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Situating Case Studies within the Design Science Research Paradigm: An Instantiation for Collaborative Networks

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Abstract. A rigorous evaluation of an artifact is one of the fundamental aspects to be considered in Design Science Research projects. This evaluation part becomes even more difficult when a large variety of artifacts must be designed for a project. This can be a challenge for the field of Collaborative Networks, which involves knowledge from several scientific disciplines. Case studies are one of the evaluation methods in Design Science Research that are used for an *ex-post* evaluation of artifacts. However, we argue that this method can also be used for the *ex-ante* evaluation, mainly when multidisciplinary research is being carried out. Therefore, the main objective of this paper is to present and discuss a multidisciplinary project of Collaborative Networks using case studies before and after the design of the artifacts. On top of the Design Science Research guidelines, this research is supported by knowledge from Business and Management Studies on how to effectively design and perform Case Study Research for artifact evaluation.

Keywords: design science research, case study research, collaborative networks, multidisciplinary research.

1 Introduction

Design Science Research (DSR) is a well-established research paradigm within the Information Systems (IS) community [1, 2]. In Business and Management Studies (BMS) management is viewed, more and more, as a design science, in an attempt to balance description and prescription-driven research approaches [3]. However, there is still much to explore regarding the applicability of DSR in other research areas, especially in how it can frame multidisciplinary research. A particular challenge to the DSR approaches and methods occurs in the field of Collaborative Networks (CNs) that require the design of a large variety of artifacts, involving several scientific disciplines.

To perform a good DSR project some fundamental aspects must be considered, such as the construction of a viable artifact [1], the rigorous evaluation of this artifact [4, 5], and the knowledge contribution of the DSR project [2]. In fact, the evaluation

of artifacts represents an essential element of DSR, but even so there is still a need for guidance and support on how to design this component of a DSR approach.

Many DSR works point out case studies as one possible approach for the *ex-post* evaluation of the artifact [4–6]. However, in multidisciplinary research (for example in the intersection between IS and BMS) case studies can be used before the design of the artifact, to evaluate some preliminary forms or some parts of the artifact, i.e. meta-artifacts [7]. This approach can be applied for collecting data (through interviews, questionnaires, etc.) that will be used as an input for the construction of the artifact, and also to support its *ex-ante* validation/evaluation. However, most of the studies in DSR referring the use of case studies as an evaluation method still fail to provide clear directions on how to effectively design and perform case studies.

The main objective of this study is to discuss a different possibility for using Case Study Research (CSR) within the DSR paradigm in multidisciplinary research. The research question is:

- How can CSR be effectively integrated within the DSR paradigm in multidisciplinary research?

Therefore, a research framework is presented for performing a multidisciplinary study, in the field of CNs, which uses DSR and CSR. Using an illustrative example developed on an ongoing doctoral project, it is argued that both conceptions of case studies from the areas of IS and BMS can be adopted in multidisciplinary research, by using CSR at the *ex-ante* stage of the artifact design, and also by selecting case studies for an *ex-post* evaluation. This is a research in progress work, where some parts of this project were already completed, such as the literature review and some exploratory study using empirical data. The next planned parts are the case studies and artifact development. The context under analysis are internationalization processes with the aim of establishing CNs between industrial enterprises associations (IEAs) and their associated small and medium enterprises (SMEs).

The paper aims at contributing to the area of IS and DSR, using knowledge from BMS on how to effectively design and perform CSR for artifact evaluation. Moreover, the results of this study can be relevant for BMS by providing new ways of doing case-based research [8], and also for researchers designing artifacts of CNs, with knowledge from different scientific disciplines. Another contribution to the field of CNs is to present a different context, i.e. the context of CNs between IEAs and SMEs to optimize internationalization processes.

For this purpose, literature on DSR and CSR is first analyzed in Section 2, by considering the fundamental aspects of each paradigm/methodology and by showing how case studies are performed in both IS and BMS. Then, the research framework is presented in Section 3, along with a multidisciplinary project of CNs designed using the developed framework. This case shows a possible way of performing multidisciplinary research, and focus on understanding how CSR can be effectively integrated with DSR. Finally, Section 4 presents a discussion and the main conclusions of this study.

