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MakerSpaces and Value Creation in Start-ups in Germany

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Abstract

Initiatives and projects such as the "Excellence Start-up Center.NRW" aim to increase the competitiveness of Germany through startups and has the explicit goal of creating new and sustainable jobs. In addition, so-called MakerSpaces are being created in parallel in many areas, which are considered as creative areas and are intended to support the construction of prototypes and the testing of hypotheses to create value for potential start-ups and to establish a valid business model. The question here is whether these initiatives and projects provide support for industrial value creation in Germany. This would require production and logistics to be considered when creating and developing new business models. Established methods of production research (e.g. simultaneous engineering) and logistics (e.g. supply chain management) should be taken into account. The results of a short survey – by questioning potential startups and advisors – show whether production and logistics are already considered in the consulting by the MakerSpaces or if there are further unmet needs.

Keywords

Value Creation; MakerSpaces; Production and Logistics; Supply Chain Management; Prototyping; Business Models; Survey; Digitalization

1. Introduction

In Germany, the promotion of knowledge-intensive start-ups and innovation culture is seen as a central building block for the further development of the high-tech strategy [1]. The Expert Commission on Research in Innovation (EFI) also recommends expanding and further developing suitable funding formats (EXIST, WIPANO) and promoting appropriate framework conditions, especially for transfer activities from the science sector [2]. The Ministry of Economic Affairs, Innovation, Digitalisation and Energy of North Rhine-Westphalia has responded to this need by funding six "Excellence Start-up Centres.NRW" (ESC) and creating the basis at six universities to develop innovation ecosystems for spin-offs from research. The selected universities are to make a contribution to NRW as a business location with their new support services for start-ups and foundations.

In addition to the role of purely digital-based companies, the preservation and expansion of physical value creation in Europe is seen, especially in Germany, as an important contribution to expanding Germany's international competitiveness and overcoming the multifaceted challenges at a national and global level. In Germany, the political initiative is linked to the successful implementation of a vision of Industry 4.0 [3]. However, the desired industrial revolution is not only associated with major technological changes but always with major social and organizational changes as well [4]. Industry 4.0 is thus not only integrated for the technological advancement of production and supply chain management [5]. A change in organization

and processes must also be taken into account and thus involve management [6, 7]. In the case of start-ups, the challenges and opportunities of Industry 4.0 must also be considered in the value creation processes and supply chain management when developing new business models and digital processes.

Particularly in start-up funding, the design and production-related issues are addressed in so-called MakerSpaces (MS) and designed for experimentation. Originally from the so-called "Maker Movement" people were led to engage in creative product-making processes by using physical and digital forums to share and collaborate in their daily lives [8]. For the past years, the number of MS increased mainly in the United States and Europe – even worldwide – by more than one thousand[1] [see Fig. 1, 9]. In addition, numerous events such as Hackertons as well as the number of publications increased, especially on the topic of "making" and "hacking" [9].

Therefore, the purpose of this paper is to answer the following research questions:

RQ1: What are the reasons for failure for Teams?

RQ2: Which methods are most commonly perceived by Teams in MakerSpaces?

RQ3: To what extent is production and supply chain management considered in the planning of Teams?

In the following section 2, we discuss the definition of MS as well as the Production requirements for Start-ups. Next, we introduce our short survey and the participants followed by the results in section 4. In Conclusion in section 5, we discuss the results of the short survey.

