ("lost in translation"), location and even the industry the customer operates in (aerospace industry customers were more confidential than customers in the hearing aid industry) when explaining why customers were sometimes hesitant in communicating their needs. Implementing DT would be difficult in this situation, as it demands extensive customer participation in the early stages of the project. This also calls into question the effectiveness of DT as a mechanism for innovation in the early stages of development, since B2B customers are not willing to engage in effective product development.

Assumption 3: Market pull is slow in B2B compared to business-to-consumer sectors, and thus it is counterintuitive to invest in understanding customers. This barrier turned out to be a distinctive factor weighing against the implementation of DT specifically from the perspective of a B2B company. In the case study company, customers only demand new product generations about once in a decade. So even if companies radically innovate, there might not be any customers who would buy such product innovations regularly. This has led B2B companies to adjust their long-term development strategy to be in line with this slower market pull. Current discussions of DT do not discuss the impacts of this slower

market pull in the B2B context. But objectively speaking, it is apparent that a B2B company will have to keep aligned with the pace of customer demand more closely than a B2C company. For instance, a cell phone manufacturer creating a revolutionary product will have an easier time finding early adopters compared to a B2B company. The lethargic pace of market pull and the general lack of need for frequent general technological leaps is a barrier for B2B companies with a well-developed PDPs thinking about adopting DT.

5 ANALYSIS

We identified specific areas where DT implementation is more likely to improve the PD process. These areas can be divided into visible areas that designers and other stakeholders working in the PDP process explicitly highlighted, and hidden areas that were more implicitly expressed.

5.1 Visible areas

Customer requirements. Product managers consider customer needs as raw data, which architects then translate into system requirements. These system requirements are digitally stored in the company's requirement database (Enterprise Architecture). The product directive document (PDD) that product managers create is an initial document that contains both customer needs and system requirements. However, designers do not use this document for many reasons, including lack of time and not being aware of the client company's way of working. We found information loss in the handoff between product managers and designers, which is the first of many product development processes. The information loss at handover during the PD process occurs because tasks are assigned to designers using Jira systems that don't reference customer needs. The case-study company was initially small, and so designers were also the product managers who collected customer needs and the sales team was also involved in service and installation. As the company has grown, the R&D department acquired several different layers and departments that stand between developers and customers and thus distance them from customer needs. Designers currently prioritize tasks through the Jira system, which leads them to work on tasks that are not very important. Although product managers know which needs are more important for customers, these priorities are not highlighted in the PDD. Requirements are not prioritized or fully visible to designers, which leads to varying interpretations of customer requirements, since the PDD lacks information on why the customer needs each requirement.

Customer openness. During the interviews, product managers and sales managers mentioned several factors, such as culture and region, that impact the degree of customer openness. Another key reason they mentioned is that most of the company's product development was incremental, and thus customer companies did not find value in being open and were happy just laying out their requirements. The researchers noted that customer involvement during the PDP increased customer satisfaction and reduced change to requirements or misinterpretation of requirements at the early stage, at least for some of the company's projects. Customers were found to be engaged during the early development phase and again during beta testing phase (at the end of product development). This leads to change requests from customers at the end of development, as they are involved in the entire PDP. From a product manager's perspective, changes to customer requirements are natural, but everyone is responsible for closely monitoring this area to identify changes as early as possible in the PDP.

Prototyping and documentation. As a consequence of the high technology level of the products, their architecture is very complex. This requires more face-to-face meetings and whiteboard sessions to visualize the system and its related ideas. A unique way of prototyping identified at the case company was using user storyboards. However, we observed that these activities were driven by individuals and not part of the system or routine. One R&D team said that prototyping for high-tech products was difficult because it was complex and expensive to prototype. Surprisingly, though, another team with a similar product did use prototyping.

5.2 Hidden areas

Mindset. The researchers observed that designer's mindset was to develop products without customer interaction because they either didn't have enough time or had interactions with customers only on major products.

