An Attempt to Close the Rigor-Relevance Gap During Case Studies

Benjamin Kuch

Abstract—**The current research centers around the question of whether or not a simultaneous coordination of economic and scientific systems can be effective. Considering a broader context, this is a vital issue to both firms and regional networks. For many business organizations the coordination on the juncture between the economic and the scientific system constitutes an important challenge in terms of competitive advantage. Since regions are composed of various functionally differentiated systems, insights from the science-economy juncture can be used as a starting point to conceive of a more generalized coordination approach. The paper draws on a literature review about the rigor-relevance gap and combines it with empirical insights from a longitudinal case study in the German mechanical engineering industry. Onsite observations and semi-structured interviews are enriched by quantitative data from the firms' resource planning systems. Continuously evaluating the empirical findings against prevailing literature, the study gradually reveals insights that are condensed to a theoretical argument of integrated coordination between economic and scientific organizations. Based on this result and in opposition to previous research, it is concluded that the rigor-relevance gap can be systematically bridged by integrating systemic communications on the interface between scientific and practical relevance.**

Index Terms—**Case study methodology, rigor-relevance gap, strategic management, systems management.**

I. INTRODUCTION

The current article addresses a coordination problem between economic and scientific systems. On the single firm level as well as on the regional network level this is a crucial challenge as it directly impacts on organizational innovativeness [1] and the identification of regional synergy potentials [2], respectively. Hence, an effective approach for the simultaneous coordination of those systems would be valuable. A serious controversy among scholars evolved over the question whether or not such an approach is possible at all [3], [4]. Especially systems theorists argue for a fundamental incompatibility of the two systems and hence refrain from an attempt to develop an integrated approach [3], [5]. A systemic approach which recognizes the constructed perspectives (i.e. the realities) of different social systems, however, seems necessary since more positivistic strategies suffer from a lack of consensus in regard to theoretical groundwork in the social science [6]-[9]. Drawing on a literature review and empirical insights from a longitudinal case study, the current article presents an argument on how to minimize the gap between economic and scientific relevance

during a collaboration of these two systems. Operationalized by a dedicated communication medium, an extended perspective on systemic communications (i.e. a fourfold selection pattern) facilitates the transition from unilateral communication (within one system) to integrated communication serving both systems. Hence, the main conclusion of this paper is that, opposed to previous literature, an integrated coordination between scientific and economic organizations is achievable on the basis of a systems theoretical approach.

For the purpose of a sound structure of the paper, the further introduction is divided into three paragraphs explaining the systems theoretical context of organizations, substantiating the crucial role of coordination, and detailing the basic terminology of the rigor-relevance gap.

Organizations are described in the literature as social systems which are based on communications in the form of decisions [10]-[12]. Communication, in this context, shall be understood as a selection process by which systems organize their environments and hence create a specific structure of the world [13]. Therefore, a communication occurs each time a system divides the world into relevant and irrelevant issues, according to a particular concept or medium (e.g. money). Following Luhmannian social systems theory further, systems are considered to consist solely of communications and the logic of the respective selections constitutes their boundaries [13]. Decisions are communications, with the specific characteristic that they contain two interlocked distinctions [14]. Firstly, a social system reduces the complexity (i.e. the variety of possible inputs) of the environment by marking a certain set of issues. Secondly, it uses this very set to select a subset out of all possible choices. Hence, decisions are communications which explicitly communicate their own alternatives [10], [14]. Building upon the concept of autopoiesis [15], organizations are using decisions in an operationally closed process, i.e. they are maintaining themselves by continuously reproducing their own idiosyncratic communicative operations [13], [16].

Due to this self-referential and autopoietic character, it is difficult for organizations to accommodate multiple communication patterns simultaneously [17]. However, especially in volatile and uncertain markets, competitive advantage, and hence the strategic management, of organizations is tightly linked to the effectiveness of their collaborations [18]-[23], which would benefit from a more integrated communication process. This is mainly due to the need for an effective coordination strategy which occurs when considering collaborating organizations [24]. Many scholars have, explicitly or implicitly, addressed coordination problems of different social systems in their scientific contributions. For instance, the analyses of science-economy, economy-economy, and science-politics system

combinations have been considered in the collaborative research literature [25]-[28], the organizational collaboration literature [29]-[31], and the public administration literature [32], respectively. Moreover, theory strands like regional innovation systems [33], [34], cluster theory [35], [36], or the multi-level-perspective [37], [38] deal with the integration of multiple social systems from different perspectives. However, the literature either neglects the vital function of communications as the basic operations of complex social systems [39] or it considers the combination of different systemic communication media to be impossible [3].

This work seeks to offer an integrated coordination approach putting emphasis on the selection codes which are at the basis of a communicative operation. While communicating, each system latently evaluates situations according to a binary structure and hence, categorizes them into an either successful or unsuccessful group [40]. On the one hand, economic organizations evaluate issues by criteria of organizational relevance, i.e. whether or not they increase performance and can be applied effectively [41]. An issue or concept is considered to be a potential if it translates into increased profitability or performance, has a good chance to materialize promptly, and is specific enough to serve the individual system regarding all idiosyncratic restrictions [41], [42]. Since all practice-related selection codes are considered to ground in an economic rationale, i.e. the medium money [43], the terms practical, economic, and business-related relevance are treated as synonyms here. On the other hand, scientific communication rests upon the dyadic divide into true or false statements [44] and is facilitated by a stringent, transparent, and reproducible approach [45]. In other words, rigor involves a solid conceptualization, data-collection, and interpretation strategy [46]. Innovativeness, however, is decoupled from methodological rigor [45]. Since novelty and significance are considered to be crucial for scientific communication, however, the current article uses a concept of scientific relevance rather than mere rigor. For the purpose of this text, scientific relevance shall be seen as a composition of rigor methodology (i.e. transparency, stringency, and reproducibility), novelty of findings, and their significance. The tensions between these communication media are dealt with in the literature and are called the rigor-relevance gap [3], [41], [45].

II. THE RIGOR-RELEVANCE GAP IN THE LITERATURE

In this section, a sample of contributions on the rigor-relevance gap is presented. Table I depicts the authors, their methodological approach, and the associated epistemological direction. It also provides information about the context of their research, and about concrete elaborated thoughts which serve as impulses to effectively address the gap. The sample is arranged according to the respective context of the literature (depicted in the fourth column). Although this is no exhaustive literature review, for this is done elsewhere (e.g. [8]), the author is confident that a good overview was achieved outlining the spectrum of research standpoints. An ontological perspective, albeit philosophically interesting, was omitted, due to its lacking impact on the empirical level [47].

In terms of epistemology, positivist approaches seek to identify and assess the relevance gap [48], analyze important influencing factors [41], and close it by applying appropriate measures [46], [49]. This, however, implies that there is a general solution which has to be found and it requires the set of influencing factors to be small enough so the problem remains manageable. Other approaches recognize the limits of research methods (e.g. critical realism) [4] and draw attention to the multitude of contexts and perspectives which have to be recognized and interpreted (e.g. interpretative perspective and contextualism) [50].

Assuming that both the problem and the respective knowledge to solve it are inextricably linked to action, pragmatism provides the epistemological background for action-oriented research methodologies [8], e.g. action research and Mode 2 knowledge production. Especially in regard to the requirements of starting with a problem-induced research question, considering various contexts, and grounding theory-building in action, action research and Mode 2 knowledge production are similar approaches [50], [51].

