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THE DESIGN THINKING METHOD AND ITS STAGES

24.1 INTRODUCTION

Design is a process that turns a brief requirement into a finished product or design solution. The design process engages a high degree of creativity but in a way that is controlled and directed by the process so that it is channeled towards producing a viable, practical solution to design problem, meeting or excelling the stated aims of the brief. While creativity in design is important, design is an activity that serves economic as well as creative goals. The design process helps ensure that a design satisfies all such considerations. The process is important to generate many possible solutions and utilizes various techniques or mechanism that encourages participants to think outside the box in the pursuit of creative or innovative solution [1].

In recent years, many people and organizations have discovered the power of Design Thinking in the case of creating innovations. This method combines users' perspectives, technological feasibility, and business perspectives to work out innovative solutions beyond typical expectation. Design Thinking has the power to transform the way we work by transforming the way we think, approach problems, and develop products and services [19]. The aim of the paper is to describe the role and basic concept of design thinking and also to analyze main steeps of design thinking process.

24.2 DESIGN THINKING – DEFINITION OF THE PROBLEM

Design thinking is an activity that is implicit in the process of design. As a concept Design Thinking emerged in the later part of twentieth century. The discourse on deign 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. The qualities of design are affected by many variables such as fixation, creativity, process strategy, and the generations of alternatives [12]. To elevate the status of design, originate the conception of Design Thinking. A significant part of the process solving activities in design thinking involves the ability to synthesize knowledge from variety of sources. This is the reason of multidisciplinary character of Design Thinking concept [14].

Design thinking refers to creative strategies designers utilize during the process of designing [22]. Design thinking is also an approach that 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 [9]. 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 [3]. 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 variety of sources [7, 18]. For this reason, design thinking has a multidisciplinary character. Attempts have been also made to distinguish design thinking as a form of abductive thought in light of tis capacity to generate novel ideas [8].

Also design and design thinking is integral part to the production of things or artifacts. Indeed, design thinking is implicated in all aspects of man-made word 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 [2]. A core premise of the design thinking concept is that innovative capacity is less determined dispositionaly than it is situationally [4, 5, 16, 17, 23, 24, 25, 26]. This means that the approach claims that innovative capacity is not to be found in a person's trait but rather in the characteristic of the situation a person engages in (such as for example specific design thinking practices) [3, 13, 15, 20, 27, 28, 29, 30].

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. There are four rules of design thinking to be fulfilled in the process. The roles are described in the Tab. 24.1 [19].

Tab. 24.1 The rules of design thinking

Rules	Explanation
The human rule	All innovator activity is ultimately social in nature. The all system is based on individuals, but team 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.
The 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.
The re-design 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 [12]. 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 easier apply foresight method to estimate basic social and technical conditions we could encounter 5, 10 or more years from now.
The tangible rule	Make innovation tangible. Being tangible is essential because we have to learn rapidly in order to produce well. Conceptual prototyping has been a central activity in design thinking is all cases.

Source: own elaboration based on: [6, 19]

Value is a term often used in design. A designer "adds value" to a particular project or brand through the creation of a visual identity. Value in this context can be thought of in several, quite different ways. For the owner of a design studio, for example, value is linked with productivity: the work completed in a given time.

Within the context of design thinking we focus on the value created by design for the client. In this context the more difficult problem is to measure and gauge the value. Design thinking has to focus on producing a design solution that communicates positively with target audience rather than merely looking different aesthetically [1].

24.3 FIVE STAGES OF DESIGN THINKING

The Design Thinking consist of five successive stages which every team using this conception may use in the process. All stages are indispensable and should be conducted subsequent without leaving some of them. We can distinguish five stages of Design Thinking (Fig. 24.1):

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

In the Tab. 24.2 there is the characteristic of all mentioned stages of Design Thinking.

Sometimes authors distinguish seven steps of design thinking such as [1] (Tab. 24.3):

- define,
- research,
- ideate,
- prototyping,
- selection,
- implementation
- and learning.

