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DESIGN THINKING AND ITS USE TO BOAST INNOVATIVENESS

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Purpose: The aim of the paper is to analyze the innovations in design thinking.
Design/methodology/approach: Critical literature analysis. Analysis of international literature from main databases and polish literature and legal acts connecting with researched topic.
Findings: It could be pointed out that exist the relationship between design thinking and the organizational innovativeness. Design Thinking began it's important role especially when start-ups were start to increase in the global market. Nowadays this method plays important role as a part of dynamic, agile action on the world stage and in various sectors of business from teaching to building IT systems. Because of that method can be used as a boast in innovative activities in many sectors. The publication describes main relations between design thinking and innovations and give an overview of the tools used in design thinking to boast innovativeness.
Originality/value: Detailed analysis of all subjects related to the problems connected with the innovations and design thinking.

Keywords: Industry 4.0; innovation, industrial enterprise, design thinking, innovativeness.

Category of the paper: literature review.

1. Introduction

Design can be defined as both noon and a verb in the context of any creative activity. As a verb, design is the process of originating and developing a plan for an aesthetic and functional product or service, which usually requires considerable amount of research, thought, modelling, iterative adjustment and re-designing. As a noon it is both for the final plan of action or the result of following plan of action. The industrial design process and methods are in part based around innovation and creativity and guides projects through a fuzzy and chaotic reality while keeping a close touch with the end user (Gullberg et al., 2021). Those concepts can be used in Industry 4.0 condition in industrial enterprise to boast it's innovativeness (Jonek-Kowalska, Wolniak, 2021, 2022; Jonek-Kowalska et al., 2022; Kordel, Wolniak, 2021; Orzeł,

Wolniak, 2021, 2022; Ponomarenko et al., 2016; Stawiarska et al., 2020, 2021; Steculа, Wolniak, 2022; Olkiewicz et al., 2021).

The aim of the paper is to analyze the design thinking from innovativeness point of view.

2. The basic rules of design thinking

Design thinking is an activity that is implicit in the process of design. As a concept Design Thinking emerged in the latter part of twentieth century. The discourse on design and design thinking is grounded in traditional disciplines such as industrial and graphic design as well as engineering and architecture. We can define design as the principal mark that distinguishes the profession from science (Brzoska, 2016). Design thinking refers to creative strategies that designers utilize during the process of designing (Visser, 2006). Design thinking is also an approach which can be used to consider issues and resolve problems more broadly than within professional design practice and has been applied in business and to social issues (Dorst, 2011, abek, Wolniak, 2013, 2016; Hys, Wolniak, 2018). Design thinking in business uses the designer's sensibility and methods to match people's needs with what is technologically feasible and what a viable business strategy can convert into customer value and market opportunity (Dorst, 2012). The qualities of design thinking are affected by variables such as fixation, creativity, process strategy, and generation of alternatives. A significant part of the problem-solving process in design thinking involves the ability to synthesize knowledge from a variety of sources (Cross, 2007; Pink, 2006). For this reason, design thinking has a multidisciplinary character. Attempts have been also made to distinguish design thinking as a form of abductive thought which has the capacity to generate novel ideas (Dorst, 2012).

Also design and design thinking is an integral part to the production of things or artifacts. Indeed, design thinking is implicated in all aspects of the manmade world from physical artifacts to symbolic and conceptual objects. Design thinking should involve all form of cognitive activities including remembering, understanding, applying, analyzing, evaluating and creating (Anderson, Shattuck, 2012). Design thinking is mainly about building innovators who can use the design thinking paradigm to transform ideas into reality, to transform organization, and to transform all aspects of life (Wolniak, 2016; Czerwińska-Lubszczyk et al., 2022; Drozd, Wolniak, 2021; Gajdzik, Wolniak, 2021, 2022; Gębczyńska, Wolniak, 2018, 2023; Grabowska et al., 2019, 2020, 2021). There are four rules of design thinking to be fulfilled in the process. The rules are described in the Table 1.

