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### **The review report of the PhD thesis**

**Title: Large-scale Lean Assessment Through a Country's Competitiveness**

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**Supervisor: Prof. dr hab. Aleksandra Gawel**

The processed review report concerns the PhD dissertation titled “Large-scale Lean Assessment Through a Country's Competitiveness” prepared by Mr. Benjamin Gozlan and supervised by Prof. dr hab. Aleksandra Gawel (Auxiliary Ph.D. supervisor is dr. Maciej Pietrzykowski). The aim of this review report is to evaluate the dissertation thesis submitted by Mr. Benjamin Gozlan. The opinion is based on the resolution of the Academic Advancement Board at the Poznań University of Economics of 19th of June 2020 appointing me as a reviewer of the dissertation (Letter of the Head of Academic Advancement Board, prof. UEP dr hab. Barbara Jankowska, of 30<sup>th</sup> of June 2020).

The processed Ph.D. thesis is devoted to rather important and interesting topic. The problem of competitiveness is extremely important from both business and management point of view. The processed thesis provides rather specific approach related to competitiveness issue both from individual business entity point of view and from individual countries' point of view. Competitiveness issue is usually related to the ability of individual entities to manage their production factors efficiency and also their ability to compete to other business entities (competitors). The proposed thesis provides

alternative attitude related to competitiveness – the proposed lean competitiveness index is related to the ability of individual entities to better manage processes related to their economy performance. The thesis itself could be understood as original one. Its character is methodological one and it is also possible to identify the key attributes of basic research.

The proposed thesis provides an overview of “traditional competitiveness approach” and “lean competitiveness approach”. The whole thesis is well structured and constructed. The whole thesis is about 259 pages material. The text of the thesis is divided into seven following basic parts: Introduction; Chapter 1 - The essence of the lean thinking system; Chapter 2 – Competitiveness of firms and competitiveness of countries; Chapter 3 – A proposed methodology for assessing lean competitiveness; Chapter 4 – Establishing a lean competitiveness index on the global competitiveness index; Final conclusions; References and Appendices. The material is also including 31 relevant tables and 10 figures. Appendices part of the thesis is divided into three sections (Appendix A; Appendix B; Appendix C). Appendix A provides an overview of the lean execution opinion survey. The appendix B provides the lean thinking elements mapping in relation to the lean executive survey. The appendix C provides the comparison of LCI scores and GCI scores for 108 countries in 2006, 2011 and 2015. Finally, the list of references, reports and on-line sources represents about four hundred different items. The huge list of literature references (over three hundred items) must be understood as the key value of the processed thesis as the proposed thesis provides an important overview of research development related to lean management and competitiveness over the last several decades.

Individual chapters and sub-chapters are in balance. The introduction into the main thesis topic is well defined and explained. The problem of the analysis is well defined and explained. The importance of the material is well defined through the well processed and relevant “the state of the arts”. The literature review explaining the problem of traditional competitiveness issues and lean competitiveness issues is interesting and it has been covering the deep study through many valuable literature sources.

The literature overview is processed in detail and it is covering different approaches related to competitiveness problem both from business point of view and management point of view. The valuable output of the proposed literature review is to combine business approach to competitiveness to country/national approach to competitiveness. Based on the proposed literature overview which is divided into two key chapters, it is possible to identify the importance of the thesis and its topic. The existing research gap related to competitiveness research is highlighted, justified and explained. The importance of large-scale lean assessment for alternative competitiveness analyses approach is highlighted. The identified research gap indicates the need for research on lean transformation addressing different units / object of competitiveness analysis both from single company's point of view and also from multinational point of view (i.e. industry, region, country). Also the necessity to make even deeper lean assessment research at the level of specific entities is highlighted.

Based on the processed literature review the main task/objective of the processed thesis is set up.

Five relevant research questions are defined (How can the lean thinking aspects in the measurement of competitiveness of countries be identified?; What methodology could support leanness assessment of private and public entities operating within countries?; What tools could be utilized to enable this assessment?; How can countries at different stages of development be grouped?; How to design, implement and test the proposed methodology?).

The purpose of the thesis is to set up the proper methodology of lean competitiveness approach and to set up the specific tools to enable leanness assessment of public and private entities operating within countries. The thesis's output could be considered as methodological one. The task is to design, implement and test lean competitiveness methodology and relevant tools and metrics to assess the perceived extent to which lean thinking principles could be adopted both by private and public entities operating with the country/economy. The task is to set up relevant methodology enabling a large-scale lean assessment through countries' competitiveness. The purposed of that effort is to support better targeting, flexibility, planning, effectiveness,

efficiency, productivity, waste elimination, processes stability and competitiveness. The idea is to use “lean thinking” as a key driver of competitive advantages especially at the country level.

