POLITEHNICA UNIVERSITY TIMISOARA
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MANAGING COMPLEXITY IN SERVICE PROCESSES. THE CASE OF LARGE BUSINESS ORGANIZATIONS

- PhD Thesis Summary -

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CONTENT

PhD Thesis Content

1. General Overview of the PhD. Thesis

The preliminary source and ideas of the PhD topic were related to the complex reality of solving and develop big outsourcing projects, in the case of services domain. From the practical perspective, and also, from the theoretical one, there has been identified a strong need in solving complex situations, through an existing framework or approach, mainly defined to simplify the problem solving situation. The **topic importance and relevance** will be explained in the following.

Outsourcing is furthermore a relevant and important sourcing strategy. According to the report "*2nd quarter 2014 EMEA (Europe, Middle East and Africa Area) ISG Outsourcing Index*" of the ISG (Information Services Group), outsourcing activities in EMEA have reached a record high in the first half of the year at. ISG is a provider of technology information, market research information and consulting services (Schuster, 2014). Such big projects need a common organizational project and program structure (Brehm & Hackmann, 2014). Major causes of increasing complexity are, among some others, strategic alliances, and outsourcing to third party (Castellano, 2014).

Dealing with complexity is the central challenge of our time (Jischa, 2008). The socio-political and global economic development represents individual companies in the service industry before extraordinary challenges: globalization, penetration of new technologies, more dynamic product life cycles. Resource scarcity, demographic change, climate change and energy transition are only some selected megatrends that affect the company as external factors and the companies need to position their strategies (Spath, 2013). Due to the existing and further increasing global networking in all economic, political and social areas complexity is, more than ever an essential success factor for organizations (Schoeneberg, 2014).

"*Complexity has received wide attention from practitioners and academics alike. We have made significant progress in understanding the different aspects of complexity in projects, programmes and portfolios*" (Oehmen et al., 2015, p.3).

Due to the ongoing globalization, companies need to deal more than ever with new markets, competitors, and individual customer needs to remain on the market in the long term. In addition to the market requirements, the company must manage ever-changing needs of internal and external customers, for example because of new information and telecommunications technologies. Within a short time, the volume of business-related complexity has steadily increased and a large part of the company has evolved from a complicated to a complex system (Schoeneberg, 2014).

"*Future research should continue to investigate how to mitigate or manage the operational day-to-day uncertainties with the long-term strategy of a company [...]. There is also a need for more research into what alternative strategies are available*" (Nordigarden et al., 2015).

Within the framework of research, it will be examined how complexity can be managed in the service sector, if the external factors take over a dominant character. In an outsourcing situation, services (based on the contractual agreement) have to be designed at the customer interface and must be integrated and adapted to the internal processes of the service provider. As outsourcing is usually associated with a takeover of an existing infrastructure, processes and personnel, the selected case study represents a suitable application to investigate the external factors influencing complexity.

The motivation of the research topic is due to the fact that complexity management is becoming increasingly important in science and industry. Prof. Thomas Bauernhansl (representing the cooperation between the University of Stuttgart and the Fraunhofer Institute) has published the topic: "*Manage complexity - the introduction of production systems in Industry 4.0*"at the mav Innovation Forum 2014 and defined the management of complexity as a *new core competence*.

Prof. Thomas Bauernhansl presented the study results of the cooperation between University of Stuttgart and the Fraunhofer Institute from 2013, in which directors and executives of leading German industrial companies were interviewed. 82% of respondents answered that the relevance of complexity will increase in the future. 56% of all respondents indicated that they do not have any method or IT system to deal with

the complexity (Bauernhansl, 2014, p. 1). The participants were asked the question: *In what areas are high complexities handled inefficiently?* The Top 3 results were the areas of: "*Processes and ordering processes", "IT"* and "*business organization"*.

In addition, Hans-Jürgen Klesse article: "*Komplexität - Mit schlankeren Strukturen zu mehr Profit*" in the German magazine "*Wirtschaftswoche*" refers to a study done by the consulting company "*A.T. Kearney*", that mention that the cost of complexity in DAX companies amounted to € 30 billion annually (Klesse, 2012). Despite the high demand on establishing a complexity management approach for business, there is still hardly any concrete IT support (as specific tools). Specific tools have been developed in different sectors and business environments, however, with a lot of lacks, for example support for objectivity and reliability only (Ravishankar et al., 2014, p. 5).

