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Orchestrating Digital Innovation: The Case of the Swedish Center for Digital Innovation

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Abstract:

In recent years, researchers have paid increasing attention to how firms facilitate and enact digital innovation in networks with diverse actors (i.e., heterogeneous networks). However, while considerable evidence shows that firms can build key capabilities via engaging with external partners, we found few studies on how they orchestrate digital innovation in situations where an academic unit plays a facilitating role in the heterogeneous network. We address this question by focusing on experiences from a national academic initiative, the Swedish Center for Digital Innovation (SCDI). Formed in 2013, the SCDI has adopted an engaged scholarship approach and a combination of activities designed to increase digital innovation capabilities among partner organizations. We argue that acquiring new knowledge through external and internal sources stimulates firms and public sector organizations engaged in digital innovation to integrate such new knowledge with their existing knowledge base. Specifically, we demonstrate how SCDI's core activities have created increased capabilities for the involved stakeholders, and we offer lessons learned and recommendations for academic units that wish to orchestrate digital innovation.

Keywords: Digital Innovation, Digital Transformation, Orchestration, Academic Partnerships

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1 Introduction

Spurred on by rapid technical evolution, firms constantly seek new ways to engage in digital innovation (Boland, Lyytinen, & Yoo, 2007; Nambisan, Lyytinen, Majchrzak, & Song, 2017; Nylén & Holmström, 2019). Consequently, rather than taking place within a firm's boundaries, digital innovation and transformation processes are increasingly distributed among a large number of networked actors (Nambisan, Wright, & Feldman, 2019). Hence, many firms now consider cross-fertilization between heterogeneous actors such as firms and research institutions (Levén, Holmström, & Mathiassen, 2014) key to digital innovation. As such, both theory and practice have shifted in focus from single innovators to innovation networks and systems (e.g., Van de Ven, 2005) and, thus, from digital innovation capability in organizations to capability to drive collaborative digital innovation in networks (Nambisan et al., 2017).

In order to pursue digital innovation effectively and efficiently, organizations need to find ways to engage with both external and internal partners. As such, researchers have reported digital innovation to radically change new products' and services' nature and structure, to enable innovation collectives that involve a diverse set of actors with diverse goals, and, more broadly, to transform entire industries (Nambisan et al., 2017, 2019; Vial, 2019). Digital innovation's dynamic, collective, and unbounded nature aligns well with the extant literature on inter-organizational innovation networks (Boland et al., 2007) and open innovation networks (Chesbrough, Vanhaverbeke, & West, 2006), which underscores that one should understand innovation as a co-creation process.

Although the literature reports on many ways to co-create digital innovation, few studies have looked at digital innovation in heterogeneous networks that involve academic partners. Specifically, we know little about the role that these networks play in co-creating digital innovations and which capabilities they require to leverage digital innovation opportunities. Against this backdrop, we explore the initiative of the Swedish Center for Digital Innovation (SCDI) and its role in orchestrating digital innovation in heterogeneous networks.

The SCDI is a strategic initiative for academic excellence in the digitalization area. The University of Gothenburg, Stockholm School of Economics, and Umeå University launched the SCDI in response to the experienced complexities associated with digitalization among organizations in the public and private sector and their increased need to better deal with these challenges. The SCDI has a vision to become an internationally leading center for digital innovation and obtain acknowledgment for its academic excellence, educational engagement, and societal impact. It strives to offer a unique context for orchestrating close collaboration between researchers, students, and practitioners to help address challenges in practice and advance new theory. Accordingly, it has a mission to engage key stakeholders from the academy, industry, and public enterprises to promote value creation based on digital innovation in Sweden and internationally. Through a university alliance between Gothenburg University, Stockholm School of Economics, and Umeå University, researchers have worked on explaining how digitalization changes innovation and transformation practices and introduces new business and operating models since 2013. The SCDI has established itself as a key player in applied research, made internationally leading contributions to IS research, and attained strong national brand recognition. The SCDI adopts an engaged scholarship approach via activities designed to increase digital capabilities among its diverse set of partner organizations. Over time, these activities have grown to include digital maturity assessments, digital clinics where practitioners and policymakers can use insights from SCDI researchers to improve their business, laboratories for collaborative design experiments to create new services and applications, executive education, and consolidation funding for creating synergies between existing research initiatives. In 2021, the SCDI comprised 51 researchers in total.

