Operationalization of Configuration Analysis in Interorganizational Information Systems Research: A Research Journey

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Abstract

Configuration analysis is still an under-developed tool for researchers to investigate interorganizational information systems (IOIS) and the forms of interorganizational integration that are supported by IOIS. In our attempt to explain observed phenomena in a target industry we applied configuration analysis proposed by Lyytinen and Damsgaard in their position paper from 2011 on an industry level. We operationalized the conceptual idea of configuration analysis in a research design defining research paradigm, type of reasoning, research goals, unit of analysis and research methods to make it feasible for IOIS research. Our findings indicate that our operationalization of configuration analysis is suitable for research fields in IOIS that have no or hardly any empirical groundwork to observe phenomena and hypothesize about the mechanics leading to the existence of the phenomena.

Keywords: Configuration Analysis, Interorganizational Integration, Interorganizational Information Systems, Research Design.

1. Introduction

Our research journey started with a genuine curiosity to learn more about the interorganizational mechanics in an industry that applies multiple forms of interorganizational integration for several decades but still struggles with high complaint rates of their customers of up to 40%. The order-to-build business models are supported by multi-tier networks ensuring production and the sales process. We showed that several factors (for example power relationships, technological dominance and product characteristics) influence the emergence of forms of interorganizational integration (Frick, 2022).

In our attempt to find an appropriate research method to investigate forms of interorganizational integration in the above-mentioned target industry, we found that researchers have applied several research methods in the domain of interorganizational integration for more than 50 years (Robey et al., 2008). At the beginning, mainly features and functions of IOIS were subject of the investigations. During the last two decades, a more complex view on technical, organizational and institutional factors led to a shift towards a holistic view of the value and supply chain that initiated a reorientation in research approaches, away from a pure cause-and-effect perspective towards an analysis of IOIS practices (Reimers et al., 2010).

The increased scope and the changing structure in interorganizational systems research led to multi-level perspectives in the analysis (Kurnia et al., 2019). Consequently, new forms of integration, their technological realization and the expansion of interorganizational integration scenarios beyond structured data (collaboration platforms) require a broader conceptual basis. Still, few studies have managed to identify and assess the manifold influential factors on the investigated IOIS in their respective domain based on a conceptual basis that characterizes the IOIS itself and provides means to understand its mechanisms of change (see exemplary (Fürstenau et al., 2020) and (Zeng et al., 2021)). Lyytinen and Damsgaard (2011) postulate configuration analysis as a method for investigating IOIS to fill the aforementioned gap Yet, they did not provide a detailed research method for configuration analyses but stated important characteristics that had to be fulfilled. Consequently, we aimed to answer the research question for our investigation: How can the configuration analysis conceptualized by Lyytinen and Damsgaard in 2011 be operationalized at the industry level?

Here, we do not mainly reflect on the research findings within the industry case but on the operationalization of a research perspective that Lyytinen & Damsgaard (2011) proposed to address the complex interaction of factors contributing to the emergence and sustainability of forms of interorganizational integration. This paper aims to (1) provide guidance for IOIS researchers to operationalize configuration analysis for their research project, and (2)

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to reflect on the proposed configuration analysis on an industry level to assess its applicability.

In the remainder of this paper, Chapter 2 reviews different forms of configuration analyses in interorganizational information systems (IOIS) research. Subsequently, the multi-stage research approach to operationalize configuration analysis is explained (Chapter 3). Chapter 4 highlights the findings and gives guidance in operationalization configuration analysis. Chapter 5 provides a discussion and critical appraisal while Chapter 6 closes with the conclusions and a brief outlook.

2. Configuration Analyses in IOIS Research

Our research journey started in 2015 where we found at that time 38 scientific contributions that contained aspects of IOIS configurations and factors contributing to their emergence and sustainability (see chapter 4.5.1 for a detailed description). To assess the current literature regarding configuration analysis in IOIS we revisited the applied structured literature review proposed by Hart (2001) from that time and collected 54 further sources that have been published in the meantime (2015-2022). We found only one paper that addressed the configuration analysis in the IOIS domain directly (Fürstenau et al., 2020). The remaining contributions offer insights into selected influential factors on different forms of interorganizational integration (see for example (Alsaad et al., 2019) or (Shree et al., 2021)).

To understand the different forms of configuration analyses in IOIS research we have to introduce the characteristics of interorganizational information systems first. Yi et al. (2005) define the term inter-organizational integration from an IOIS perspective as "[...] the extent to which two organizations that are electronically connected by IOSs are viewed, operated, and managed as a unified entity." They emphasize that interorganizational integration involves more than a purely electronic or process-oriented combination of components to accomplish a task. Three main levels of interorganizational integration can be identified:

(1) Technical integration - Interorganizational integration requires electronic data exchange between organizations. The development of information technology and architecture in recent decades has led to the emergence of a wide range of technical variants of technical integration scenarios (e.g. (Nurmilaakso, 2008), (Penttinen et al., 2018)) which can be classified into different phases depending on the technology and architecture paradigm used (Schubert & Legner, 2011).