Industry experts in Germany confirm that after the implementation of Industry 4.0 in their companies, the productivity gains are up to 50%, depending on the complexity of production use cases (Bauernhansl et al., 2015).

The aim of the PhD research program is to design a systematic approach of complexity management for industrial service creation in the wholesale environment.

Currently existing approaches of the science will be analyzed and developed. Furthermore, a suitable simulation model to identify the costs and benefits of existing and potential complexity will be developed. As an application case, the service design of various sub-processes in order processing will be analyzed. To prepare an application for the industry, appropriate working practices and recommendations for action will be developed.

In the last years, the state of science represents no standardized solution for the combination of industrial services and complexity, based on a use case with dominant influence on customers so far, despite the numerous large-scale projects in the service sector. An important argument comes from Peter Addor, a researcher of complexity management which determines that complex situations cannot be controlled; only the application of a model, such as system dynamics, allows to master complexity (Addor, 2014).

The general objective of this PhD research is to evaluate and characterize the relevant business research directions of complexity management and develop a *Business Complexity model* for a large-scale business environment by using various interdisciplinary researches of different management areas. For this purpose, a methodological, procedural and organizational approach for the scientific and practice will be developed to complete existing research gaps. The result will be applied in a use case of a high volume outsourcing project, in which IT services are contractually agreed between customer and service provider.

The **operational objectives** of the research approach are:

OP1. Analysis and synthesis for building a bibliographic overview of the complexity of management with business relation and provide the scientific basis for the research on business Complexity Management;

- **OP1.1.** Analysis and synthesis for creating a bibliographic summary of relevant business complexity management, to represent a basis not only for the present research work, but also for further research in this area - **Chapter 2**;
- **OP1.2.** Analysis and synthesis (for creating a knowledge inventory) of further relevant and necessary research areas/topics of dealing with complexity and defining the requirements for a business management complexity model - **Chapter 3**;

OP2. Create (Design) a framework and a model (with an associated methodology) for the characterization, development and evaluation of business management complexity for the application in a large-scale business environment, in order to perform an adequate analysis and to establish systematic strategies and

measures in form of detailed requirements. Appropriate management tools and methods are designed to concretize and fulfill the possibility to manage complexity - **Chapter 4**;

OP3. Evaluation and application of the developed complexity model for a large-scale business environment, as the IT Outsourcing projects are;

OP3.1. Theoretical and applied research of a business complexity model for the identification and evaluation of complexities in business situations, using a typical example of an IT Outsourcing project - **Chapter 5.1**;

OP3.2. Evaluation and final review of the theoretical framework, the model and the application of the designed complexity model in large-scale business projects - **Chapter 5.2**.

In order to achieve the operational objectives, there have been valorized and exploited the theoretical knowledge acquired from the first Industrial Engineering programme at the *Hochschule für Technik und Wirtschaft Berlin, Germany* and the second programme of Master of Arts - Management at *AKAD Lahr Germany*, as well as the practical knowledge achieved from more than 15 years of experience with management responsibilities in large-volume outsourcing projects.

The overall goal and operational targets are systematically developed and documented in the different chapters of the PhD thesis as shown in Figure 1.

