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Review of Doctoral Dissertation

The review of the doctoral dissertation of mgr Ibrahim Khan Mohammed, entitled „The impact of Information Technology on the agility of Indian Small and Medium sized Enterprises”, written under the supervision of prof. dr hab. inż. Stefan Trzecieliński.

Introduction

The basis for the review is a letter from Prof. PP Dr. Hanna Włodarkiewicz-Klimek, Dean of the Faculty of Engineering Management, Poznan University of Technology, dated 17.07.2023, informing about the decision of the Discipline Council for Management and Quality Sciences of Poznan University of Technology to appoint me as a reviewer in the doctoral proceedings of mgr Ibrahim Khan Mohammed.

The dissertation submitted for review is in the research field of agility of enterprises. In particular, the dissertation is devoted to the enterprise agility of Indian SMEs and the role of IT solutions in enhancing it. This issue is of significant theoretical and practical importance. On the one hand, it contributes to the development of knowledge about the factors that promote the agility of enterprises (especially SMEs). On the other hand, the research results obtained have potentially important implications for the development of SMEs in India, a group of enterprises crucial to the Indian economy, for their ability to identify and respond to emerging market opportunities, and to create new market opportunities.

The research problem, which is "The relationship between the types of ICT and the scope of their use, and agility (Brightness, Flexibility, Intelligence and Shrewdness), and the ability of the enterprise to respond to market opportunities and to create market opportunities through innovation activities." (p. 17), has been correctly formulated by Mr. Ibrahim Khan Mohammed. The problem is significant and relevant, as well as appropriate to the rank of the

doctoral dissertation. The definition of the research problem is preceded by the identification of the research gap, which has been done on the basis of an in-depth literature analysis on the subject. The research problem is reflected in well-formulated research questions RQ1-RQ4 formulated in the dissertation and the hypotheses H1-H3.

The aim of the dissertation, which is “to identify if and how IT affects the agility of Indian SMEs and which IT/ICT can improve the agility of these enterprises” (s. 12), is up-to-date, significant and correctly worded. PhD Student has also developed specific objectives: 3 theoretical (scientific) and 6 utilitarian (practical) objectives.

Evaluation of the dissertation's structure and content

The reviewed work consists of an introduction, four chapters and conclusions. In total, its volume, including bibliography, lists of figures and tables, and an appendix, is 274 pages (197 pages of main text). The dissertation contains 19 figures, 12 tables and one appendix with 2 attachments. The dissertation is based on 720 literature reports – monographs, scientific papers and conference materials. The structure of the dissertation is adequate.

The introduction provides a comprehensive rationale for the selection of the topic, characterizes the subject matter, defines the objectives of the study, discusses the identified research gap and the research problem, formulates the research hypotheses and research questions, and characterizes the structure of the dissertation. The introduction is systematic and precise, and is the result of the Author's in-depth analysis of the literature on the importance of agility for SMEs in India and on the role of IT as an enabler of enterprise agility. A comment should be made about the order of the issues presented. I believe that the research objectives should be placed only after the discussion of the research gap and the research problem statement. There is also some dissatisfaction with the literature grounding of the hypotheses (they are the result of all the considerations in the introduction).

The first chapter is devoted to an in-depth, systematic characterization of SMEs in Indian economy. First of all, Mr. Ibrahim Khan Mohammed comprehensively discussed the importance of SMEs to the Indian economy, which is an essential contribution to the justification of the research problem undertaken. In addition, he defined the key terms for the nature of SMEs and characterized the specifics of SMEs in Indian economy. The introduction to the dissertation and the formulated research problem prove that key research motivation was to support the development of SMEs in India, that the choice of this group of enterprises was in a sense a trigger for the research work. At the same time, however, a rationale is missing as

to whether, and if so why, the relationship between IT and agility is of a special nature precisely in SMEs (relative to the population as a whole), whether it is different for this group of companies due to the specific characteristics of SMEs, or perhaps the characteristics of Indian SMEs.

The second chapter of the dissertation has the character of a systematic, theoretical discussion of the issue of enterprise agility, in all its complexity, taking into account not only current knowledge, but also emerging future research directions in this area. The first part of the chapter contains the results of an extensive literature review regarding the understanding and definitions of key concepts: from the essence of agility notion, through organizational agility, agile manufacturing, supply chain agility, workforce agility, strategic agility, and enterprise network agility. Next, in the chapter, the indicators of agility are characterized, and agility capabilities and practices became the basis for adopting a clear understanding of the concept of enterprise agility and its dimensions. The characterization of drivers and enablers of enterprise agility is somewhat unsatisfactory. In section 2.1 where the subsequent concepts are discussed, only in relation to agile manufacturing agility enablers are identified in a systematic way. The content of subsection 2.2.1 (Drivers and enablers of enterprise agility) is also too general. In my opinion, a presentation of the typology of agility enablers should be presented in the dissertation, along with a justification for the choice of IT in the context of the other factors.