There are several sub-tasks of processed thesis. The most relevant are the following:

- To propose the concept and definition for lean competitiveness.
- To assemble a lean competitiveness opinion survey, capturing the voice of the business community.
- To establish the proposed lean competitiveness metrics: the overall “LEAN COMPETITIVNESS INDEX” (LCI) and its three sub-indices LCI’s BASIC REQUIREMENTS, LCI’s EFFICIENCY ENHANCERS and LCI’s INNOVATION AND SOPHISTICATION FACTORS.
- To implement the global competitiveness index’s dataset for year 2006-2015 into the proposed structures and calculate the three sub-indices and the overall LCI scores.
- To test the validity of the proposed LCI.
- To examine trends of overall GCI and the LCI through the study years.
- To examine correlations between study measures.
- To examine the parameters of regression functions explaining the GCI measures by the LCI measures.
- To examine the stability of the proposed LCI measures through the study years.
- To examine relationship between the GCI and the LCI for groups of countries at different stages of development.

To reach the above mentioned tasks and goals the proper methodology is designed and specified. The proposed methodology is divide into three key phases.

1] design phase;

2] establishment and implementation phase;

3] test phase.

Individual steps and approaches related to methodology approach are specified and well explained. The methodology itself is rather close to methodology developed for the purpose of Global competitiveness index construction. Individual modifications for the purpose of LCI index design and development are highlighted and explained. The rational arguments supporting the proposed methodology approach are introduced. Data necessary for individual analyses are specified and the analyzed time period is covering about ten years (2005-2016). The sources of data are also specified. The character of data coming into the analyses is secondary one. Individual applied formulas could be considered as standardized ones. The collected data are analyzed through traditional statistical instruments as e.g. correlation analysis, regression analysis, McNemar analysis etc.

The third chapter of the thesis could be consider as the core of proposed methodology. Also the key designs of LCI index construction and its individual sub-indices are introduced. The Lean Competitiveness approach is derived from Global Competitiveness approach. The simplified Lean competitiveness index is developed through the significant modification of Global competitiveness index and based on key dataset collected for the purpose of Global competitiveness index calculation.

The chapter number four is devoted to the calculation of real value/score of Lean competitiveness index and its individual sub-indices scores. Lean competitiveness index is calculated for the set of 108 countries over the period 2006/2007 – 2015/2016. Individual calculations are also done for individual sub-indices (LCI's BASIC REQUIREMENTS, LCI's EFFICIENCY ENHANCERS and LCI's INNOVATION AND SOPHISTICATION FACTORS). Individual countries are sorted according to their ranks with respect to GCI and LCI. The key differences between both indicators are discussed. The important part of the analysis is GCI and LCI comparison made with respect to individual countries' stage of economy development (with respect to their individual GDP/cap). Individual countries under the analysis are sorted into five groups respecting their stage of economy development (Stage 1 - Factor driven; Transition from stage 1 to stage 2; Stage 2 – Efficiency driven; Transition from stage 2 to stage 3; Stage 3 – Innovation driven economies/countries). Relevant values for individual indices are

calculated and relevant weights to calculate the final scores are also defined. The key relations between GCI and LCI are analyzed and the influence of LCI index and its sub-indices on GCI and its sub-indices are calculated/evaluated. The key data comparison is done for three selected years representing the analyzed time period (2005; 2011; 2015). Finally, the LCI measures are tested to verify their stability both as independent indicator and also in relation to GCI.

The final conclusion is summarizing the thesis's results. The importance of individual findings is discussed. The strengths and weakness of individual findings are discussed and specified, as well. The potential/necessity of future research related to the lean thinking and lean competitiveness is discussed and specified. The important unexplained question/problems related to lean assessment and competitiveness for the purpose of individual countries' competitiveness are highlighted. Individual findings are relevant both in relation to individual research questions and also in relation to individual research tasks. The LCI's potential and importance are defined together with relevant and justified methodology design necessary for LCI and its individual sub-indices calculation. At the end of the conclusion part, the necessity to modify LCI index (in relation to fourth industrial revolution requirements, industry 4.0 and GCI 4.0 requirements) is mentioned/highlighted.

The thesis itself could be considered as valuable material and its outputs could be considered as inspirational. On the other hand, there are also several weaknesses reducing the value of individual research outputs and findings. The main problems are the following:

- 1) There are too many research questions and tasks. The character of the thesis does not provide enough space to go really deep into individual analyses to reach really significant results.
- 2) Several statements are not supported by relevant findings, evidences or arguments.
- 3) The proposed LCI is rather specific type of index, but its methodology is too simplified. There is lack of logic and arguments supporting its individual sub-indices construction. The process of weights distribution is not well explained. It

is not possible to distribute weights equally as the influence of individual variables is definitely different.

