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Pinpointing the Driving Forces Propelling Digital Business Transformation

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Abstract: Comprehending the motivating factors that drive Digital Business Transformation (DBT) is crucial for cultivating success in DBT initiatives. The objective of the research outlined in this paper was to pinpoint and categorize the factors that inspire companies to embark on the DBT journey. Through qualitative analysis, employing expert interviews as the method, the authors extracted the necessary information to address three key research questions: (i) What are the external drivers of DBT in the plastic extrusion machine industry? (ii) Which internal factors are driving DBT in these companies? (iii) Is there anything else significantly impacting the DBT initiatives? The identified driving forces propelling DBT in German businesses within this industry include external factors: skill shortage, social impact, COVID-19, supply bottlenecks, competitiveness, and customer requirements; internal factors: cost reduction, process acceleration, efficiency increases, and time savings; and mixed factors: attitude of young people, basic education, and work–life balance. The insights derived from this research enhance the understanding of the circumstances and dynamics of traditional companies across other Western European countries. Our findings enrich the existing theory by presenting a distinctive threefold categorization of the drivers behind DBT, providing unique insights into the factors propelling the advancement of DBT initiatives.

Keywords: digital business transformation; digital disruptions; digital transformation; DBT drivers; DT drivers

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1. Introduction

Digital transformation (DT) constitutes a profound shift geared towards achieving enhanced performance. Embarking on this transformation necessitates disruptive innovation, entailing the replacement of antiquated processes. A risk-oriented strategy becomes imperative within the company for the transformation. This approach entails short-term risk escalation in order to mitigate long-term risks (Evans et al. 2021). DT exerts its influence across three key dimensions: externally, by focusing on the digital enhancement of the customer experience; internally, by affecting business processes; and comprehensively, by influencing all segments and functions of the business, often culminating in entirely novel business models (Abdelaal et al. 2018). It is crucial to discern that DT stands apart from mere change or continuous improvement, where organizations simply refine existing practices. Transformation is synonymous with doing things differently (Evans et al. 2022). Comprehending the drivers of DT is imperative for businesses to navigate the intricacies of DT challenges, as some may perceive themselves as incapable of achieving DT independently (Rupeika-Apoga et al. 2022).

The COVID-19 pandemic has significantly expedited DT within the industrial sector in the last two years (Soto-Acosta 2020). Even companies that were previously distant from DT found themselves compelled to take substantial leaps towards digitalization, driven by the lockdown measures (Soto-Acosta 2020). In fact, 44 percent of the industrial sector attributes the impetus for digitalization in their organizations to the impact of COVID-19 (Kuhlein and Sobania 2021). Simultaneously, it becomes evident that all forms of transformation

engender conflicts between established competencies and the challenges of the present and future (Abdelaal et al. 2018).

Digital transformation is the dominant concept affecting the present and future of many industries, including transportation and logistics, manufacturing, healthcare, and retail (Gold Line Removals 2023; Yifat 2022). In manufacturing, it is closely connected to the concepts of Industry 4.0 and Industry 5.0, shaping its future both from the technological and people perspectives (Ardito et al. 2019; Leng et al. 2022). The primary rationale for selecting the German plastic extrusion machinery sector lies in its historical status as a global leader in extrusion technology. It has been a concealed powerhouse for an extended period. However, current trends indicate that numerous other nations are vying for a stake in this market. Given that mechanical advancements in this field are not experiencing substantial growth, this presents an opportune sector for initiating research. This initial research could serve as a foundation, potentially extending to other industries and regions in the future.

This paper delves into the current status of Digital Business Transformation (DBT) processes, with a specific focus on the plastic extrusion machinery manufacturing industry in Germany. The literature has identified several external and internal DBT driving forces, as presented in the Section 2. However, our existing knowledge has gaps that require filling. These include the specifics of the nature of these challenges and the response of companies in the heavy machinery manufacturing industry to these challenges.