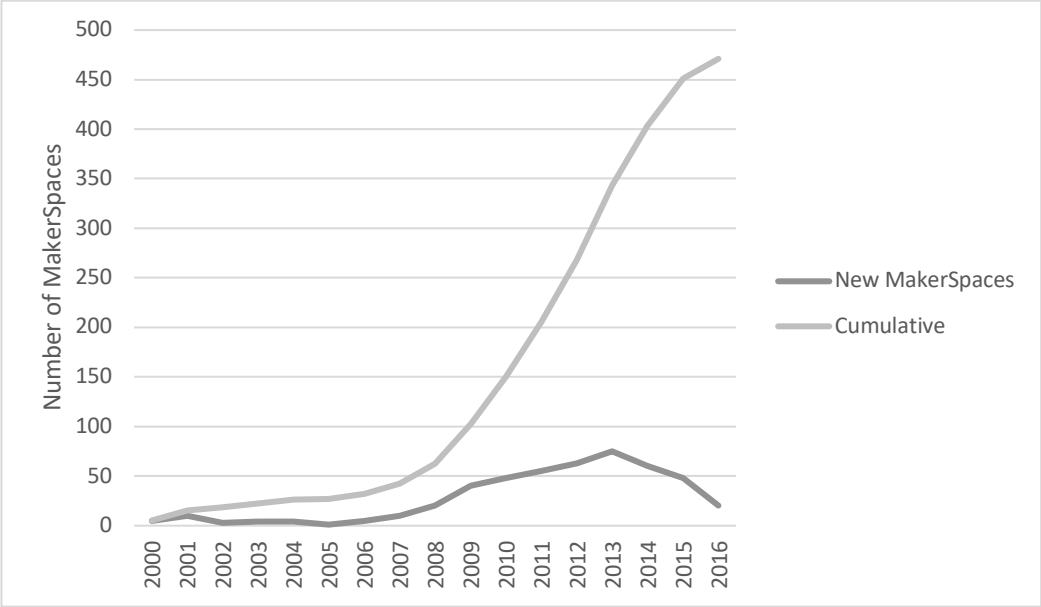

Figure 1: Evolution of the number of MakerSpaces in EU28 per year [9]

[1] https://www.popsci.com/rise-makerspace-by-numbers/ - last access January 20th 2022 at 11.09 a.m.

2. State-of-the-Art

2.1 MakerSpaces

One of the first HackerSpaces is considered to be the Homebrew Computer Club 7, which was founded around 1975 in Silicon Valley. Here, hobbyists met informally in a garage to work on do-it-yourself projects, discover technical potential and most likely also discuss politics and society [9]. The term "Maker Movement", on the other hand, ranges from an IT-oriented view to a traditional art-oriented view [9]. This resulted in MakerSpaces (MS), which nowadays have different characteristics as a basis. These can be referred to as FabLabs, HackerSpaces, or MakerSpaces. These characteristics have a spatial offer in common. The basic idea is to offer the community and entrepreneurs an infrastructure so that they can work on everyday problems as well as product ideas and find particularly creative solutions. In addition, they provide a place for free expression, development, and production of expertise and experience. [9, 10, 11]

The focus of MakerSpaces is on publicly accessible creative spaces that put the maker mentality and tinkering practices at the center. The concept refers to any generic space that encourages active participation, collaboration, and thus knowledge sharing among individuals and teams through the original use of technology. In particular, predefined structures are avoided to allow creative processes to be freely designed. [9, 11]

In general, four different goals pursued by an MS can be identified. First, bringing creative technology developments back to communities and cities is an important aspect. The related basic idea of open source and sharing have already led to descriptive innovations in the past. Thus, the proliferation of MS could bring a transformative force. Third, this is accompanied by the vision of creating better integration of science, technology, and business. The idea of spreading craftsmanship early and easily in the community generally leads to increased access to digital manufacturing technologies and tools. Potential startups subsequently support local economies and impact regions positively. [1, 9]

Tailored offerings and collaborative problem-solving in an open-space environment accelerate high-quality manufacturing. Such accelerated prototyping of new, highly customizable products is only possible in MS, in a risk-free and cost-effective manner. Thus, by default, MS are designed to create an environment that encourages the sharing of experiences and expertise. They encourage the use and creation of open content and data, including open hardware and software. Through a creation process based on unrestricted access to documentation, manuals, source code, or design drafts, projects are open to anyone who wants to reuse, revise, remix, and redistribute/process them. [1, 9, 10]