Changes to processes and practices change. The study company is well structured, but we found a lack of clarity regarding roles, responsibilities, and definitions. During interviews, we noted that interviewees felt there was ambiguity in defining tasks as new product development or existing product improvement. In addition, many employees struggled to find experts in specific knowledge areas. Experienced employees have expertise in their fields and represent a reserve of intrinsic knowledge. Similarly, when asked about DT, one such experienced employee stated that it was not their natural way of working. The company's PDP is a linear process without room for iteration. Even though we observed iterations in the company's development process, they appear organic and not well-structured. A lot of experience was needed to understand the need for iteration and how to "fail quickly." Depending on the scope of a project (complexity of development, urgency of customer needs, sales potential, etc.), certain parts of the early phases in the PDP (such as planning meetings) were cut short, affecting the frequency of project meetings during the development process.

Digital tools. The company's PDP uses several digital tools, such as the Product Lifecycle Management (PLM) tool used to manage CAD design and documents and Jira for project management. These tools lack integration, however, that would allow visually tracking work progress and information flow.

6 DISCUSSION

DT has the potential to leverage the customer expertise to co-create products and services ([Liedtka et al., 2013](#)). This can be implemented in a B2B company by having designers show tangible prototypes to customers for continuous feedback. Tangible prototyping is one of the five principles of DT. Prototyping helps designers validate their work ("fail fast").

The literature highlights that DT can work both ways: a businessperson can design products, and designers need to think from a business perspective ([Mootee, 2013](#)). This cross-functional process can improve product design. Cross-functional work routines are also one of the key ideologies in DT. Structuring this process can add value to product improvements. Because employees working in customer service is close to the customer, they can help R&D solve specific design problems faster.

An effective PDP that works with customers in a B2B situation requires a degree of controlled flexibility, and hence the process is quasi-formalized ([Grafmüller, 2019](#)), depending on the types of products developed. In other words, in a B2B situation, the development process is highly dependent on the customer. This puts a limit on how much of the process can be changed. This predicament means that a B2B company must consider several different factors before introducing a new process in their company, such as how the new process will impact a company's long-term development agreement with its customers. Since DT seeks to optimize the entire PDP, the repercussions of adopting any of its principles could ripple throughout the product development process, from conceptualization to delivery, and even to post-delivery customer interactions. This is one major barrier to its adoption in this context. Combining this situation with the previous points about DT reducing R&D productivity and the limits as to how much the process could be changed, DT that demands interdisciplinary collaboration and experimentation seems like a needless addition that would further complicate the PDP instead of optimizing it. The underlying takeaway here is that any organization will include people willing to accept new processes and people who resist them, and the open-endedness of DT principles add fuel to the fire for change-resistors.

One of the most effective ways to ensure successful implementation is to mesh DT methods and practices with organizational culture ([Rauth et al., 2014](#)). But because an organization such as the one studied here includes several different cultures and communities (who in some cases follow different product development processes), it would be difficult for an implementation manager to adapt DT in such a way that it ensures compatibility with all these company micro cultures. Such communities of practice have the potential to accelerate innovation through increased knowledge exchange; however, they may not be aligned with an organization's mission or vision ([J. S. Brown & Duguid, 1991](#)). If

they fail to find the common ground, the adoption might fail—or even worse, the adoption could affect the effectiveness of the micro cultures that are not compatible with the process changes, thus cancelling out the effectiveness of adopting DT.

7 IMPLICATIONS FOR PRACTICE

After we analyzed the situation at the case study company and compared our findings with the DT literature, we identified four actions that could increase customer-centricity at B2B companies with a well-developed PDP.

Co-create to gain a competitive advantage. One major issue we found in the case company was how the company's representatives interacted with their customers. Designers in the case study company have a mindset that it was not necessary to interact with customers in order to develop good products. Their instinct was to try and sell products or ideas to their customers rather than listening to what the customer had to say. Establishing a relationship of trust and providing customers with the right input—for example, showing prototypes—helps representative connect with customers who may show an unwillingness to co-create (Grafmüller, 2019). In line with Ahmed et al.'s (2019) findings about using hybrid DT processes for effectiveness Grafmüller (2019) concurs that using dedicated processes that consider customer preferences will help companies to co-create. The open-endedness and adaptability of DT principles is ideally suited to establishing co-creation processes with diversified customer types.

