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Do-it-Together Concept for Production Ecosystems

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Abstract

The do-it-yourself mentality is particularly widespread in the furniture sector. Homemade furniture is very popular. The individualisation of furniture can be observed in internet forums, such as the online platform Pinterest. These creative ideas of potential customers show a need for individualized sustainable pieces of furniture. The current production structures, however, do not allow individual production according to the end customer's specifications. In addition, information logistics faces a major challenge: making the creative ideas of end consumers available to producers in parametric form. Topics such as customer requirements in relation to sustainable production, material specifications, industrial property rights, fair production conditions and traceability are the focus of this data interchange. An open and innovative European furniture ecosystem must be created to connect all stakeholders in the production process. This is made possible by a platform that channels the creativity of consumers and makes it designable and producible through the professional skills of designers. This requires the involvement of manufacturing specialists who can produce personalised products through sustainable intelligent production technologies. An exchange of information must also take place securely and quickly in order to protect the personal rights of the sources of ideas. This is being developed in the EU research project INEDIT - Open Innovation Ecosystem for do-it-together process. By connecting many different stakeholders along the entire value creation process, a change towards efficient collaborative collaboration is achieved. This paper presents a project insight for the development of an international co-creation platform by presenting the problem and linking it to a potential solution.

Keywords

Sustainability; Social Manufacturing; Supply-Chain-Networks; Lean Manufacturing; Information Logistics

1. Introduction

1.1 Initial situation

For decades, industrial change has led to an increase in prosperity. Starting with the first industrial revolution, key technologies such as the steam engine, the use of electricity or the use of computers have increased the industrial performance of individual economies. The increase in economic output is directly related to increased prosperity [1]. As a result of growing prosperity and increasing digitalisation, people are more and more changing their demands on the value of consumer goods as well as material and immaterial services. The current fourth industrial revolution relates to the use of data in the context of production. The driving force behind this evolution is the increased urge for personalized products [2]. In many areas, consumers are looking for products that they can personalise to meet their individual needs [3]. This is reflected in the challenge to adapt the production of products to individual customer requirements. Manufacturing companies try to implement production according to batch size one. However, high costs and the integration

of new technologies are necessary. Furthermore, different customer requirements mean that used resources or the necessary expertise are no longer available centrally but decentrally. This leads to international logistics networks for producing individual goods. In order for the production of individualized goods to be produced according to specific customer wishes, a continuous distribution of information must be ensured. This applies to both internal and external business processes.

1.2 Problem definition and motivation

For years, industrial companies have pursued the goal of designing products in such a way that they can be manufactured as cost-effectively as possible (e.g. automation, lean production), neglecting the needs of customers [4]. Classical product development follows two essential patterns. Either products are developed and manufactured in a customer-neutral way, or the products are based on a market need [5]. Customer-neutral products are usually function-bound and are not subject to any need for individualization. Usually, these are functional products such as pipes, concrete, etc. Products influenced by customers are mainly found in the consumer goods industry. Here, the development process is geared to the needs of the customer. At present, these customer needs are determined by surveys or studies. The knowledge gained is incorporated into the product development process. The manufactured products can then be advertised and brought to market. This entails the danger that the manufactured products may not or only partially address customer needs. This type of product design has shaped society and boosted the growth of individual large companies. Small and medium-sized enterprises (SMEs) in particular have difficulties with their current incremental innovation strategy, organisational structure and business models to withstand market pressure [6]. The trend towards ever more individual products is one of the greatest challenges and at the same time a great opportunity to strengthen the position of SMEs.

With regard to sustainability, issues such as energy management or resource-conserving production are currently not in the focus of manufacturing companies. Companies do not collect data that enables production to be evaluated according to ecological aspects [7,8]. However, the changing market pressure caused by sustainability initiatives is causing companies to rethink their approach in this area as well. Companies are faced with the challenge of incorporating the sustainability aspect into their product development. This means a general rethinking and the creation of new structures to fulfil changing customer requirements and to sell products.