Based on the identified research gap, the objective is to determine the driving forces behind the DBT initiatives within companies from this sector. To achieve this objective, the authors present three research questions (RQs) which are based on the presented literature review and derived from the principal objective of the research presented in this paper:

RQ1: What are the external drivers of DBT in the plastic extrusion machine industry?
RQ2: Which internal factors are driving DBT in these companies?
RQ3: Is there anything else significantly impacting the DBT initiatives?

The structure of the rest of this paper is as follows: In Section 3, we outline the research approach employed to collect primary data for this study. Section 4 offers a concise overview of the novel insights generated through our research, while Section 5 presents a comparative analysis of this new knowledge in relation to established concepts and findings from the existing literature. We also present responses to the Research Questions (RQs) in Section 5. Section 6 contains the implications of this research for theory and practice, and discusses limitations in our research.

2. Literature Review

The literature underscores the persistent role of digitalization as a driving force behind the process of DT (Corejova and Chinoracky 2021; Ko et al. 2022; Lang 2021). Digitalization encompasses the sociotechnical application of digitization techniques to broader social and institutional contexts, effectively establishing digital technologies as an integral infrastructure (Tilson et al. 2010; Tolstolesova et al. 2021). Often, digitalization is closely associated with groundbreaking shifts in companies' business models, the adoption of new technologies, the development of adaptable products, and the pervasive influence of social media in the contemporary era. In recent years, companies have been grappling with heightened pressure to adapt due to the accelerated pace of technological evolution and intensified competition. Despite its paramount importance for businesses, the concept of digitalization is described in the literature in a multifaceted and diverse manner (Osterwalder and Pigneur 2010). Digitalization has its roots in the realms of IT craftsmanship and industrialization, concepts that have been established for years, but it also represents the latest evolutionary step (Schmidt and Drews 2016). Digitalization can be seen as a catalyst for change within a company in two significant ways: first, it shifts the focal points of entrepreneurial opportunities within the economy, and, secondly, it transforms business practices, providing the most effective means to capitalize on these opportunities (Kraus et al. 2021).

Digital disruptions signify the profound impact of digitalization on the functioning of companies, the economy, and society. The era of digital disruptions commenced in the mid-2000s and was catalyzed by a series of advancements in various facets of digital infrastructure (Autio 2017). Digital disruption aims to supplant human activities with automated processes. New technologies, especially those with disruptive potential, necessitate organizational transformation to sustain competitiveness (Manyika et al. 2023). This transformation spans not only technological architecture but also extends to strategic, managerial, and social dimensions (Rocha et al. 2021). A multitude of emerging technologies compel companies to reconfigure their traditional operational models. These technologies encompass machine learning, artificial intelligence, virtual reality, IoT, blockchain, and more (Dokuchaev 2020; Miklosik and Evans 2020). Intelligent applications are also gaining wide acceptance (Dokuchaev 2020), incl. ML- and AI-powered apps such as chatbots (Miklosik et al. 2021). Digital disruption requires distinctive management approaches and can precipitate the need for DT. Approaches akin to those used in managing disruptive innovation are essential (Rocha et al. 2021). Disruptive innovation involves the introduction of novel, previously unfamiliar products or services that start as niche innovations and have the potential to revolutionize markets. It is often referred to as a breakthrough innovation. In essence, disruption entails radical upheaval, and, at times, the dissolution of conventional business processes and models, whereas transformation describes an ongoing process of change (Meyer 2023). To achieve success, companies have four different strategies at their disposal: they can leverage their existing strengths, scale down, withdraw, or pivot and venture into new business domains (Birkinshaw 2022). There is a common belief among managers that large, established companies are incapable of change. However, extensive research over a three-year period involving companies from diverse sectors in the Global 500 ranking contradicts this notion. The research reveals that incumbents possess three capabilities that confer a formidable advantage over new competitors: they excel at handling complexity, exhibit long-term perseverance, and harness customer relationships to expand into adjacent business areas. Rather than adopting a defensive stance, successful market leaders continue to evolve by leveraging these strengths (Malnight and Buche 2022).