Very interesting and useful approach to design thinking is to undertook the improvisation. In the Tab. 24.4 there is an analysis of problem how to embody improvisation in the design thinking activity.
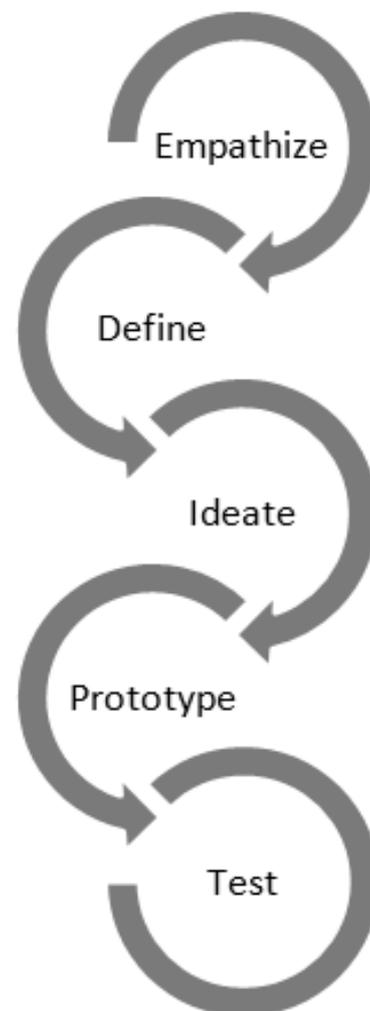
Fig. 24.1 The five steps of Design Thinking
Source: own elaboration

Tab. 24.2 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, and 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 that was collected during the previous phases of the process of empathization, 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 that to meet by the design. During the analysis should be rejected standard frame of mind and habits, in order to design the most creative and customer's 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 be sufficiently satisfied the needs of the customer. Example questions: - Do you understand what 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 to 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 taken into account. Generating good ideas requires not only technical knowledge on the topic, but also ingenuity, courage and creativity. In order to facilitate this process should refrain from criticism of ideas generated by other team members. This phase should be completed by evaluating and selecting the best idea on the basis of which then created a prototype solution. At this stage, a design team might also choose to harness one of the multitudes of art and design movements as paradigms. A design brief can be given a modernist, abstract, constructivist or deconstructivist for example. As the ideate stage progresses, it will become clear whether there are any misunderstundings or shortcomings in the definition stage and whether sufficient levels of research were carried out. Feedback can be sought through the design process to clarify points doubt with the client and to address aspects that were ill-defined during the definition stage. Example questions: - Do you understand the brief? - Do you have sufficient research information? - Which methods will be used for idea generation?
Prototype	In this step, it is necessary to build one (or in some cases several solutions) for presentation to the assembly and test them. During the building phase the prototype is created and 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 sufficient requirements set by the customer, or are to be made to change its concept. 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,

Stage	Characteristic
	even if you have previously will conduct tests using prototype solutions, but frequent building, improvement and testing of prototypes. This approach ensures that client's expectations are fulfilled and minimize the risk of potential failure. The aim of prototype is to test particular aspects of a design solution. To do this all important aspects should be effectively evaluated. To convey the idea of what it will look like, a prototype does not need to be made with the final materials. Example questions: • Do all potential solution 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 user in order to obtain its opinion on the generated product. In this way, you can test it's 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 in the testing process many people. Omission of this step in the design can lead to a situation that the proposed solution not quite meets the required assumptions and expectations of customers. Example questions: • Has the client signed off the designs? • 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: own elaboration based on [1, 11, 21]

Tab. 24.3 Seven stages of Design Thinking

Stage	Characteristic
Define	A precise understanding of the problem and its constrains which allows 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, and 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 design development and its final delivery to the client.
Learning	The stage helps designer 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: own elaboration based on [1]

Tab. 24.4 Phases of the embodied design improvisation process applied to physical interaction