This paper proceeds as follows: in Section 2, we discuss the theory behind orchestrating digital innovation and the role of dynamic capabilities. In Section 3, we present our research design, the case context, and the results from the analysis. In Section 4, we discuss new insights into the role of academic units in orchestrating digital innovation in heterogeneous networks and our study's implications for research and practice. In Section 5, we present lessons learned and conclude the paper.

2 Orchestrating Digital Innovation in Heterogeneous Networks

Digital innovations can have far-reaching and difficult-to-foresee implications (Nylén, Holmström, & Lyytinen, 2014; Nambisan et al., 2017; Svahn, Mathiassen, & Lindgren, 2017). Their adoption induces changes in work practices, organizational structures, and strategies (Boland et al., 2007). Furthermore,

they have increasingly become combinatorial in that they combine existing modules with newly embedded digital capabilities (Yoo, Boland, Lyytinen, & Majchrzak, 2012; Henfridsson, Nandhakumar, Scarbrough, & Panourgias, 2018).

Studies that have examined different digital innovations in diverse fields such as biotechnology (Van de Ven, Polley, Garud, & Venkataraman, 1999), automobiles (Henfridsson & Yoo, 2013), and digital music (Holmström, 2015) show that firms enact digital innovation in a complex web of social and technical interactions and complementary resources and knowledge (Nylén et al., 2014). As a consequence, digital innovation processes cut across organizational boundaries and into networks (Lyytinen, Yoo, & Boland, 2016). Accordingly, co-creation lies at the core of digital innovation, and, in the literature, we can find many examples about how co-creation strategies manifest. We distinguish three research streams in the literature on digital innovation that reflect different approaches to co-creation in digital innovation processes (see Table 1).

Table 1. Research Streams in Digital Innovation Research

Research streams	Approach to co-creation	Key references
Intra-organizational innovation	Focused on how organizations appropriate and use digital innovations in organizational practices.	Leonardi (2011), Henfridsson & Bygstad (2013), Nylén et al. (2014), Gregory et al. (2015), Renken & Heeks (2019)
Inter-organizational digital innovation	Focused on how relations between organizations impact digital innovations.	Boland et al. (2007), Jonsson, Westergren, & Holmström (2008), Jonsson, Holmström, & Lyytinen (2009), Westergren & Holmström (2012), Svahn et al. (2017), Muller, Päske, & Rodil (2019)
Industry-level digital innovation	Focused on how digital innovations emerge and become institutionalized in industries.	Lucas & Goh (2009), Lee & Berente (2012)

First, the research stream on intra-organizational digital innovation focuses on how organizations develop, appropriate, and use digital innovations in organizational practices. Initial efforts in this research stream focused on effects of digitizing internal organizational processes (e.g., Fichman 2004) and included studies that examined firm-level processes and products (Swanson & Ramiller 1997) with a particular emphasis on local work practices. For instance, Leonardi (2011) showed how digital tools often have a dynamic, unpredictable, and sometimes even a negative impact on innovation routines and processes. Moreover, researchers have noted how digitizing products presents new opportunities for innovation in long-established industries (Henfridsson & Bygstad, 2013). Specifically, scholars have focused on understanding the paradoxes and dilemmas that digitization creates for organizations developing, deploying, and managing digital innovation (e.g., Kallinikos, Aaltonen, & Marton, 2013; Lyytinen et al., 2016; Nambisan, 2013; Tilson, Lyytinen, & Sørensen, 2010).