Industry 4.0 denotes the intelligent interconnection of machinery and processes within the industrial sector, facilitated by information and communication technology. This interconnection can serve as the foundation for entirely novel business models and services (BMWK 2022). In Germany, Industry 4.0 is often referred to as the fourth industrial revolution. Although there is no standardized set of guidelines or concrete implementation concepts, nor is there a universally agreed-upon definition, the literature consistently acknowledges it as a driving force behind DBT. The intelligent factory approach strives to render the growing complexity arising from the extensive use of information and communication technologies in production more manageable for companies. Self-optimization is envisioned to reduce the susceptibility of machines and production processes to errors. In a smart factory, individuals, machines, and resources can engage in direct communication and interaction via the Internet of Things and services, thereby enhancing production efficiency. Moreover, it facilitates the integration of both internal and external stakeholders into business and value creation processes, the amalgamation of products with high-quality services, and the networked integration of all production systems through the internet (Siepmann and Graef 2016). Industry 5.0 represents a call for a global transformation in the industrial landscape, further propelling DBT initiatives. This time, it places a central focus on human well-being within manufacturing systems, thereby striving to achieve social objectives that extend beyond employment and growth, robustly ensuring prosperity for the sustainable development of humanity as a whole (Leng et al. 2022).

The COVID-19 pandemic has emerged as a prominent driving force, significantly accelerating the course of DBT. The pandemic imposed extensive demands on both society and the economy, leading to an abrupt and complete transformation of everyday life and routines. The sudden transition of employees to remote work presented a formidable challenge for employers, particularly for those companies that were heavily reliant on

paper-based processes and ill-prepared for a digital work environment. The pandemic, in effect, acted as a catalyst for the long-anticipated acceleration of DBT, prompting a fundamental reevaluation within many organizations (Büscher et al. 2020). Numerous companies found themselves compelled to adopt cloud-computing solutions to facilitate the sharing and accessibility of critical data (Büscher et al. 2020; Miklosik and Evans 2020). The surge in remote work also drove a notable increase in the use of video and audio conferencing, necessitating investments in technological infrastructure, including bandwidth expansion, network equipment, and software for cloud services (De' et al. 2020). Cloud services have already been identified as pivotal drivers of DT in the past (Abolhassan 2017; Dokuchaev 2020; Reinking 2017; Strecker and Kellermann 2017). Lockdown measures led to a substantial upswing in the utilization of internet-based services, resulting in internet traffic during lockdown periods surging to levels 25 to 30% higher than usual (Branscombe 2020).

3. Materials and Methods

To gather firsthand insights from experts within plastic extrusion machine companies, we conducted semi-structured interviews. This approach is highly regarded for its flexibility and openness, allowing for an interpretative analysis of the findings, leading to a deeper and more comprehensive understanding of the research subject (Bortz and Döring 1995). In this research context, the expert interviews focused on the interviewees' professional expertise, emphasizing their knowledge rather than their personal identity. The interviews were conducted from 19 October 2022 to 26 October 2022. The research sample comprised experts from seven different companies, each with a long-standing history exceeding 80 years, all of which identified as traditional yet innovative enterprises.

In the process of selecting companies and their experts, a comprehensive review of the exhibitor list from the K trade fair in Düsseldorf was conducted. Notably, the K fair stands as the world's largest plastics trade fair. The search involved entering the keywords "pipe extrusion machines" specific to Germany in the trade fair's website search bar (K Trade Fair 2022). This search yielded a list of 20 manufacturers specializing in plastic pipe extrusion machines tailored for infrastructure applications such as water, sewage, and gas pipes, particularly those involving polyolefins. Given the global prominence of the K fair, it is reasonable to assume that the most significant and prominent companies within the targeted sector would be represented at this event.