Social systems theory, which is based upon a constructivist epistemology, also recognizes the context-sensitivity of the relevance gap. A certain context is represented by a social system communicating with an idiosyncratic medium in a self-referential manner. Hence, this perspective decouples from concrete human actors and seeks to analyze the underlying communication patterns. This implies that a system defines or constructs its own meaning, i.e. what is relevant [3], [5], [13], and that methodology may have to actively contribute to innovativeness [52].

TABLE I: THE RIGOR-RELEVANCE GAP IN THE LITERATURE

Literature (authors, year)	Methodology	Associated Epistemology	Context of the research / Impulses (i.e. attempts to reduce the rigor-relevance gap, recommendations, and insights)
[49] (Wren *et al.*, 1994)	empirical	positivism (implicit)	Business schools / Closing the rigor-relevance gap requires a basis of capable doctoral students as well as a reward system which encourages the awareness of real-world problems.
[53] (March and Sutton, 1997)	conceptual	constructivism (implicit)	Business schools / No real solution to the problem: continuous struggle between two worlds. Organizational performance and (perceived) organizational structures are mutually dependent. Organizational cohesion is a constructed reality.
[54] (Korpiaho *et al.*, 2007)	literature review	Do not present an epistemological argument.	Business schools / Broaden the spectrum of business school concepts: (1) scientific mission, (2) implementation mission, (3) social mission.
[6] Knights *et al.*, (2008)	conceptual	constructivism (implicit)	Business schools / Develop networks along three steps: (1) identify problems, (2) attract and convince key-stakeholders, (3) strive for institutionalization.

Literature (Authors, year)	Methodology	Associated Epistemology	Context of the research / Impulses (attempts to reduce the rigor-relevance gap, recommendations, and insights)
[48] (Ghosh *et al.* 2010)	empirical	positivism (implicit)	Business schools / Business schools have to empirically prove the practical impact of their contributions and hence their effectiveness.
[55] (Learmonth *et al.* 2012)	empirical	Discussing examples of positivism and deconstruction.	Business schools / The concept of relevance does not contain any ontological value. Rather, it is dependent on context and influenced by powerful agents. Deconstruction is considered to provide a basis for reflective and critical discussions in order to avoid precipitate judgments about the world.
[56] (Butler *et al.* 2015)	empirical	Discussing examples of post-positivism, interpretive perspective, and critical theory.	Business schools / Bridging the gap between rigor and relevance always involves the risk of a compromised scientific ethos, e.g. due to material rewards.
[41] (Cheng and McKinley, 1983)	empirical	positivism (implicit)	Conception of relevant research / Impact of bureaucracy on organizational performance. Impact is dependent on paradigm maturity of the research field: high maturity requires higher restrictions, i.e. degree of bureaucracy.
[57] (Tranfield, 2002)	conceptual	constructivist (implicit)	Conception of relevant research / Apply Mode 2 principles to ground theories in application.
[9] (Tranfield *et al.,* 2003)	conceptual	Discussing examples of positivism and phenomenology.	Conception of relevant research / Evidence-informed practice. The systematic literature review as a method to combine practitioners' perspectives and scientific rigor.
[46] (Gnyawali and Song, 2016)	literature review	positivist (implicit)	Conception of rigorous research / Research should primarily ensure rigor. Relevance is mainly dependent on the research question which should be defined in a cooperative process with practitioners.
[42] (Thomas and Tymon, 1982)	conceptual	pragmatism (implicit)	Concrete fields of action / Strategies to resolve organizational problems. Research findings have to: properly describe the organizational setting; contribute to relevant goals; provide leverage points for the practitioner; be readily available; exceed common sense.
[58] (Berggren and Söderlund, 2008)	conceptual	constructivism (implicit)	Concrete fields of action / Project management education against the backdrop of Mode 2 society. Alternating process between reflection and action. Six learning modes connecting theory to practice and vice versa: (1) reflection reports, (2) learning contracts, (3) roundtable examinations, (4) live cases, (5) thesis work, (6) knowledge theatres.
[45] (Wolf and Rosenberg, 2012)	conceptual	Comparison of positivism, constructivism, and hermeneutics	Concrete fields of action / Analysis of the research process. 14 recommendations along the five research stages, i.e. research idea, research model and hypotheses, data collection and interpretation, research report, dissemination. The important role of qualitative research, case studies in particular, is emphasized.
[52] (Alvesson and Sandberg, 2013)	conceptual	constructivism (implicit)	Concrete fields of action / Identification of three fields of action: (1) institutional conditions (e.g. broaden publication outlets) (2) professional norms (e.g. upgrading innovativeness), and (3) researcher's identity (e.g. cultivate a more intellectually broad-minded and independent identity). Researchers need to constructively ground their ideas in data, as opposed to neo-positivist methodologies.
[59] (Shrivastava and Mitroff, 1984)	conceptual	interpretive (implicit)	Concrete fields of action / Frames of reference (researchers and practitioners construct their theory with underlying assumptions). Develop systemic knowledge, apply a qualitative methodology enriched by quantitative data, and choose research variables with direct action implication for practitioners.
[60] (Hatchuel, 2001)	conceptual	pragmatism (implicit)	Knowledge / Collaborative science-economy-networks. Jointly define and agree upon a set of rules for research-oriented partnerships as a precondition to increase actionable knowledge.
[61] (Starkey and Madan, 2001)	conceptual	pragmatism (explicit)	Knowledge / Creating knowledge networks transcending traditional scientific boundaries. Orienting the academic incentive system toward collaboration with practitioners.
[62] (Van de Ven and Johnson, 2006)	conceptual	constructivism (implicit)	Knowledge / Knowledge production and transfer have to be designed effectively, drawing attention to conflict management in order to conciliate different perspectives.
[63] (Thorpe *et al.* 2011)	conceptual	pragmatism / constructivism (implicit)	Knowledge / The concept of the knowledge translation value-chain. Researchers need to acknowledge different contexts and perspectives which constitute relevance. Knowledge is produced while it is applied. Theory and practice have to be mingled along the knowledge production process.
[8] (Fendt and Kaminska-Labbé, 2011)	literature review	pragmatism (explicit)	Knowledge and design-driven action research / Rigor-relevance gap is a direct consequence of predominant paradigms. Ontology is less important than Epistemology. Knowledge artefacts being generated during action research help to bridge the gap between theory and practice.
[64] (Kilduff and Kelemen, 2001)	conceptual	deconstruction (explicit)	Roots of the rigor-relevance gap / Strategies to resolve organizational problems. Continuously consider practitioners as counterparts of research and frequently alter the analytical perspective since the empirical context is constantly changing as well.
[65] (Hodgkinson *et al.,* 2001)	conceptual	critical realism (implicit)	Roots of the rigor-relevance gap / The concept of pragmatic science. Use a more pragmatic and context-dependent concept of rigor. Before closing the rigor-relevance gap, a competency gap has to be addressed in order to ensure capable scientific personnel. Moreover, critical reflection and the permission to produce unintended results support an effective collaboration between researchers and practitioners.
[50] (Aram and Salinpante, 2003)	conceptual	Discussing examples of positivism and contextualism	Roots of the rigor-relevance gap / Comparison of epistemological conceptions. Bridging the gap means to pursue problem-driven research, to transcend dichotomous boundaries (e.g. inductive vs. deductive), and to follow a utilization-based conception of validity.