(2) Organizational integration - Interorganizational integration requires coordination and adaptation of the organizational structures and processes of the companies involved. At the organizational level, various forms of interorganizational integration can be distinguished. Electronic cooperation processes integrate the internal processes on the customer side with the processes on the supplier side. They thus extend to all phases of a business relationship (e.g. (Papazoglou & Ribbers, 2005), (Wallbach et al., 2019)).

(3) Institutional integration - Last (or rather first), interorganizational integration concerns business relationships between independent companies, which are governed by institutional arrangements. The latter can be individual arrangements as well as contractual agreements between companies. Of particular interest here are, among others, new business models based on inter-firm cooperation (Dai & Kauffman, 2002) or interoperability at the business level (e.g. (Rajaguru & Matanda, 2013), (Helo et al., 2021)).

2.1. Intuitive understanding of configurations in IOIS research

Regarding the three levels mentioned above, numerous forms of interorganizational integration can be found in literature. Definitions refer to one or more levels where researchers postulate a classification of the forms of interorganizational integration they have perceived. Exemplary contributions have been made by (Barrett & Konsynski, 1982), (Bensaou & Venkatraman, 1995), (Schubert, 2008), (Steinfield, 2014) and (Kauremaa & Tanskanen, 2016).

Typical forms of interorganizational integration depend on influential factors on all three levels. However, the definition of forms of interorganizational integration marks only the beginning of a systematic examination of interorganizational structures and the IOIS supporting them. As typical descriptive models, classification models in interorganizational integration contain a comprehensive collection of all possible forms of IOIS. They mainly focus on the classification of an IOIS considering different criteria, usually related to technological, organizational and/ or institutional characteristics. Depending on the level of detail, they can precisely describe an IOIS both in terms of its characteristics, the complex interplay between the characteristics and its functional scope. However, these model approaches generally lack any development perspective, since the influencing factors and change mechanisms leading to the emergence of an IOIS cannot necessarily be derived from its characteristics. This leads to a situation in which the unit of analysis can be described in detail, but the mechanisms of change acting on it remain unclear (Reimers et al., 2010).

2.2. Configuration Analysis in IOIS research

Lyytinen & Damsgaard (2011) address this issue by postulating configuration analysis as an alternative way to investigate IOIS, the forms of interorganizational integration IOIS support and the complex interplay of different characteristics influencing the emergence of IOIS. Still, configuration analysis is not per se a new analysis approach in the field of IOIS or Information Systems Research. The term "configuration" is found in almost all disciplines as a common designation for a particular object that can be assembled from several components. (Meyer et al., 1993) define configuration as "[...] any multidimensional constellation of conceptually distinct characteristics that commonly occur together." In doing so, they emphasize "coherent patterns" that result from the interdependencies of the individual attributes. Configurations are thus not based on a random coming together of individual factors but reflect a limited number of stable states ((Lyytinen & Damsgaard, 2011), (Hinings, 2018)).

Lyytinen & Damsgaard (2011) understand IOIS configurations as organized clusters of IOIS users. In doing so, they refer to similar uses of the concept of configuration in physics, organizational research, or service science, which in their view are transferable to the IOIS domain. Both authors take a stand for an alternative approach to IOIS research, which can lead to new results if a uniformly defined understanding of configuration is considered. They define meaningful research paths for future configuration analyses. Still, their roughly sketched configuration analysis outlines possible research areas and is therefore open to interpretation. In fact, for our research initiative we had to operationalize the proposed configuration analysis to identify and investigate the different forms of interorganizational integration in the target industry.

3. Research approach

Usually, a sound research design entails one or more research questions aiming at understanding a phenomenon or gaining new insights, defining the appropriate research method(s) to acquire and analyze the necessary data and reflect on the results and limitations in a critical appraisal of the research analysis (Creswell, 2003). In our case we aimed at finding out more about the different factors influencing the emergence and diffusion of IOIS in the respective industry (Frick, 2022) but had no fitting research method at our disposal that could provide us with a configuration analysis Lyytinen & Damsgaard (2011) proposed. At the time of our research initiative that started in the year 2015 there were hardly any documented research reports on an operationalized configuration analysis in the IOIS domain. So we had to think about our research design and how to operationalize the configuration analysis that led to our initial research question (see first chapter in this paper).

Lyytinen & Damsgaard (2011) state that "The condition for cogent configurational analysis is that investigators can theoretically justify what types of elements will count in creating stable configurations." Following Creswell (2003) and De Vaus (2001), we defined all the necessary elements of a research design that eventually contribute to a configuration perspective. It depends on the research paradigm, type of reasoning, research goals, unit of analysis and the selected research methods what kind of configuration analysis is applied. The following chapter details the distinct elements of our research design.

4. Research design for configuration analysis in the IOIS domain

A broader conceptual basis is required to understand the forms of interorganizational integration between the industry actors. At the same time, there are only few approaches in scientific literature that consider as many influencing factors as possible in their conceptualization. The configuration perspective of IOIS according to Lyytinen & Damsgaard (2011) categorizes configurations of interorganizational integration into different configuration types (dyad, hub and spoke, industry and community-wide). Their typology is supplemented by a selection of key elements that represent certain factors influencing the configurations (organizing vision, key functionality, structure, mode of interaction and mode of appropriation). Still, two challenges arise: (1) significantly more detailed logical and linguistic elements are needed to describe configurations in the IOIS domain as Lyytinen & Damsgaard (2011) provide first insights but no complete differentiation, and (2) there is a lack of explanatory approaches for the configurations observed in the target industry. Consequently, the research has an explorative character and pursues descriptive and explanatory research goals.

