

Abstract of a doctoral dissertation entitled:

"A Model for Computer-Aided Innovation Support in Organisations"

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Abstract

An important task of contemporary management, especially strategic management, is the search for sources of value creation in organisations. Innovation, which is based on the preparation of creative ideas for new goods and services that can be commercialised and directed to the market, is considered to be one of the most important sources of value creation.

Research to date indicates that the innovation of an organisation translates into value created for the customer (R. F. Lusch, S. Nambisan 2015, p. 156), value to the organisation (ibid., 2015, p. 156), strategic innovation (W. Dyduch, 2015, p. 22), organisational development (C.M. Olszak, 2018, p. 99), the efficiency of the organisation (H.K. Tang, 1998, pp. 41-51), the maintenance of competitive advantage (M. Voigt, K. Bergener, 2013, pp. 225-234; C.M. Olszak, 2015, pp. 110-123), and the development of economies (M. Zastempowski, 2010, pp. 71-78). Supporting innovation processes at the individual

and strategic level, in turn, enhances the creativity of employees and encourages them to share innovative ideas, developing the organisation's internal entrepreneurship (intra-entrepreneurship). To be more effective, innovation processes require tool support in the form of IT/ICT systems, tools and software in addition to strategic support. The problem of supporting the innovation of organisations with computer tools, addressed within the framework of this dissertation, is a response to current trends in management concerning the implementation of methods that increase the efficiency of organisations. The

dissertation addresses the problem of developing innovation in organisations by identifying methods and tools to support it within organisations. Moreover, the dissertation provides answers to the current needs of science and managerial practice in the area of trends in computer-aided innovation support in organisations.

Against the background of previous scientific inquiries in the area of innovation of organisations, a **research gap** can be identified **concerning the elements of computer-aided innovation support**. These elements were used to identify and empirically test the author's conceptual model which takes into account the interactions and interdependencies between the innovation of the organisation, computer-aided support and organisational context. The proposed conceptual framework takes into account previous attempts and the needs of the market based on the information obtained on the needs, requirements and vision from the business perspective in this regard. The model identified in the qualitative research is intended to: a) improve the process of managing the innovation of organisations; b) improve the process of communication and information flow; c) develop and invigorate innovation in organisations, d) develop and continuously improve employee innovation, e) develop and continuously improve the organisation.

The models identified can be a starting material for further research in the area of development and improvement of the innovation of organisations by R&D units, as well as an indication of the possibilities in terms of supporting innovation.

The **subject** of the dissertation concerns, on the one hand, an important area of organisation activity, i.e. innovation, and, on the other hand, the dynamically developing computer-aided organisational processes and phenomena, as well as support for the modelling of these processes.

The research problem addressed by this dissertation concerns the answer to the following research question: *How do organisations implement computer-aided innovation, what problems do they face and what solutions do they apply?*

The main objective of the dissertation is to identify a conceptual model for computer-aided innovation support in organisations. Due to the complexity of the main objective, the following **specific objectives** were established: 1) **The theoretical and cognitive objectives** of the dissertation: a) to systematise knowledge on models for computer-aided innovation support in organisations; b) to identify links between computer-aided innovation support in organisations and effectiveness; c) to identify the existing computer systems for supporting innovation in organisations; 2) The **methodological**

objective of the dissertation is to conduct qualitative research in order to identify patterns, ways and methods of computer-aided innovation support in organisations in Poland, and to develop the author's practical model on computer-aided innovation support for organisations on their basis. 3) The **utilitarian objectives** of the dissertation include: a) identification of business requirements for the model of computer-aided innovation support in organisations; b) diagnosis of business needs regarding computer-aided innovation support in organisations; c) identification of visions from the business perspective regarding further development of computer-aided innovation support in organisations, c) development of a set of recommendations regarding computer-aided innovation support in organisations.

The following specific research questions were formulated:

1. Does the sophistication of computer support of an organisation translate into sophistication of innovation support?
2. Does the use of *Design Thinking* methodologies affect innovation and entrepreneurship of organisations?
3. Do companies use modern working methods?
4. What factors build/define computer-aided innovation support in organisations?
5. To what extent does the organisational environment and context translate into computer-aided innovation support in organisations?
6. How do the participants in the organisation evaluate the original model concept? Is there a chance that it will be implemented?