Table 1.
Rules of design thinking

Rules	Explanation
Human rule	All innovator activity is ultimately social in nature. Human rule is based on individuals, but teamwork is also necessary to invent new and challenging innovations. The team should be diverse and agile to do the process of creating innovations best. People are the most valued asset in the design process.
Ambiguity rule	Innovators must preserve ambiguity. (Never go home with just one idea.) Innovation demands experimentation at the limits of knowledge, at the limits of the ability to control events and with the freedom to see things differently. The innovation must always be in a rebuilding mode. The process of creating innovation can be long and the ambiguity may be frustrating, but it is necessary to create alternative futures.
Redesign rule	All innovation is re-innovation. When looking to the future, it is always helpful to look to the past. Try to understand previous solution of the problem and learn from them. Because technology and social circumstances change constantly, it is imperative to understand how needs have been addressed in the past and by whom. Then we can more easily apply the foresight method to estimate basic social and technical conditions that we could encounter 5, 10 or more years from now.
Tangible rule	Make innovation tangible. Being tangible is essential because we need to learn rapidly in order to produce well. Conceptual prototyping has been a central activity in design thinking in all cases.

Source: On basis: (Plattner et al., 2015; Carleton, Cockayne, 2013).

3. Stages of design thinking

Design Thinking consists of five successive stages. All stages are indispensable and should be done sequentially without leaving out any of them. We can distinguish five stages of Design Thinking as follows (Figure 1, Table 2):

- empathize,
- define,
- ideate,
- prototype, and
- test.

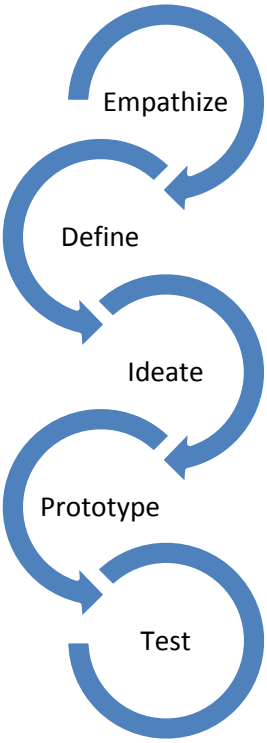

Figure 1. Five steps of Design Thinking.

Source: Wolniak, 2017.

Design thinking process realisation in the company should take into account following steps (Hobcraft, 2020):

- Design Thinking starts with empathy, a deep human focus to gain insights which may reveal new and unexplored ways of seeing, and courses of action to follow in bringing about preferred situations for business and society.
- It involves reframing the perceived problem or challenge at hand, and gaining perspectives, which allow a more holistic look at the path towards these preferred situations.
- It encourages collaborative, multi-disciplinary teamwork to leverage the skills, personalities and thinking styles of many in order to solve multifaceted problems.
- It initially employs divergent styles of thinking to explore as many possibilities, deferring judgment and creating an open ideation space to allow for the maximum number of ideas and points of view to surface.
- It later employs convergent styles of thinking to isolate potential solution streams, combining and refining insights and more mature ideas, which pave a path forward.
- It engages in early exploration of selected ideas, rapidly modelling potential solutions to encourage learning while doing, and allow for gaining additional insights into the viability of solutions before too much time or money has been spent

- It tests the prototypes which survive the processes further to remove any potential issues.
- It iterates through the various stages, revisiting empathetic frames of mind and then redefining the challenge as new knowledge and insight is gained along the way.
- It starts off chaotic and cloudy steamrolling towards points of clarity until a desirable, feasible and viable solution emerges.

Table 2.
Five stages of Design Thinking

Stage	Characteristic
Empathize	Stage is used to determine the characteristics of the audience for which the product is designed through detailed observations, interviews or surveys. This way you can find detailed information about the product users and their needs. Innovation always starts with a thorough diagnosis of the needs and expectations of users and potential users of the product while also understanding the technical conditions and markets conditions of the product.
Define	In this step the team should specify the user needs. The interdisciplinary team should carry out a synthesis of the information which was collected during the previous phase of the process to determine the extent of the problem. A design brief should present the client's requirements for a job. These may be verbal or written, simple or complex. A brief should contain a specific goal to be met by the design. During the analysis standard frame of mind and habits should be rejected, in order to design the most creative and customer-oriented solutions. This stage is relatively difficult, because people naturally will work on specific solutions, which are known to them, and do not move in the uncertainty of many possible directions. Note, however, that too rapid concretization of solutions can lead to a situation in which a solution will not sufficiently satisfy the needs of the customer. Example questions: • Do you understand what the client is asking for? • Does the client understand what they are asking for? • Do you agree on the definition of terms? • Does the brief have any flaws? • Can you manage client expectations?
Ideate	At this stage, using tools such as brainstorming, we should generate as many creative ideas as possible. Please note that, in accordance with the rules of brainstorming even the most improbable ideas and solutions should be considered. Generating good ideas requires not only technical knowledge on the topic, but also ingenuity, courage and creativity. In order to facilitate this process everyone should refrain from criticism of ideas generated by other team members. This phase should be completed by evaluating and selecting the best idea. Then a prototype of the solution should be created. At this stage, a design team might also choose to harness one of the multitudes of art and design movements as a paradigm. As the ideate stage progresses, it will become clear whether there are any misunderstandings or shortcomings in the definition stage and whether enough research was done. Feedback can be sought through the design process to clarify points with the client and to address aspects which were ill-defined during the definition stage. Example questions: • Do you understand the brief? • Do you have enough research information? • Which methods will be used for idea generation?