2.2 Production Requirements

Various challenges must be addressed to design an efficient value creation. The design of a business model that takes digitalization and Industry 4.0 into account can be supported by methods such as the Business Model Canvas [12] or Design Thinking [13]. These methods are already used in this context to design the value proposition or the revenue system [14, 15]. However, the resulting adjustments at the level of the design of the value creation processes require deeper methods, comparable to the challenge of existing companies to master the digital transformation [16]. Methods that focus on a systematic analysis of the current state of the company and the required degree of digitalization include the Industry 4.0 Maturity Index [17] or the VDMA Industry 4.0 Toolbox [18]. In the case of a start-up, these frameworks can only provide indications for designing the value creation processes, as they do not yet have any existing processes and need more than this strongly technology-driven perspective. As with existing companies, however, it is unrealistic to assume that a start-up can be built directly only on cyber-physical systems and fully digital solutions [19]. At the same time, the life cycle of a factory far exceeds that of its products, so new planning must at least take current possibilities into account [20].

When building new companies, the same or at least similar questions must therefore be answered as to when digitally transforming existing companies. Especially for later scaling, the planning of the value chain is crucial for cost-efficient product creation. Therefore, supply chain management must also be planned at an early stage.

Supply chain management is defined as "integrated process-oriented planning and control of the flow of materials, information and money along the entire value chain from the end customer to the supplier" [21]. The goals of supply chain management are very relevant, especially when scaling the production of physical goods, as shown by the examples of improved customer orientation, flexibility, reduction of inventory along the value chain, synchronization between supply and demand, and demand-oriented production [21].

To find out how relevant these design fields are for assisted founding teams with physical product ideas and how they are already taken into account in the pre-founding and founding phase, questions were derived based on the tasks of supply chain management.

In general, it was first asked whether the scaling phase had already been considered to assess the maturity of the current planning. The other questions (Are you already in exchange with suppliers?, How is production planned?, Where is production planned?, What are the customers' delivery requirements?) are based on the tactical tasks of the supply chain management task model (network planning). The further questions about inventory planning, supplier selection, and production or assembly capability integrate the operational level of the SCM task model (availability and feasibility check). Finally, the consideration of current challenges regarding sustainability and transparency was queried. The operational level was explicitly neglected since the survey addressed particular start-up projects before series maturity. [21]

3. Survey

The survey is a mixture of qualitative and quantitative research methods. On the one hand, free answers were required, so that subjective opinions of individual persons could be included in the results and the evaluation had to be done in word form. On the other hand, this survey, due to its composition of advisors and startup-oriented teams as well as startups, forms a homogeneous average of relevant and affected persons, so that the survey represents a representative sample. Besides the closed questions and multiple-choice answer options, a clustering of the submitted written answers was initially carried out, which in further steps led to a representation of percent. [22, 23] To be able to cover a basic population of the surveyed participants, an online survey was conducted – also in consideration of the short survey duration (two months). This offered the participants a certain degree of flexibility and allowed the questioner to evaluate the results digitally without delay. [24]

On the one hand, the target groups of the survey were persons and teams interested in founding a company (further referred to as Teams) who are in contact with an ESC (and the Centre of Entrepreneurship and Transfer, short CET) and who use or have used the offers for business model development and prototype development. On the other hand, the target group is composed of supervisors of the first target group as well as employees of the ESC and CET. They are direct supervisors and mentors with access to the industry as well as transfer managers and information and technology managers who have years of expertise in a wide range of industries and fields of activity (further referred to as Supervisors). Thereby a wide spectrum is covered.

In general, some questions were asked to both Teams and Supervisors. On the other hand, due to the different perspectives and backgrounds, some questions were only asked to the individual target groups.