The considerations made within the four chapters contributed to the achievement of the above objectives. Of these chapters: a) the initial two developed a theoretical foundation for the two constructs: innovation of organisations and computer-aided support for organisational processes, based on which a **conceptual framework** was constructed along with a **conceptual model**, and b) two were research chapters, in which the conducted research process was described, the input of which was the construction of research tools, and the output of which were the **author's practical concepts** and **practical models** as well as **recommendations** for further improvement and development in the future.

The first chapter presents the research context and discusses the theoretical underpinnings of innovation and innovativeness of organisations, micro-foundations of

innovation, and strategic innovation. The problems of measuring and evaluating innovation were also presented, along with the stimulators and barriers to the development of innovation. The **second chapter** presents the issue of computer-aided support of organisational processes and the possibilities of supporting process modelling with IT/ICT tools. Subsequently, IT systems developed so far on the market and used to support the innovation of organisations were presented, in particular aspects such as the importance and place of IT/ICT, the resources of the systems, their characteristics and evaluation of the selected ones that support the innovation of organisations, from those supporting decision-making, through systems supporting teamwork, to the presentation of solutions that directly support innovation management. **The third chapter** presents the developed research methodology and conceptual model together with the formulated questions, as well as the sources of information obtained, and describes the research process carried out taking into account the empirical context adopted. **The fourth research chapter** presents a prototype of the author's model for computer-aided innovation support in organisations, its evaluation and verification by the participants in the organisation, and its applicability. The conclusions of the research process are described and recommendations for the future are presented.

Based on the **analysis of secondary sources**, the following conclusions can be presented:

a) on the one hand, as a result of primary research conducted in 2015-2020, a research gap was noticed in the form of the lack of a computer model comprehensively supporting the innovation of organisations also at the level of micro-foundations of innovation, which would take into account the feedback from the systems currently used in practice and the needs, requirements and visions from the business perspective in this regard, b) on the other hand, an attempt was made to present a model including systemic factors supporting innovation.

Qualitative analyses were conducted to fill the gap thus identified.

The research process implemented consisted of three stages, namely: **a) analysis of the respondents' evaluations; b) qualitative research** in the form of unstructured interviews; and **c) a focus study**.

Based on the analysis **of the answers from the respondents**, based on the results obtained

in the first stage of the research process, based on the conducted surveys, information was obtained that was used to construct the scope of the research tool for the second stage of

empirical research, that is open interview questionnaire. In the period from October 2021 to February 2022, on a sample of 100 representatives of organisations, a survey on computer-aided innovation support in organisations was conducted among representatives of companies from different industries. The second purpose of the survey was to indicate the leading organisations that used modern IT solutions to support the development of the qualitative study and to present the results of the qualitative study conducted for all organisations in the market. To conduct the survey, an anonymous questionnaire was used, designed by the author of the study. The survey was conducted remotely, it was distributed via e-mail and a note was published on social media (Facebook and LinkedIn) to invite people to take part in the scientific study, a link to the survey was advised. The age of the study population was between 19 to 56 and above. All persons that took part in the survey - the representatives of the companies - were professionally active and spoke about the activities of their organisations. The survey was fully anonymous.

Qualitative research in the form of unstructured interviews was conducted from October to November 2021. For this stage of the research, modern and agile companies from various industries – logistics, medical, food, clothing, services and packaging – working very hard on their efficiency and innovation with advanced computer support were selected. Companies from various industries with innovative solutions that affect the quality of people's lives and make them easier have been invited to collaborate. The solutions are socially useful and have a unique formula. Importantly, organisations co-create value together with customers in the area of prosumption as customers are their partners in the improvement

and development of products and services, which results in full-scale value creation. The choice of the sample was intentional and the goal is to show both the diversity of products and services and the motives behind their creation. The above-mentioned motives of all the studied organisations include: a) concern for people's health, the desire to increase the quality and comfort of their lives and concern for safety and the natural environment, which is particularly evident in the overall activity of Sokpol, HL Display, the virtual assistant of GLASSON opticians' salons or Infermedica; b) saving time, consumer experience, streamlining shopping processes based on original, unusual solutions, for which the TYXO virtual tailor by eTailor Sp. z o. o. and sharing warehouse space offered by the ForLogistic.com platform can be distinguished; c) optimisation of organisation, processes, products and services, which is clearly the goal of such organisations as Optimatis and Inprogress Design Lab.