We selected mechanical engineering firms holding global leadership positions in their respective domains. To be eligible for inclusion in the research sample, a company needed to have a minimum of five years of existence and be involved in the entire process of developing, designing, manufacturing, and selling their products. In total, we selected seven manufacturers specializing in plastic pipe extrusion machines for infrastructure products, including water, sewerage, and gas pipes. Out of the 20 companies considered, 10 were excluded due to their small size or low relevance in the industry. Out of the ten relevant companies, we were able to include seven in the research sample, thus including 70% of them in the research. The list of companies included is provided in Table 1.

Table 1. Companies included in the research sample.

Number	Name of the Company
E1	Graewe GmbH Maschinenbau
E2	Krah Pipes GmbH & KH
E3	Battenfeld-Cincinatti Germany GmbH
E4	Drossbach Maschinenbau GmbH
E5	Hans Weber Maschinenfabrik GmbH
E6	KraussMaffei Technologies GmbH
E7	Unicor GmbH

Expertise was not limited to the C-level as specialized knowledge can also be found at lower organizational levels (Meuser and Nagel 1991). We included managing directors, sales managers, production managers, and business development managers who had substantial experience in their companies and a strong industry background.

The interviews were audio-recorded and transcribed. Interviewees were informed that the interviews would be recorded, and the results would be made public. Questions were designed to be open-ended, allowing interviewees to provide comprehensive insights into the subject. The analysis of the expert interviews aimed to identify common themes and patterns in the discussions. Transcribed interviews were analyzed using the NVivo software (V1.7). Codes were created by categorizing statements into different thematic areas and assigning sub-codes as necessary. Statements were categorized into areas encompassing implementation challenges, the implementation process, and the future prospects of the companies. The data analysis adhered to the qualitative content analysis methodology (Mayring 2000), involving the systematic extraction and evaluation of information from textual or other qualitative data sources, such as interviews.

Tables were constructed to categorize individual codes, with corresponding phrases being generalized and reduced to preserve only the critical statements. Throughout this paper, experts are referred to as "E" followed by a consecutive number (E1, E2, and so forth). Qualitative content analysis was used to interpret the findings. This process involved the separation of relevant statements from less pertinent ones, followed by the summarization and analysis of individual interview segments to determine their relevance. Question–answer pairs were organized, and any emerging novel aspects and ideas were documented separately. Subsequently, the relevant statements were assessed in alignment with the research questions. When interpreting and discussing the results, the outcomes of the analysis were compared with existing studies, emphasizing both commonalities and distinctions. This comparative approach led to the generation of fresh insights, which are presented and discussed.

4. Results

Fundamentally, it can be asserted that all change initiatives within a company fundamentally serve the purpose of ensuring the company's continuity. This category delves deeply into the underlying motivations. Companies do not undertake DBT initiatives merely for the sake of DBT itself; they do so because these initiatives offer tangible benefits and help the company maintain its competitiveness in the market. This perspective is underscored by E2: "The digital transformation that makes no sense to us is a digital transformation simply for the sake of digital transformation." There are numerous factors that drive a company to implement DBT, and these motivations can be external, internal, or a combination of both.

4.1. External Drivers for Digital Business Transformation (DBT)

External factors are often the impetus for DBT. An illustrative example of this is evident in the case of E2, where the statement emphasizes the impact of external factors on DBT: "We encountered a distinct digital transformation during the COVID period when our employees were physically unable to travel abroad for equipment assembly. As a response, we digitized the assembly process using various video systems." Valuable insights gleaned from the experts have been condensed and are presented in Table 2.

Table 2. External drivers of DBT.