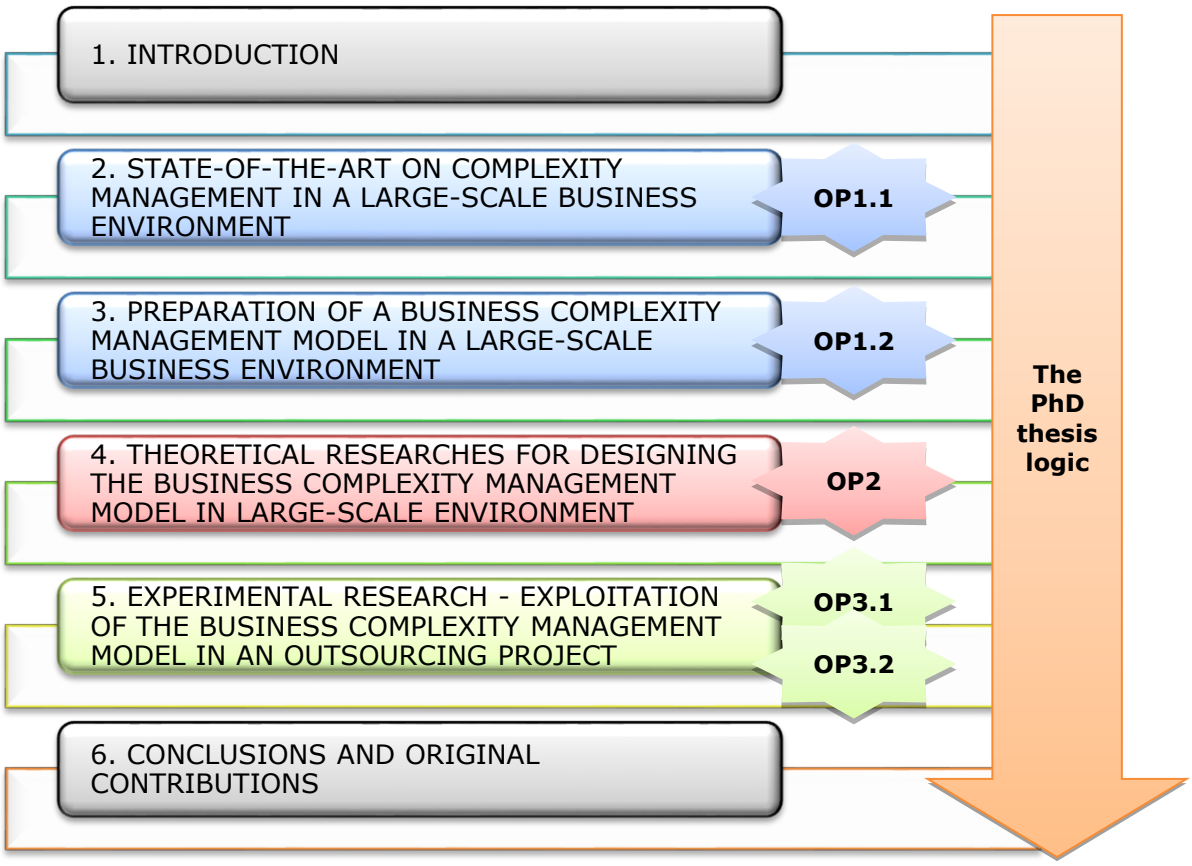

Fig. 1. The general overview of the PhD thesis associated with the research approach (own schema)

The PhD thesis consists of 6 chapters with a total length of 137 pages (including the bibliographic list of articles, books and web pages that were used and adequate cited in the text). In addition, 13 annexes were defined in order to support the debates and explanations with supplementary details. Totally, the PhD thesis lengths on 169 pages and consists 29 tables, 28 figures, and 4 mathematical formulas.

The way on how each operational objective has been targeted is proved by the content of each PhD thesis chapter that described the developed research activities, the results achieved together with relevant conclusions. Briefly, each chapter content is described in the following.

Chapter 1, INTRODUCTION, describes the problem of the research topic, the motivation and the scientific and practical importance. Using selected examples, the challenge and the current state of research is underlined. Furthermore, the objective of the entire PhD approach is briefly outlined.

Chapter 2, STATE-OF-THE-ART ON COMPLEXITY MANAGEMENT IN A LARGE-SCALE BUSINESS ENVIRONMENT, provides an overview of the current state of research, with bibliographic reference, regarding complexity relevant research results. A targeted categorization of the various sub-directions of complexity management supports the need for differentiation. The differences between the approaches are underlined and assessed individually and mutually. Also, the practical oriented state of research is analyzed, discussed and compared with the (pure) theoretical scientific state of research.