The scope includes more than 40 participants and was conducted from November 2021 to January 2022. Around half of the surveys were not completed. Simply by the fact, that some questions could not be answered by the participants. These incomplete answers were removed from the evaluation. All results come

from fully completed surveys (20). Statistically, the number of participants does not indicate any possibility of significance, but in our case, it is negligible due to the participation of experts. Some of the experts have been working together with start-ups and start-up-oriented teams for more than 20 years. This made it possible to capture a broad spectrum and additionally include changes over time.

4. Results

The results of the survey are as diverse as its participants. The remainder of this section will first present the results for each target group and then focus on the results of the common questions.

The results show that more than half of the respondents have a technical-scientific background (e.g., Bachelor/ Master of Science, see Fig. 1). This is due to the proximity of the TU Dortmund University and the adjacent technology center.

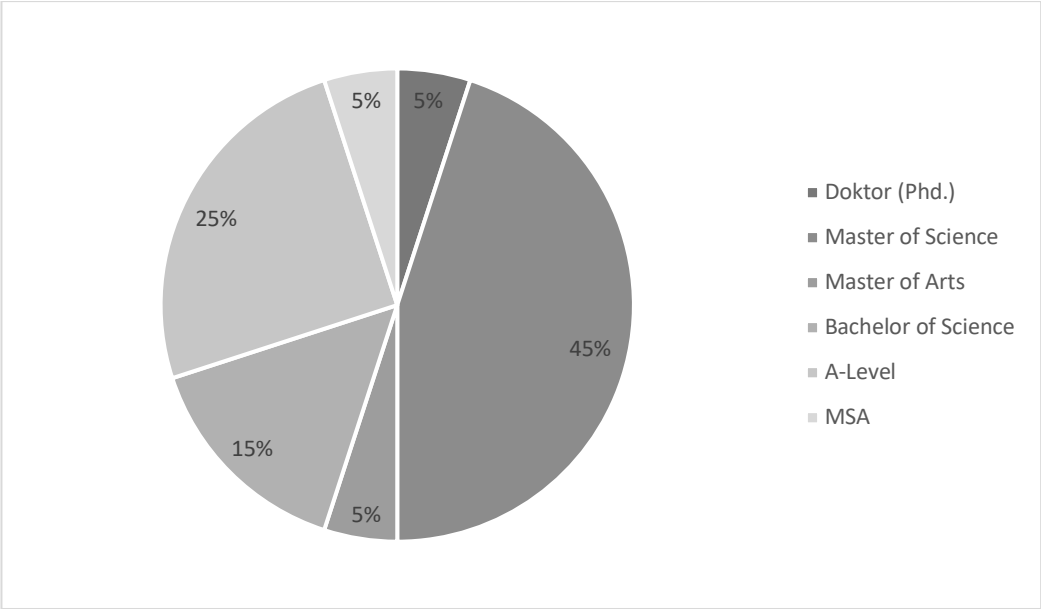

Figure 2: Highest educational degree of participants

On average, in their careers Supervisors have worked or continue to work with 18.93 Teams. In the numbers from supervisors is a wide disparity. The range is from five to 85 Teams. It should be noted that the experts already mentioned above could not specify the number of Teams here. Of the 18.93 Teams, an estimated 1.73 have been founded, although this is based on estimates and the data is not available, particularly for the experts with a high number of Teams under supervision. The planned start-ups of currently mentored Teams are 1.27, so in total there are potentially a total of 3 Teams per Supervisor. In addition, some Teams are in the planning stages of formation. The chances of success among all currently supervised Teams are estimated to be rather average. The range here also extends from one hundred percent conviction to failure. Reasons for this are seen in particular in the product-market fit and the lack of market potential. In addition, a lack of motivation among team members, an incorrect team structure, and a lack of support are given as reasons for the failure of teams (see Fig. 3).

In comparison, the Teams see the greatest problems and challenges in understanding and assessing customer problems and in the lack of innovation and development of the new product. Furthermore, a lack of motivation is also named as one of the main reasons (cf. Fig 4).