Step	Activity	Purpose
Question	Identify design and research challenges/questions	Provide a guide for design activity
Storyboard	Sketch users, devices, behaviors and scenarios	Generate initial design concepts
Prototype	Develop physical instances of device look/feel	Test critical functions and usage
Improvise	Enact impromptu/typical interaction scenarios	Explore use cases in great depth
Video record	Record a few scenarios and establishing shots	Demonstrate device interactions
Crowd source	Deploy video prototypes as web-based studies	Learn how people perceive scenarios
Lab/field study	Live, in person tests of prototypes and scenarios	Confirm/extend web-based findings

Source: [19]

CONCLUSION

In nowadays word the Design Thinking concept is more and more used to create innovative solutions in business and engineering. This activity emerged in the last part of XX century and it is growing faster and faster. We can distinguish some (five or seven) steps of design thinking which are described in the paper. By using this detailed and useful approach organization can develop better products or better service to fulfil the needs of customer.

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BIBLIOGRAPHY

1. G. Ambrose, P. Harris. *Design Th!nking.* Lausanne: AVA Publishing, 2010.
2. L. Anderson, J. Shattuck. „Design-based research: A decade of progress in education research?" *Educational Researcher*, nr 41, 2012, p. 16-25.
3. T. Brown. „Design thinking." *Harvard Business Review*, nr 6 vol. 86, 2008.
4. J. Brzóska. „Innovation as a factor of steel sector companies value growth." *Prace Instytutu Metali Nieżelaznych,* nr 2, 2016, p. 17-23.
5. J. Brzóska. „Modele biznesu a wykorzystanie innowacji w przedsiębiorstwach społecznych". *Zeszyty Naukowe Politechniki Śląskiej. Seria: Organizacja i Zarządzanie,* nr 78, 2015, p. 51-67.
6. T. Carleton, W. Cockayne. *Playbook for strategic foresight and innovations.* Standford: Standford University, 2013.

7.   N. Cross. *Designery ways of knowing.* Boston: Birghauser, 2007.

8.   K. Dorst. *Frame Innovation: Create new thinking by design.* Cambridge, MA: MIT Press, 2012.

9.   K. Dorst. „The core of „design thinking” and its applications.” *Design Studies*, nr 32, 2011, p. 521-532.

10. J. Edelman. „Understanding radical breaks: media and behavior in small reams engaged in redesign scenarios.” Dissertation, Stanford University, California 2012.

11. J. Helman, M. Rosienkiewicz. „Design Thinking jako koncepcja pobudzania innowacji”. R. Knosala (red.). *Innowacje w Zarządzaniu i Inżynierii Produkcji,* Oficyna Wydawnicza Polskiego towarzystwa Zarządzania Produkcją, tom 1,2016, p. 62-72.

12. H.L.K. Joyce, S.C. Ching, B. Wong, H. Huang-Yao. *Design thinking for education. Concept and Applications in teaching and Learning*, Taipei: Springer, 2015.

13. K. Katana. „Przedsiębiorstwo przyszłości oparte na zarządzaniu innowacjami”. *ZN Politechniki Śląskiej. s: Organizacja i Zarządzanie*, nr 85, 2015, p. 153-164.

14. L. Kimbell. „Rethinking design thinking. Part I” *Design and culture*, nr 3, 2011, p. 285-306.

15. R. Kozubek. „Socially responsible innovation - theoretical considerations”. *ZN Politechniki Śląskiej. s: Organizacja i Zarządzanie,* nr 84, 2015, p. 123-133.

16. M. Matusek. „Innowacje usług w przedsiębiorstwach produkcyjnych - jak uniknąć "paradoksu usług". *Organizacja i Kierowanie*, nr 2, 2016, p. 87-103.

17. M. Pichlak. „Innowacje usługowe - próba konceptualizacji”. *Zeszyty Naukowe Politechniki Śląskiej. Seria: Organizacja i Zarządzanie*, nr 78, 2015, p. 367-377.