Expert	Paraphrase	Reduction	Generalization
E2	But one particular digital transformation we experienced was during the COVID-19 period, where our staff were simply physically prevented from flying abroad to assemble equipment, so we digitized assembly via various video systems	Use of VR to handle the traveling restrictions during COVID-19 for installation abroad	Government COVID-19
E2	So this digital disruption that is now so invoked is nothing new for us, but actually standard in order to sustainably exist on the global market	Sustainable survival on the world market	Competitiveness Sustainable survival
E2	Yes, COVID-19 has been a disruption, a crisis that has forced us to find solutions faster	COVID-19 crisis as driving aspect	
E3	Until the COVID-19 crisis and thus the destruction of the supply chains, this was really a taboo subject in the area of purchasing with us, so that it had not been carried out	During the pandemic, supply collapsed, so we removed an old taboo subject and used other procurement methods	Destruction of supply chains
E3	Our purchasing department has been forced to procure the products via Amazon or other platforms in the meantime	Products are purchased via different platforms	Supply bottlenecks
E4	Digitization based on Agenda 2030—this is what we do for us, not because of the directive, but we want to do something good for the world	Social impact	Agenda 2030, social impact
E6	We win orders through our control	Competitive advantage	Customer wants digitized products
E6	However, the subsidies are only available if these machines deliver Industry 4.0, i.e., big data and digitalization, and are prepared for this to also save costs and energy	Government funding (Italy) for digitalization to reduce energy	Government, Agenda 2030
E6	We currently have a huge problem with skilled workers and it is now a necessity that we use these digital solutions and also artificial intelligence in order to remain competitive as a location for Germany or Western Europe	Skills shortage, competitiveness	Digital solutions and artificial intelligence as a necessity to remain competitive
E6	Firstly, we want to reduce CO_2 emissions and produce in a climate-neutral way by 2030	Social impact, no CO_2-footprint until 2030	Agenda 2030
E7	Solving the problem of the shortage of skilled workers through automation is a very important issue in our future planning	Solving the problem of the shortage of skilled workers through automation	

In summary, one of the primary external drivers for DBT is the long-term competitiveness of companies. The interviewees demonstrated a reliance on the development of automated systems to ensure their future resilience and to mitigate external factors such as a scarcity of skilled labor. Other external situational factors motivating DT initiatives include Agenda 2030, with a focus on social impacts, the impact of the COVID-19 pandemic, external stakeholders such as customers, and challenges related to supply bottlenecks and material shortages. For instance, one company utilized virtual reality (VR) to continue machine installations abroad despite COVID-19 restrictions, thus safeguarding their competitiveness. Other companies have similarly taken measures to adapt to market conditions, including innovative approaches to procurement and sales in response to supply chain disruptions. These companies have departed from conventional practices to sustain their operations. Moreover, most companies also consider the 2030 Agenda, which encompasses 17 Sustainable Development Goals (SDGs) aimed at fostering socially, economically, and ecologically sustainable development. A pivotal aspect is the endeavor to offset CO_2 emissions, with the objective of achieving climate-neutral production.

4.2. Internal Drivers for Digital Business Transformation (DBT)

In addition to the external drivers of DBT within a company, there are also internal factors that can instigate transformations. These internal motivations can stem from intrinsic desires, signifying that the impetus for certain behavior originates from within the individual rather than external sources. An illustration of this can be found in the statement from E5: *"You notice it because you need less staff for things, and certain processes run faster."* This highlights how the recognition of improved efficiency and the reduction in labor requirements can be intrinsic motivators for DBT. Findings in regard to internal DBT drivers are presented in Table 3.

Table 3. Internal drivers of DBT.