4.1. Research paradigm

Every scientific work is based on a scientific-theoretical orientation of the researchers involved (Moon & Blackman, 2014). From this, the fundamental position of the researcher towards his object of research, the application of scientific procedures to achieve the research goals as well as his interpretation of the research results can be derived.

As researchers in the field of Information Systems Research it is our conviction that we deal with phenomena and issues that manifest themselves in reality and can be explained logically. On the other hand, organizations that are normally an integral part of any IOIS research endeavor are socially constructed entities. Consequently, the identification of universal or generalizable theories is much more difficult since situational conditions can differ greatly from organization to organization.

To resolve this supposed contradiction between a rational and subjective view of the world we find ourselves in the scientific philosophy of critical realism, where we are deliberately used to objectively evaluate research results in a highly empirical environment (Mingers, 2004). Critical realism in principle entails the routinized language and rehearsed procedures we use to define and explain phenomena (Easton, 2010). Basically, the position of critical realism can be summarized in three principles (Mingers, 2004): (1) the intention to understand and explain, beyond mere description, why things are the way they are, (2) the recognition of different objects of knowledge whose investigations may require different research methods in order to understand them, and (3) the realization of the fallibility of results, which makes the researcher particularly attentive to his assumptions and the limitations of his work. These three principles underlie the present research and serve to define the process of knowledge gain that influences the research procedure and the interpretation of the results.

4.2. Type of reasoning

The first principle of critical realism states that beyond the mere description of a phenomenon, the researcher wants to understand and explain the underlying causal relationships. From our epistemological point of view (constructivism) we believe that meaning comes into existence in and out of our engagement with the realities in our world (Moon & Blackman, 2014). In the present case of the described phenomena in the target industry, the goal is thus to determine corresponding explanatory approaches for the lack of interorganizational integration, the delayed IOIS diffusion and the different IOIS infrastructures in use by observation and interaction with the responsible industry stakeholders. Since only very limited similar phenomena have been investigated or discussed in the target industry so far and in the IOIS environment in general, a deductive reasoning is difficult to apply. There are only few general theoretical findings from which useful hypotheses can be derived and tested.

Induction as a second type of reasoning is also not suitable, since, in contrast to a deductive approach, it does not conclude from a rule and the result to the respective individual case, but from the individual case and the rule to the result (Reichertz, 2014). In both cases, the rule, i.e., the underlying theory or explanatory approach, is already present. In our research, therefore, the aim is to identify a type of reasoning that can assist in the search for explanatory approaches (the rules).

In the sense of critical realism, abduction is a suitable type of reasoning, since in its search for explanations for an observed phenomenon it constructs hypotheses about the mechanisms responsible for it and the factors involved in them (Lawson, 1997). It provides the opportunity to identify plausible explanations for a given evident result, to compare them, and to formulate comprehensible arguments about them for the construction of the explanations (Walton, 2005). However, due to the creative part in their execution, there is a lack of a comprehensible strategy how the researcher can at least track down an explanatory approach apart from random guessing. (Reichertz, 2014) defines so-called "main stations" of the abductive reasoning process: observation, surprise, search for a rule, experimental testing of conjectures, and development of hypotheses. In the observation the researcher informs himself about the object of investigation and equally finds a surprising situation, which he cannot resolve conclusively with already learned knowledge. He starts searching for rules, and by trying out different assumptions he can finally draw different abductive conclusions, which have to be formulated as hypotheses afterwards.

4.3. Research goals

In view of the potentially broad research project, it is of particular importance to clearly define the objectives of the work and the associated research questions. This includes the precise delineation of the intended methodological and content-related knowledge gain to be achieved by means of configuration analysis in the target industry. The present work addresses the following research objectives:

(a) *Determination of explanatory approaches to the observed industry-wide phenomena in the target industry:* The observed phenomena ((1) Lack of interorganizational integration despite IOIS use, (2) Different degrees of diffusion of IOIS despite similar requirements for data exchange, and (3) Infrastructural differences despite similar industry characteristics) can only be explained to a limited extent with conventional interpretations. The goal is to discover explanations that argue from an industry-wide perspective. To this end, as many relevant perspectives as possible are to be included from which interorganizational integration is driven and practiced. The construction of industry-specific explanatory approaches makes it possible to identify factors influencing different intercompany integration approaches and to assign the respective effects at industry and actor level.

(b) *Methodological elaboration and evaluation of the conceptual configuration analysis approach:* The configuration analysis proposed by Lyytinen & Damsgaard (2011) has hardly been empirically operationalized, nor has its general applicability been verified. Our study provides one of the first opportunities to apply configuration analysis to a real-world example and to identify possible measures to complement or modify it. The knowledge gained contributes to an improved conceptual understanding of configuration analysis and of the concept of configuration in general.