TABLE I: CONTINUED

Literature (authors, year)	Methodology	Associated Epistemology	Context of the research / Impulses (i.e. attempts to reduce the rigor-relevance gap, recommendations, and insights)
[3], [5] (Kieser and Leiner, 2009, 2011)	conceptual	constructivism (explicit)	Roots of the rigor-relevance gap / No real solution due to autopoietic character of organizational processes.
[66] (Rasche and Behnam, 2009)	conceptual	constructivism (implicit)	Roots of the rigor-relevance gap / System interaction: Autopoietic character of both practice and science require working with fictions, i.e. irritations. Hence, courageous researchers and practitioners have to more frequently risk failure by assuming that fictions of the other system are indeed relevant to the own system.
[4] Hodgkinson and Rousseau, 2009)	conceptual	critical realism (explicit)	Roots of the rigor-relevance gap / Critique of Kieser and Leiner [3]: (1) basic assumptions in social science are hard to validate; (2) there are many examples of successful collaboration between theory and practice effectively bridging the rigor-relevance gap.

Building upon and synthesizing the reviewed literature, some interesting deliberations shall be presented and discussed in more detail in this part of the text. Firstly, a formal framework of the opposing aims of science and business is presented [65], [67] and the structure of this framework is compared to ideas from the theory of social systems [3], [5], [13], [44]. Secondly, recommendations in terms of methodology are considered. Thirdly, concepts for an effective operationalization, i.e. how to actually address the relevance gap on the researcher level, are reflected upon.

In their research on the practitioner-researcher divide, Anderson *et al.,* 2001 [67] and Hodgkinson *et al.* [65] formulate and discuss a structure of the rigor-relevance gap and thus provide a solid groundwork to build upon. The basic element of their framework is a simple but conclusive fourfold typology, i.e. a rigor-relevance matrix, that characterizes a particular research according to the dimensions of methodological rigor and practical relevance. Each dimension is divided into two categories, representing a low and a high level of fulfillment. Interestingly, this sort of binary structure is pretty much akin to the codification in social systems theory. The major difference is that communication codes of social systems are usually standalone concepts [3], [5], [68], whereas the rigor-relevance matrix combines two binary divisions. However, since communications represent operations to divide the world of systems into relevant and irrelevant issues, a combination of selection criteria is conceivable and mainly depends on the focus of the respective social system. The theoretical standpoint of social systems theory has been criticized in the literature. Most important in regard to this study, Hodgkinson and Rousseau [4] dissect the argument of Kieser and Leiner [3] and mainly criticize them on two grounds: (1) Kieser and Leiner assume that social systems are autopoietic in character, however, do not provide compelling empirical evidence to substantiate it. Luhmann's theory of social systems is indeed complex, abstract, and not too much devoted to practical application [10]. However, highly generalizable theories of society require abstract concepts [13]. Hence, it seems fair that researchers clearly state the theoretical groundwork and assumptions their argument is based upon, in order to allow for a controversial and fruitful discussion. Most interestingly, Hodgkinson and Rousseau [4] themselves postulate critical realism as the mandatory epistemological perspective without offering a conclusive train of thought for their decision. In the sequel, they argue that critical realism contradicts the dichotomous structure of the scientific selection code, i.e. true or false, neglecting that Luhmann's theoretical deliberations ground in a constructivist perspective. The communication code constitutes a pattern by which reality is constructed from a particular system, i.e. how the important issues are separated from the unimportant ones; (2) Hodgkinson and Rousseau [4] present a long list of examples that opposes the rather pessimistic standpoint of Kieser and Leiner [3]. Among others, the domains of engineering, software, and health care are quoted, representing very successful collaboration fields where rigor leads to relevance and relevance therefore requires rigor [4]. However, the availability of well-working collaboration examples should not distract researchers from the general incompatibility of communication structures mentioned by Kieser and Leiner [3]. Hence, in terms of current and future research, collaborative communication which is subject to controversies and causes friction is particularly interesting. The framework being presented in this article acknowledges the evidence of successful and expedient science-economy collaboration, and understands it as *integrated communication*. An approach seeking to sustainably address the rigor-relevance gap, however, can only be effective if it accounts for the fields where scientific and economic communication diverge.

In terms of methodology, the rigor-relevance literature emphasizes the need to leave the rather narrow positivist perspective or at least extend it by applying qualitative research in order to allow for the development of germane theory addressing real-world problems [50], [67], [69]. The case study method in particular is recommended since innovative theoretical concepts most often stem from empirical impulses found in single cases [45].

In addition to the methodological recommendations, the literature can be reviewed in regard to its degree of specificity. Many articles analyze the nature of the rigor-relevance gap and its implications soundly (e.g. [8], [57], [60]), however, much fewer propose concrete concepts on the level of the individual researcher (e.g. [45]). This article, therefore, identifies two important concepts, i.e. reflection and refocusing, and wants to further the argument on the researcher level in the context of case study application. Reflection, i.e. a critical and cooperative dialogue between researchers and practitioners, is considered to play a vital role in supporting research that is both rigorous and relevant [45], [58], [64], [65]. Most importantly, action and reflection are interdependent modes, and effective reflection can only happen in a well-organized and reflection-oriented environment [58]. Social systems theory is based to a large extent on reflection as well, since it is one of the fundamental principles in regard to self-reference [70], [71]. Besides reflection, it has been emphasized that relevant research has

to account for the ever changing framework conditions in the social science [8], to properly deal with conflicting perspectives [62], and likewise has to develop theories accounting for new organizational phenomena [45]. In order to do so, however, research has to allow for some flexibility in regard to the research output, i.e. also unintended results have to be followed up and appreciated [65]. This flexibility is the ability to dynamically refocus a research study while conducting it. In order to prevent this process from becoming mere relativism or eclecticism, both sufficient time and a soundly structured environment have to be provided. Referring again to social systems theory, refocusing corresponds to a shift in perspective induced by environmental irritations, being crucial to the effectiveness of collaboration [66]. Due to the arguments mentioned above, this article reviews the rigor-relevance matrix [65], [67] from a systems theoretical perspective and translates its typology into a communication-based concept which allows the researcher to continuously deal with controversies between the science and the business system.

III. METHODOLOGY

In order to substantiate the deliberations from the literature review, a case study has been conducted from September 2014 to August 2016 against the backdrop of the collaboration of five German companies producing machinery and equipment for production and packaging processes of the pharmaceutical industry. Their total annual revenue was approximately \$1.35bn (€1.20bn) and they employed over 8,000 people worldwide. The headquarters of the companies were relatively close to each other, approximately 100 mi (150 km) on average. This regional character provided a supportive setting for the collaboration between the scientific and economic system [72]. Another considerable advantage was the fact that the five firms had already collaborated in the past which paved the way for an effective cooperation process.

As already learned from the literature review, a qualitative research approach seemed appropriate because, in a social science context, the accommodation of various perspectives is a critical success factor [73]. Moreover, longitudinal studies in particular suit the challenging analysis of organizational development and change processes [74], [75].