Cont. table 2.

Prototype	In this step, it is necessary to build one (or in some cases several solutions), assembly and test the prototype(s) prior to the presentation. During the building phase the prototype is created as a physical representation of a solution to the problem. The basic function of the prototype is the ability to present visual solutions for users and fast feedback on its operation. This way you can check whether the project complies with the requirements set by the customer or are changes to made. A prototype gives the design team and client the ability to visualize and handle a design concept, to get an idea of its physical presence and tactile qualities. You can never be entirely sure that the final product will be a success, even if you have previously conducted tests using prototype solutions, Frequent building, improvement and testing of prototypes may be necessary. This approach ensures that the client's expectations have been fulfilled and the risk of potential failure has been minimized. The aim of prototype is to test various aspects of a design solution. To do this all aspects of the design solution should be effectively evaluated. To convey the idea of what the design solution might look like, a prototype does not need to be made with the final materials. Example questions: • Do all potential solutions require prototyping? • What elements will the prototype test? • What functionality will the prototype have?
Test	In the last stage the prototype should be presented as a solution to the original client in order to obtain their opinion on the generated product. In this way, you can test its functioning. At this stage, the aim is to check the functioning of the designed solution in a real environment in which the product will be used. Specify the necessary parameters and their values, so you can clearly determine the results of the test. In this step you should involve many people in the testing process. Omission of this step in the design process can lead to a situation that the proposed solution does not quite meets the required assumptions and expectations of customers. Example questions: • Has the client signed off on the design(s)? • Have printers or other production professionals been booked? • Has the artwork been delivered to production professionals? • Has the job been proofed against the design? • Has the finished job been delivered?

Source: On base: Ambrose, Harris, 2010; Tschimmel, 2012.

Sometimes authors distinguish seven steps of design thinking, such as define, research, ideate, prototyping, selection, implementation and learning as shown in Table 3 (Hobcraft, 2020).

Table 3.
Seven stages of Design Thinking

Stage	Characteristic
Define	A precise understanding of the problem and its constraints which allow a more exact solution to be developed.
Research	The stage reviews information, such as the history of the design problem, end-user research and opinion-led interviews. In this stage we can identify potential obstacles.
Ideate	In this stage end-user motivations and needs are identified and ideas are generated to meet these, for example through brainstorming.
Prototyping	In this stage we should to resolve ideas, which are presented for user-group and stakeholder review, prior to being presented to client.
Selection	In this stage the proposed solution is reviewed against the design brief objective. Some solutions might be practical but may not be the best ones.
Implementation	In this stage we should finalize the design for the purpose of delivery to the client.
Learning	The stage helps the designer(s) to improve their performance and, for this reason, designers should seek client and target audience feedback and determine if the solution met the goals of the brief. This may identify improvements that can be made in the future.

Source: On basis: Ambrose, Harris, 2010.

4. Design Thinking and inovativeness

The method of design thinking can be used to resolve many problems connected with innovativeness (Wolniak, Sułkowski, 2015, 2016; Wolniak, Grebski, 2018; Wolniak et al., 2019, 2020; Wolniak, Habek, 2015, 2016; Wolniak, Skotnicka, 2011; Wolniak, Jonek-Kowalska, 2021; 2022). For example following issues can be resolved using described method (Hobcraft, 2020; Sułkowski, Wolniak, 2015, 2016, 2018; Wolniak, Skotnicka-Zasadzień, 2008, 2010, 2014, 2018, 2019, 2022; Wolniak, 2011, 2013, 2014, 2016, 2017, 2018, 2019, 2020, 2021, 2022; Gajdzik, Wolniak, 2023):

- redefining value,
- human-centred innovation,
- quality of life,
- problems affecting diverse groups of people,
- involving multiple systems,
- shifting markets and behaviours,
- coping with rapid social or market changes,
- issues relating to corporate culture,
- issues relating to new technology,
- re-inventing business models,
- addressing rapid changes in society,
- complex unsolved societal challenges,
- scenarios involving multidisciplinary teams,
- entrepreneurial initiatives,
- educational advances,
- medical breakthroughs,
- inspiration is needed,
- problems that data can't solve.