On 8 February 2022, an online **focus study** was conducted with the representatives of organisations such as: ForLogistic, HL Display, Infermedica and Optimatis, who expressed interest in taking part in the final stage of the research process. The purpose of conducting the qualitative study based on the focus approach was to: a) present and initially assess: the prototype of the author's model of computer-aided innovation support for organisations, use cases, the interface view of the ICT system supporting innovation in organisations, and the proposals for names for the system; b) collect comments and suggestions; and c) make the reported corrections. Then, the participants verified and finally accepted the developed solutions, which turned out to be: a) not one, as originally proposed, but four models of computer-aided innovation support for organisations, as well as: use cases, an interface view of the ICT system supporting innovation in organisations, and the name of the system was chosen unanimously. In addition, based on the statements of the focus study participants, two models were additionally proposed as recommendations for further development of the computer system supporting innovation in an organisation, namely: 1) an innovator using AI and machine learning in the further development of the computer system supporting innovation in an organisation; 2) an innovative team using AI and machine learning in the further development of the computer system supporting innovation in an organisation. Additionally, a recommendation for further development and improvement of computer-aided innovation in organisations using UX and presumption in the form of a practical model was proposed.

To sum up the considerations, the issue of organisational innovativeness discussed in this doctoral dissertation presents the current trends of the new reality in the area of computer-aided innovation in organisations, what currently determines it and what is the vision for further development. Moreover, this doctoral dissertation provides answers to the current needs of science and managerial practice in the area of trends in computer-aided innovation support in organisations.

No.	Research question	Type of study	Conclusions
1	<p>Main research question: <i>How do organisations implement computer-aided innovation, what problems do they face in doing so and what solutions do they use?</i></p>	<p>1) analysis of respondents' evaluations 2) qualitative</p>	<p>Referring to the existing data from the websites and KRS [National Court Register] documents of the organisations involved in the second stage of the research process, it was found that they are medium to large in size, innovative and care about innovation culture.</p>
2	<p>Specific question: 1. Does the sophistication of computer support of an organisation translate into sophistication of innovation support?</p>	<p>qualitative</p>	<p>The results of the conducted research show that there is a relationship between the degree of sophistication of computer support of an organisation and its innovativeness.</p>
3	<p>Specific question: 2. Does the use of <i>Design Thinking</i> methodologies affect innovation and entrepreneurship of organisations?</p>	<p>1) analysis of respondents' evaluations 2) qualitative</p>	<p>The results of the conducted research show that the application of the Design Thinking methodology significantly affects the innovativeness and entrepreneurship of organisations.</p>
4	<p>Specific question: 3. Do companies use modern working methods?</p>	<p>1) analysis of respondents' evaluations 2) qualitative</p>	<p>The results of the conducted research show that the Agile methodology and the Agile Mindset approach significantly influence the micro-foundations</p>

			of innovation, which in turn translates into the innovativeness of an organisation.
5.	Specific question: 4. What factors build/define computer-aided innovation support in organisations?		
6	Specific question: 5. To what extent does the organisational environment and context translate into computer-aided innovation support in organisations?	1) analysis of respondents' evaluations 2) qualitative	The results of the conducted research show that the environment and the organisational context build and significantly influence the computer support of an organisation's innovativeness.
7	Specific question: 6. How do the participants in the organisation evaluate the original model concept? Is there a chance that it will be implemented?	focus.	As a result of the conducted focus research: a) the prototype of the model of computer support of an organisation was validated, b) missing functionalities and areas resulting from the needs, requirements and vision from the business side were identified, c) four practical models of computer-aided organisation innovation emerged after verification, and d) three practical recommendations were

			formulated within the framework of the model approach.
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The most important conclusions drawn from the completed survey of respondents' evaluations showed that: **1)** the vast majority of respondents found that computer-aided development has an impact on the development of organisational innovativeness. It is also very likely that the respondents noticed a significant relationship between computer-aided innovation in organisations and the generated product, marketing, process and organisational innovations. **2)** the vast majority of the respondents did not have any issues with th computer-aided system. **3)** the vast majority of the respondents noticed a correlation between the level of sophistication of the computer-aided system and advancement in innovation. **4)** half of the surveyed population confirmed that the organisation they work for used good practices and modern methods of working. Representatives of organisations that use modern working methodologies also specified what kind of practices and solutions they use. The most commonly identified methodology was the Agile mindset, which is usually defined as a set of beliefs, convictions and actions consisting of a positive attitude, a thirst for knowledge, a drive for success of the whole team, pragmatism and being ready to fail. Kaizen philosophy came in second - continuous improvement and involving all employees of the organisation in said improvements. Third place was claimed by the Design Thinking method - creative problem-solving. The method of providing innovative solutions through the use of specific working methodologies that stimulate creativity, and translating these activities into a business model The respondents also indicated the use of ITIL - as a set of best practices for managing the IT area and ICT infrastructure and IT services. Respondents also indicated the Lean method as a business management strategy, based on providing customers with the products/services they expect, in the least complicated way possible, while respecting the working staff. Other methodologies were identified by a much smaller number of respondents, which included Trello - a web-based Kanban tool that helps teams collaborate and manage work, and is a robust, flexible system but less powerful than traditional project management software, followed by uniFLOW - a scalable and secure cloud-based solution that adapts to and grows with the business. It eliminates the need to invest in and manage local servers thanks to flexible subscriptions that include printing and scanning, supporting and complementing every stage of the document lifecycle, plus Kanban - a production