Hence, following case study methodology, data has been collected from various sources, striving for triangulation [76], [77]. Fig. 1 illustrates the methodological approach in a consolidated form and provides additional information on the data collection process.

project phase	Target definition	Fit analysis	Collaboration process generation
data collection			
Onsite observations	-	5 (duration: 1-2 weeks)	
Jours fixes and workshops	5 (duration: intra-day)	Every 8-12 weeks (duration: intra-day or two-day meetings)	
Semi-structured interviews	5 (level: head of department)	30 (level: subject matter experts)	18 (level: head of department)
Quantitative analyses	Internal survey (level: head of department)	Enterprise resource planning data analysis	Enterprise resource planning data analyses (one per sub-project)
Working papers	-	Approximately 40 identified potentials, each using a working paper as a discussion platform.	

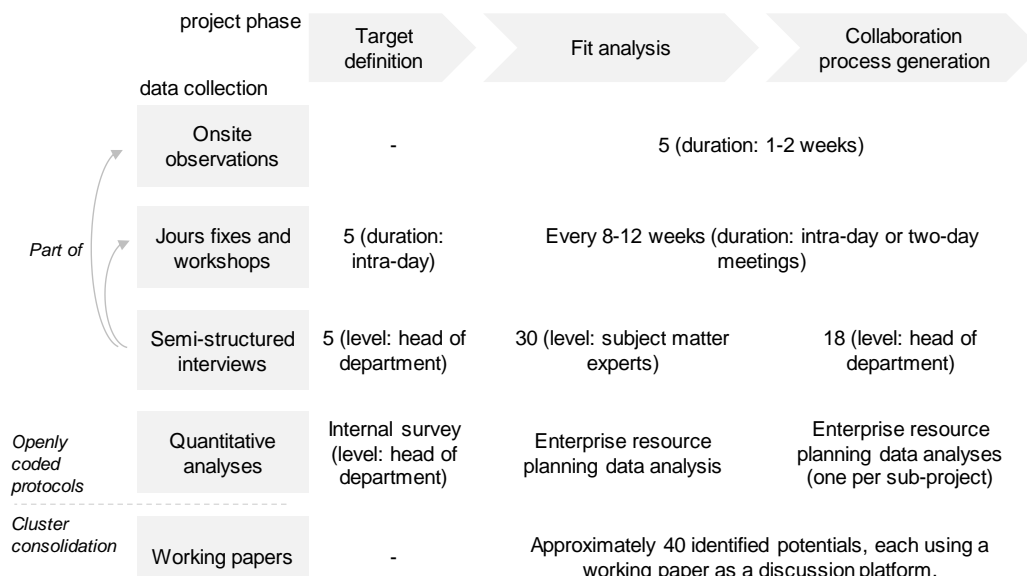*Part of*, *Openly coded protocols*, *Cluster consolidation*

Fig. 1. Data collection and development along the case study phases.

Data sources included onsite observations and interviews, meetings and workshops, and quantitative data analyses. Qualitative data, accounting for the larger part of the overall data, was coded by protocols and it was continuously being compared to existing literature and challenged in open discourses with practitioners. Open codes were used at first, then clusters were identified, and a consolidated structure of ideas and perspectives was developed. The consolidation was operationalized by working papers, a collaborative communication medium which proved to effectively facilitate the integration on the juncture between economic and scientific communication. Their functional principle, i.e. an associated selection code, is described in the following section in more detail.

Considering the data consolidation approach along the working paper development process, the empirical insights have been grounded in a theoretical discourse and in opposing practical perspectives, which increases methodological rigor of collaborative research [78], [79]. Moreover, the data was triangulated with internal survey data and quantitative analyses of data from the enterprise resource planning systems, thus following recommendations from grounded theory [80]. On this basis, an argument on how to integrate communications from the science and the economic system was developed and shaped. In terms of project design, the case was structured by three phases, i.e. target definition, fit analysis, and collaboration process generation.

In the target definition phase at the beginning of the project, the overall objective was discussed and agreed upon. Not surprisingly, the aims considered in this phase were mainly motivated by the economic perspective of the business organizations. Hence, the rigor-relevance gap came into

effect right at the start of the research. However, since the observation of collaborating businesses raises enough scientifically relevant questions, this was not detrimental to the research.

During the second phase, a mixed-methods approach was followed in order to assess mutual fit levels of the partnering firms. Data from the enterprise resource planning systems as well as from internal surveys were collected and combined with semi-structured interviews, in order to scrutinize and compare procurement profiles and business strategies.

The third phase, i.e. collaboration process generation, was driven by synergy potentials between the collaborating departments which were identified during onsite observations, workshops, and regular meetings. Again, the qualitative data was enriched by quantitative data from the enterprise resource planning systems. Although the synergy process within the economic system also raised a number of interesting questions, the current article focuses on the coordination process between the scientific and the economic system. The researcher primarily communicated in the medium of the scientific system but operated in the economic system. Hence, multiple ends had to be considered simultaneously and coordination between them was vital to the project. The active role of the researcher during the study helped to avoid latent problems concerning the mutual interference of the studied system and the observer [81], since the intertwined constellation was a consciously designated part of the study design. Hence, the scientist was acknowledged as the fulcrum of the scientific project influencing and changing the world being studied [64].

IV. DEVELOPING THE ARGUMENT OF INTEGRATED COMMUNICATION BETWEEN SCIENCE AND PRACTICE

While studying the empirical case for two years, the author observed an evolution of the organizational processes. At the beginning of the research, collaboration between the involved systems (five procurement departments and the external, scientific facilitator) happened through loosely coupled communications, as it had been before the case study.

Within the first two phases of the project the communication started to concentrate on particular focuses which led to projects being coordinated on collaboration level and executed within the various organizations. At this stage, however, the economic rationale dominated the communication, since the topics were mainly driven by their impact on cash flows. This held true although the classical communication medium of the economic system, i.e. money [43], was translated into more organization-specific sub-media and respective selection codes. A detailed analysis of intra-organizational communication media within the economic system, serving as translation strategies in regard to the basic communication medium, is beyond the scope of this article. Rather, the disparity between scientific and economic communication was analyzed and could be observed clearly enough during the case, ostensibly corroborating prevailing critique [3]. For example, the economic organizations were trying to dissolve controversies in a straightforward manner in order to reduce complexity, whereas the scientist most often sought to generalize empirical findings for the purpose of theory-building [27].