Expert	Paraphrase	Reduction	Generalization
E2	The greatest potential for savings would actually be in bookkeeping because that consumes a lot of resources and time, especially in the accounting season. This is why it would be very important to me to digitize the entire "avoidance of accounting", including the tax office and the tax advisor	Reducing human resources, and speeding of administration processes	Process acceleration, cost savings
E3	We mostly take the digital transformation as an increase in efficiency. We want to adapt existing structures	DT for increasing the efficiency and optimizing the company organization structure and workflow	Efficiency increase
E3	There are other potential savings such as visit reports and effectiveness, distributing and implementing these measures, we see great potential savings there, but these are more time savings, but time is money, as we all know.	Reduction in the time for processes and cost reduction	Cost reduction, time savings
E3	At the moment, most digitization projects are related to increasing efficiency and speed, but in the coming years more and more SDG components will certainly be included	At the moment mainly DT projects are realized to increase the efficiency of processes; later we plan to also implement SDG	Efficiency increase, later SDG components
E4	In the production it will be a dramatic reduction of course because time is money and digitalization means that you use time in the best possible way, so of course it is a reduction	Cost reduction through time saving	
E4	Also mistakes, like in order processing and purchasing, as people make a lot of mistakes and that is why the clearer the picture we see, the less mistakes we make.	Reducing of mistakes, increase in the transparency of the workflow	Error reduction, increase in transparency in the company
E5	You notice it in the fact that you need fewer staff for things and certain processes run faster	Increasing speed, cost reduction due to less employees	Cost reduction through personnel savings
E5	This means shortening the time from order receipt to the first tap	Increase in speed	
E5	Digitization can save a lot of costs in the administrative area; for things that used to be very time-consuming, you can save a lot there	Cost saving	
E7	Partly, costs could be saved through digitalization in distribution due to less air travel	Cost savings through less travel	Cost savings
E6	There are considerations in this direction to push this further in order to also make it easier for the customers to be able to react more quickly	Simplify the user interface for our customers, and increase the speed in processes	

It is evident that, in addition to external factors, internal initiatives play a significant role in maintaining competitiveness. Cost reduction and process acceleration stand out as key drivers in this regard. Many of the DBT initiatives contribute to process optimization,

resulting in cost and time savings. These improvements span various areas, including accounting, procurement, sales, and construction. Process optimization not only reduces the need for personnel but also minimizes the occurrence of errors. It simplifies processes and procedures, benefiting both employees and external stakeholders while reducing vulnerability to errors. Crucially, successful DBT within a company heavily relies on a motivated team that consistently drives progress. In conclusion, internal DBT efforts lead to enhanced efficiency and are, therefore, a valuable pursuit for every company.

4.3. Working Time Model as a Driver for Digital Business Transformation (DBT)

In addition to the distinct external and internal motivations for DBT, there exists a realm where transformation is propelled by factors that straddle both the internal and external domains. This is notably evident in the context of skill shortages and the resultant emergence of new working time models and working cultures, including the use of home offices and digital nomadism. The primary impetus behind this transformation is to ensure the company's own production capacity, a facet influenced externally by the availability of skilled workers. An exemplary statement highlighting this aspect as a catalyst for DBT is found (E7): "*Addressing the issue of skills shortage through automation is a very important one in our future planning*". This underscores the significance of addressing skill shortages through automation as a pivotal component of future planning and DBT initiatives. More information on the working time model and DBT is shown in Table 4.

Table 4. Working time model as a driver of DBT.

Expert	Paraphrase	Reduction	Generalization
E1	Digital nomads are certainly possible in many areas but rather difficult in our industry because the on-site presence often has to be there and the conversation between employees directly at the machine also has a lot of value	Digital nomads cannot be implemented in the company	On-site presence often necessary
E2	Talking about work–life balance, quality lifetime, 4-day week or 1-day week, and home office, we still find it very difficult to find a mode in which the old, the middle, and the young generations can work together in the company	Difficulties in finding a suitable working time model for each individual (work–life balance)	Work–life balance
E2	So, there are both in the company-areas where home office is possible and areas where it is not, and for us as management it is extremely difficult and the question arises whether both working time and working models can be handled in the company	Home office possible, but concerns whether a general working time model can be found	Home office, looking for a general work model
E3	This means that in a month an employee must be in the office for a fixed number of days	Compulsory presence in the office, for a certain number of days	Compulsory presence for a few days
E5	We actually use home office as an active element at the moment	Home office as an active telement	Home office
E6	It is clearly possible to work in a home office with us	Home office possible	
E7	We do not talk about home office, but about mobile working; the sales department has been doing this for years anyway, but we have now extended it very strongly to project management and construction	Home office extended to many areas	Increase in home office
E7	Addressing the skills shortage through automation is a very important issue in our future planning	Addressing skill shortages through automation	Substitution of human workforce by automatization