management method. The last methodology, DevOps, which revolves around the development, operations and quality assurance, also emphasises close collaboration and communication between IT maintenance professionals (administrators) and software development professionals (developers). It takes into account the interdependence of IT development and maintenance. It reduces time and streamlines the implementation of software changes.

5) The respondents also mostly commented on the fact that in the organisations they work for, there is no original research model for building a management system for innovativeness of the organisation.

6) For the most part, the respondents felt that creative thinking is promoted and accepted by both the organisation and the organisational culture and managers. The latter group not only promotes this style among employees, but also sets a good example on its own in this regard.

7) The following were indicated among the types of innovations applied in the organisations the respondents work for : a) organisational innovations, i.e. implementation of a new organisational method in the principles of operation adopted by the enterprise; b) marketing innovations - implementation of a new marketing method, involving significant changes; c) product innovations consisting in introducing new or improved commodity, service; d) process innovations entailing implementation of a new or significantly improved production or delivery method, which can be categorised as significant changes in terms of technology, devices and/or software; e) sales innovations related to new ideas, creative thinking, new solution in the form of a device or method; f) social innovations, i.e. both product and process innovations and new business models. What they have in common is the co-creation of solutions to social problems that are more effective than current solutions, and lead to the development of new areas of cooperation and better use of resources. It should be stressed that the most frequently indicated innovations were those of an organisational nature, i.e. improving the management system and streamlining work.

8) When asked at what levels objectives had been set in their organisations, respondents answered that very high performance had been achieved at the three levels identified - operational, tactical and strategic. Based on this question, it is clear how much importance the respondents place on the level of the management staff in the terms of innovativeness; that it sets a good example for their employees and their own attitude encourages them to be more innovative.

The most important conclusions drawn from the conducted qualitative study, based on the analysis of the obtained results, are the following: 1) considering the

respondents' opinion on the eventuality of creating a comprehensive system supporting the innovativeness of the organisation, it was stated that it would be, however, a single system, dedicated to strengthening the microfoundations of innovativeness, reporting innovations and managing them, which would influence the innovativeness of the organisation. **2)** the elements of the ICT system interface supporting the innovativeness of the organisation, as indicated by the respondents, were taken into account within the use cases of the solution. **3)** ultimately, representatives of the organisations, who were invited to participate in the focus study included: ForLogistic, Optimatis, HL Display and INFERMEDIACA, as the owner of the Glasson organisation was unavailable at the agreed date. **4)** a report with the results of the conducted research process was prepared and attached as Appendix 4 to this dissertation, and forwarded via email to the representatives of the organisations, who were interviewed and took part in the focus study. **5)** the needs of the organisations, the interviewed representatives work for, in terms of building the original model of computer-aided innovation system for the organisation, which were included within the created practical models, were all written down. **6)** information concerning the business requirements related to building the original model of computer-aided innovation system for the organisation, which were included within the created practical models, were collected. **7)** data regarding future visions for further possible improvements of the computer-aided innovation system of the organisation, which were included within the created practical models, was also collected. **8)** The trend and value from collaboration and communication during brainstorming meetings were believed to produce the best results. They are also the most frequently chosen method for rapid interaction and creating solutions. Coming up with solutions together, engaging with the organisation, gives employees a sense of community and relevance to the organisation, of having shared goals and priorities and values, and this is the strongest way to feel connected to the organisation, if we are looking in the same direction, if we understand each other well, and if individual goals, priorities and values are taken into account in a holistic view of how the whole organisation functions. **9)** The analysis shows that the impact of attitudes was rated higher by respondents than economic and socio-organisational factors. Therefore, it can be concluded that there is an increased awareness of the importance of internal attitude of both the employer and the employees towards the performance of an organisation. **10)** the correlation of the level of customer loyalty and the loyalty programmes that are offered to them is clearly noticeable in organisations such as Optimatis, HL Display and Sokpol. A correlation