Only the development of a collaboration medium, in the form of idiosyncratic working papers, fostered the integration of scientific and economic communicative selections. These working papers had a jointly agreed upon structure and provided room for scientific deliberations that were translated into, or matched with, organizational relevance during regular meetings and sub-projects. Therefore, they served as an operationalized reflection platform which provided junctions for additional communications along the collaboration process. The researcher produced the working papers, ensuring a scientific line of argument, containing a problem statement, methodological approach, and expected relevance. Although methodological rigor had no priority for the organizations, the created communication platform significantly supported the collaboration between the business and the research perspective. This was mainly due to a newly generated fourfold selection code in regard to the collaboration which is depicted in Fig. 2.
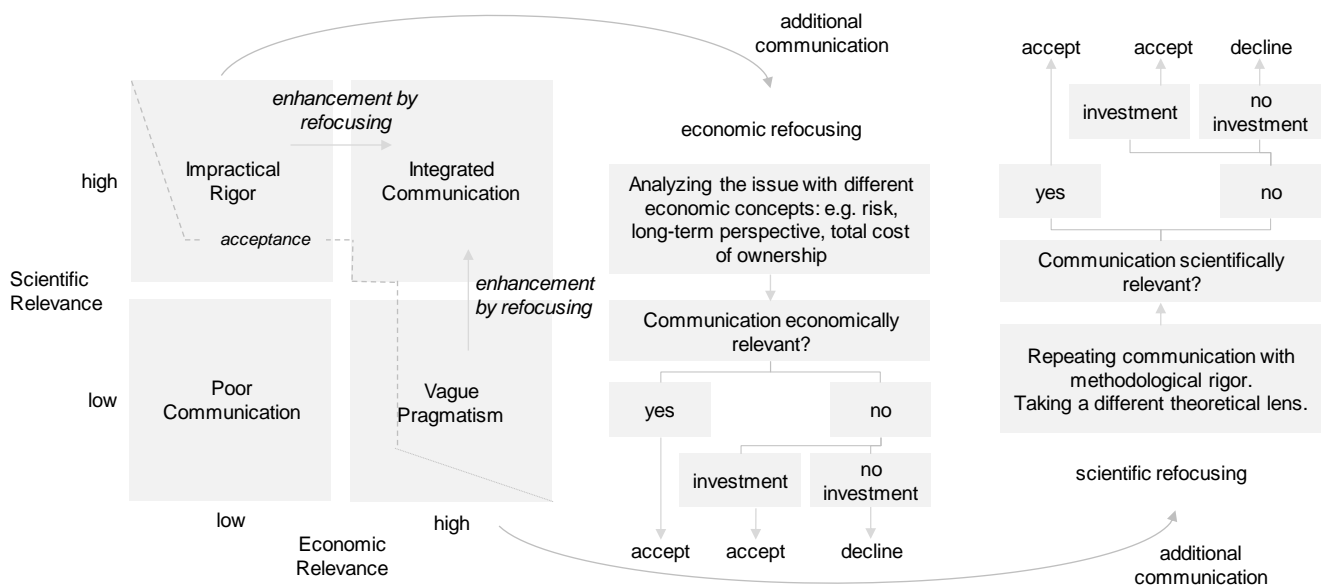

Fig. 2. Combined selection code for communications in research-business collaborations (the fourfold structure on the left-hand side is based on [67] and develop into a concept of refocused communications).

The basic structure of the selection code was borrowed from [67] and translated into a communication concept within a social systems theory context. Vital to the concept is the idea of additional, refocused communications: if a communication is relevant in regard to one system but irrelevant in regard to the other one, the process of refocusing is to be carried out. The researcher drives the process, albeit conceivably drawing on resources from the business system. For each sub-project carried out during a case study leading to a conflict between the two perspectives of relevance, additional communications are required in order to evaluate whether or not the local gap between the systems can be bridged. As learned from the literature, the autopoietic character of social systems impedes such collaborative communication [3], [5], [17]. However, there are numerous examples of effective and very successful cooperation [4]. Moreover, many companies are performing or supporting basic research while pursuing a stringent economic rationale and they are collaborating with universities in order to identify and lever knowhow potentials [82], [83].

For several industries, e.g. medical devices or pharmaceuticals, methodological rigor is even imposed upon business organizations by the government and hence becomes a vital factor in creating competitive advantage. The impact of the institutional environment on sustained competitive advantage is extensively discussed in the literature [84], [85]. In these cases, successful communication is likewise *integrated communication* concurrently meeting the requirements of the economic and the science system. Such integrated communication was also observed during the empirical case. Especially sub-projects involving external and internal change, e.g. the substitution of longstanding suppliers for the purpose of economies of scale, required the project group to accurately scrutinize organizational structures, processes and inter-organizational relations, providing a sound groundwork for scientific theory-building. It likewise served the economic rationale because experience taught the organizations that rushing into particular fields would imply a great risk of belatedly soaring internal efforts or even project failure. The way science is operating, i.e. looking for true statements by applying a transparent method, was perfectly aligned with the economic rationale of the departments and the entire firms. These results seem to corroborate the more optimistic views in the literature [4]. However, in order to stabilize an effective collaboration process between the business and the research system, the pleasant examples of integrated communications are neither sufficient nor are they very interesting in terms of research. Emphasis should rather be put on non-integrated communications which are serving one system well but are neglecting the other one.

Business organizations often proceed rather practically and are neglecting rigorous approaches which would meet the requirements of the scientific system. The collaborative communications in these fields shall be called *vague pragmatism* since they do undervalue scientific selection modes. Interestingly, whether or not a particular task during the conducted case study was considered to require methodological rigor (e.g. the above mentioned change management processes), would strongly depend on organizational development paths, experiences made with the

particular subject matter, and budget restrictions. Hence, no absolute measure can be given to categorize communications in either group. Rather, past and current perspectives of the organizations are shaping the accuracy and effectiveness of particular communications.

By using the newly defined communication medium (i.e. working papers), however, the researcher had the chance to decelerate the process to some extent looking for scientific leverage points. This was possible by either repeating the communication with increased methodological rigor (e.g. operationalized by additional internal surveys, conducted to follow up particular tasks), or analyzing the results through another theoretical lens. The current case study, for example, commenced with sound theoretical equipment in regard to supply chain collaboration. However, during the theory-building process, the empirical insights started to shed light on the vital position of communications as a fulcrum for collaboration activities. In order to account for these insights, the theoretical perspective was enlarged by communication-based organizational theory. Thus, the research focus was slightly shifted from agent-based business collaboration toward communication-based collaboration between science and business. In this adapted context, many of the observations could be interpreted much more compellingly. Since scientific refocusing (e.g. shifting a theoretical perspective or applying rigor to an organizational approach) requires both structure and time, only the combination of a customized communication medium and a longitudinal case design provides the necessary environment to soundly incorporate and intertwine scientific deliberations with rationales of economic organizations. The working papers featured a scientific structure while discussing economically important questions during the case. Hence, they provided a platform for the coordination of the scientific and the business system on sub-project or even activity level. This represents an institutionalization of the scientific communication process within the business organization.

The other form of non-integrated communication shall be labelled as *impractical rigor*, since a scientifically interesting question can be rigorously scrutinized, however, without any organizational relevance. As with vague pragmatism a possible solution to the coordination problem can be found in the extension of the communication process. Additional communications which shifted the perspective and revealed organizational relevance were identified along three dimensions: risk, total cost of ownership and long-term strategy. For instance, a bottom-up collaboration approach (i.e. enhancing cognitive proximity by intertwining knowhow on employee level), provides several interesting research questions but organizations may dread large initial efforts and lacking direct effects. However, taking a long-term perspective combined with a risk analysis in order to quantify negative effects of a sluggish information flow against the backdrop of volatile markets, the economic rationale is dissected more precisely and different facets can be discussed. The idea behind it is to provide new impulses for organizations to avoid lock-in effects that emerge and grow if organizational proximity is too strong [38], [86]-[89].