The goal therefore must be, to build an ecosystem of sustainable and interconnected production. This should match and withstand the requirements of digitalisation as well as the requirements of the customers. The involvement of different parties in the life cycle of a product must be guaranteed in order to enable small companies to access new technologies and networks.

2. Objective of research work

Nowadays, companies operate in the social era and try to strengthen their brand by integrating a sales platform. In addition to the product, companies try to sell an experience and enable interaction between customer and product. Many companies rely on the inclusion of platforms on which they carry out a new type of market research. The aim is to create a product in an affluent society that fulfils undiscovered customer needs and thus achieves a market advantage for the company. It illustrates the paradigm shift towards a platform economy. CUSUMANO provided the following definition [9]: “A platform strategy - as opposed to a product strategy - requires an external ecosystem to generate complementary product or service innovations”. In particular, this involves adapting the products to the customers’ requirements and thereby increasing the added value for the customers through an increased emotional bond. The Internet is used to include end consumers on platforms. In Europe, 76% of people in western Europe use the Internet [10]. This is equivalent to around 300 million people. It illustrates the enormous reach that can be achieved through

interaction on the Internet. The furniture industry in particular is lagging far behind other industries when it comes to using the Internet. In the furniture industry, only 16% of business is done online. For other products such as books or clothing, the proportion is over 60% [11]. This means that there is great potential for improvement in this sector.

The platform concept is used in the European research project INEDIT to achieve closer cooperation between a wide range of partners. The platform not only covers a specific area in the life cycle of a piece of furniture, but also covers all life phases from the generation of ideas to production and sales. The overall objective is to design and implement a framework for a new ecosystem that enables stakeholders to collaborate from conceptualisation to materialisation. The core elements of the project are shown in Figure 1.

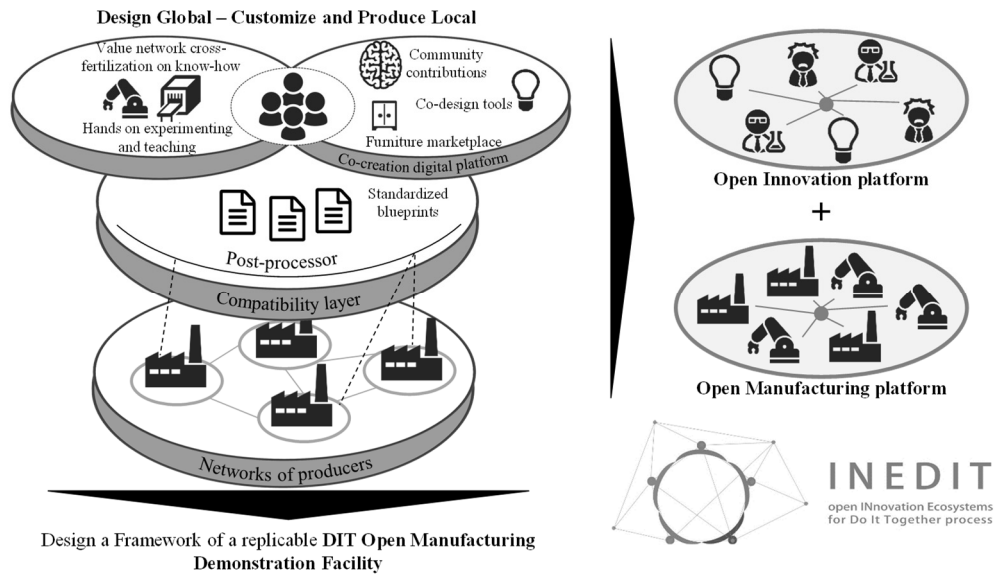


Figure 1: Conceptualization of the INEDIT objectives

INEDIT's customer-focused process on the one hand aims to channel the skills of consumers to enable them to make their own furniture. On the other hand, it enables industrial companies to integrate innovative technologies for machines (e.g. 3D-printing of recyclable plastic or wood), processes and sustainable use of resources into their portfolio. To achieve this goal, INEDIT integrates new methods and technologies to support creativity and design processes within the ecosystem. It supports access to production resources through the development of new sustainable production processes. These are integrated into agile production networks and thus simplify the personalization of furniture through a directed data flow up to the production level. Despite focusing on consumers, INEDIT will develop sustainable business models that are profitable for all stakeholders in an environmentally friendly way. In the following chapter, the core aspects of the platform concept will be discussed.