18. D.H. Pink. *A whole new mind: Why right brainers will rule the future.* New York: Riverhead, 2006.

19. H. Plattner, Ch. Meinel, L. Leifer. *Design Thinking research. Building innovation.* Standford: Springer 2015.

20. M. Szafraniec. „Supporting innovation in Poland: the role of information and communication technologies as national and regional smart specializations”. w: *16th International Multidisciplinary Scientific GeoConference. SGEM 2016,* 30 June - 6 July, 2016, Albena, Bulgaria. Conference proceedings. Book 2, Informatics, geoinformatics and remote sensing. Vol. 1, Informatics, geoinformatics. Sofia: STEF92 Technology, 2016, p. 445-452.

21. K. Tschimmel. „Design Thinking as an effective Toolkit for Innovation”. w: *Proceedings of the XXIII ISPIM Conference: Action for Innovation: Innovating from Experience*. Barcelona 2012.

22. W. Visser. *The cognitive artifacts of designing.* Lawrence Erlbaum Associates, 2006.

23. R. Wolniak, B. Skotnicka-Zasadzień. „The use of value stream mapping to introduction of organizational innovation in industry”. *Metalurgija*, vol 53., iss. 4, 2014, p. 709-712.

24. R. Wolniak. „Innovation in the context of economic situation in the EU countries". *Zeszyty Naukowe Akademia Morska w Szczecinie*, nr 24 2010, p.141-147.

25. R. Wolniak. „Innowacyjność procesowa na przykładzie efektów wdrożenia potokowej formy produkcji w przedsiębiorstwie przemysłowym". J. Kaźmierczak, J. Bartnicka, (red.). *Zarzadzanie innowacjami w produkcji i usługach*, Opole: Oficyna Wydawnicza PTZP, 2014, p. 191-201.

26. R. Wolniak. „Inteligentne specjalizacje w województwie śląskim." *Systemy Wspomagania Inżynierii Produkcji*, z. 4, 2016, p. 139-149.

27. R. Wolniak. „Metody i narzędzia Lean Production i ich rola w kształtowaniu innowacji w przemyśle". R. Knosala (red.) *Innowacje w zarządzaniu i inżynierii produkcji.* Opole: Oficyna Wydawnicza Polskiego Towarzystwa Zarządzania Produkcją, 2013, p. 524-534.

28. R. Wolniak. „Relationship between selected lean management tools and innovations". *Zeszyty Naukowe Politechniki Śląskiej. Seria Organizacja i Zarządzanie*, z 75, 2014, p. 157-266.

29. R. Wolniak. „The role of QFD method in creating innovation". *Systemy Wspomagania Inżynierii Produkcji*, z. 3, 2016, p. 127-134.

30. I. Żabińska, E. Sujowa. „Policy of innovation development at the wood sector in Poland". *Modern Machinery Science Journal*, nr 1, 2016, p. 1531-1536.

THE DESIGN THINKING METHOD AND ITS STAGES

Abstract: *The paper presents the most important issues related to the concept of Design Thinking. The purpose of the publication was in particular to analyze the stages used in the implementation of Design Thinking in organizations. The article is focused on a detailed analysis of the five-step approach but also outlined a competitive seven-step approach to the problem. The publication also discusses Design Thinking relationships with innovation*

Key words: *innovation, design, design thinking, creativity, innovative approach*

METODA DESIGN THINKING I JEJ ETAPY

Streszczenie: *W publikacji przedstawiono najważniejsze kwestie związane z koncepcją Design Thinking. Celem publikacji była w szczególności analiza etapów stosowanych przy implementacji Design Thinking w organizacjach. Skoncentrowano się na szczegółowej analizie podejścia pięcioetapowego, przedstawiając również w zarysie konkurencyjne siedmioetapowe podejście do problemu. W publikacji omówiono również związki Design Thinking z innowacyjnością.*

Słowa kluczowe: *innowacje, design, design thinking, kreatywność, podejście innowacyjne*

Dr hab. inż. Radosław WOLNIAK, prof. Pol. Śl.
Politechnika Śląska
Wydział Organizacji i Zarządzania
Instytut Inżynierii Produkcji
ul. Roosevelta 26-28, 41-800 Zabrze
e-mail: Radoslaw.Wolniak@polsl.pl