In both cases of non-integrated communication, i.e. vague pragmatism and impractical rigor, a communication can be acceptable even if the process of refocusing does not

sufficiently increase relevance in the other system. Due to long-term interdependencies in a practical context, one systemic medium (e.g. scientific relevance) should be endowed with a certain tolerance range within which it can be used without directly delivering for the other system. For example, if business organizations acknowledge a researcher's support and recognize the benefits for their collaboration, they might be keen to support mere scientific communication with resources to some extent, e.g. by conducting an additional internal survey whose direct impact on organizational performance cannot be ensured. Considering the long term, however, this way of thinking perfectly aligns with the overall economic rationale for prospective potentials can be levered most effectively if the researcher, as an important driver of the collaboration, can also satisfy the scientific stakeholders. Scientific relevance can therefore be considered as some sort of investment to facilitate integrated communication in the future. The same logic applies vice versa when a researcher works on a sub-project from which no direct scientific value can be derived. In this case, the researcher invests resources for the purpose of integrated communications in the future. Of course these investment communications, i.e. communications that are only serving one system, must not consume too much project resources and should be discussed transparently during regular meetings.

V. Conclusion

Drawing on insights from an empirical longitudinal case, an argument for the integrated coordination of functionally differentiated and operationally closed systems is offered. Pivotal to the argument is the combination of communication codes determining the selection processes in complex social systems. Thus, the number of selection possibilities increases which is why an extended comprehension of systemic communication is generated. The binary selection code is substituted with four alternatives arrayed on a combinatorial matrix of the scientific and the economic code. Those sections of the matrix which are linking opposed levels of approval (i.e. impractical rigor or vague pragmatism) cause subsequent communications and, hence, enlarge the overall set of opportunities to reproduce communication. In terms of operationalization, the matrix selection is accommodated in a communication medium (scientifically structured working papers) providing a space to integrate economic and scientific relevance.

Referring it to the requirements derived from the literature review, the newly defined communication medium represents a reflection platform which supports the conflict management process between the research and the business system. It decelerates the process at strategic points, e.g. before decisions, and hence provides time and structure in order to thoroughly examine whether or not a task during the case can serve both systems simultaneously. A practical advantage of this approach is that the researcher does not wait until final results from a longer process are available to find out that either the applied method or the economic value was too weak. Rather, the researcher is continuously involved in a scientific communication process embedded in a business context and is required to intervene on the activity or

sub-project level. The necessary structure to do so is provided by the working papers which accommodate the economic rationale in a scientific format. Hence, applying this kind of communication medium on the juncture between business and research helps practitioners to make collaboration projects more effective.

Opposed to current literature, it is concluded that the rigor-relevance gap can be systematically bridged by integrated communications on the interface between scientific and practical relevance. This likewise offers a leverage point for the coordination of two functionally differentiated social systems, i.e. economy and science. The concept seeks to draw attention of researchers to communications when analyzing collaborations between scientific and economic systems. Since many business organizations benefit from or even depend on an effective cooperation with scientific systems, this approach delivers valuable impulses for both the strategic management of single organizations and network approaches on the regional level. Albeit inter-organizational collaboration within the economic system provides a whole range of interesting research problems which could be addressed by a similar research approach, the contribution of this article is limited to the mediation between the scientific and the economic system, leaving substantial questions (e.g. about different communication media within collaborations of business organizations) to future research.

References

[1] P. Lindelöf and H. Löfsten, "Proximity as a resource base for competitive advantage: University–industry links for technology transfer," *The Journal of Technology Transfer,* vol. 29, no. 3-4, pp. 311-326, 2004.

[2] E. Westkämper and C. Löffler, *Strategies of production: technologies, concepts and implementation [Strategien der Produktion: Technologien, Konzepte und Wege in die Praxis]*, Berlin: Springer Vieweg, 2016.

[3] A. Kieser and L. Leiner, "Why the rigour-relevance gap in management research is unbridgeable," *Journal of Management Studies*, vol. 46, no. 3, pp. 516-533, 2009.

[4] G. P. Hodgkinson and D. M. Rousseau, "Bridging the rigour-relevance gap in management research: It's already happening!," *Journal of Management Studies*, vol. 46, no. 3, pp. 534-546, 2009.

[5] A. Kieser and L. Leiner, "On the social construction of relevance: A rejoinder," *Journal of Management Studies*, vol. 48, no. 4, pp. 891-898, 2011.

[6] D. Knights, C. Alferoff, K. Starkey, and N. Tiratsoo, "Bridging the academic-practitioner divide: A case study analysis of business school collaboration with industry," in *Handbook of collaborative Management Research*, A. B. Shani, S. A. Mohrman, W. A. Pasmore, B. Stymne, and N. Adler (Eds.), Los Angeles: Sage Publications, 2008, pp. 403-420.

[7] H. Joas and W. Knöbl, *Social Theory [Sozialtheorie]*, Frankfurt am Main: Surkamp, 2004.

[8] J. Fendt and R. Kaminska-Labbé, "Relevance and creativity through design-drivenaction research: Introducing pragmatic adequacy," *European Management Journal*, vol. 29, pp. 217-233, 2011.

[9] D. Tranfield, D. Denyer, and P. Smart, "Towards a methodology for developing evidence-informed management knowledge by means of systematic review," *British Journal of Management,* vol. 14, no. 3, pp. 207-222, 2003.

[10] D. Schoeneborn, "Organization as communication: A Luhmannian perspective," *Management Communication Quarterly,* vol. 25, no. 4, pp. 663-689, 2011.

[11] H. Willke, *Systems theory: theory of control [Systemtheorie: Steuerungstheorie]*, 3rd ed. Stuttgart: Lucius & Lucius, 2001.

[12] R. D. McPhee and P. Zaug, "The communicative constitution of organizations: a framework for explanation," in *Building Theories of Organization: The Constitutive Role of Communication*, L. L. Putnam and A. M. Nicotera (Eds.), New York: Routledge, 2009, pp. 21-48.

[13] N. Luhmann, *The society of society [Die Gesellschaft der Gesellschaft]*, Frankfurt am Main: Suhrkamp, 1997.

[14] D. Seidl and K. H. Becker, "Organizations as distinction generating and processing systems: Niklas Luhmann's contribution to organization studies," *Organization*, vol. 13, no. 1, pp. 9-35, 2006.

[15] F. G. Varela, H. R. Maturana, and R. Uribe, "Autopoiesis: The organization of living systems, its characterization and a model," *Biosystems*, vol. 5, no. 4, pp. 187-196, 1974.

[16] H. Willke, *Systems Theory: Theory of Intervention [Systemtheorie: Interventionstheorie]*, Stuttgart: G. Fischer, 1994.

[17] G. Kneer, "Organization and society [Organisation und Gesellschaft]," *Zeitschrift für Soziologie,* vol. 30, no. 6, pp. 407-428, 2001.

[18] K. Pavlovich and M. Akoorie, "Innovation, sustainability and regional development: the Nelson/Marlborough seafood cluster," *Business Strategy and the Environment*, vol. 19, no. 6, pp. 377-386, 2010.

[19] R. Njøs and S. E. Jakobsen, "Cluster policy and regional development: scale, scope and renewal," *Regional Studies, Regional Science,* vol. 3, no. 1, pp. 146-169, 2016.

[20] M. Iansiti and R. Levien, "Strategy as ecology," *Harvard Business Review*, no. 2, pp. 1-11, 2004.

[21] R. Sahamie, D. Stindt, and C. Nuss, "Transdisciplinary research in sustainable operations - An application to closed-loop supply chains," *Business Strategy and the Environment*, vol. 22, no. 4, pp. 245-268, 2013.