(c) *An expansion of the database and the state of knowledge about configurations of interorganizational integration at industry level:* The findings obtained from a comprehensive empirical survey of the target industry serve to obtain and describe a complete picture of the configurations of interorganizational integration contained therein. The survey serves both as a source of data and as a template for further studies, possibly in other industries or industry segments.

4.4. Unit of analysis

The configuration perspective reflects a multi-perspective view on enterprise networks and the IOIS that support them. It is no longer sufficient to focus on an IOIS itself as the unit of analysis. The research questions raised in our work mainly revolve around configurations and their constituent influencing factors. Consequently, the configurations of interorganizational integration themselves are to be chosen as the unit of analysis. De Vaus (2001) characterizes the unit of analysis as "[...] the 'thing' about which we collect information and from which we draw conclusions." The configuration perspective allows the use of a self-contained logic and language for a holistic investigation of IOIS-supported enterprise networks. It is not limited to a mere identification of different factors influencing a configuration but provides a characterizing typology for the categorization of configurations.

As Lyytinen & Damsgaard (2011) put it in their position paper, "The configuration concept forms the fundamental observation and analysis unit for the analysis of IOIS adoption." The two authors focus on the process of IOIS adoption within which they want configurations to be studied. However, their approach is also applicable to other stages of IOIS diffusion, as configuration analysis per se is not limited to a specific diffusion stage.

4.5. Research methods

The variety of methodological approaches usually complicates the search for a suitable analysis tool for an upcoming research project. This is especially true when the unit of analysis is in a domain that is only partially known to the researcher(s). In our case, only little publicly available information exists about the IOIS-supported enterprise networks active in the target industry. On the other hand, configuration analysis according to Lyytinen & Damsgaard (2011) does not provide predefined procedures for a research proposal, but only a limited number of proposals based on a chosen research interest. Thus, in terms of feasibility and proportionality, a selection of research methods has to be made that takes into account the organizational framework of our research project and leaves enough room for a multi-perspective investigation.

The exploratory nature of the research project suggests that the research methods used must be flexible enough to allow the researcher sufficient freedom for creativity in information gathering (Blaikie, 2000). According to the problem definition, there is a lack of methodological and content-related information to be able to answer the posed research questions about the target industry in a meaningful way. Consequently, a review of relevant scientific literature for the delimitation of the configuration term as well as the operationalization of the configuration analysis is just as necessary as the empirically driven determination of IOIS configurations in the target industry.

Accordingly, a multi-phase research procedure was developed, comprising four main phases: (I) Phase 1: Literature Review, (II) Phase 2: Data Collection, (III) Phase 3: Data Analysis, and (IV) Phase 4: Validation.

4.5.1 Phase I (Literature Review)

The first phase pursued three goals, namely: *Identification and acquisition of relevant literature contributions on the subject of configuration of interorganizational integration (identification)* – based on the literature review proposed by Hart (2001) we found 38 scientific articles, that deal with the configuration perspective and a corresponding IOIS reference. The focus of the literature analysis was on structure and influential factors of IOIS configurations in the domain of information systems and related disciplines. After four rounds of literature search we ended up with 19 search terms (ranging from inter-organizational systems, inter-organizational integration, inter-organizational relation and business network to electronic data interchange, data exchange and interfirm), which focus on IOIS. These were supplemented in pairs with 8 search terms that characterize the configuration term and related terms (configuration, taxonomy, typology, category, classification, cluster, type, form).

The JOURQUAL ranking of scientific journals published in Germany is suitable for the determination of literature sources in the context of a detailed literature search in the domain of information systems and related disciplines. A sub-ranking was selected for the literature search carried out here: “Information Systems”. Within the sub-ranking, 89 journals are listed that are potentially suitable for a search. Of these, all A+, A-, and B journals were selected because they ensure high scientific quality of articles, as well as certain C journals whose content focus seemed promising for a search. A total of 35 journals were identified for the literature search.

Analysis of the literature contributions found with regard to configuration types and influencing factors - we had to identify the relevant configurational aspects in the found 38 contributions and applied a coding scheme for data collection. As coding technique, we used the so-called "Descriptive Coding". Descriptive coding is particularly appropriate in qualitative studies where a vocabulary must first be developed for further analysis (Turner, 1994). Overall, we found 76 different configuration characteristics and 31 influencing factors in the identified literature.

Derivation of a theoretical frame of reference for further use in the phase of data collection - The construction of a theoretical frame of reference is necessary for the subsequent phase, the data collection, to realize a theory-guided investigation for the empirical study. Frames of reference "[...] enable a preliminary conceptual-theoretical integration of the most important components of the research field at the beginning and at the end of a research process about a research object" (Becker, 1993). Lyytinen & Damsgaard (2011) propose a definition in their position paper (organizing vision, key functionality, structure, mode of interaction and mode of appropriation), but this is still too imprecise for an initial configuration analysis in an industry or industry segment. Our theoretical frame of reference entails three levels of perspective (institutional, organizational and technical) with two subsections for each level and overall 6 categories of influencing factors where three categories are assigned to the first level of perspective (institutional), two categories belong to the organizational level and one category to the technical level.