Table 4. *Cont.*

Expert	Paraphrase	Reduction	Generalization
E2	Basic attitude of new employees, the ageing of Germany, integration of new people in Germany (shortage of skilled workers). An absolute problem are also young people coming from universities and schools, their basic attitude and also their knowledge, which in my opinion leaves something to be desired	Attitude of young people, basic education from schools and universities is no longer enough	Mindset of young people, quality of education of young people
E7	We are in an area where it is very rural, we do not have any universities on the outside, and some of the employees have to travel long distances. You simply have to think about how to retain employees and how to find new employees	Finding and retaining employees is difficult, so suitable working models must be found	Work models

It is evident that the scarcity of skilled workers poses a significant challenge, and DBT initiatives are actively addressing this issue. This is achieved through a dual approach: firstly, by reducing the reliance on human labor through the digitalization of manual tasks; secondly, by embracing the concept of "remote workplaces" and offering appealing working time models to attract and retain employees. This often involves offering options like home offices, whether on a daily or full-time basis. In some instances, there is a willingness to hire digital nomads, granting them flexibility in terms of working hours and locations. Additionally, the mindset and education of the younger workforce play a pivotal role in addressing staffing challenges. The desire for new working time models represents a unique combination of internal and external influences. This necessitates the consideration of government regulations, such as timekeeping, tax implications, and the dynamics of the digital nomad lifestyle, among other factors.

5. Discussion

The primary drivers for both past and future DBT initiatives are fundamentally centered on maintaining competitiveness and ensuring the survival of companies in Germany as a business destination. These core motivations can be categorized into external and internal factors, with a unique mixed reason giving rise to novel working time models. External incentives for DBT (*RQ1*) encompass issues like the shortage of skilled workers, and the impact of the COVID-19 pandemic, in line with (Soto-Acosta 2020), external stakeholders, economic crises, and associated material shortages. Long-term competitiveness emerges as a pivotal external driver for DBT initiatives, confirming the findings of Manyika et al. (2023). Consequently, companies included in this research concentrate on developing automated systems to future-proof their operations while addressing external challenges like skilled labor shortages. In contrast to the findings from some previous studies (Cirjevskis 2022; Dokuchaev 2020), most participants (except for E2) did not think that new technologies were the main drivers of DT in their companies.

On the internal front (*RQ2*), DBT initiatives are primarily characterized by transformations that aim to reduce costs and expedite processes. These changes cut across various departments within a company and can ideally lead to workforce optimization and a reduction in errors. Overall, internal DBT pursuits are geared towards enhancing a company's efficiency. The special driver of DBT identified during the interview analysis is the mixed reason (*RQ3*), where the shortage of skilled workers acts as a catalyst for introducing new working time models and working cultures. Many interviewees expressed difficulties in recruiting new employees and responded by offering various options, ranging from occasional home office arrangements to complete remote work. In addition to job seekers and their preferences, both the government and work councils exert influence over the implementation of certain DTs, such as home office possibilities. For example, some experts mentioned resistance from work councils against introducing home offices. Changes in reg-

ulations imposed by the government can also impose constraints, occasionally preventing the implementation of specific transformations. The driving aspects of DBT based on our research study are summarized in Figure 1.