Design thinking is an approach to collaboration, learning, problem solving and innovation. In practice the whole design process is a structured framework for identifying challenges, gathering information's, generating potential innovations, refining ideas and testing new solutions. The main reason why companies strive for innovation is to be more flexible and adaptable to the new and dynamic business environment on the market. In this situation new adaptive instruments are needed to initiate this new ideas. This opportunity is provided by the design thinking method because it can be a strategic and a key tool facilitating the combination of internal processes in an organization and take them to a new level by focusing on the customer and its needs. Practice in many organizations shows that when managers perceive the framework of design thinking ad an approach in their every activity and such of their companies (new products, new services and experiences, marketing, human resources, innovation, etc.)

the result is reaching desirable market solutions with an added value for the user and also secure realization and profit for the organization (Ivanova, Koleva, 2020).

According the type of analysis we can achieve various effects using design thinking methods. In the table 5 we distinguished some typical varieties of Design thinking. Each of them can have various impacts on the innovations. There are also many typical common Design thinking tools. We describe them in the table 5.

Table 4.
Types of Design thinking

Type	Characteristic
Design Thinking	Also known as Meta Design Thinking, Strategic Design Thinking, and Transformation by Design. Method starts upstream with no outcome assumptions, and results in diverse outcomes.
Product Design Thinking	Starts downstream with product creation assumptions and results in product outcomes.
Service Design Thinking	Starts downstream with service creation assumptions and results in service outcomes.
Experience Design Thinking	Starts downstream with experience creation assumptions and results in experience outcomes.

Source: On base: Hobcraft, 2020.

Table 5.
Design thinking tools

Tool	Characteristic
Visualization	Tools involves the use of imagery, either visual or narrative. In addition to traditional charts and graphs, it can take the form of storytelling and the use of metaphor and analogies, or capturing individual ideas on post-it notes and whiteboards so they can be shared and developed jointly.
Ethnography	It encompasses a variety of qualitative research methods that focus on developing a deep understanding of users by observing and interacting with them in their native habitat. Techniques here would include participant observation, interviewing, journey mapping, and job-to-be-done analysis.
Structured collaborative sense-making techniques	Tools like mind mapping facilitate team-based processes for drawing insights from ethnographic data and create a "common mind" across team members. Collaborative ideation, using brainstorming and concept development techniques, assists in generating hypotheses about potential opportunities. These tools leverage difference by encouraging a set of behaviors around withholding judgment, avoiding debates, and paying particular attention to the tensions difference creates in the process of seeking higher-order thinking and creating more innovative solutions.
Assumption surfacing	Tool focuses on identifying assumptions around value creation, execution, scalability, and defensibility that underlie the attractiveness of a new idea.
Prototyping	Its techniques facilitate making abstract ideas tangible. These include approaches such as storyboarding, user scenarios, metaphor, experience journeys, and business concept illustrations. Prototypes aim to enhance the accuracy of feedback conversations by providing a mechanism to allow decision-makers to create more vivid manifestations of the future.
Cocreation	Toll incorporates techniques that engage users in generating, developing, and testing new ideas.
Field experiments	Tolls are designed to test the key underlying and value-generating assumptions of a hypothesis in the field. Conducting these experiments involves field testing the identified assumptions using prototypes with external stakeholders, with attention to disconfirming data.

Source: On base: Liedka, 2015; Ivanova, Koleva, 2020.

5. Conclusion

According to the research carried by D. Modrzejewska (2020) exist the relationship between design thinking and the organizational innovativeness. Design Thinking began it's important role especially when start-ups were start to increase in the global market. Nowadays this method plays important role as a part of dynamic, agile action on the world stage and in various sectors of business from teaching to building IT systems. Because of that method can be used as a boast in innovative activities in many sectors. The publication describes main relations between design thinking and innovations and give an overview of the tools used in design thinking to boast innovativeness.

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