4.5.2 Phase II (Data Collection)

There is a lack of corresponding theoretical background in the target industry for a structured survey. The explorative nature of the present study therefore suggests closing the information gap by means of qualitative data collection. For this purpose, a survey method must be chosen that is suitable for collecting data from industry members in an adequate form. On the other hand, a sampling strategy must be selected that ensures the most comprehensive and complete data collection possible.

One method of data collection that fits the requirements described above is the so-called in-depth interview. An in-depth interview is suitable for "[...] exploring often unconscious emotions, motives and thoughts" (Patton, 2015). This characteristic is particularly important in the present case, as the formation of IOIS configurations is characterized by influencing factors that occur at multiple levels and in varying intensity. Furthermore, despite the use of an interview guide, in-depth interviews offer a certain flexibility in the direction of the interview, which is due to the open attitude towards new insights and content. The interactivity between interviewer and interviewees, the probing of salient statements, and the resulting openness of interviewees to new ideas or thoughts are further characteristics of in-depth interviews (Legard et al., 2003) that are suitable for the exploratory research approach. Based on an interview guideline with 24 questions we conducted in the years 2015 and 2016 overall 21 interviews with interview partners from 19 organizations (3 software vendors, one standardization organization, 7 retailers, 2 buying groups, 2 immediacies, 4 manufacturers) active in the target industry. We collected about 40 hours of transcribed audio material.

4.5.3 Phase III (Data Analysis)

The third phase of the research project comprises the analysis of the collected data regarding answering the research questions posed. Since the data were obtained during in-depth interviews, a qualitative analysis approach was selected. Similar to the analysis stage in Phase I, coding was again used for this purpose. In contrast to the literature analysis, structured coding was used in addition to the descriptive coding approach. Structured Coding offers the possibility to mark certain text passages that are connected to one or more research question(s) in terms of content (Saldaña, 2009). We defined more than 550 codes from which we identified about 40 influencing factors and 12 configurations of interorganizational integration in the target industry.

4.5.4 Phase IV (Validation)

The fourth phase is not to be understood as a stand-alone activity but took place at regular intervals together with the activities in Phases 2 and 3. For this purpose, the approach of content triangulation was used. Here, statements made are considered from several perspectives and different roles, whereby the same or similar statements from several interview partners can be considered validated (Patton, 2015). In this specific case, not only different industry actors in the two industry segments were interviewed for this purpose, but also at least two representatives from each role (if possible), so that both an intra- and cross-role validation of the statements was possible. Accompanying documents (including market studies, press articles, standardization documents) and observations (including participation in industry-wide meetings) supplemented the interview data.

5. Discussion

The configuration analysis proposed by Lyytinen & Damsgaard (2011) is intentionally vague in their position paper. They basically refer to anything as configuration analysis that is methodologically dedicated to the study of configurations of interorganizational integration. Thus, they allow interested researchers a certain freedom in the choice of methods, but at the same time leave them with the choice of an appropriate research design, which may well vary from case to case.

5.1. Research paradigm and type of reasoning as prerequisites for configuration analysis

Configuration analysis is per se not bound to a distinct research paradigm or type of reasoning. Its setup and choice of appropriate research methods is rather dependent on the unit of analysis and the available data beforehand. The researchers' philosophy of science and the type of reasoning then provide the necessary prerequisites to perform a configuration analysis. In our case, critical realism with its stance to find explanations for observed phenomena helped us to choose abduction as type of reasoning to identify fitting hypotheses for the phenomena in the target industry. Overall, we formulated two hypotheses for three observed phenomena. In retrospect, abduction has proven useful as type of reasoning for the present research. However, it is not applicable per se to all configuration analyses. Rather, the abductive inference from the case and result to the underlying rules expects certain preconditions. Especially the fact that there are no conclusive rules for found phenomena is an important criterion for the use of abductive reasoning. In the present case of the target industry, this is partly true since there is hardly any in-depth information on IOIS or theoretically well-founded research so far.

On the other hand, the target industry consists of classic retail structures that manufacture and distribute products for end customers in cooperation with their suppliers. Similar structures can be found in food retailing or in the automotive industry, among others, which have been the subject of several research studies (see for example (Bensaou & Venkatraman, 1995), (Rajaguru & Matanda, 2013) and (Kurnia et al., 2019)). However, these research studies show that the factors contributing to the emergence and sustainability of IOIS differ from industry to industry (Shree et al., 2021). Forms of IOIS might be similar but the mechanisms of change have to be investigated in the specific contexts (Laakkonen et al., 2019). The lack of empirical data coupled with the lack of theoretical groundwork thus provides good conditions for abduction as type of reasoning.

However, a situation like the one described above is rarely found in everyday scientific life. Typically, there is always some prior work in a research area that has contributed both empirical and conceptual insights. Further configuration analyses, as they are outlined by Lyytinen & Damsgaard (2011) in their research agenda, presuppose an empirically founded basic understanding. Further methods, such as cluster analysis, or theories, such as institutional theory, can be applied. These approaches seem valid in the follow-up of our work for the target industry, as there is now enough data to conduct deeper configuration analyses.