Second, the research stream on inter-organizational digital innovation focuses on how relations between organizations impact digital innovation. In embracing digital innovation, incumbent firms must increasingly develop new capabilities to identify novel ideas in existing institutional contexts (Henfridsson & Yoo, 2013; Nylén et al., 2014) and to engage external audiences in these processes (e.g., Henfridsson & Lindgren, 2010). For instance, Boland et al. (2007) considered the “wakes of innovation” that deploying a suite of 3D visualization tools in the construction industry unleashed as they impacted other actors’ roles and responsibilities in a construction project. Similarly, Dougherty and Dunne (2012) showed how the use of new digital tools in drug discovery transformed knowledge partitioning between key actors and, subsequently, led to radical changes in the innovation activities that two scientist groups conducted. Svahn et al. (2017) demonstrated how, by leveraging connectivity by exposing its cars to external developers such as through open APIs, Volvo Cars expected to generate a new level of functional diversity in the automotive industry. Eaton, Elaluf-Calderwood, Sorensen, and Yoo, (2015) conceptualized distributed tuning as the innovation process through which heterogeneous actors shape digital technologies into organizational resources.

Third, the research stream on industry-level digital innovation focuses on how field-level digital innovations emerge and become institutionalized. For instance, the fundamental changes in photographic technology (i.e., digital photography's triumph over traditional techniques) transformed an industry in which the Kodak Company previously held a dominant position (Lucas & Goh, 2009). The capability for innovation, which refers to the ability to integrate, build, and reconfigure internal and external competences to address rapidly changing environments (see Teece, Pisano, & Shuen, 1997, p. 516), is key for fostering digital innovations regardless if digital innovation occurs in an intra-organizational context, inter-organizational context, or industry context.

The study of dynamic capabilities has become one of the most active research streams in the strategic management literature, in part because it successfully addresses how firms respond to rapid technological and market change (Eisenhardt & Martin, 2000; Helfat et al., 2007). Dynamic capabilities provide the capacity to create, extend, and modify a firm's resource base (Helfat et al., 2007) and, as such, are intimately related to innovation. In the strategy process, dynamic capabilities aid in transforming an organization's knowledge resources and operational routines (Eisenhardt & Martin, 2000). New resource combinations enable an organization to pursue its value-creating strategy by changing the way it solves problems (Zahra, Sapienza, & Davidsson, 2006).

Recent contributions to the dynamic capabilities field have paid increasing attention to integrative capabilities (e.g., Helfat & Campo-Rembaro, 2016) as a means through which an organization can orchestrate its innovation ecosystem. Integrative capabilities function to create positive interaction among disparate resources (Wang, Lo, & Yang, 2004), which, with the aforementioned increased practice of networked innovation, is key for success. Additionally, the innovation literature has paid considerable attention to the role of accumulating and integrating knowledge resources in firm innovation. Researchers have emphasized the importance of internal (Brown & Eisenhardt, 1997) and external learning sources (Leonard-Barton, 1992) for firm innovation success. Both learning sources complement each other and can be important precursors to innovation (Hartman, Tower, & Sebora, 1994). In particular, in the digital innovation and digital transformation context, knowledge integration capability enables a firm to combine various production inputs such as skills, knowledge, software, and technology to produce successful outcomes (Nylen et al, 2014).

3 The SCDI and the Orchestration of Digital Innovation

In this section, we elaborate on the ways in which the SCDI has orchestrated digital innovation and digital transformation in a heterogeneous network. We first discuss stakeholder needs as they have driven SCDI's efforts. We then discuss SCDI's key activities in facilitating digital innovation and conclude by discussing how these activities contribute in building digital innovation capabilities.

3.1 Stakeholder Needs

Since its inception, the SCDI has explored digitalization as a major force that affects the private sector, the public sector, and society as a whole (Arvidsson, Holmström, & Lyytinen, 2014; Svahn et al., 2017; Selander & Järvenpää, 2016). Digitalization comes from digital innovations that, in combination, bring about novel actors, structures, practices, values, and beliefs that change, threaten, replace, or complement existing rules in organizations, platforms, ecosystems, and industries (Westergren & Holmström, 2012; Svahn et al., 2017, Hultin, Introna, & Mähring, 2020). We have seen cases of digital innovation that lead to digital transformation (Jonsson, Mathiassen, & Holmström, 2018) yet also cases where digital innovation fails to translate into digital transformation (Nylén et al., 2014; Koutsikouri, Lindgren, Henfridsson, & Rudmark, 2018) due to a lack of digital capabilities (Nylén & Holmström, 2015). Thus, digitalization constitutes a major challenge for industry and society alike, which we exemplify in four major areas (see Table 2).