2 Literature Review

2.1 Fundamentals of Design Science Research

Undoubtedly, the important work by Hevner et al. [1] has been inspiring many research contributions in the area of DSR. These authors provide new insights for IS researchers and practitioners on how to effectively conduct, evaluate and present DSR. This work is mostly influenced by the seminal thinking of Simon [9] about the design theory and the design process. The main goal of DSR is to create innovative artifacts addressing unsolved problems in organizations [10]. Such artifacts may include:

- conceptual artifacts, such as constructs, models, methods, and frameworks [4];
- formal logical instructions, such as algorithms and instantiations [4];
- system design, language/notation, guidelines, requirements, patterns, and metrics [11];
- social innovations [3];
- new properties of technical, social, or informational resources [12];
- architectures, design principles, and design theories [13].

Hevner [14] develops an approach based on a complementary 3-cycle model (Figure 1): (1) *relevance cycle* – to bridge the contextual environment with the design science activities; (2) *rigor cycle* – to connect the design science activities with the knowledge base (from scientific foundations, experience, and expertise); and (3) *design cycle* – to iterate between the core activities of developing and evaluating the design artifact.

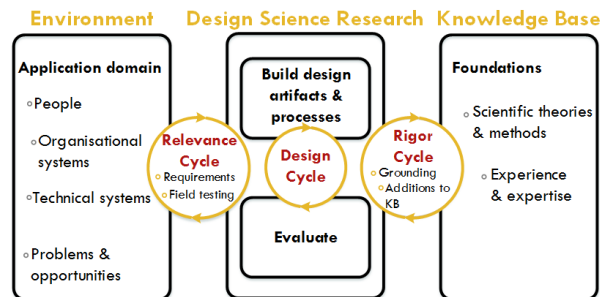


Fig. 1. The 3-cycle model of Design Science Research [14]

Well designed and developed artifacts are expected to contribute with new knowledge to the body of scientific evidence and to real-world applications [10]. Gregor and Hevner [2] identify four types of knowledge contributions, based on the existing state of knowledge, in both the problem and the solution domains: (i) invention (new solutions for new problems); (ii) improvement (new solutions for known problems); (iii) exaptation (known solutions extended to new problems); and (iv) routine design (known solutions for known problems). To conduct proper DSR in

IS, Peffers et al. [15] develop and evaluate a methodology (DSRM) consisting of six steps: (i) problem identification and motivation; (ii) definition of the objectives for a solution; (iii) design and development; (iv) demonstration; (v) evaluation; and (vi) communication.

2.2 Design Science and Multidisciplinary Research

Many knowledge regarding DSR has been developed in other research areas, such as architecture and engineering disciplines. Some examples of recent studies have been done in the social domain [16], as well as in the engineering domain, with specific focus on requirements engineering [17], ontology engineering [18], and production engineering [19].

Some important contributions have also been made in BMS. The work of van Aken [3], developed in the same year as the renowned paper by Hevner et al. [1], makes a distinction between description- and prescription-driven research, discussing management as a design science. The author suggests that the traditional description-driven research in BMS (based on the paradigm of the explanatory sciences) must be balanced with more prescription-driven research (based on the paradigm of the design sciences) in order to mitigate relevance and utilization problems. Denyer et al. [20] also make important contributions to this area presenting a DSR approach to management, with a discussion of prescriptive knowledge in the form of design propositions following the so-called CIMO-logic. CIMO-logic combines problematic *Contexts* with certain *Intervention* types to deliver specific *Outcomes*, following generative *Mechanisms*. Holmstrom et al. [21] propose a design science approach to bridge practice to theory rather than theory to practice in Operations Management. Finally, Hodgkinson and Starkey [22] make a critical assessment of contributions from the British Academy of Management, suggesting that design science and critical realism have the potential to face the existing relevance problem in the area.

Nevertheless, more contributions from other research areas are needed, especially in what concerns multidisciplinary research.

2.3 Case Studies as an Evaluation Method and Case Study Research

The evaluation of artifacts represents an essential element of DSR [1, 15]. However, with the exception of a few recent works, there is still the need for more guidance on how to design the evaluation component of DSR [4–6]. Peffers et al. [4] perform a review on 148 DSR articles to analyze the “artifact / evaluation method” combination in order to support researchers in the evaluation method selection. Venable et al. [23] develop a comprehensive framework for evaluation in DSR, comprising a four-step methodology and making an important distinction between “*ex-ante vs. ex-post*” evaluation and “*artificial vs. naturalistic*” evaluation. Prat et al. [6] present a holistic view of artifact evaluation in IS, resulting in a high-level abstraction model of evaluation methods and in some instantiations of this model through a set of generic evaluation methods.