5.2. Reflections on the research design

At the time of the first draft to operationalize the proposed configuration analysis in the year 2015 we had almost no previous work at hand to at least validate our research approach or refer to a successful research study. In recent years configuration analysis has become a research approach that found some acceptance in the research community. Fürstenau et al. (2020) for example used configuration analysis to investigate platforms. Kreuzer (2017) investigates e-Invoicing adoption. All approaches had to design their specific research methods, even defining the type of reasoning the research paradigm or appropriate methods to collect and analyze data.

The appropriate choice of a *unit of analysis* is always challenging, in recent contributions as in our research journey. Here we chose configurations of interorganizational integration as unit of analysis. Thus, a construct has been chosen that has so far only been conceptually defined in the position paper by Lyytinen & Damsgaard (2011). Such a choice bears a certain risk since it is not clear from the beginning whether this unit of analysis exists according to its definition. At the same time, such a choice prevents the use of already established research designs for known units of analysis (Fürstenau et al., 2020). During our phases of data collection and data analysis we found that IOIS configurations are a suitable unit of analysis to identify specific patterns of interorganizational integration. Still, we found that there is even a more promising unit of analysis for future research in the IOIS domain: nested configurations. In the target industry we observed that every industry actor is part of at least two or more interorganizational configurations. That circumstance makes nested configurations the norm of interorganizational integration that should be subject to further investigation (Lyytinen & Damsgaard, 2011).

In the *literature review phase* in 2015, a total of 38 articles addressing configurations of interorganizational integration have been identified. The literature base was supplemented by additional contributions in other formats (e.g., in book form). It cannot be ruled out that some existing contributions have not been captured. This is mainly since there is no uniform conceptual understanding of configurations of interorganizational integration in literature. Our revisited literature search (see chapter 2) found 54 more contributions. At least, the research interest in IOIS configurations and their contributing factors has not declined. Still, we mainly found characterizing features describing configurations (see for example (Kauremaa & Tanskanen, 2016), (Kurnia et al., 2019) and (Zeng et al., 2021)). Only one contributions reflects the concept of configuration as such (Fürstenau et al., 2020).

In the phase of *data collection*, the selection of organizations and their interviewees pursues the goal of achieving a set of data that is as diverse as possible (regarding the included perspectives and roles of the industry actors), but also valid at the same time. Thus, many statements were confirmed several times with different interview partners in terms of internal validity. Nevertheless, the total of 21 interviews provides a limited view of the target industry. Additionally, still unknown results could be obtained by adding further interview partners. Although this situation is mitigated by the sampling strategy based on Patton (2015), the data collection is still not representative.

Furthermore, the issue of quantitative data collection must be discussed regarding the feasibility of a study. The determination of the complex network of actors, configurations and influencing factors is associated with a significant effort. This effort is necessary to obtain an initial inventory of the configurations in an industry or industry segment. However, the research and permanent collection of quantitative data as a supplement to the qualitative configuration analysis (e.g., in the form of transaction logs, quantity of electronically exchanged invoices) may become an unsolvable task in the target industry, since some actors do not collect the corresponding data. Corresponding prerequisites for data collection must therefore be checked in advance.

The theoretical frame of reference developed for later *data analysis* is used to characterize configurations of interorganizational integration and to identify the factors influencing them. Due to the explorative nature of our research project, a very broad focus was chosen, which allows for the investigation of many different factors, but cannot provide very deep, specific answers. Many of the identified contributions in the literature search focus on selected factors that again are investigated in more detail (see for example (Alsaad et al., 2019) or (Zeng et al., 2021)). Consequently, they provide a narrow but detailed analysis that does not cover for the additional complex factor interplay that can typically be found in an industry-wise perspective.

The semi-structural approach to the interviews provided only limited comparable results for some questions due to the open-ended nature of the approach. This situation was partly compensated by the comparison of different actors' views. However, in the case of a large number of identical or similar statements, many answers of the interviewees remained that were only expressed once in one way. These aspects can only be used to a very limited extent against the background of ensuring internal validity.

The use of descriptive and structural coding to analyze the interview transcripts generated a comprehensive code base for further data analysis. Other coding procedures would have generated additional results, if necessary, enriching the existing analysis. In the context of coding, however, the limitation is not primarily the choice of coding procedure but ensuring internal validity (Patton, 2015). In our case, internal validity was supported by the choice of appropriate sampling and coding strategies. Further strategies depend on the analysis method itself (for example a questionnaire (Alsaad et al., 2019) or structured coding (Wallbach et al., 2019)).

In the attempt to develop explanatory approaches for the three identified phenomena in the target industry, the work is subject to the limitations of abduction as type of reasoning. Walton (2005) characterizes it as "abductive reasoning," which is characterized by three features: (1) Several explanatory approaches are developed and compared with each other, which (2) are based on a concrete, evident data basis ("body of evidence"). From this (3) hypotheses can be developed, which assume the existence of rules. Thus, abduction is suitable for generating hypotheses. In our literature sample where hypotheses are formulated and tested abduction is typically not mentioned or systematically applied beforehand. The reasoning for stated hypotheses bases on logical arguments or empirical evidence that lacks a formal approach to justify their formulation. The better the evidenced knowledge about the unit of analysis, the higher the probability that the formulated hypotheses are true. Conversely, it also means that hypothetical statements formulated in this way must be tested to confirm or refute them. Due to project restrictions, this step was not part of the research. The external validity of the hypotheses formulated was supported by means of a second round of reviews among the interview partners but cannot replace the necessary step of a hypothesis test.