These needs were encountered uniformly across both public and private sector organizations in the SCDI projects, and the SCDI directly targeted them in existing collaborations.

Table 2. Overview of Needs Among Stakeholders

Area	Rationale	Example of needs
Better understanding the implications that arise from digitizing current operating and business models.	Swedish firms lack the ability to capture benefits from digitalization (Swedish Agency for Growth Policy Analysis, 2019).	The Agency for Digital Government needs to understand the potential negative aspects of digitalization (e.g., digitalization could further disenfranchise marginalized groups). Astra Zeneca needs to understand how digitizing healthcare changes the role of pharmaceutical companies.
Accelerating digital innovation and scaling innovations for new services and digital transformation.	Both the private and public sectors in Sweden lack digital innovation (Swedish National Digitalization Council, 2018; Magnusson, Polutnik, & Ask, forthcoming).	Ericsson needs to find models for how to scale digital innovations happening in, for example, the “Ericsson Garage”. Epicenter needs to facilitate innovation and scaling for its members.
Better understanding strategies for accelerated digitalization.	Sweden should accelerate how quickly it digitizes society to reach “pole position” (Government Offices of Sweden, 2015).	CombiEnt needs to better understand its actual and potential role in its members’ accelerated digitalization efforts. Sigma and Acando need to understand how they can support their clients’ accelerated digitalization.
Building capacity for existing and future co-workers and managers in relation to digital competence.	Sweden will lack 70,000 and the EU will lack 250,000 individuals with IT competence by 2022 (Almega, 2017).	VGR, Sydved, Scania, and LF need to lift digital competence among coworkers.

3.2 Facilitating Digital Innovation: Key activities

The SCDI has an aim to substantially impact Swedish organizations’ digital capabilities to better address significant societal challenges in the wake of digitalization. Using involved stakeholders’ combined resources, the SCDI has built and scaled academic excellence in order to work towards its vision. It facilitates that vision via activities that we show in Figure 1 and Table 3.