The third chapter is devoted to a discussion of Information Technology issues. The typology of IT and the IT role in managing enterprises are characterized. The considerations in this chapter are systematic and comprehensive, and are the result of an extensive literature review. I highly appreciate the focus of the deliberations on the specifics of IT in the context of SMEs. In particular, the Author's important theoretical contribution is the identification of IT tools used by SMEs in India as an introduction to the analysis of the relationship between IT and agility of SMEs in India.

Referring to the entire theoretical part of the dissertation, one should definitely appreciate the richness of the literature sources used. However, PhD Student did not indicate the procedure used in the literature review, did not specify which databases he included in the review and according to what criteria he incorporated individual items for further analysis.

The fourth chapter contains the results of the empirical research. The research model with an indication of the area of empirical research (IT & agility in Indian SMEs) is well defined, and the methods of empirical research have been correctly selected in the context of the aim of the dissertation. Some doubts are raised by the lack of consideration of factors other

than IT in the empirical research, especially since the Author himself emphasizes the importance of simultaneously considering agility enablers, for example (p. 60): „(...) relying on IT infrastructure itself without a skillful and knowledgeable workforce cannot be agile to the changing environment. Similarly, talented and skillful employees alone cannot deliver competitive edge without proper organizational resources such as IT infrastructure”. At the same time, it would undoubtedly increase the complexity of the research.

In the first part of chapter four the construction of the research tool (questionnaire), the selection of the research sample, the way of collecting data and the statistical methods used are presented. Next, all variables (dependent and independent) with a discussion of their structure (frequency tables were used) are characterized. In this section (4.2), I would also expect a systematic description of the research sample, but this was only included in final conclusions. In addition, the descriptive data of the variables and their distribution are not presented, only frequency tables (which are not a typical way of presenting this type of data) were reported. It was surprising that in the data analysis the perspective of levels on a scale were adopted rather than the perspective of individual variables (then a graphical presentation would be a histogram). Some comments can also be made on the survey tool. The questions regarding the use of different types of IT inquired about different aspects related to their use: from “how common”, “how beneficial”, “how helpful”, “how effective” *etc.* The substantive basis for these differences in statements, which refer to significantly different concepts, is not clear to me. In the questionnaire, the statements were not always appropriate for the Likert scale, resulting in incorrect answer lists in several questions (*e.g.*, question DvS1). At the same time, I believe that the scales proposed in the dissertation (scales measuring both the use of IT tools and enterprise agility), after minor adjustments, could be an important theoretical proposal for a standard tool for measuring both phenomena.

The next part of chapter four contains the most important empirical findings on the relationship between IT and agility dimensions. For each agility dimension, the theoretically assumed relationships are presented in a very clear way (using tables and figures), the results of the correlation analysis are cited, and they are set in a broader context. The work lacks tables with correlation results. Discussing the results of the analyses, no correlation coefficients are given, nor is the strength of the correlation determined (there is only mention of a statistically significant, positive relationship). When discussing the results, there is also a lack of reference to relationships that proved to be statistically insignificant (although theoretically assumed). In addition, it should be noted that correlation analysis does not imply causation. In the study, based on an in-depth analysis of the literature, it was assumed that the dimensions of agility

would be the dependent variables, and that the use of various IT tools would promote their growth. While this assumption is strongly supported by the literature discussion, reverse causality is also possible, where higher agility favors the implementation and use of IT tools. In a few cases, Author himself interprets the obtained results inversely (*e.g.* „The analysis of Spearman’s rank correlations reveals that the independent variable (Iv3) is significantly positively correlated with the dependent variable (DvI1). This implies that the systematic trainings given to Indian SME employees supports the effective implementation of ERP in managing enterprise resources.”). As a whole, the presentation of the research results is systematic and clear, although it would be even easier to follow if the research hypotheses were restated at the beginning of the chapter and referred to in a summary of the research results (*e.g.* in the form of a table).

I consider the final part of the fourth chapter, devoted to the analysis of the directions of changes in the use of IT for the development of SMEs agility, to be particularly valuable. Based on the results of empirical research and indications from the literature review, the Author formulates the original proposals in relation to each of the dimensions of agility, taking into account not only the specifics of individual IT tools, but also the broader context of developing enterprise agility.

In conclusions, the Author cited the most significant results of his study with their relation to the aim of the dissertation and the research questions. He discussed in detail the theoretical and practical implications of the conducted research, addressed its most important limitations, and made recommendations for further research. The considerations contained in this part of the dissertation demonstrate Mr. Ibrahim Khan Mohammed's researcher maturity.