Chapter 3, **PREPERATION OF A BUSINESS COMPLEXITY MANAGEMENT MODEL IN A LARGE-SCALE BUSINESS ENVIRONMENT,** examines additional management disciplines that include complexity relevant aspects for designing a complexity management model in large-scale business situations. Furthermore, results of two pre-studies are presented, in order to characterize the comprehensive requirements management, to identify complexity relevant assumptions and define a framework for the following design phase. The result of this chapter is a holistic list of functional and non-functional requirements for a large-scale complexity management.

In **Chapter 4**, **THEORETICAL RESEARCHES FOR DESIGNING THE BUSINESS COMPLEXITY MANAGEMENT MODEL IN LARGE-SCALE ENVIRONMENT,** a framework for a holistic approach for a Business Complexity Management is developed, named "*Large Business Complexity Management*". Within this section, the different elements of this comprehensive approach to manage complexity are described in detail. The challenges of outsourcing projects are clustered and structured. Starting from the previous state of research, complexity criteria are developed for large-scale business environments and these criteria are linked with management tools.

In **Chapter 5**, **EXPERIMENTAL RESEARCH - EXPLOITATION OF THE BUSINESS COMPLEXITY MANAGEMENT MODEL IN AN OUTSOURCING PROJECT,** a typical business situation in an IT Outsourcing project is described (research context), which serves as a basis for applied research and for testing and validation of the designed model.

In sub-chapter 5.1 are presented the research results and debates of a simulated use case (IT Outsourcing project of large scale) in order to exploit the defined model (methodology with specific methods and tools) of the "*Large Business Complexity Management*". The simulated application results of the proposed model are discussed and the appropriate conclusions are made (regarding the application edited for usage in the cooperation between the involved parties of the project).

In sub-chapter 5.2, the functional and non-functional requirements for a large-scale complexity management case, which are listed in Chapter 3, are analyzed and evaluated within the context of the theoretical approach presented in Chapter 4 and the findings of the framework application, in sub-chapter 5.1.

In **Chapter 6, CONCLUSIONS AND ORIGINAL CONTRIBUTIONS,** the results of the research are summarized and the core messages of the findings are presented. In addition, the results interpretation is shown together with the meaning for the various research complexity-related disciplines, in a consolidated form. Reference to the

previously identified gaps in the research is made together with their complete description.

Finally, the thesis ends with a **BIBLIOGRAPHY** which contained 176 cite titles (articles, books and web pages) and a list of **ANNEXES** with supporting documents of the research. These include:

- Overview of the current status of research regarding business complexity management in large business projects;
- Detailed information of various complexity management models presented in literature;
- Supplementary information and details of the present thesis;
- Details of the proposed contractual model to establish complexity management for service provision.

The research results dissemination consists of the following **articles** that were presented and published during the PhD programme (2013 – 2016):

1. **Rennung, F.,** Paschek, D., Draghici, A. (2014). A Complexity Management Model for Industrial Services. *Review of Management and Economic Engineering, 4th International Management Conference, "The Management between Profit and Social Responsibility"* (pp. 439-449). Cluj-Napoca: Todesco. *(ISI Thomson WOS:000367105500058)*
2. Luminosu, C., **Rennung, F.**, Draghici, A. (2014). Efficiency measurement of human resources integration methods in outsourcing situations. *Annals of the Oradea University- Fascicle of Management and Technological Engineering Vol. XXIII (XIII)/1,* 187-190. DOI: 10.15660/AUOFMTE.2014-1.2988 *(Ulrich's web, Google, Crossref, Copernicus, CiteFactor, Scipio etc.)*
3. **Rennung**, **F.**, Luminosu, C., Draghici, A. (2014). Human resources integration methods used in big organizational change projects. In: (n.d.) *Human Capital without Borders: Knowledge and Learning for Quality of Life, Proceedings of the MakeLearn 2014 International Conference*, Bangkok, Celje, Lublin: ToKnowPress (pp. 775-784) *(EconPaper-Ideas, Google)*
4. **Rennung, F.**, Luminosu, C., Draghici, A. (2014). Evaluation of methods for customer integration to the quality of IT services. *CENTERIS 2014 - Conference on ENTERprise Information Systems, Procedia Technology 16/2014*, 101 – 109, DOI: 10.1016/j.protcy.2014.10.073 *(Springer, ISI Thomson WOS:000360404800012)*
5. Gogan, L.-M., **Rennung**, F., Draghici, A. (2014). A proposed tool for managing intellectual capital in small and medium size enterprises. *CENTERIS 2014 - Conference on ENTERprise Information Systems, Procedia Technology 16/2014,* 728-736. DOI:10.1016/j.protcy.2014.10.022 *(Springer, ISI Thomson WOS:000360404800081)*
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7. **Rennung**, **F.**, Luminosu, C., Draghici, A. (2015). Strategic Management – Managing the Potential Complexity-Risks in Outsourcing. *4th World Conference on Business, Economics and Management (BEM-2015), Procedia Economics and Finance, Vol. 26,* 757 – 763. DOI: 10.1016/S2212-5671(15)00835-7 *(Springer, ISI Thomson WOS:000381990300110)*
8. **Rennung, F.**, Luminosu, C., Draghici, A. (2015). Service provision in the framework of Industry 4.0. *SIM 2015: 13th International Symposium in Management, Procedia -*