Use DT tools to ensure the unfiltered voice of customers reaches relevant stakeholders. We observed that the loss of information when translating customer needs in the PDP process was a common and recurring issue for the B2B company. The root cause of this barrier was the many handovers involved in the process, which ultimately downplayed the voice of the customer in the company. This issue can be resolved by using DT's ability to employ a variety of tools suited for this purpose, such as tools for identifying needs, tools for generating ideas, tools for testing ideas, and so on (Elsbach & Stigliani, 2018). Since several such handover points exist during the project execution phase, adopting a hybrid process such as Lean Design Thinking Methodology (LDTM) (Ahmed et al., 2019) would help reduce these filters by ensuring that all the relevant stakeholders working on a project are exposed to the unfiltered voice of customers.

Adopt a project-based approach to DT implementation. In a finding similar to Liedtka et al.'s (2013), the product developers at the B2B company we studied were at a disadvantage because they were not users of the products they design. Given this situation, it was very difficult for the designers to truly understand the needs of the customers for whom they developed products because customers tend to solve their own problem and some customers are closed off. Designers at the case study company currently try to overcome this situation by supplementing their knowledge with information from other experienced internal stakeholders, but this sometimes seems to be ineffective Javalgi et al. (2014), Liedtka et al. (2013), and Mootee (2013) all suggest that this hurdle could be overcome by leveraging empathy, one of the key principles of DT. We suggest that by adopting a project-based approach to DT, where relevant stakeholders are given opportunities to place themselves in their customers' shoes and truly understand their needs, designers can gain a better understanding of their customers' values and needs. This would ensure that stakeholders working in a project align themselves according to common goals and make more-relevant prioritizations based on actual customer needs and requirements, rather than relying solely on secondary information from stakeholders who regularly interact with customers.

Share project progress with customers using prototypes. As with companies using a PDP based on a stage-gate method, the case company consolidates most customer interactions within the initial preliminary study phase and in the testing phase at the end of the PDP. The lack of communication (or intermittent customer interaction) was found to gradually lead to dwindling engagement and morale among employees working on the product. By leveraging the “tangible prototyping” ideology, as DT advocates, companies could share project progress with customers using tailored prototypes and minimal viable prototypes to get valuable feedback while maintaining control over information at its

source. Thus, implementing this DT principle would improve customer engagement not only at the outset but also throughout the product development cycle, something that is critical when confronting the longer development cycles common in B2B companies.

8 CONCLUSION

We identified barriers and opportunities associated with DT implementation in a B2B company using a single case-study in a high-tech product company. Based on our results it became evident that successful implementation would only be possible through structured work methods derived from the DT umbrella construct, with continual improvement made possible through a feedback loop observing the pilot DT programs and restructuring the DT work methods accordingly. Future work expanding on this study should broaden its scope to examine B2B companies in different fields and compare those results to the findings presented in this article.

The results from this study could be a starting point for developing a framework to serve as a high-level template to improve the customer-centricity of B2B companies. Such a framework should also be geared towards overcome the barriers we identified and leveraging the opportunities we highlight, thereby facilitating B2B companies' adoption of DT principles. This framework should be designed to incorporate DT principles in the form of workshops, which, when orchestrated successfully, will arrive at clear development goals and team alignment. Lastly, one key point that B2B companies must take into account while implementing DT is that their chances of success depend on the shared commitment of designers, managers, leaders, and all relevant stakeholders in a company. The intent of the framework (and DT in general) is thus not to create "design thinking companies" but rather to create independent design thinkers within companies.