between the implementation of loyalty programmes on a lower scale and a high level of customer loyalty is observed in Glasson. A correlation of a low indication was recorded for ForLogistic. However, there is no correlation in the case of the TYXO virtual tailor. Also, there is no reply from the representative of Infermedica. **11)**, the greatest correlation between factors that influence the efficiency of an organisation, such as an average profitability: assets, sales and equity capital, was observed in GLASSON, Sokpol, HL Display and Optimatis. With regard to the virtual tailor, TYXO, and ForLogistic, there is a low level of correlation.

The following recommendations for the participants of the qualitative study from the organisation were formulated:

- 1) ForLogistic Glasson, Sokpol, Optimatis, HL Display, to take into account the issue of construction, maintenance and development of a knowledge base as part of the continuous improvement, the continuity of business operations and the continuity of ICT systems operation.
- 2) ForLogistic, Glasson, Sokpol, which do not benefit from R&D potential, to train the employees of those companies to become competent and aware of available programs and projects that are financed from external funds and can take their businesses to higher levels of both innovation and efficiency.

In turn, the conducted focus study was the basis for the following: **1)** a prototype of a practical model was presented of computer-aided innovation support for organisations. **2) validation of the prototype of the computer-aided innovation support for organisations was performed** in collaboration with the participants of the focus group, which was a priority in order to assess whether the conclusions drawn based on the collected research material were accurately understood, interpreted, developed, formulated and captured, and whether the interfaces that were observed during the primary research conducted as part of the second stage of the research process were correct. **During the validation process, the need to construct not one but four practical models of computer-aided innovation support in organisations emerged.** **3)** during the focus study, the feedback of the respondents on the proposed use of the mobile and desktop (central) applications was collected. **4)** the participants of the focus study indicated which functionalities should be added to the content of the interface view for the users of the innovation management system that supported the innovation of an organisation. **5)** the participants contributed to the selection of the name for the innovation management system that supported the innovation of an organisation. **6)** Practical models of computer-aided innovation support in organisations were verified with the

assistance of the participants. 7) recommendations for further development and improvement of the system of innovation management and influencing organisational innovation in the form of three models were proposed: a) an innovator with the use of AI and machine learning in the further development of the computer system supporting the innovation of an organisation; b) an innovative team with the use of AI and machine learning in the further development of the computer system supporting the innovation of an organisation, and c) the use of UX and prosumption in the further development of the computer system supporting the innovation of an organisation.

The following models constitute the contribution to the discipline of management and quality sciences: a) conceptual, b) practical, for the computer-aided innovation of an organisation, c) **recommendations, also in the model approach,** for further improvement and development in that matter.

The limitations of the conducted research were related to the specific time of the COVID 19 pandemic, falling within the time frame of the research process, 2021-2022, which made it very difficult to collect the research material. Hence, the survey research sample is very small (N=100) and the decision was made to analyse the answers from the respondents instead of performing the quantitative analysis.

The direction of future research is a continuation of the consideration related to the created practical models of computer-aided innovation support in organisations and the planned process of constructing and implementing in a selected organisation of an innovation management system to support the organisation's innovation, which will become the subject of the next, planned research process.

To sum up the considerations made as part of the framework of the doctoral dissertation, it should be stated that the main goal of the doctoral dissertation, that is, the identification of the conceptual model of computer-aided innovation support in organisations, was achieved. Moreover, it should be stated that the assumed specific objectives were also achieved, including: 1) theoretical and cognitive objectives of the dissertation: (a) systematisation of knowledge on models of computer-aided innovation support in organisations; (b) identification of correlation between computer-aided innovation support in organisations

and effectiveness; (c) identification of existing information systems that support innovation of an organisation; 2) the methodological objective of the dissertation, which was to conduct qualitative research to identify patterns, ways and methods of computer-aided innovation support in organisations in Poland and to develop, based on the findings, the author's practical

model of computer-aided innovation support in organisations; 3) utilitarian objectives of the dissertation such as: (a) determination of business requirements for the model of computer-aided innovation support in organisations; (b) diagnosis of business needs with regard to computer-aided innovation support in organisations; (c) recognition of the vision on the part of business with regard to further development of computer-aided innovation support in organisations; (d) development of a set of recommendations related to computer-aided innovation support in organisations, also in the model approach.

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