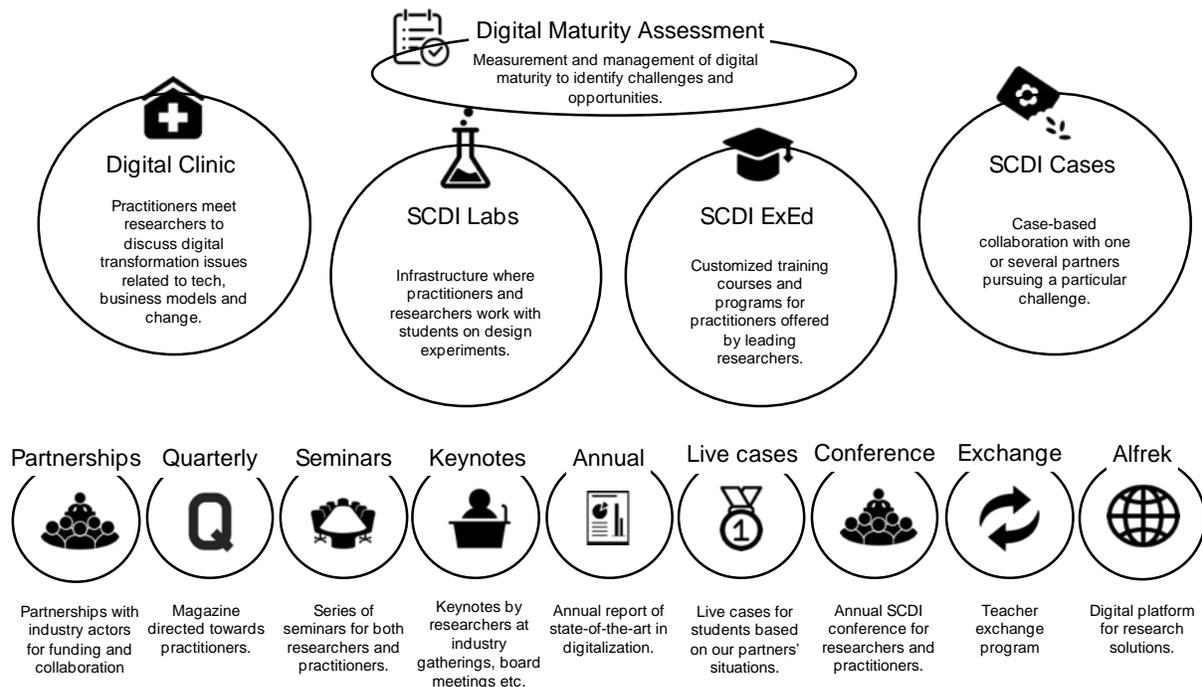


Figure 1. The SCDI Digital Innovation Orchestration Model

These activities resulted from international benchmarks for best practices, which includes innovative activities that leading academic institutions currently use, and emerged over time. The digital maturity assessment forms the basis for identifying areas where organizations most need support in order to enhance their digital capabilities (i.e., the focus for continued work in the core activities). We summarize the key activities in Table 3.

Table 3. Overview of Key Activities, Output, and Effect in SCDI

Core activity (amount)	Examples of involved actors	Output	Effect
Digital maturity assessment (300+ assessments of digital maturity since the start).	Both SCDI stakeholders and other organizations that wish to measure and monitor their digital maturity.	Overview and monitoring of digital maturity. Increased fact-based decision making related to digitalization.	Increased digital maturity and competitive ability for participating organizations. National increase from 41% to 47% digital maturity (2019-2020).
Digital clinics (50+ yearly digital clinic sessions).	Grönska, Sigma, Acando, Epicenter, Sveaskog, Holmen Skog, Astra Zeneca, regional government agencies, etc.	New value offerings. New digital services. Insight and avenues for future research. Quality assurance of consulting recommendations.	Increased digital capability and growth. Increased quality in research, practice and policy. New methods for maintenance management, investment prioritization, etc. Tweaks to existing digital strategies. New national policies for digitalization.
SCDI labs (two labs created, 10 projects completed).	Chromeaway, DIGG, Holmen Skog, Combient, VGR, Ericsson, Scania, etc.	Applications and services. Proof of concepts and proof of value.	Increased digital capability and growth. Increased quality in research and practice.
SCDI ExEd (100+ instances per year, 5,000+ participants).	SKF, Holmen skog, Latour Invest, ABB, AB Volvo, Aalto University, Volvo Cars Corporation.	Participants with leading-edge competence and knowledge. Research funding.	Increased digital competence among practitioners.
SCDI case studies (20+ active cases per year).	Volvo Cars Corporation, Sundsvall, CEVT, ABB, Bonnier, Amnesty, Sydved, etc.	Internal reports and academic publications (+150 publications).	Improved operations in the case organizations and in organizations that use the research findings.

3.3 Building Digital Innovation Capabilities

Since the University of Gothenburg, Stockholm School of Economics, and Umeå University established the SCDI in 2013, it has garnered significant experience in each core activity. In collaborating with stakeholders, the SCDI has identified three digital innovation capabilities as key: technical, organizational, and matchmaking.

We define technical capability as the ability to develop new products by understanding product technologies, evaluating product designs' feasibility, testing prototypes, and assessing technical specifications (see Pavlou & El Sawy, 2011). When firms do not have enough time to engage in experimentation or play out risky ideas, they will find it more efficient to draw on established knowledge, insights, and experience when identifying and importing new approaches to digital innovation already established among the scholars at SCDI. They will likely find such inputs easier to align and incorporate into their current working mode, and their employees will be more likely to quickly accept them. SCDI laboratories serve as the platform for developing technical capabilities. In such a context, firms engage with SCDI faculty in design experiments, which results in new ideas and prototypes.