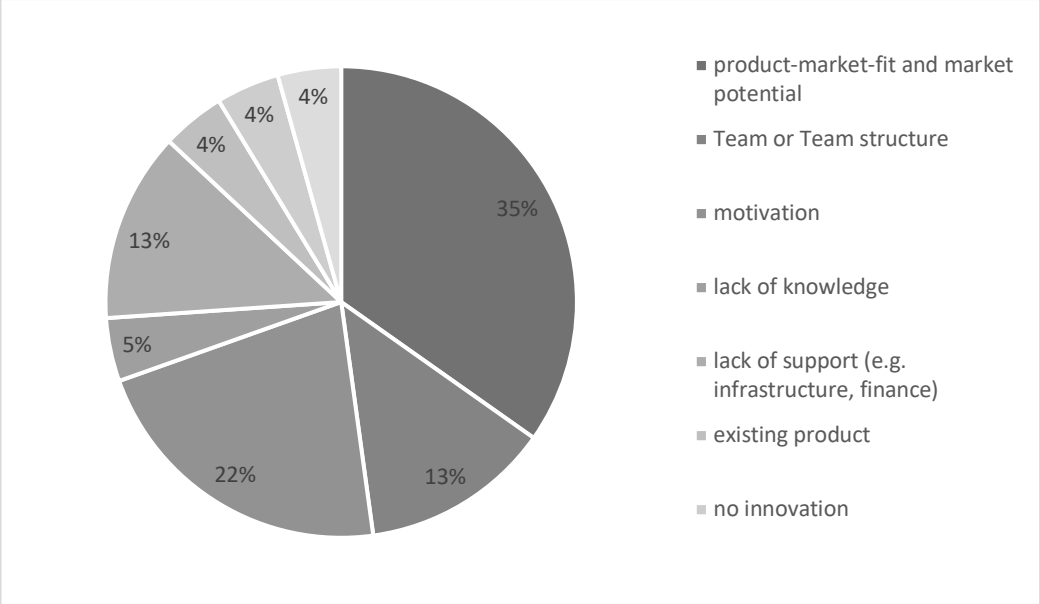

Figure 3: Typical reasons for failure according to supervisors

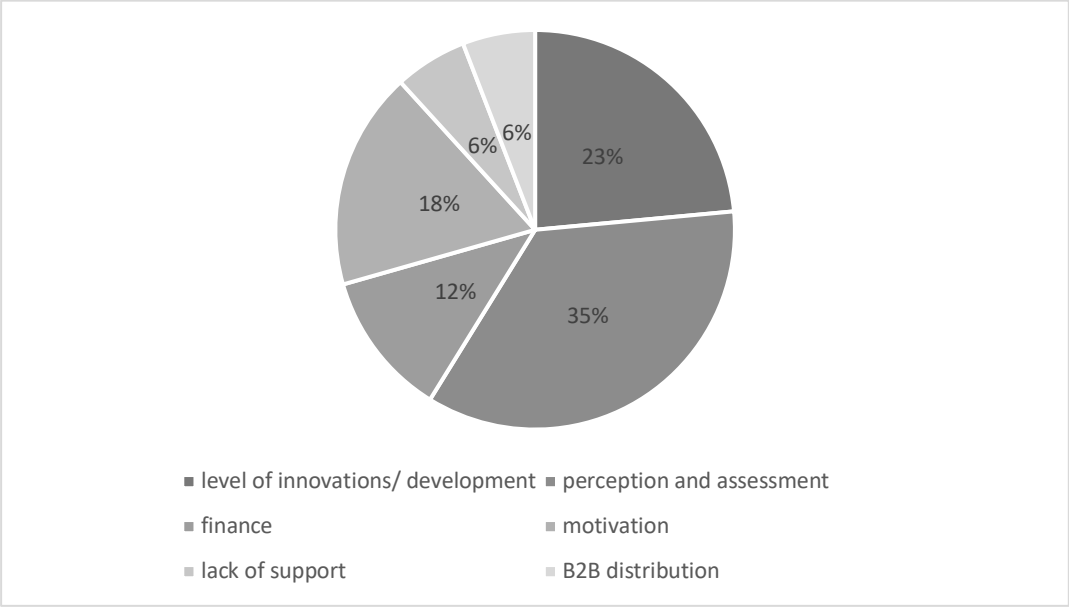

Figure 4: Biggest Problems and challenges according to the Teams

The current financing of the Teams is mostly granted through a funding scholarship. This is primarily the NRW start-up scholarship. Other options are the “EXIST Gründerstipendium” or a validation program such as VIP+, which are accompanied by the future possibility of an investor entry. In addition, fully self-financing takes place in 10% of the cases, which has the disadvantage that the focus is not completely placed on the foundation. In addition, a mixture of both options can take place.

In general, the teams consist of 3.6 members. In this survey, there was no founding of individuals.

Regarding business planning and business model development, the Business Model Canvas is mainly used. Since it was developed for business model development, this is not surprising. Other approaches are the Lean Canvas or the "jobs to be done" method. Design Thinking is primarily used