2.1 Do-it-together

Started with the usage of experimental and construction kits, the urge of the consumer for individualization became more and more entrenched over time. People began to transform their own ideas into objects. From the 1940s onwards, the idea of producing furniture for self assembly spread. By buying individual elements in a compact cardboard box, transport was made easier and the "unfinished" furniture was more affordable [12]. The necessary contribution of the buyer by assembling the individual parts led to an increased appreciation of the end product, as working time and energy were invested [13]. The consumer was involved in the production process. The aspect of an individualised end product which is particularly important today, however, is not yet present in the furniture for assembly [14]. If everything was assembled according to instructions, the similarity of the furniture was more an indication of correct and flawless work. This is where

the so-called "do-it-yourself" concept begins. "Do-it-yourself" refers to all forms of self-made work in all areas [13]. However, the person who did it himself did not receive any professional training, but rather learned the skills himself [12].

The guiding principle of the newly conceived platform is "Design Global - Produce local". This implies the cooperation of different partners and describes the further development of the "do-it-yourself" concept. According to HIRSCHER ET AL., social manufacturing is a way of producing physical products by enabling individuals or groups to contribute to all activities of the development process, such as Idea, design and production [15]. Social manufacturing can be seen as crowdsourcing for manufacturing, which promotes a paradigm shift towards a decentralized and socialized approach of mass individualization of products [16]. It was first tested in the fashion industry, based on collaboration in the production of garments, which allows consumers to participate in different phases of the production process. At the same time, it enables consumers to create new innovations during the design process. This is just an added value created through collaboration. Furthermore, social, economic, environmental, knowledge, experience and emotional benefits can be identified [15]. The social concept approaches of cooperation in value creation networks go hand in hand with the strengthening of small and medium-sized enterprises. The social bond to local companies is also based on good and open communication. Smaller companies therefore have an advantage for open innovation processes [17]. The smaller production series of highly individualised products also fit very well with the smaller capacities of smaller companies. Finally, this type of collaboration in networks offers great potential for new business opportunities leading to new business ethics. This is based on the importance of joint learning, novel value creation and collaborative production in an extensive network [15].

All this is summarized within the concept "do-it-together". The independent individualization of furniture according to the "do-it-together" concept, which is typical for the furniture industry, is to be replaced and the advantages mentioned are to be exploited. As can be seen in Figure 2, the "do-it-yourself" concept is intended to generate added value.