6 Conclusions and Outlook

Our research journey aimed at the provision of empirical groundwork to conduct a configuration analysis in the domain of interorganizational integration. For this purpose, a research design was developed and operationalized, that helped to identify 12 configurations of interorganizational integration in a target industry that are influenced by 39 influencing factors. We developed two hypotheses that help to explain the observed phenomena in the target industry.

The research design to operationalize configuration analysis gives guidance and a methodological approach for other researchers in the IOIS domain to conduct their research project, namely (1) research paradigm: define the process of knowledge gain that influences the research procedure and the interpretation of the results (in our case critical realism), (2) type of reasoning: identify the epistemological point of view (in our case constructivism) and choose the appropriate type of reasoning to arrive at valid statements and theories (in our case abduction), (3) research goals: depict fitting research goals for the configuration analysis (in our case identification of explanatory approaches to the observed industry-wide phenomena, elaboration and evaluation of the conceptual configuration analysis approach and expansion of the database and the state of knowledge about configurations at industry level), (4) unit of analysis: choose a fitting unit of analysis to collect information and draw conclusions from (in our case configurations of interorganizational integration) and (5) research methods: select research methods that help to achieve the research goals and leave enough room for a multi-perspective investigation in the configuration analysis (in our case literature review to define a frame of reference, in-depth interviews (transcribed and coded), different analysis perspectives on the empirical findings and ensuring internal validity).

The presented findings reflect one of the first attempts to operationalize the configuration analysis proposed by Lyytinen & Damsgaard (2011). The results indicate that our manifestation of the proposed research design is especially fitting for research domains that have no conclusive rules for found phenomena so far. This circumstance is hard to find nowadays and even in our investigated target industry only partially true. Consequently, it may be challenging to adapt the same or a similar operationalization of configuration analysis on other already well investigated industries. Still, the design itself provides means of many different forms of manifestations and is adaptable in various contexts.

Further research should unfold in different manifestations of configuration analyses and thereby offer the opportunity to identify valid research approaches based on goal and context of various research endeavors. Thereby, researchers may follow the proposed research paths presented by Lyytinen & Damsgaard (2011) that outline possible shifts in perspective on configuration analysis (Differences among individual adopters within adopter configurations, Differences among adopter configurations, Dynamics of adopter configurations, Dynamics of adopter ensembles and Dynamics of configurational ensembles).

References

Alsaad, A., Mohamad, R., & Ismail, N. A. (2019). The contingent role of dependency in predicting the intention to adopt B2B e-commerce. *Information Technology for Development*, *25*(4).

Barrett, S., & Konsynski, B. (1982). Inter-Organization Information Sharing Systems. *MIS Quarterly*, *6*(4), 93–105.

Becker, F. G. (1993). Explorative Forschung mittels Bezugsrahmen - ein Beitrag zur Methodologie des Entdeckungszusammenhangs. *Zeitschrift Für Personalforschung*, 111–127.

Bensaou, M., & Venkatraman, N. (1995). Configurations of Interorganizational Relationships: A Comparison Between U.S. and Japanese Automakers. In *Management Science* (Vol. 41, Issue 9, pp. 1471–1492).

Blaikie, N. (2000). Designing Social Research. In *Designing social research The logic of anticipation*. Polity Press.

Creswell, J. W. (2003). Research Design: Qualitative, Quantitative, and Mixed Methods Approaches. In *Research design Qualitative quantitative and mixed methods approaches*. Sage Publications.

Dai, Q., & Kauffman, R. J. (2002). Business models for Internet-based B2B electronic markets. *Proceedings of the 34th Annual Hawaii International Conference on System Sciences*, 1–23.

De Vaus, D. (2001). Research Design in Social Research. In *British Educational Research Journal* (Vol. 28). Sage Publications.

Easton, G. (2010). Critical realism in case study research. *Industrial Marketing Management*, *39*(1), 118–128.

Frick, N. (2022). Nested Configurations of Interorganizational Information Systems: Observations in the German Furniture Industry. *Proceedings of the*