to identify customer needs. Alternatives for this are stakeholder analysis or hypothesis testing. Details are always neglected in the development of the products and the business model. In particular, the Teams stated that they neglected

customer interests, their business financing, or the technical realization. Other areas are marketing or product extensions for the future (see Fig. 5).

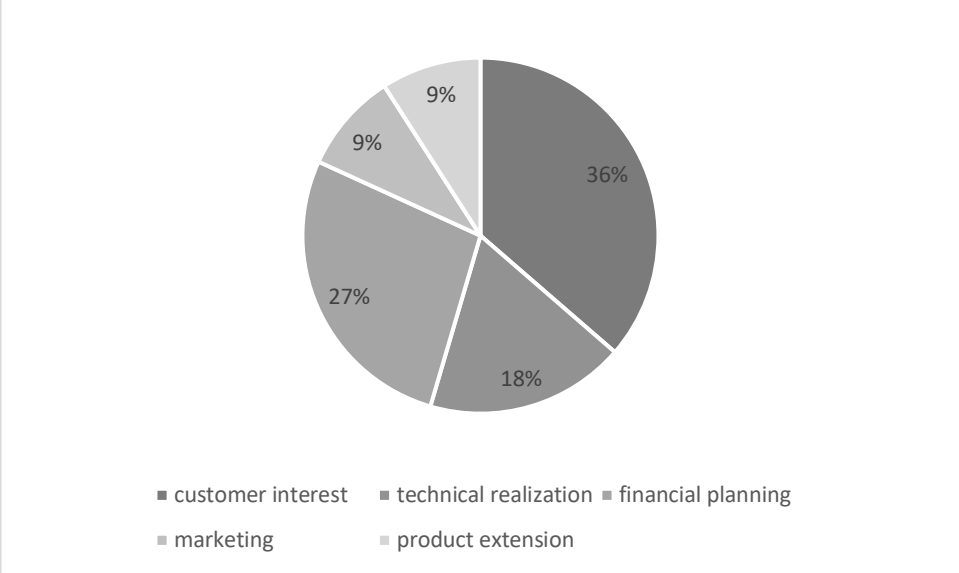

Figure 5: Deliberately neglected according to the Teams

In most cases, the production of a prototype is driven forward in parallel with the development of the business model. Only a quarter of the teams deal with a "make-or-buy" decision. Prototyping is mainly done in digital form (as the development of Applications or via AutoCAD/ 3D model) or using 3D printing. Consideration of future production and delivery is affirmed by 57% of the Teams. Only 43% do not consider this initially (see Fig. 6). Furthermore, few Teams take supplier information into account during their planning. Indeed, five out of six are planning their production within Germany.