Social and Behavioral Sciences, Vol. 221, 372–377. DOI: 10.1016/j.sbspro.2016.05.127. *(Springer, ISI Thomson WOS: 000381938100044)*

9. **Rennung, F.,** Luminosu, C., Draghici, A. (2015). Importance and Evaluation of Complexity-Causing and Increasing Factors as a Determining Success Indicator in Outsourcing Operations. In: (n.d.) *Managing Intellectual Capital and Innovation for Sustainable and Inclusive Society: Managing Intellectual Capital and Innovation; Proceedings of the MakeLearn and TIIM Joint International Conference 2015* (pp. 257-264). Bangkok, Celje, Lublin: ToKnowPress.*(EconPaper-Ideas, Google)*
10. Gogan, L. M., Borca, C., **Rennung, F.,** Sîrbu, R. (2015). Intellectual capital management - A possible approach. (n.d.) *Managing Intellectual Capital and Innovation for Sustainable and Inclusive Society: Managing Intellectual Capital and Innovation; Proceedings of the MakeLearn and TIIM Joint International Conference 2015* (pp. 1321-1327). Bangkok, Celje, Lublin: ToKnowPress. *(EconPaper-Ideas, Google)*
11. **Rennung, F.,** Borca, C., Luminosu, C., Draghici, A. (2015). Evaluation model for success factors in large industrial projects. *Proceedings of the 7th International Conference on Manufacturing Science and Education - MSE 2015,* pp. 26-31, Sibiu:ULBS.
12. Costescu, I., Duran, D., **Rennung, F.** (2015). Some Considerations about Outsourcing Strategies. *Scientific Bulletin of Politehnica University of Timisoara, Romania; Transactions on Engineering and Management; Vol. 1, Issue 1, 2015,* 16-19.*(CNCSIS index C+D)*
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15. Paschek D., Draghici A., **Rennung F.,** Trusculescu A., (2016). Individual risk early warning systems as a management instrument to handle crises, *RMEE - Review of Management and Economic Engineering*, 140-147.
16. Paschek D., **Rennung F.**, Trusculescu A., Draghici A. (2016). Corporate Development with Agile Business Process Modeling as a Key success factor. *CENTERIS - Conference on ENTERprise Information Systems 2016 in Porto, October 05-07, 2016, Procedia Computer Science, 100/2016,* 1168-1175. DOI:10.1016/S1877-0509(16)32534-0.*(Springer, to be index in ISI Thomson)*

2. Overall Conclusions of the Research

The present PhD thesis completes previous Complexity Management approaches and models, and closes the existing research gap; the main focus of the enrichment of existing models are the methods and instruments to manage and control complexities in business environments. In addition, an important added-value is the transformation of theoretical complexity management models to a concrete business-environment use case (large-scale projects, e.g. IT Outsourcing projects). Based on the interim results of this research, necessary methods and concepts were described in detail to fulfill a holistic approach of complexity management in large business environments; this was named the "*House of Large Business Complexity Management"*. Standardized strategic management instruments, which should be implemented, like stakeholder analysis, were only listed and integrated into the discussion of this research, because of the defined limitation of the research. This contractual basis, in the handling of complexities, have to be agreed between the organizations involved. Furthermore, this allows a permanent evaluation and managing of the complexities of the involved parties and companies.