We define organizational capability as a firm's ability to perform a coordinated task using organizational resources to achieve a particular end result (O'Regan & Ghobadian, 2004). The SCDI has two platforms for developing organizational capabilities: SCDI ExEd and digital clinics. Executive education activities focus on increasing the competence of executives from organizations such as IKEA, the Swedish Chamber of Commerce, SKF, Volvo Cars Corporation, and Latour Investment in digitalization and digital innovation. The digital clinic sessions include content that ranges from general discussions about digital strategies to concise recommendations about governance and organizational configurations for executing digital agendas.

We define matchmaking capability as a firm's ability to find an actor to perform a coordinated task using organizational resources to achieve a particular end result. As digital innovation projects progress and evolve, expertise and capabilities in a team or division may become insufficient to meet their objectives, which heightens the need for managers to act as boundary-spanners and access complementary resources or capabilities that reside outside the focal division.

Table 4. Overview of Key Activities, Progress, and Impact

Core activity	Description of progress	Examples of impact cases
Digital maturity assessment	At present, 100 public and 40 private sector organizations have assessed their level of digital maturity using the SCDI methodology (> 4,000 respondents). These organizations use the results to make decisions in regards to prioritizing digital initiatives, and the SCDI uses them to create a dialogue between the organizations in order to produce cross-organizational learning and inspiration. In addition, the assessment has also spawned more than 30 digital clinic sessions where the organizations receive scientific support in interpreting the results and formulating digital strategies.	The Municipality of Sundsvall has decided to use the factors in the digital maturity model as strategic principles on which they base their digital strategy. As a result, it has conducted a new collaboration whereby it funds researchers from the SCDI to actively participate in the municipality's digital transformation over the coming years. It has also resulted in new solutions such as a software maintenance system currently under development. In 2021, negotiations began to make the digital maturity assessment national and compulsory for all organizations in the public sector.
Digital clinics	At present, the SCDI has organized more than 50 digital clinic sessions that range from general discussions in regards to digital strategies to concise recommendations in regards to governance and organizational configurations for executing digital agendas.	The Västra Götaland Region (the second largest healthcare provider in Sweden) used SCDI digital clinics actively in designing its digital strategy and organizing and governing its digitalization effort. Through recurring sessions, it has since begun implementing the strategy, governance, and organization.
SCDI ExEd	The SCDI has conducted more than 50 executive education activities directed towards increasing the competence of executives from organizations such as IKEA, the Chamber of Commerce, SKF, Volvo Cars Corporation, Latour Investment in digitalization and digital innovation. In addition, it has also conducted more than 100 yearly keynotes at different professional venues in order to diffuse research findings and educate external stakeholders.	The Pocket MBA for chief information officers (CIOs) inspired a participant (Sydved/Stora Enso) to initiate a shift to a platform strategy. The firm's research fund funded the project, which entered its second year in 2020. As a result, the firm has substantially reconceptualized itself (a wood supplier) into a platform.
SCDI laboratories	In 2017, the SCDI created the first SCDI laboratory (Blockchain Lab). Since then, it has conducted five design experiments in close collaboration with key stakeholders and resulted in new ideas for service innovation and several new projects in the pipeline. In 2020, the SCDI created the second laboratory (SCDI AI Business Lab) through a grant from the Kempe Foundation.	In 2018, Kommuninvest (the Swedish municipal loan agency) contacted the SCDI to design a proof of concept for blockchain-based loan management. In 2012, the agency had begun implementing the proof of concept into its operations, and it has also resulted in a separate project with Länsförsäkringar (a major insurance firm in Sweden) for blockchain-based dynamic insurance pricing.
SCDI case studies	The SCDI has 20+ cases per year that it conducts as single case studies or multiple case studies.	Many SCDI cases exist. For instance, <i>MIS Quarterly</i> published two recently: Svahn et al. (2017) and Sandberg, Holmström, and Lyytinen (2020).