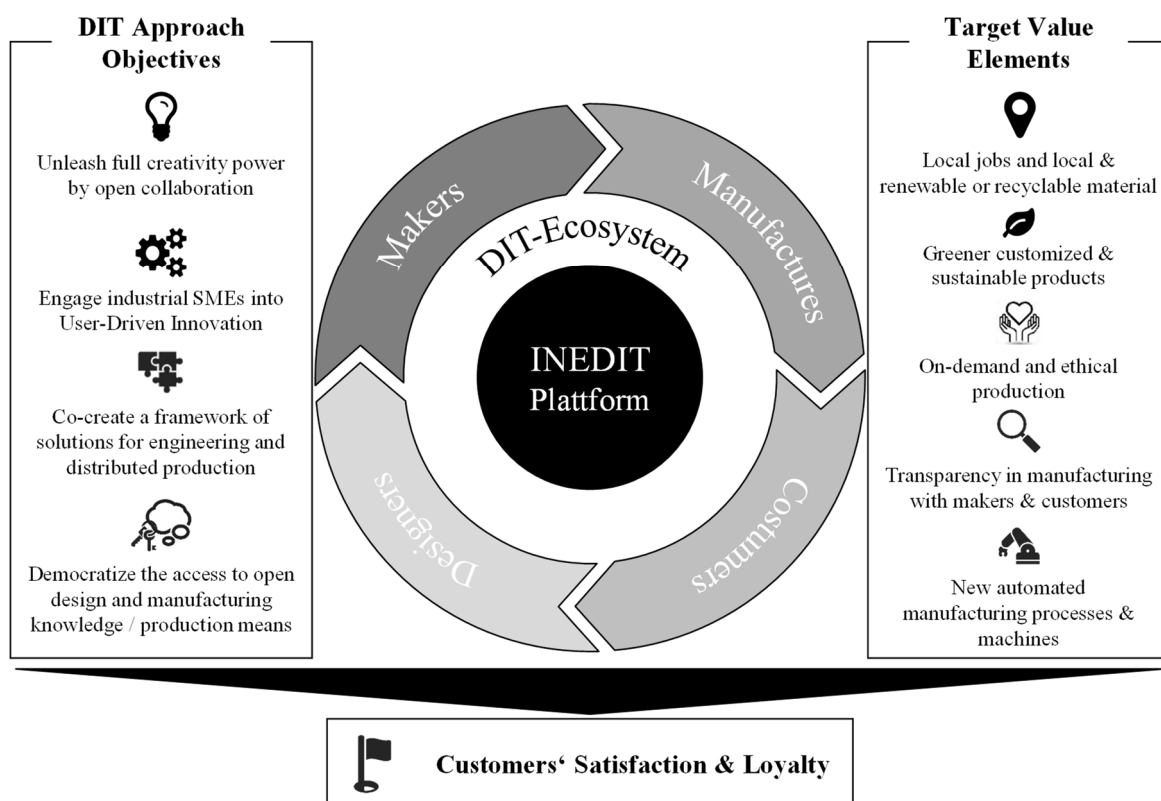


Figure 2: INEDIT Objectives and Targeted Value Elements

2.2 Sustainability

In today's society, a sustainable way of life is widespread and can be realized especially in wealthy regions through a diverse range of sustainable goods. In contrast to this, for industrial companies the environment is perceived as irrelevant [7]. Companies act according to imposed standards, which, differ worldwide and are predominantly perceived as obstructive. This is one of the reasons why production is relocated globally. In such a way, environmental requirements can be avoided. Furthermore, the prevalence of environmental management systems in companies is very low [8]. Many companies do not collect any data to evaluate the energy consumption of individual machines and systems. Furthermore, no data and protocols are collected on the equipment used that could be used for evaluation purposes. All these aspects do not generate any usable added value for the product for companies as things stand today. For most companies, pure data collection and evaluation as well as evaluation according to sustainability aspects is an activity that does not contribute to sales. Even savings in energy consumption are not very attractive for companies at today's prices for raw materials.

Only end customers can change this. The trend towards sustainable products is obvious [14]. The movement towards a sustainable lifestyle, driven mainly by the younger generations, could also represent a potential opportunity for the manufacturing industry. A sustainably produced product will increase the chance of selling it in the future [18]. To do this, however, companies must first use sustainable raw materials and use them in energy-efficient production processes. The co-creation platform of the INEDIT research project is intended to strengthen this development. Sustainable cooperation is one of the core aspects of the platform. The platform is intended to promote sustainable and resource-saving production. For this purpose, the evaluation of the environmental impacts of newly developed designs is made possible via the platform. The evaluation refers to the complete life cycle of the product. The DIT environmental assessment model calculates a set of Environmental Key Performance Indicators (E-KPIs) on the basis of the production instructions created. These can then be evaluated using an assessment model in order to derive action measures that can reduce part of the calculated environmental impact. Instructions for action should then be translated into real production instructions and transferred to the machining centers in use. However, instructions for action can also be included in the design process (e.g. proposal of an alternative, more sustainable material). In this way, the platform supports the development and production of sustainable furniture.