Demands, which were derived from the current state of research and necessary additional requirements, which were created through the adopted approach, were summarized and defined in detail. Based on these requirements, the holistic approach named the *House of Large Business Complexity Management* was developed. In the next step, the theoretical approach was applied in the detailed described use case (large scale business projects), e.g. IT Outsourcing projects, in form of a simulation. Through a final review, a check was carried out in order to demonstrate if the requirements are fulfilled.

The different objectives and sub-objectives, defined at the beginning of the research (Introduction chapter), were followed and evaluated separately. The result is that all the targets are suffused. The developed procedure allows the concrete implementation in business environments on different and suited organizational levels. The possibility and application of the "House of Large Business Complexity Management" model enabled the service provider to possess complexities and thus have a **Unique Selling Proposition (USP)** in the respective market. Furthermore, the frequently listed problems and prevention grounds for concluding an outsourcing contract were eliminated because of an available solution designed in order to avoid the often-mentioned and listed complexity trap.

The House of Large Business Complexity Management can also support a part of the industrial project in the framework of *Industry 4.0*, in case that these projects are of an appropriate size and complexity. The developments of these projects are automated and IT-supported networking in the case of various organizations, in order to achieve a compound of different value chain and processes. In the industrial sector, these objectives influence the results of the projects implementation, which have a complexity critical extent, so that the use of the House of Large Business Complexity Management model is justified.

Complexity management is a highly interdisciplinary field of science, so within the present thesis numerous scientific disciplines were taken into account. As a result, the findings of this thesis can be used in the future by designing adequate links to all these scientific areas (see Figure 2). The developed complexity model can be used in large-scale business situations, where appropriate adaptation of the complexity criteria is meaningful. The model and the corresponding management tools can be supported in projects where significant organizational, contractual, procedural and IT related changes are to be controlled and managed (according to the dimensions of the *House of Large Business Complexity Management* model presented in Chapter 4).

By using the Complexity Balance Scorecard tool (CBSC) in large-scale project situation, the involved parties are capable to predict complexity as well as to prevent of the complexity trap. Furthermore, this model enables to avoid, to manage or to reduce complexity, as a management strategy.