[22] F. Zhu and M. Iansiti, "Entry into platform-based markets," *Strategic Management Journal,* vol. 33, pp. 88-106, 2012.

[23] G. B. Dagnino, "Complex systems as key drivers for the emergence of a resource- and capability-based interorganizational network," *Emergence: Complexity and Organization*, vol. 6, no. 1-2, pp. 61-69, 2004.

[24] S. Schmid, P. Grosche, and U. Mayrhofer, "Configuration and coordination of international marketing activities," *International Business Review,* vol. 25, no. 2, pp. 535-547, 2016.

[25] A. B. Shani, S. A. Mohrman, W. A. Pasmore, B. Stymne, and N. Adler (Eds.), *Handbook of collaborative management research*, Los Angeles: Sage Publications, 2008.

[26] J. P. Walsh, M. L. Tushman, J. R. Kimberly, B. Starbuck, and S. Ashford, "On the relationship between research and practice: debate and reflections," *Journal of Management Inquiry,* vol. 16, no. 2, pp. 128-154, 2007.

[27] A. Panda and R. K. Gupta, "Making academic research more relevant: a few suggestions," *IIMB Management Review,* vol. 26, no. 3, pp. 156-169, 2014.

[28] A. David and A. Hatchuel, "From actionable knowledge to universal theory in management research," in *Handbook of collaborative management research*, A. B. Shani, S. A. Mohrman, W. A. Pasmore, B. Stymne, and N. Adler (Eds.), Los Angeles: Sage Publications, 2008, pp. 33-48.

[29] J. Knoben and L. Oerlemans, "Proximity and inter-organizational collaboration: A literature review," *International Journal of Management Reviews,* vol. 8, no. 2, pp. 71-89, 2006.

[30] M. P. V. de Oliveira, K. McCormack, M. B. Ladeira, P. Trkman, and J. Van Den Bergh, "Supply chain process collaboration and internet utilization: An international perspective of business to business relationships," *Economic and Business Review*, vol. 13, no. 4, pp. 203-226, 2011.

[31] U. Ramanathan and A. Gunasekaran, "Supply chain collaboration: Impact of success in long-term partnerships," *International Journal of Production Economics*, vol. 147, pp. 252-259, 2014.

[32] T. J. Catlaw, "Governance and networks at the limits of representation," *The American Review of Public Administration*, vol. 39, no. 5, pp. 478-498, 2009.

[33] T. Grønning and S. M. Fosstenløkken, "The learning concept within innovation systems theorizing: A narrative review of selected publications on national and regional innovation systems," *Journal of the Knowledge Economy,* vol. 6, no. 2, pp. 420-436, 2015.

[34] L. C. Chen, "Building extra-regional networks for regional innovation systems: Taiwan's machine tool industry in China," *Technological Forecasting and Social Change*, vol. 100, pp. 107-117, 2015.

[35] M. E. Porter, "Clusters and the new economics of competition," *Harvard Business Review*, vol. 76, pp. 77-90, 1998.

[36] H. Cheng, M. S. Niu, and K. H. Niu, "Industrial cluster involvement, organizational learning, and organizational adaptation: An exploratory study in high technology industrial districts," *Journal of Knowledge Management*, vol. 18, no. 5, pp. 971-990, 2014.

[37] P. Cooke, "Socio-technical transitions and varieties of capitalism: Green regional innovation and distinctive market niches," *Journal of the Knowledge Economy*, vol. 1, no. 4, pp. 239-267, 2010.

[38] F. Geels, "The multi-level perspective on sustainability transitions: responses to seven criticisms," *Environmental Innovation and Societal Transitions,* vol. 1, no. 1, pp. 24-40, 2011.

[39] M. Essig, "Purchasing consortia as symbiotic relationships: developing the concept of consortium sourcing", *European Journal of Purchasing & Supply Management,* vol. 6, no. 1, pp. 13-22, 2000.

[40] N. Luhmann, *Sociological enlightenment 2 [Soziologische Aufklärung 2],* 5th ed. Wiesbaden: VS Verlag für Sozialwissenschaften, 2005.

[41] J. C. Cheng and W. McKinley, "Toward an integration of organization research and practice: A contingency study of bureaucratic control and performance in scientific settings," *Administrative Science Quarterly,* vol. 28, no. 1, pp. 85-100, 1983.

[42] K. W. Thomas and W.G. Tymon, "Necessary properties of relevant research: lessons from recent criticisms of the organizational sciences," *The Academy of Management Review,* vol. 7, no. 3, pp. 345-352, 1982.

[43] N. Luhmann, „The economy of society as an autopoietic system [Die Wirtschaft der Gesellschaft als autopoietisches System]," *Zeitschrift für Soziologie,* vol. 13, no. 4, pp. 308-324, 1984.

[44] N. Luhmann, *The science of society [Die Wissenschaft der Gesellschaft]*, Frankfurt am Main: Suhrkamp, 1992.

[45] J. Wolf and T. Rosenberg, "How individual scholars can reduce the rigor-relevance gap in management research," *Business Research,* vol. 5, no. 2, pp. 178-196, 2012.

[46] D. R. Gnyawali and Y. Song, "Pursuit of rigor in research: illustration from coopetition literature," *Industrial Marketing Management*, vol. 57, pp. 12-22, 2016.

[47] R. Carnap, *The logical structure of the world: pseudoproblems in philosophy [Der logische Aufbau der Welt: Scheinprobleme in der Philosophie]*, 2nd ed., Hamburg: Felix Meiner Verlag, 1961.

[48] S. Ghosh, M. D. Troutt, J. Thornton, and O. F. Offodile, "An empirical method for assessing the research relevance gap," *European Journal of Operational Research,* vol. 201, pp. 942-948, 2010.

[49] D. A. Wren, M. R. Buckley, L. K. Michaelsen, "The theory/applications balance in management pedagogy: Where do we stand?," *Journal of Management*, vol. 20, no. 1, pp. 141-157, 1994.

[50] J. D. Aram and P. F. Salipante, "Bridging scholarship in management: epistemological reflections," British Journal of Management, vol. 14, no. 3, pp. 189-205, 2003.

[51] D. MacLean, R. MacIntosh, and S. Grant, "Mode 2 management research," *British Journal of Management,* vol. 13, pp. 189-207, 2002.

[52] M. Alvesson and J. Sandberg, "Has management studies lost its way?: Ideas for more imaginative and innovative research," *Journal of Management Studies,* vol. 50, no. 1, pp. 128-152, 2013.

[53] J. G. March and R. I. Sutton, "Organizational performance as a dependent variable," *Organization Science,* vol. 8, no. 6, pp. 698-706, 1997.

[54] K. Korpiaho, H. Päiviö, and K. Räsänen, "Anglo-American forms of management education: a practice-theoretical perspective," *Scandinavian Journal of Management,* vol. 23, pp. 36-65, 2007.

[55] M. Learmonth, A. Lockett, and K. Dowd, "Promoting scholarship that matters: The uselessness of useful research and the usefulness of useless research," *British Journal of Management*, vol. 23, no. 1, pp. 35-44, 2012.

[56] N. Butler, H. Delaney, and S. Spoelstra, "Problematizing 'relevance' in the business school: the case of leadership studies," British Journal of Management, vol. 26, no. 4, pp. 731-744, 2015.