2.3 Information network and business model

Open innovation platforms explicitly include the business model as a source of value creation for all participants [19,6]. However, many open innovation platforms create products that are unsustainable and have neither a high utility value nor a positive long-term impact on the quality of life of consumers. They also have difficulties establishing themselves in the market. The deficit of the existing platforms is that the business models are not sustainable, focus exclusively on customer benefits and often cover only a part and not the entire value chain of product creation.

The business models of existing platforms address only a part of the stakeholders in the value chain of product design. While business models of some platforms reach a large community of consumers to understand their needs, the business model of other open innovation platforms is primarily production-oriented. RAYNA distinguishes between two types of platforms where product design is supported either by the consumer community or by cooperating manufacturers [20]. Examples of consumer-oriented communities are Quirky, FanVoice or even deinschrank.de. On these platforms, manufacturers are not integrated into the design process. This creates a need for low manufacturing complexity of the products. With the low complexity, mass production can be achieved, which is inflexible to change requests. Representatives for production-oriented platforms are Opendesk and Ideapoke. Complex products can be manufactured on these platforms. However, customers do not have the opportunity to participate intensively

in the creation process, as the ability of the producers is in focus. In order to exploit the full potential, all partners along the value chain must be included in the business model of the co-creation platform [21]. The business model of the INEDIT DIT Open Innovation Platform will include both consumer-oriented and product-oriented open innovation. Designers, developers and manufacturers will be involved to ensure customer-oriented production.

Currently, business models of open innovation platforms are primarily designed for the mass production of products. Individual preferences and sustainability cannot be taken into account. Therefore, mass production must be transformed into mass customisation by addressing customers and creating an interface between digital and physical space. By establishing a co-creation platform where both consumers and professionals work closely together to develop products, INEDIT is contributing to this change by going beyond digital value creation. This link between consumer and production enables the INEDIT platform to develop products with a higher manufacturing complexity than existing platforms. As design and local collaboration spaces are considered necessary to achieve appropriate open knowledge generation across the entire value chain [22], INEDIT will innovate the existing landscape of business models.

With regard to the functions necessary for successful collaboration, many current platforms still lack sufficient components for successful open innovation product development [23]. The lack of tools and the associated restriction of community cooperation ultimately leads to a higher risk for an unsuccessful platform [24]. Therefore, a business model is needed that takes into account a value creation network that encompasses both the scope of online and offline collaboration. A major challenge with existing open innovation platforms is the participation of users in the commercial profit of the platform. Innovative users will only be won over in the long term if they receive sufficient incentives for cooperation [25]. A revenue mechanism that takes into account both monetary and non-monetary rewards has not yet been developed and there are only a few platforms that currently benefit from online collaboration.

3. Outlook and vision

The mentioned problems, which are to be found particularly in the furniture industry, are to be addressed by the co-creation platform. The establishment of the platform should, on the one hand, strengthen the cooperation between partners from different countries and on the other hand strengthen small and medium-sized enterprises in the global market. The sustainability goals are to be anchored in a business model. A reward system is to ensure sustainable cooperation. INEDIT wants more people to be able to implement their own ideas and identify more strongly with their furniture. Due to the higher emotional bond and the more appropriate functions of a piece of furniture, a trend reversal is to be initiated that will put an end to the throw-away society. The newly created production and information networks should result in increased innovative strength. The production technologies will undergo a major change due to the processing of recycled raw materials and the urge for individual production. Compared to today, the corresponding information network for the international exchange of information and knowledge must become much more efficient. In addition, the company's IT must also enable customer-oriented production. This includes the production of prototypes as well as the flexible reaction to short-term change requests.

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Biography



Andreas Külschbach M.Sc. (*1991) has been working as a project engineer at FIR at RWTH Aachen University since 2017. In his current position as part of the Production Management Division, he supports companies in various industries in the design and implementation of efficient production and logistics systems. He also participates in different research projects.



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