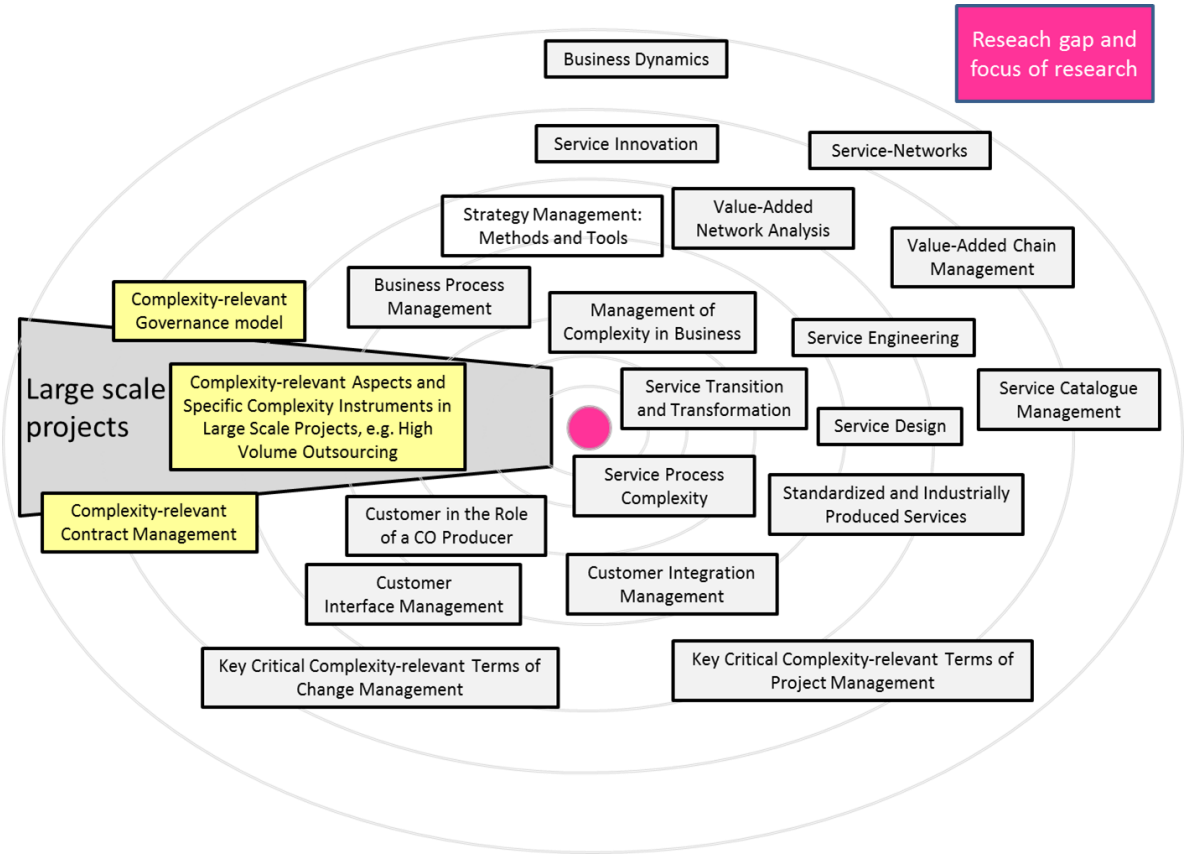

Fig. 2. Focus of research gap and scope of this research (own graphic)

3. Own Original Contributions of the Research

The main original contributions of the thesis to the studied research and knowledge field are:

- The analysis and synthesis of the main and relevant references in the field of complexity management for large-scale business environment. These have concluded to an inventory of the most well-known and accepted definitions of the concepts in the field, together with the description of the main approaches of complexity management - Chapter 2;
- The description of the complexity management research topics in relation with the large-scale business environment dynamics (research results and gaps from the academia and practitioners, large spread of the outsourcing processes and the Industry 4.0 framework actual implications) – Chapter 2;
- The analysis and synthesis of the literature dedicated to the large-scale service-oriented projects (particular to outsourcing process and phenomena and to IT Outsourcing projects specifics) in order to better describe and delimitate the research context – Chapter 2;
- The analysis of the relevant theories and approaches related to complexity management provided by different connected disciplines (research subjects as: service provisioning management, customer integration and customer relationship management, systems engineering, network management, general management and strategic management, innovation management, project management, business process management, IT science and contract management) that have prooved the need for interdisciplinary researches and that could be the basis for other researches in the field. The created knowledge pool has provided strong arguments for the creative solution of the designed business complexity management model – Chapter 3;

- Design and implementation of two preliminary studies (two proposed diagnosis approaches):
    - Correlation of complexity driver with the EPM model (see Study 1);
    - Strategic methods to manage large outsourcing projects (see Study 2).

  These preliminary researches enable the better understanding and characterization of the complexity problems that occur in practice and also, confirmed and complete the findings of (Bauernhansl et al., 2014) - Chapter 3;
- Identification and formulation of the functional and non-functional requirements of the designed business complexity management model in large-scale business environment, based on the literature review, the analysis of the available approaches (provided by different disciplines) and the preliminary studies and practical observations - Chapter 3;
- The design of a business complexity management model called the "*House of Large Business Complexity Management*" and an associated methodology for the practical exploitation, including managerial methods and tools and an Excel tool for the operationalization of the implementation. This is the main contribution to the theoretical researches in the field of complexity management, in the case of large-scale business environment – Chapter 4;
- The proposed model for business complexity management testing and validation through a use case (IT Outsourcing project) that have proved the fulfillment of the defined requirements (functional and non-functional) and the efficiency and effectiveness of the adopted approach from the practical perspective (including the propose combination of the designed methods and tools) – Chapter 5.

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