All of these works point out case studies as one of the typical naturalistic evaluation method in DSR, to be used for the artifact *ex-post* evaluation. However, in multidisciplinary research, for example in the intersection between IS and BMS, case studies can be used before the design of the artifact. The present paper aims at demonstrating a possible way of doing this, by evaluating some preliminary forms or some parts of the artifact, i.e. meta-artifacts [7]. Therefore, we argue that case studies can be applied as a method for collecting data (through interviews, questionnaires, etc.) that will function as an input for the construction of the artifact, and its subsequent *ex-ante* validation/evaluation. In addition, most of the work in IS referring the use of case studies as an evaluation method still fail to provide clear directions on how to effectively design and perform the case studies themselves.

Case Study Research in Business and Management Studies. In BMS, particularly in the case of Operations Management, CSR is a reputable and widely-accepted research methodology. It gained importance in these areas mainly with the seminal works by Yin [24] and Eisenhardt [25], and later by Voss et al. [26]. In fact, Ketokivi and Choi [27] reinforce this growing interest by stating that a renaissance of CSR in Operations Management occurred in the last twenty-five years. Case studies are preferred in general when [24]: (i) "how" or "why" questions are used; (ii) the researcher has no control or little control over events; or (iii) the focus is on a contemporary phenomenon within a real-life context.

However, many authors argue that CSR should be used not only for inductive research, as recommended by Yin [24] and Eisenhardt [25], but also for deductive research [28] or for abductive research [29]. Therefore, Ketokivi and Choi [27] propose three different methodological approaches to CSR, in order to analyze its methodological diversity and to increase its transparency: (i) theory generation (inductive research); (ii) theory testing (deductive research); and (iii) theory elaboration (abductive research). Each approach has its peculiarities, mainly concerning the emphasis and interplay between theory and practice, as described in Figure 2 by the thickness of the arrows.

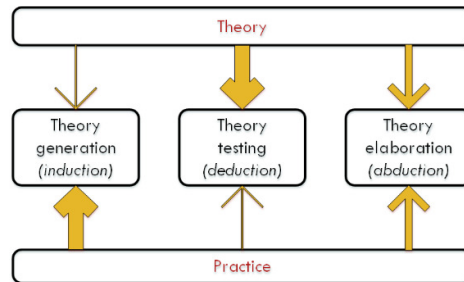


Fig. 2. Three methodological approaches to CSR (Adapted from Ketokivi and Choi [27])

An effective design of case studies is a fundamental part of any CSR project [24]. Voss et al. [30] revisit case research in OM, giving important recommendations for effectively designing CSR: (i) have knowledge about the theoretical and empirical contexts; (ii) ensure (internal, construct, and external) validity and reliability of the CSR; (iii) select an appropriate research logic (theory generation, theory testing or

theory elaboration); (iv) select cases (single or multiple; holistic or embedded); and (v) develop a research protocol (phenomena under study, unit of analysis, research instruments, procedures, etc.). After successfully designing the CSR, the next stages are to conduct, analyze, and report case research [24, 26, 28].

Different Perspectives for Using Case Studies. In BMS, a case study is presented as an empirical description of a contemporary phenomenon within its real-life context, and it is typically based on a variety of data sources [24]. In DSR, case studies are viewed as observational methods for the application and the evaluation of an artifact to a real-world context [1, 4, 5]. These two definitions are in some way similar but also different, essentially in what concerns the methodological approach, these differences being perceptible in some specific cases in the literature.

Barratt and Barratt [31] present a comprehensive case study to explore internal and external supply chain linkages. Although focusing on a single case, these authors develop a set of research propositions that provide important insights to extend the supply chain visibility. Before presenting their findings, a detailed description of the methodology is presented. They start to describe the methodology with the background and motivation of the study, referring the duration and the procedures followed. Then, they justify the rationale of using a single case study, arguing that even though a single case may offer only limited generalizability, it allows for a more in-depth exploration and understanding of the phenomena. Additionally, other important aspects are described in detail: (i) the sampling approach (qualitative design with embedded multiple units of analysis); (ii) the unit of analysis (information-based supply chain linkage) and informants (e.g. supply chain and logistics directors, and account managers); (iii) the data sources (semi structured interviews, documentation, and observation); and (iv) the data analysis (transcription of interviews, construct and validity, and data triangulation). Finally, the resulting propositions are viewed in a theory generation perspective, providing relevant contributions for theory and practice. However, the authors also recognize some lack of external validity (limited generalizability) that is typical in inductive studies [24].