55th Hawaii International Conference on System Sciences.
Fürstenau, D., Auschra, C., & Klein, S. (2020). A configuration approach to multi-sided platforms in healthcare: An ALS platform case. *International Conference on Information Systems, ICIS 2020 - Making Digital Inclusive: Blending the Local and the Global*.
Hart, C. (2001). *Doing a Literature Search A Comprehensive Guide for the Social Sciences*. Sage Publications.
Helo, P., Hao, Y., Toshev, R., & Boldosova, V. (2021). Cloud manufacturing ecosystem analysis and design. *Robotics and Computer-Integrated Manufacturing*, *67*.
Hinings, C. (Bob). (2018). Why should we bother? What are configurations for? *Strategic Organization*, *16*(4).
Kauremaa, J., & Tanskanen, K. (2016). Designing interorganizational information systems for supply chain integration: A framework. *International Journal of Logistics Management*, *27*(1).
Kreuzer, S. (2017). Explaining organizational susceptibility to coercive pressure: results from a field experiment on e-invoicing IOIS adoption. *Information Systems and E-Business Management*, *15*(1).
Kurnia, S., Parker, C., Ali, M., & Karnali, R. (2019). The impact of multilevel contextual factors on is adoption at the inter-organizational level. *Communications of the Association for Information Systems*, *44*(1).
Laakkonen, A., Hujala, T., & Pykäläinen, J. (2019). Integrating intangible resources enables creating new types of forest services - developing forest leasing value network in Finland. *Forest Policy and Economics*, *99*.
Lawson, T. (1997). *Economics and reality*. Routledge.
Legard, R., Keegan, J., & Ward, K. (2003). In-depth Interviews. In J. Ritchie & J. Lewis (Eds.), *Qualitative Research & Evaluation Methods: Integrating Theory and Practice* (pp. 138–169). Sage Publications.
Lyytinen, K., & Damsgaard, J. (2011). Inter-organizational information systems adoption--a configuration analysis approach. *European Journal of Information Systems*, *20*, 496–509.
Meyer, A. D., Tsui, A. S., & Hinings, C. R. (1993). Configurational approaches to organizational analysis. *Academy of Management Journal*, 1175–1195.
Mingers, J. (2004). Real-izing information systems: Critical realism as an underpinning philosophy for information systems. *Information and Organization*, *14*(2), 87–103.
Moon, K., & Blackman, D. (2014). A Guide to Understanding Social Science Research for Natural Scientists. In *Conservation Biology* (Vol. 28, Issue 5).
Nurmilaakso, J. M. (2008). Adoption of e-business functions and migration from EDI-based to XML-based e-business frameworks in supply chain integration. *International Journal of Production Economics*, *113*(2), 721–733.
Papazoglou, M., & Ribbers, P. (2005). *Building B2B Relationships - Technical and Tactical Implementations of an E-Business Strategy*. John Wiley & Sons, Inc.
Patton, M. Q. (2015). *Qualitative Research & Evaluation Methods: Integrating Theory and Practice* (4th Editio). Sage Publications.
Penttinen, E., Halme, M., Lyytinen, K., & Myllynen, N. (2018). What Influences Choice of Business-to-Business Connectivity Platforms? *International Journal of Electronic Commerce*, *22*(4).
Rajaguru, R., & Matanda, M. J. (2013). Effects of inter-organizational compatibility on supply chain capabilities: Exploring the mediating role of inter-organizational information systems (IOIS) integration. *Industrial Marketing Management*, *42*(4).
Reichertz, J. (2014). Induction, Deduction, Abduction. In *The SAGE Handbook of Qualitative Data Analysis*.
Reimers, K., Johnston, R. B., & Klein, S. (2010). Toward a Theory of IOIS Variance. *International Journal of Strategic Information Technology and Applications*, *1*(3), 36–56.
Robey, D., Im, G., & Wareham, J. D. (2008). Theoretical foundations of empirical research on interorganizational systems: assessing past contributions and guiding future directions. *Journal of the Association for Information Systems*, *9*(9), 497–518.
Saldaña, J. (2009). The coding manual for qualitative researchers. In *The coding manual for qualitative researchers*. Sage Publications.
Schubert, P. (2008). Integration Scenarios for Business Collaboration. *AMCIS 2008 Proceedings*, Paper 258.
Schubert, P., & Legner, C. (2011). B2B integration in global supply chains: An identification of technical integration scenarios. *Journal of Strategic Information Systems*, *20*(3), 250–267.
Shree, D., Kumar Singh, R., Paul, J., Hao, A., & Xu, S. (2021). Digital platforms for business-to-business markets: A systematic review and future research agenda. *Journal of Business Research*, *137*.
Steinfield, C. (2014). Inter-organizational Information Systems. In H. Topi & A. Tucker (Eds.), *Computing Handbook, Third Edition, Volume 2: Information Systems and Information Technology* (pp. 1–33). CRC.
Turner, B. A. (1994). Patterns of Crisis Behaviour: A Qualitative Inquiry. In A. Bryman & R. G. Burgess (Eds.), *Analyzing Qualitative Data* (pp. 195–215). Routledge.
Wallbach, S., Coleman, K., Elbert, R., & Benlian, A. (2019). Multi-sided platform diffusion in competitive B2B networks: inhibiting factors and their impact on network effects. *Electronic Markets*, *29*(4).
Walton, D. (2005). Abductive Reasoning. In *University of Alabama Press*. The University of Alabama Press.
Yi, Y., Soh, C., & Huang, L. (2005). Strategic and operational benefits of IOS-enabled interorganizational integration. *Association for Information Systems - 26th International Conference on Information Systems, ICIS 2005: Forever New Frontiers*, 589–601.
Zeng, F., Chan, H. K., & Pawar, K. (2021). The effects of inter- and intraorganizational factors on the adoption of electronic booking systems in the maritime supply chain. *International Journal of Production Economics*, *236*.