REFERENCES

- Ahmed, B., Dannhauser, T., & Philip, N. (2019). A Lean Design Thinking Methodology (LDTM) for Machine Learning and Modern Data Projects. 2018 10th Computer Science and Electronic Engineering Conference, CEEC 2018 - Proceedings. <https://doi.org/10.1109/CEEC.2018.8674234>
- Astley, W. G. (1985). Administrative Science as Socially Constructed Truth. *Administrative Science Quarterly*, 30(4), 501. <https://doi.org/10.2307/2392694>
- Brown, J. S., & Duguid, P. (1991). Organizational Learning and Communities. *Organization Science*.
- Brown, T., & Katz, B. (2011). Change by design. *Journal of Product Innovation Management*. <https://doi.org/10.1111/j.1540-5885.2011.00806.x>
- Carlgren, L., Rauth, I., & Elmquist, M. (2016). Framing Design Thinking: The Concept in Idea and Enactment. *Creativity and Innovation Management*. <https://doi.org/10.1111/caim.12153>
- Eisenhardt, K. M. (1989). Building Theories from Case Study Research. *Academy of Management Review*. <https://doi.org/10.5465/amr.1989.4308385>
- Elsbach, K. D., & Stigliani, I. (2018). Design Thinking and Organizational Culture: A Review and Framework for Future Research. *Journal of Management*. <https://doi.org/10.1177/0149206317744252>
- Fejes, A., & Thornberg, R. (2009). Handbok i kvalitativ analys. Liber.
- Galbraith, J. R. (2005). Designing the customer-centric organization: A guide to strategy, structure and process. In Spring. <https://doi.org/Book Summary>
- Grafmüller, L. K. (2019). Co-creation of high-tech products in the B2B domain (1st ed.). Gabler Verlag. <https://doi.org/10.1007/978-3-658-28412-1>
- Hemel, C. van den, & Rademakers, M. F. (2016). Building Customer-centric Organizations: Shaping Factors and Barriers. *Journal of Creating Value*. <https://doi.org/10.1177/2394964316647822>
- Hirsch, P. M., & Levin, D. Z. (1999). Umbrella Advocates Versus Validity Police: A Life-Cycle Model. *Organization Science*, 10(2), 199–212. <https://doi.org/10.1287/orsc.10.2.199>
- Ingle, B. R. (2013). Designing for Growth. In *Design Thinking for Entrepreneurs and Small Businesses* (pp. 103–115). https://doi.org/10.1007/978-1-4302-6182-7_9
- Javalgi, R. G., Hall, K. D., & Cavusgil, S. T. (2014). Corporate entrepreneurship, customer-oriented selling, absorptive capacity, and international sales performance in the international B2B setting: Conceptual framework and research propositions. *International Business Review*. <https://doi.org/10.1016/j.ibusrev.2014.04.003>
- Lee, J. Y., Sridhar, S., & Palmatier, R. W. (2015). Customer-centric org charts aren't right for every company. In *Harvard Business Review*.
- Liedtka, J. (2018). Why Design Thinking Works. In *Harvard Business Review*.
- Liedtka, J., King, A. (Andrew C., & Bennett, K. B. (Kevin B. (2013). Solving Problems With Design Thinking 10 Stories of What Works, (Preview Version of Chapters 1 and 9). *Solving Problems With Design Thinking*.

- Micheli, P., Wilner, S. J. S., Bhatti, S. H., Mura, M., & Beverland, M. B. (2019). Doing Design Thinking: Conceptual Review, Synthesis, and Research Agenda. *Journal of Product Innovation Management*. <https://doi.org/10.1111/jpim.12466>
- Mootee, I. (2011). *Design Thinking for Creativity and Business Innovation Series*. Harvard Graduate School of Design Executive Education.
- Mootee, I. (2013). *Design Thinking for Strategic Innovation: What They Can't Teach You at Business or Design School* (1st ed.). Wiley.
- Rauth, I., Carlgren, L., & Elmquist, M. (2014). Making It Happen: Legitimizing Design Thinking in Large Organizations. *Design Management Journal*. <https://doi.org/10.1111/dmj.12015>
- Shah, D., Rust, R., Parasuraman, A. P., Staelin, R., & Day, G. (2006). The Path to Customer Centricity. *Journal of Service Research - J SERV RES*, 9, 113–124. <https://doi.org/10.1177/1094670506294666>
- Yin, R. K. (2009). *Case Study Research Design and Methods* Fourth Edition. In *Applied Social Research Methods Series*.