The study of Barratt and Barratt [31] is a good example of a rigorous case study design. The authors present a sound description of the CSR approach, addressing all the main factors described in the literature for successfully conducting case studies. In contrast, looking at the design science literature, many authors refer the use of case studies for the artifact evaluation stage but without a clear detail on how the whole CSR has been conducted. Some studies naturally present the selected cases in a detailed way, as well as the informants and the data sources used [15]. However, other important aspects are not clarified, such as the validity and reliability of the CSR approach, the research logic (if it is inductive, deductive or abductive), the nature of the case (if it is holistic or embedded), and the detail of the CSR protocol.

2.4 Concluding Remarks

From the analyzed literature on case studies in IS and BMS, it is clear that, in practice, researchers use quite different methodological approaches. From one side, CSR represents a rigorous methodology in BMS, with a set of steps and requirements that need to be followed for obtaining more robust cases and for contributing to

theory and practice. From the other side, case studies are a typical evaluation method in IS, mainly used to observe if an artifact is valid in a specific empirical context. These definitions are valid for a particular research area where the study occurs. However, the problem still remains for researchers that are working with DSR in a multidisciplinary context, as it is the case presented in this paper, for example, with the intersection of IS and BMS. In these cases, the questions are whether a researcher needs to consider all the rigor that is imposed in BMS, or if case studies can only be used for an *ex-post* evaluation of the artifact. This gives room for the following research question: How can CSR be effectively integrated within the DSR paradigm in multidisciplinary research?

It is not the purpose of this study to compare DSR with CSR, as this comparison was already made by previous research, e.g. [19, 32, 33]. Instead, the objective here is to respond to the previously stated research question and to understand the interplay between these two methodologies/paradigms in multidisciplinary studies. As referred above, we argue that case studies can be used not only after the development of the artifact but also for an *ex-ante* evaluation, by evaluating meta-artifacts that will function as an input to build the final artifact. The rigor of the design process must be present during the entire study, not only at the design stage of the artifact. A rigorous design of the CSR approach is also important. Therefore, using knowledge from both DSR and CSR, a research framework for a multidisciplinary project of CNs is presented in the next section.

3 Design of a Multidisciplinary Project of Collaborative Networks

3.1 Context

This project presented in this section is an ongoing multidisciplinary doctoral project, developed on the intersection of two main research areas: (i) International Business (IB); and (ii) Information Management (IM). This doctoral project will study different IEAs that act as an institutional network support for the internationalization of their associated SMEs. Despite receiving some support from governments and from other institutional entities, many SMEs still face difficulties in managing their internationalization processes [34]. In some cases, they have a restricted access to relevant information or limited contact with knowledge and experience from key players, reducing the chance of entering in new markets with success [35]. In other cases, the poor information management capability of SMEs represents another hindrance for their internationalization processes [36].

Therefore, the objective is to understand the problems and the needs from both IEAs and SMEs, as well as to analyze the network dynamics that are formed through this institutional-based business environment. The ultimate goal is to design new information and knowledge management solutions and artifacts, following the DSR paradigm. The expected result is to improve the decision-making capability of SMEs to internationalize and to empower IEAs for acting as a fundamental institutional support by establishing CNs to optimize internationalization processes.

CNs are networks of organizations that are formed by different and autonomous geographically distributed entities, which are heterogeneous regarding operating environment, culture, social capital, and goals [37]. These CNs allow companies and organizations to share risks and benefits [38], representing also important sources of information and knowledge [34]. Interactions and collaborative processes in CNs are most of the times supported and mediated by information and communication technologies [39] and differ from other network forms (supply chains, virtual enterprises, clusters, etc.). This because collaboration is “an intentional property that derives from the shared belief that together the network members can achieve goals that would not be possible or would have a higher cost if attempted by them individually.” [37]

The aim in this section is to show how this multidisciplinary project was designed, giving more detail in parts such as the design of the CSR, the description of the artifact, and the DSR knowledge contribution.

3.2 Research Framework

Based on the theoretical background of Section 2 and on the proposed research questions, the aim was to build a multidisciplinary research framework encompassing knowledge and contributions both from IS, with focus on DSR [15], and from BMS, with focus on CSR [24]. This doctoral project is a possible way of doing multidisciplinary research, focused on understanding how DSR can frame this kind of research and on showing how CSR can be integrated with DSR.