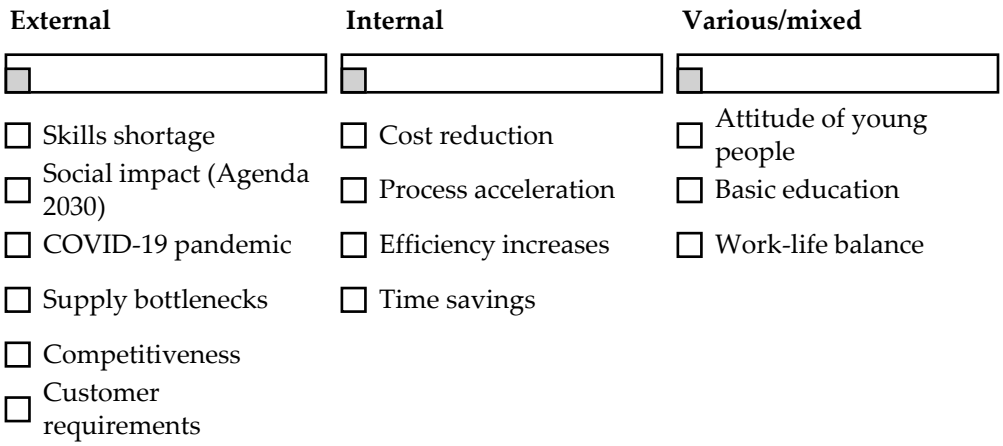

Figure 1. Main DBT drivers.

6. Conclusions

It is essential to evaluate whether the findings of this research have broader implications for the current state of research in this field. The results presented in this paper shed light on the factors affecting the progress and success of DBT initiatives of companies operating in the pipe extrusion sector in Germany. These insights can serve as a model for understanding the situation and dynamics of similar traditional companies in this industry across other Western European countries. By meticulously examining these companies, this research provides a comprehensive overview of both the external and internal drivers of DBT.

These findings enhance the theory by providing a unique threefold categorization of DBT drivers and offering unique insights into the factors behind the progression of DBT initiatives in Germany. Our research validated certain observations found in the existing literature. For instance, it underscored the scarcity of skilled labor and identified long-term competitiveness as a prominent external factor influencing the adoption of DBT (Manyika et al. 2023; Soto-Acosta 2020). On the other hand, some of the findings from previous studies (Cirjevskis 2022; Dokuchaev 2020) were challenged by the results of this research. As an example, the majority of interviewees did not consider new technologies to be the primary catalysts for digital transformation in their respective companies.

In regard to managerial implications, companies in the pipe extrusion sector exhibit comparable challenges, rendering this study valuable in spotlighting both the external and internal DBT drivers. The significance of this work extends beyond illuminating the obstacles confronted by traditional mechanical engineering companies in Germany as they navigate digital transformation-related stakeholder engagement. It serves as a reference for other enterprises grappling with similar issues. Given the ongoing pivotal role of the German mechanical engineering sector in the country's industrial landscape and economic well-being, the insights from this research should be considered by the government in the formulation and implementation of policies aimed at supporting the industry.

While every effort was made to uphold objectivity during the qualitative analysis, it is crucial to acknowledge that one of the authors of this study also serves as the CEO of a company that participated in the research. This author's significant market knowledge was leveraged to gain valuable insights into the industry and its challenges. However, it is essential to recognize the potential for a degree of bias stemming from this affiliation. To mitigate this, the other author actively engaged in the qualitative analysis and cross-verified the results to minimize any potential bias. The research sample included 70% of all relevant

companies within the industry. However, it is worth noting that the sample size may be viewed as relatively small, and we acknowledge this as a limitation of our study.

Our research offers inspiration for future investigations, with the research agenda potentially centered on applying the developed methodology to collect and assess data from other industries within Western Europe. Furthermore, extending the research beyond this geographical region could facilitate inter-regional comparisons. We also anticipate that quantitative analysis may be employed in future research, particularly if the industry under examination comprises a larger number of entities than the industry studied in the research presented in this paper.

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