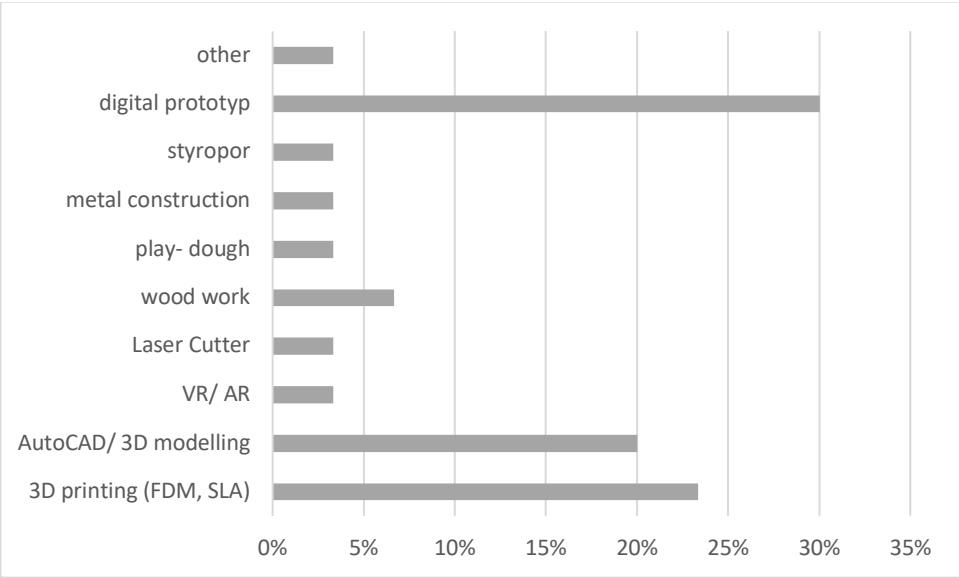

Figure 6: Methods used for prototyping

5. Discussion and Limitations

First of all, it is striking that the chances of success are rated moderately well by the supervisors. On a scale of 1 (very good) to 6 (no chance), the average is 3.06. The reasons here may lie in differences in perception. Many Teams are convinced of their idea and reject criticism as "unfounded" or “unjustified”. Furthermore, the Teams believe they understand the customer problem. Interestingly, the lack of market fit as well as the market potential is mentioned as the main reason for the failure by supervisors and equally listed as a problem and the biggest challenge by the Teams. Additionally, Teams report intentionally not addressing customer needs and technical implementation at the beginning. In this regard, new business models cannot succeed in reality without incorporating customer needs and the appropriate technical implementation. Reasons for this approach of the Teams are explained by the supervisors with a wrong self-perception, a certain naivety, and a lack of trust in the supervisors. Furthermore, the Teams produce their prototypes with the help of the MS. The Teams mainly (50%) use digital services, which can be explained by the increasing number of digital solutions and internet-based start-ups [25]. Further the results show that most of the start-ups with physical product ideas indicate that they are already thinking about the scaling phase, but hardly consider the tasks of supply chain management systematically. It should be emphasized that the majority are planning production in Germany and therefore the assumption of a positive influence of start-ups on industrial value creation in Europe is plausible.

Success factors can be derived as a reverse conclusion. Teams should therefore be realistic, rely on their mentors, and have a clearer focus on customer needs. In addition, production planning is an important element to take into account efficient production and later scaling.

Why the design fields of supply chain management are not yet systematically considered in the pre-start-up phase should be the subject of further research. Since the Design Thinking and Business Model Canvas methods are used very frequently, the conclusion is obvious that a supplementary methodology to highlight the design fields of supply chain management for start-up projects could make a contribution.

In summary, the Teams mostly need their support in identifying customer problems and maintaining motivation. Furthermore, it has been noticed that the number of digital solutions and digital business models is increasing. Therefore, an expansion of MS towards a combination with DataSpaces should be considered. A larger offer for a low-code environment as well as the support regarding digital and internet-based solutions should be investigated in further research work.

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Biography

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