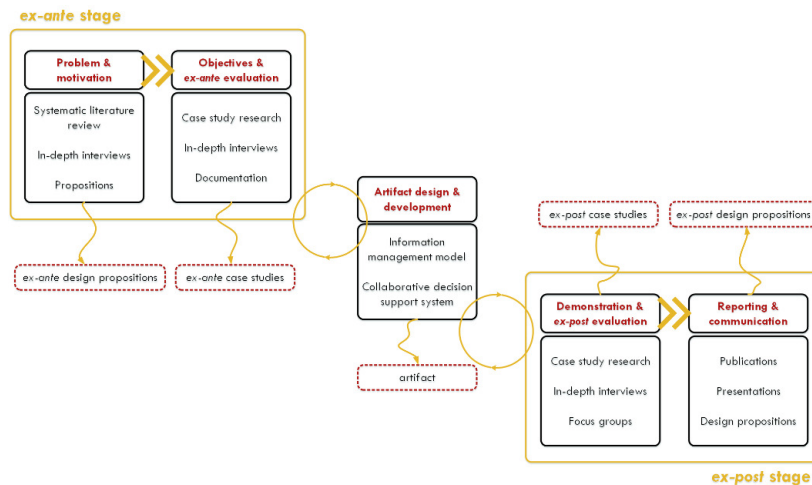


Fig. 3. Research framework of this doctoral project (Based on Peffers et al. [15])

The result is then a doctoral project divided in three main stages of research (Figure 3): (i) *ex-ante* stage (define the problem and express the motivation for the study; define the objectives of the artifact and perform an *ex-ante* evaluation); (ii)

artifact design stage (design and develop the artifact); (iii) *ex-post* stage (demonstrate the artifact and perform an *ex-post* evaluation; report and communicate the results).

The design process is always present along all stages of the project, i.e. design propositions will be developed and case studies will be designed before and after the design/development of the artifact. Two artifacts will be designed and developed: (i) an information management model; and (ii) a collaborative decision support system. Naturally, some iterative processes may occur during the course of this project, such as reporting and communication of some early results or iterations, leading to the re-definition of objectives and to new processes for artifact design and development (to improve effectiveness). Currently, this project is at the *ex-ante* stage, more precisely at the definition of the specific artifacts to be developed.

3.3 Research activities

Problem and Motivation. A systematic literature review (SLR) was first performed, as a way to analyze the scientific relevance of the research, and to define the problem scope and the motivation of this study. This form of research synthesis is common in organization and management studies [20]. Accordingly, the SLR was done to investigate the role of information, knowledge and collaboration in internationalization decisions of SMEs, as well as to understand the state-of-the-art of approaches to tackle these issues. The main findings obtained with this SLR were [40]: (i) there is no detailed systematic analysis on the specific content and scope of the information required for making decisions in internationalization; (ii) there is a lack of comprehensive and systematic studies addressing how SMEs manage internationalization information generated in collaborative contexts; (iii) there is no evidence on how SMEs can convert information into knowledge to support decision-making in internationalization processes. In order to guarantee the practical relevance of the research, and to better define the problem and the motivation of the study, interviews with IEAs were performed. The main goal of these interviews was to provide an in-depth analysis on the relation and the impact of IEAs in internationalization processes of SMEs. This part of the research is completed. The ongoing part is to use the results both from the SLR and from the exploratory study to develop a theoretical/conceptual framework, together with some design propositions (*ex-ante* design propositions). This framework and these design propositions will be then tested in the next stage of the research, providing the contextual knowledge for the design of the CSR and of the artifact to be developed, which represent the next planned parts of this project.

Objectives and *Ex-ante* Evaluation. To help in the definition of the desired objectives for the solutions to be developed, a more focused research will be performed using a CSR. As mentioned earlier, in DSR, case studies are only pointed out to be used at the *ex-post* evaluation stage of a specific artifact [4, 5]. However, considering the multidisciplinary nature of this project, CSR will be used for both *ex-ante* and *ex-post* evaluation of the artifact. Therefore, a qualitative design of a multiple embedded case study will be used to describe the existing relationships between information, collaboration and knowledge creation, in the

internationalization processes of SMEs. The main goal will be to specify the requirements for an effective transformation of information into knowledge on internationalization, mediated through collaborative processes and tools. This CSR will be developed following the recommendations for effectively designing CSR [8, 27, 28, 30]. Table 1 summarizes the CSR design applied at this stage of the research.