[57] D. Tranfield, "Formulating the nature of management research," *European Management Journal*, vol. 20, no. 4, pp. 378-382, 2002.

[58] C. Berggren and J. Söderlund, "Rethinking project management education: Social twistsand knowledge co-production," *International Journal of Project Management,* vol. 26, pp. 286-296, 2008.

[59] P. Shrivastava, I. I. Mitroff, "Enhancing organizational research utilization: the role of decision makers' assumptions," *The Academy of Management Review*, vol. 9, no. 1, pp. 18-26, 1984.

[60] A. Hatchuel, "The two pillars of new management research," *British Journal of Management,* vol. 12, no. s1, pp. S33-S39, 2001.

[61] K. Starkey and P. Madan, "Bridging the relevance gap: Aligning stakeholders in the future of management research." *British Journal of Management*, vol. 12, no. s1, pp. S3-S26, 2001.

[62] A. H. Van de Ven and P. E. Johnson, "Knowledge for theory and practice," *Academy of Management Review,* vol. 31, no. 4, pp. 802-821, 2006.

[63] R. Thorpe, C. Eden, J. Bessant, and P. Ellwood, "Rigour, relevance and reward: Introducing the knowledge translation value-chain," *British Journal of Management*, vol. 22, no. 3, pp. 420-431, 2011.

[64] M. Kilduff and M. Kelemen, "The consolations of organization theory," *British Journal of Management* , vol. 12, no. s1, pp. S55-S59, 2001.

[65] G. P. Hodgkinson, P. Herriot, and N. Anderson, "Re-aligning the stakeholders in management research: lessons from industrial, work

and organizational psychology," *British Journal of Management*, vol. 12, no. s1, pp. S41-S48, 2001.

[66] A. Rasche and M. Behnam, "As if it were relevant: A systems theoretical perspective on the relation between science and practice," *Journal of Management Inquiry,* vol. 18, no. 3, pp. 243-255, 2009.

[67] N. Anderson, P. Herriot, and G. P. Hodgkinson, "The practitioner–researcher divide in industrial, work and organizational (IWO) psychology: Where are we now, and where do we go from here?," *Journal of Occupational and Organizational Psychology*, vol. 74, pp. 391-411, 2001.

[68] N. Luhmann, *Social systems [Soziale Systeme: Grundriss einer allgemeinen Theorie]*, 2nd ed., Frankfurt am Main: Suhrkamp, 1985.

[69] R. A. Bettis, "Strategic management and the straightjacket: an editorial essay," *Organization Science,* vol. 2, no. 3, pp. 315-319, 1991.

[70] N. Luhmann, *Sociological enlightenment 5 [Soziologische Aufklärung 5]*, 3rd ed., Wiesbaden: VS Verlag für Sozialwissenschaften, 2005.

[71] J. Kegelmann, *New Public Management: Opportunities and Limits of a New Controlling Model [New Public Management: Möglichkeiten und Grenzen des Neuen Steuerungsmodells]*, Wiesbaden: VS Verlag für Sozialwissenschaften, 2007.

[72] M. Lindenstein-Walshok and B. Stymne, "Collaboration in the innovative region," in *Handbook of collaborative management research*, A. B. Shani, S. A. Mohrman, W. A. Pasmore, B. Stymne, and N. Adler (Eds.), Los Angeles: Sage Publications, 2008, pp. 293-314.

[73] D. Denyer and D. Tranfield, "Using qualitative research synthesis to build an actionable knowledge base," *Management Decision*, vol. 44, no. 2, pp. 213-227, 2006.

[74] A. M. Pettigrew, "Longitudinal field research on change: Theory and practice," *Organization Science*, vol. 1, no. 3, pp. 267-292, 1990.

[75] A. H. Van de Ven, G. P. Huber, "Longitudinal field research methods for studying processes of organizational change," *Organization Science*, vol. 1, no. 3, pp. 213-219, 1990.

[76] R. K. Yin, "Case study evaluations: a decade of progress?" *New Directions for Evaluation*, vol. 76, pp. 69-78, 1997.

[77] K. M. Eisenhardt and M. E. Graebner, "Theory building from cases: opportunities and challenges," *Academy of Management Journal*, vol. 50, no. 1, pp. 25-32, 2007.

[78] W. A. Pasmore, R. W. Woodman, and A. L. Simmons, "Toward a more rigorous, reflective, and relevant science of collaborative management research," in *Handbook of Collaborative Management Research*, A. B. Shani, S. A. Mohrman, W. A. Pasmore, B. Stymne, and N. Adler (Eds.), Los Angeles: Sage Publications, 2008, pp. 567-582.

[79] K. M. Eisenhardt, "Building theories from case study research," *Academy of Management Review,* vol. 14, no. 4, pp. 532-550, 1989.

[80] B. G. Glaser and A. L. Strauss, *The Discovery of Grounded Theory: Strategies for Qualitative Research*, Chicago: Aldine Pub. Co, 1967.

[81] S. R. Barley, "Images of imaging: notes on doing longitudinal field work," *Organization Science*, vol. 1, no. 3, pp. 220-247, 1990.

[82] M. A. Petruzzelli, V. Albino, and N. Carbonara, "External knowledge sources and proximity," *Journal of Knowledge Management*, vol. 13, no. 5, pp. 301-318, 2009.

[83] A. M. Petruzzelli, "The impact of technological relatedness, prior ties, and geographical distance on university-industry collaborations: a joint-patent analysis," *Technovation*, vol. 31, no. 7, pp. 309-319, 2011.

[84] M. W. Peng, "Towards an institution-based view of business strategy," *Asia Pacific Journal of Management*, vol. 19, no. 2, pp. 251-267, 2002.

[85] M. W. Peng, S. L. Sun, B. Pinkham, and H. Chen, "The institution-based view as a third leg for a strategy tripod," *The Academy of Management Perspectives*, vol. 23, pp. 63-81, 2009.

[86] R. Boschma, "Proximity and innovation: a critical assessment," *Regional Studies,* vol. 39, no. 1, pp. 61-74, 2005.

[87] J. Eklinder-Frick, L. T. Eriksson, and L. Hallén, "Effects of social capital on processes in a regional strategic network," *Industrial Marketing Management*, vol. 41, no. 5, pp. 800-806, 2012.

[88] K. Ingold and J. Balsiger, "Sustainability principles put into practice: Case studies of network analysis in Swiss climate change adaptation," *Regional Environmental Change*, vol. 15, no. 3, pp. 529-538, 2015.

[89] M. Länsdesmäki and T. Suutari, "Keeping at arm's length or searching for social proximity? Corporate social responsibility as a reciprocal process between small businesses and the local community," *Journal of Business Ethics*, vol. 108, no. 4, pp. 481-493, 2012.

Benjamin Kuch was born in Stuttgart, on March 21, 1988 and received a diplom-ingenieur degree in the field of technology management from the University of Stuttgart (Germany) in 2013.

In the course of several internships he worked with different consulting firms, mainly in change management contexts. His research has started in 2013 and puts emphasis on synergy potentials in the regional production network while scrutinizing coordination problems between organizations from various social systems (e.g. the economic and the scientific system).

Mr. Kuch was awarded a scholarship from the *German Academic Scholarship Foundation* during his studies from 2010 to 2013 and currently receives a general scholarship from the *German Research Foundation* for his overall research program.