- 4) There is no data overview. No data set is provided. It is not possible to verify individual results.
- 5) The processed data is not tested. Individual time series are suffering because of multi-collinearity and spurious regression. Individual time series or data sets are not tested to eliminate spurious regression negative impact on results. Too high values of R2 could be considered as evidence of spurious regression and vector similarity among individual time series.
- 6) The lean competitiveness index methodology proposal is suffering especially in relation to its second pillar LCI's EFFICIENCY ENHANCERS. Its character is too simple and the choice of individual inputs is not well explained.
- 7) There is no relevant effort related to final LCI score interpretation. There is no effort related to interpretation of individual LCI's sub-indices score interpretation.
- 8) The proposed methodology could be suitable for past-time analysis, but as the WEF changed the methodology of GCI calculation it would be really difficult to apply LCI index in the future. The proposed LCI index is too complicated for data collection process.
- 9) However the Ph.D. thesis is devoted to LCI index and lean thinking both in relation to public and private sector. There is no really detail analysis devoted to the differences existing between public and private sector. The proposed index could be suitable for private business, but it is not suitable for public sector as the its outputs' character is definitely different in comparison to private sector's character output.
- 10) LCI and GCI indicators comparison is not processed in deep. There is no effort to make really deep analysis of differences between LCI and GCI score. Even more LCI index and its sub-indices are not enough discussed as alternative approach to GCI. The importance of LCI is not enough highlighted. The advantage of LCI is not enough specified.

- 11)The thesis does not provide enough relevant arguments explaining the importance of LCI and its potential for management activities. What is the sense of the LCI? How do we can apply LCI results?
- 12)LCI efficiency enhancers could be considered as the weakness of the whole proposed approach and methodology. Its construction is rather weak. The reduction of GCI efficiency enhancer indicators for the purpose of LCI efficiency enhancers construction is not explained.
- 13)Unfortunately, the processed material provides deeper analyses only for three selected years. The choice of those three years (2006, 2011 and 2015) is not well explained. It is not clear whether those three years could be considered as really representative one. The year 2006 could be considered as the year of economy slowdown. The year 2011 is the year of economy recovery after the 2008/2009 economy crisis and the year 2015/2016 is also rather specific because of global economy transformation process.
- 14)Finally, however the thesis is devoted to many research tasks and questions, it does not provide enough relevant answers and findings. The thesis „opened several idea doors”, but many other “idea doors are waiting behind them to be opened”. The thesis raised more question than manage to answer. On the other hand the lean thinking and lean competitiveness index could be considered as important and interesting topic for future research both in management and business economy research issues. The processed material does not provide any clear output and conclusion. On the other hand, it could be considered as inspiration for future discussion and research devoted to lean thinking research and its potential for alternative approach to competitiveness analyses.
- 15)The processed thesis is suffering because of language and spelling mistakes.

Except for before mentioned shortcomings, there are also several strengths making the processed thesis valuable. The most important are the following:

- 1) The thesis is devoted to ambitious and rather important topic.
- 2) The character of the research is multi-disciplinary one.



- 3) The proposed LCI index could be applied not only for individual business entity analysis, but also for sector, regional or country competitiveness analyses.
- 4) The proposed LCI index is not so complicated as GCI index.
- 5) The analysis proved the possibility to apply LCI index and its sub-indices as the alternative way of individual countries' competitiveness analysis.
- 6) The proposed material is based on well processed "the state of the art". The lean thinking literature overview is processed in detail and different approaches are discussed and explained.
- 7) The whole material could be considered as important stimuli for future research in the area of lean thinking and lean competitiveness management.
- 8) The processed material – especially the first two chapters could be considered as very useful material for didactical purposes.
- 9) The proposed methodology is far to be perfect, but it is good starting point for future discussion and even deeper research in the area under the investigation.
- 10) The proposed material could be understood as an interesting starting literature for anyone who is interested to get knowledge in the area of lean thinking and lean competitiveness issues.

However, the proposed material is not perfect. It is possible to consider it as good piece of research and good Ph.D. study process output.

There are few questions related to the processed Ph.D. thesis:

- 1) Could you explain the real importance of LCI index?
- 2) Could you propose some approach related to results' interpretation?
- 3) What do you think about the future perspectives of LCI as the methodology for GCI calculation changed?
- 4) What do you think about the problem of spurious regression and correlation? Data for regression and correlation analyses are not tested for multicollinearity.
- 5) What is the main advantage of LCI in comparison to GCI? Could you specify the real added value/importance of LCI index and its components?

Finally, Mr. Benjamin Gozlan, M.Sc. did the relevant research regarding the role of lean thinking and lean thinking management for the purpose of competitiveness issues analyses at the country level. The dissertation thesis is an original solution to the research problem. Its author demonstrated general economic and especially management knowledge and the ability to conduct independent scientific research. Mr. Gozlan designed and performed well-processed research, using relevant research methods and approaches. All the above statements indicate the author's expertise in the field of economics.

Taking into account the topic selection, research assumptions and methodological approach, as well as the substantive and formal value of the dissertation, I conclude that it meets the requirements laid down in article 13.1 of the Act of March 14, 2003 on Academic Degrees and Titles and Degrees and Title in the field of Art (Official Journal of Laws of 2007, item 1789) in connection with article 179 of the Provisions introducing the Act – Law on Higher Education and Science of July 3, 2018 (Official Journal of Laws of 2018, item 1669). On this basis, I recommend the dissertation thesis for approval and public defense.

prof. Ing. Luboš Smutka, Ph.D.

A handwritten signature in black ink, consisting of a stylized 'S' followed by a horizontal line and a flourish.