The formal side of the dissertation in principle does not raise any objections. It is written in correct and understandable language. Although the text is not free of individual errors, so-called typos and punctuation (*e.g.*, pp. 8, 12, 16, 17, 147, 153) and other linguistic or stylistic errors (*e.g.*, writing Spearman's rank correlation in lower case; starting a sentence with “And”). Only the bibliographic description is prepared carelessly and contains many errors. The entire work, the reliability in the preparation of figures, tables and charts, as well as the type and shape of the font, compensate for the few formal and editorial imperfections.

Conclusions

Both the degree of achievement of the dissertation' aim and objectives, and the quality of their implementation I evaluate positively. Such an assessment is influenced by the following main qualities of it:

- 1) Identification of an important and topical research problem and its very sound, comprehensive justification - both theoretically and practically;
- 2) Consistency of the conceptual base, which is key to evaluating the quality of the doctoral dissertation. The basic concepts for the reviewed study were the following categories: enterprise agility and its dimensions, SME, IT and ICT (in SMEs). These concepts were defined based on an in-depth review of the literature, in a correct manner, sufficient for the preparation and implementation of a reliable empirical research;
- 3) The research methodology adopted is relevant. Both the stages of the research process and the description of the activities undertaken in the research are not objectionable. The logical and transparent manner of the research procedure indicates PhD Student's ability to conduct scientific analysis and is suited the purpose of the dissertation;
- 4) The Author's own research results obtained are significant:
 - He determined the role and influence of information technology on improving the agility of SMEs in India - both theoretically and empirically;
 - He formulated the directions of changes in the use of IT for the development of SMEs agility, taking into account not only the specifics of individual IT tools, but also the broader context of shaping enterprise agility.

Mr. Ibrahim Khan Mohammed has solved well the research problem undertaken.

- 5) The reviewed dissertation makes an important contribution to the development of theory regarding the enablers of enterprise agility. The theoretical determination of the relationship between IT and agility of SMEs in India (including the dimensions of such agility) and the results of its empirical verification should be considered an important and original achievement. For the first time such a comprehensive agility framework has been used in the context of Indian SMEs. The work has also an important practical significance. On the one hand, it is related to the choice of SMEs in India as the subject of the study, *i.e.*, enterprises of particular importance to the Indian economy. On the other hand, the value of the work in practical terms is determined by the directions formulated by PhD Student for changes in the use of IT for the development of SMEs in India;
- 6) Finally, the form of presentation, the layout and the scientific apparatus are satisfactory.

It is worth noting that the quality of the reviewed dissertation would be even higher if it were not for some shortcomings. These include:

- 1) In the theoretical chapters, there is relatively little scientific discussion of the views and concepts presented in the literature. In particular, it would be valuable if the formulation of individual research hypotheses were in the nature of a discussion, based on a critical, in-depth analysis of the literature reports;
- 2) Noteworthy is the wide range of literature sources used in the study. However, PhD Student did not indicate the procedure used in the literature review, did not state which databases he considered in the review, and by what criteria he included (and rejected) individual items for further analysis;
- 3) The dissertation makes a very good case for the importance of IT as an enabler of SME's agility. However, it would have been more complete if a typology of agility enablers (other than IT tools) had been discussed in a structured way, along with the rationale for choosing IT in the context of the other factors;
- 4) It has not been explained why the relationship between IT tools and agility has a special character in SMEs, whether it is different for this group of companies (compared to the population as a whole), whether this difference is due to the specific characteristics of SMEs or perhaps SMEs in India;
- 5) The study used the correlation method. The correlation analysis does not imply causation. In the study, based on an in-depth analysis of the literature, PhD Student assumed that the dimensions of agility would be the dependent variables, and that the use of various IT tools would promote their growth (are thus independent variables). While this assumption is strongly supported by the literature discussion, reverse causality is also possible, where higher agility favors the implementation and use of IT tools. In several cases, the Author himself interprets the obtained results inversely;
- 6) The dissertation does not provide some of the relevant analysis results, for example, tables with correlation analysis results are not included;
- 7) Empirical research has verified the relationship between IT tools and dimensions of enterprise agility. It seems reasonable to verify also the relationship between IT and agility as a holistic construct. Such a study would require different statistical methods than those used in the dissertation.
- 8) Finally, the bibliographic description is prepared carelessly, it contains many errors.

The comments raised in the review are mostly of a debatable nature and do not detract from the unequivocally positive assessment of the substantive level of the dissertation. The dissertation under review is an independent, cohesive scientific work of high academic merit as regards the formulation of research questions, methodology, theoretical and empirical foundation, documentation, treatment of the literature and form of presentation. A study of the dissertation allows to conclude that Mr. Ibrahim Khan Mohammed is capable of planning and effectively conducting scientific research in the discipline of management and quality sciences.

Therefore, I declare that the dissertation of Mr. Ibrahim Khan Mohammed, entitled „The impact of Information Technology on the agility of Indian Small and Medium sized Enterprises”, fully meets all formal and customary requirements for the doctoral dissertations and I request that Mr. Ibrahim Khan Mohammed be admitted to the following stages of the PhD procedure.