Table 1. Summary of the CSR design

Recommendation	Description
Knowledge on the theoretical context	SLR, conceptual framework and design propositions prior to the CSR
Knowledge on the empirical context	Interviews with IEAs prior to the CSR
Sampling	Qualitative design of a multiple embedded case study
Unit of analysis	Two IEAs and some of their associated SMEs
Informants	Personnel working in internationalization processes and owners/managers of IEAs and SMEs
Data sources	In-depth semi-structured interviews, documentation and observations
Data analysis	Transcription and coding of interviews with MAXQDA, and cross-case analysis, until reaching a point of data saturation
Research logic	General theory and empirical context balanced, following an abductive research for theory elaboration
Construct validity	Transcripts of interviews sent back to the informants for corroboration, responses from the informants supported by documents and observations (data triangulation), and diversity of informants (role and position)
External validity	Replication logic of the multiple-case studies to different contexts or to the same context of internationalization but in different countries, cultures, and industrial sectors
Reliability	Case study protocol to repeat the data collection procedures

Therefore, the design of the CSR is ready and the next stages will be to conduct, analyze and report the results [24]. These results will also be used to test and refine the design propositions developed in the previous research stage (*ex-ante* design propositions). With this CSR it will be possible to define the objectives for the solution to be developed, as well as to perform a naturalistic *ex-ante* evaluation of the artifact. Therefore, the meta-artifacts will be designed and developed in parallel with the CSR.

Artifact Design and Development. This stage of the research will follow the design cycle of the DSR paradigm, taking place in parallel with the CSR, as a way to iterate between the design and the evaluation of the artifact. Therefore, at some points in time, data will be collected from the informants of IEAs and SMEs who will be involved in discussing and giving feedback on intermediate concepts of the artifact (meta-artifacts). The expected result is the design of two artifacts intended to be used as core components for the development or configuration of socio-technical systems supporting the internationalization processes of SMEs in an IEA context. This result will be a combination of conceptual artifacts, i.e. models and methods. As described in Peffers et al. [4], a method represents actionable instructions that are conceptual (not algorithmic). A model is a simplified representation of reality documented

through a formal notation or language. The specific objectives of this research stage are:

- to perform a requirements gathering process for designing the artifacts;
- to design an information management model adaptable to the processes of internationalization in collaboration, mediated by IEAs (artifact 1);
- to design a collaborative decision support system to explore the information management model and capitalize internationalization knowledge (artifact 2).

In terms of contribution for DSR knowledge (Section 2.1), the final artifact will represent a mix of: (i) improvement (new solutions for known problems), by the information management model; and (ii) exaptation (known solutions extended to new problems), by the decision support system.

Demonstration and Ex-post Evaluation. To perform the demonstration and *ex-post* evaluation of the artifact, CSR and focus groups will be used. The procedures to perform this new CSR will be the same applied in the *ex-ante* evaluation, regarding the data sources, data analysis and validity ensuring. The difference here is that new informants and new SMEs will be interviewed, with modifications and improvements being made according to the feedback obtained. The *ex-post* evaluation of the artifact will also include focus groups with IEAs and SMEs of different industrial sectors. This will allow to strengthen the validation of the artifact, as well as the generalization of the findings.

Reporting and Communication. The scientific and practical contributions of this doctoral project will be reported in international peer-reviewed journals and in international refereed conferences, on selected areas from the following broader domains: Information Management, Information Systems, Business Management, International Business, and Collaborative Networks. The scientific and technical results of this doctoral project will be communicated in international and national refereed conferences, doctoral consortiums, workshops, and meetings with interested individuals. These results will include the final theoretical/conceptual framework and theory, as well as the final design propositions (*ex-post* design propositions). Moreover plans for the evolution and sustainability of the artifact will also be developed and disseminated.

4 Discussion and Final Considerations

The DSR paradigm is very useful to be used when the objective of a specific project is to create innovative artifacts, in order to contribute in a balanced way for both the scientific knowledge and the empirical part that is under study. Particularly in the case of IS, DSR has been proving its importance and it is consensual that it is now a well-established and reliable research paradigm in this area. However, like any other research area, there is always aspects that need to be discussed and improved to increase validity and reliability. In this paper, two research gaps related with DSR were considered: (i) more DSR studies are needed from other research areas (outside IS), particularly in what concerns multidisciplinary research; (ii) although representing a typical evaluation method, researchers in DSR fail to provide clear

insights on how to effectively design and perform case studies; moreover, case studies are only pointed out for the *ex-post* evaluation of the artifact, leaving aside the use of this evaluation method for the *ex-ante* evaluation. These identified gaps allowed to define the following research question: How can CSR be effectively integrated within the DSR paradigm in multidisciplinary research?

This paper shows how case studies can be designed in DSR bringing important guidelines and considerations from BMS on how to effectively design CSR, a reputable research methodology in this area. Therefore, a research framework of an ongoing doctoral project that uses DSR and CSR in the multidisciplinary field of CNs is presented. In this project, DSR is adopted as the main research paradigm to better connect the knowledge base with the environment of the different multidisciplinary contexts involved. Results show that, in fact, CSR may be used for both the *ex-ante* and *ex-post* evaluation of the artifact to be developed, when considering this specific multidisciplinary research.

One limitation of this study is the generalization of this specific research framework. Every project has its own needs and peculiarities, especially in the case of projects involving knowledge from different research areas, and it is difficult to design a general research framework to be adapted in many different contexts. Therefore, for this research framework, the methods and techniques have to be adapted to the specific context under study. Yet, this paper brings new insights on understanding the interplay between DSR, from IS, and CSR, from BMS. Analyzing the developed research framework, it is possible to realize the importance of a rigorous design of the CSR, mainly in what concerns the research logic (inductive, deductive or abductive research) and the case nature (holistic or embedded), as well as ways of ensuring its validity and reliability. These aspects are most of the times not considered in DSR works that make the use of case studies. A rigorous design of the artifact is one of the fundamental aspects of DSR projects. Nonetheless, we argue that this rigor on the design must happen at all stages of the project, including when designing the CSR approach.

This paper can contribute first to the area of IS and DSR, using knowledge from BMS on the effective and rigorous design of case studies for artifact evaluation. Moreover, the results obtained can also be relevant for researcher in BMS. As stated by Spring & Santos [8], new ways of doing CSR are needed to fully understand the changes that are happening in the Operations Management field. So, we believe that DSR can be relevant to these areas because it can be used as a more cyclical research design, ensuring a balanced interplay between theory and the CSR (important aspects indicated by Spring & Santos [8]). Finally, this paper can also contribute for researchers that are designing artifacts involving CNs, by showing an illustrative example on how to design a multidisciplinary project of CNs. Moreover, the context of internationalization and the establishment of CNs between IEAs and SMEs to improve these processes is a different CN context, which represents a new contribution to the field of CNs.

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References

1. Hevner, A., March, S., Park, J., Ram, S.: Design science in information systems research. *MIS Q.* 28, 75–105 (2004).
2. Gregor, S., Hevner, A.: Positioning and presenting design science research for maximum impact. *MIS Q.* 37, 337–355 (2013).
3. van Aken, J.E.: Management research based on the paradigm of the design sciences: The quest for field-tested and grounded technological rules. *J. Manag. Stud.* 41, 219–246 (2004).
4. Peffers, K., Rothenberger, M., Tuunanen, T., Vaezi, R.: Design science research evaluation. 7th International Conference on Design Science Research in Information Systems and Technology, DESRIST 2012 (2012).
5. Venable, J., Pries-Heje, J., Baskerville, R.: A comprehensive framework for evaluation in design science research. 7th International Conference on Design Science Research in Information Systems and Technology, DESRIST 2012 (2012).
6. Prat, N., Comyn-Wattiau, I., Cnam, C.: Artifact evaluation in information systems: Design Science Research – a Holistic view. 19th Pacific Asia Conference on Information Systems (2014).
7. Vahidov, R.: Representing meta-artifacts. Design-type research in Information Systems: Findings and practices. pp. 115–134. IGI Global (2012).
8. Spring, M., Santos, J.B.: Case study research in operations management: New contexts, new theories, new approaches. 22nd International Annual EurOMA Conference (2015).
9. Simon, H.A.: The sciences of the artificial. MIT press (1996).
10. Hevner, A., Chatterjee, S.: Design research in information systems: Theory and practice. Springer Science & Business Media, New York, USA (2010).
11. Offermann, P., Blom, S., Schönherr, M., Bub, U.: Artifact types in information systems design science: A literature review. 5th International Conference on Design Science Research in Information Systems and Technology, DESRIST 2010 (2010).
12. Järvinen, P.: Action research is similar to design science. *Qual. Quant.* 41, 37–54 (2007).
13. Vaishnavi, V.K., Kuechler, W.J.: Design science research methods and patterns. (2015).
14. Hevner, A.: A three cycle view of design science research. *Scand. J. Inf. Syst.* 19, 87–92 (2007).
15. Peffers, K., Tuunanen, T., Rothenberger, M.A., Chatterjee, S.: A design science research methodology for information systems research. *J. Manag. Inf. Syst.* 24, 45–77 (2007).
16. van Aken, J.E.: Developing generic actionable knowledge for the social domain: Design science for use in the swamp of practice. *Methodol. Rev. Appl. Res.* 2, 9–25 (2015).
17. Plachkinova, M., Peffers, K., Moody, G.: Communication artifacts for requirements engineering. 10th International Conference on Design Science Research in Information Systems and Technology, DESRIST 2015 (2015).
18. Ostrowski, L., Helfert, M., Gama, N.: Ontology engineering step in design science research methodology: A technique to gather and reuse knowledge. *Behav. Inf. Technol.* 33, 443–451 (2014).
19. Lacerda, D.P., Dresch, A., Proença, A., Antunes Júnior, J.A.V.: Design science research: A research method to production engineering. *Gestão & Produção.* 20, 741–761 (2013).
20. Denyer, D., Tranfield, D., van Aken, J.E.: Developing design propositions through

- research synthesis. *Organ. Stud.* 29, 393–413 (2008).
21. Holmstrom, J., Ketokivi, M., Hameri, A.-P.: Bridging practice and theory: A design science approach. *Decis. Sci.* 40, 65–87 (2009).
 22. Hodgkinson, G.P., Starkey, K.: Not simply returning to the same answer over and over again: Reframing relevance. *Br. J. Manag.* 22, 355–369 (2011).
 23. Venable, J., Pries-heje, J., Baskerville, R.: FEDS: A framework for evaluation in design science research. *Eur. J. Inf. Syst.* 1–13 (2014).
 24. Yin, R.K.: *Case study research: Design and methods.* (2009).
 25. Eisenhardt, K.M.: Building theories from case study research. *Acad. Manag. Rev.* 14, 532–550 (1989).
 26. Voss, C., Tsiriktsis, N., Frohlich, M.: Case research in operations management. *Int. J. Oper. Prod. Manag.* 22, 195–219 (2002).
 27. Ketokivi, M., Choi, T.: Renaissance of case research as a scientific method. *J. Oper. Manag.* 32, 232–240 (2014).
 28. Barratt, M., Choi, T.Y., Li, M.: Qualitative case studies in operations management: Trends, research outcomes, and future research implications. *J. Oper. Manag.* 29, 329–342 (2011).
 29. Dubois, A., Gadde, L.E.: Systematic combining: An abductive approach to case research. *J. Bus. Res.* 55, 553–560 (2002).
 30. Voss, C., Johnson, M., Godsell, J.: Revisiting case research in operations management. 22nd International Annual EurOMA Conference (2015).
 31. Barratt, M., Barratt, R.: Exploring internal and external supply chain linkages: Evidence from the field. *J. Oper. Manag.* 29, 514–528 (2011).
 32. Dresch, A., Lacerda, D., Miguel, P.A.: A distinctive analysis of case study, action research and design science research. *Rev. Bus. Manag.* 17, 1116–1133 (2015).
 33. Nabukenya, J.: Combining case study, design science and action research methods for effective collaboration engineering research efforts. 45th Hawaii International Conference on System Sciences (2012).
 34. Costa, E., Soares, A.L., Sousa, J.P.: A new insight in the SMEs internationalization process. 16th IFIP WG 5.5 Working Conference on Virtual Enterprises, PRO-VE 2015 (2015).
 35. Hsu, W.-T., Chen, H.-L., Cheng, C.-Y.: Internationalization and firm performance of SMEs: The moderating effects of CEO attributes. *J. World Bus.* 48, 1–12 (2013).
 36. Rodriguez, V., Barcos, L., Jesús Álvarez, M.: Managing risk and knowledge in the internationalisation process. *Intang. Cap.* 6, 202–235 (2010).
 37. Camarinha-Matos, L., Afsarmanesh, H.: Collaborative networks: A new scientific discipline. *J. Intell. Manuf.* 16, 439–452 (2005).
 38. Parung, J., Bititci, U.: A metric for collaborative networks. *Bus. Process Manag. J.* 14, 654–674 (2008).
 39. Carneiro, L.M., Soares, A.L., Patrício, R., Azevedo, A.L., Pinho de Sousa, J.: Case studies on collaboration, technology and performance factors in business networks. *Int. J. Comput. Integr. Manuf.* 26, 101–116 (2013).
 40. Costa, E., Soares, A.L., Sousa, J.P.: Information, knowledge and collaboration management in the internationalisation of SMEs: A systematic literature review. *Int. J. Inf. Manage.* 36, 557–569 (2016).