4 Discussion

To help actors orchestrate digital innovation, the SCDI uses the digital maturity assessment as the first point of contact. The digital assessment does not require any previous contact (i.e., all organizations and not just SCDI partners can use it). Through using the assessment, an organization can see other organizations' digital maturity and qualitative stories from them on initiatives they have seen as instrumental in increasing digital maturity, which creates an impetus for further contact between the organizations and, at the same time, pushes for the SCDI to serve as the primary interaction point. The

model underlying the assessment provides a conceptual approach for talking about and creating narratives surrounding organizations and their digitalization efforts (Nambisan et al., 2017). Thus, organizations can search for and find other organizations that may help them in their digital innovation initiatives. We regard such search as the basis for a matchmaking capability where uniform language and insight into strengths and weaknesses surrounding digitalization offers a vestige of collaboration.

The activities related to executive education and digital clinics create organizational capabilities for the organizations that engage in a broader relationship with the SCDI beyond the digital assessment. Through executive training, the SCDI continues to work with executives to instill a common understanding of what digital innovation is and how one should organize and orchestrate it. This understanding increases executives' knowledge from both an inter- and intra-organizational perspective since the executive education sessions mostly attract participants from a wide variety of organizations that, in turn, learn from one another and shape important connections. The digital clinics help stakeholders in a single organization setting work with researchers to create new strategies, new organizational structures, and so on in a spirit of dynamic problem-solution pairing (Nambisan et al., 2017). Similarly, in the SCDI laboratories (the Blockchain Lab and the SCDI AI Business Lab), stakeholders work practically with researchers to design and develop concrete technical artifacts and to build technical capabilities. These laboratories help transfer knowledge between researchers and practitioners and to other stakeholders since the researchers reuse the knowledge in other projects and make aspects of it available through scientific publishing. Since much of the work that the SCDI conducts with stakeholders in the laboratories focuses on collaborative projects, the SCDI has to solve a quagmire of intellectual property (IP) issues on a case-per-case basis.

Combined, these three dynamic capabilities (technical, organizational, and matchmaking) constitute elements of integrative capabilities. Integrative capabilities, as Helfat & Raubitschek (2018) have noted, play a paramount role in orchestrating networked innovation. Without these capabilities, a firm risks not being able to amply reconfigure its resource base in response to changes in the environment. Since agency in innovation processes increasingly becomes distributed outside traditional setups (Nambisan et al., 2019), the role that third-party academic units such as the SCDI play becomes more important.

With this paper, we contribute to research by identifying how academic units, such as the SCDI, may work as intermediaries in networks for digital innovation. Through the list of core activities that the SCDI conducts, we show that the activities serve different functions in terms of enhancing capabilities in partner organizations.

In terms of implications for practice, we offer insight into the plethora of available options for industry-academic partnerships in heterogeneous networks. The SCDI did not initially design the integrative capabilities that resulted from the activities; rather, they emerged over time as a response to re-configurations in the network itself. Here, we believe that academic units need to engage with networks of digital innovation to try to remain sensitive to the signals from the network. When new actors join, the academic unit's role and the way it helps orchestrate digital innovation will invariably change. In other words, the dynamic capabilities that actors seek place significant demand on the academic unit. Accordingly, researchers at the SCDI have found dividing the center into local nodes with local directors and a high level of autonomy as beneficial for attaining a higher degree of agility in the center as a whole. We hope that the activities that we present here and their links to enhanced integrative capabilities for the partner organizations will inspire academic units to explore new roles as orchestrating digital innovation in heterogeneous networks.

The empirical material underlying this study includes not only external data, such as government reports and accounts from participating organizations on their rationales for and benefits from engaging with SCDI, but also our own personal experiences. As such, the latter introduces subjectivity into our study. We acknowledge the limitations that this method implies for our research's rigor, yet, given our motivation for writing this paper, we find it appropriate.

5 Conclusions and Lessons Learned

The SCDI has conducted an engaged scholarship approach and used various activities in combination to increase digital capabilities among partner organizations. As a key contribution from our experience, we have found that multiple capabilities play an important role in orchestrating digital innovation. Specifically, the SCDI's core activities have created technical, organizational, and matchmaking capabilities that have manifested in increased integrative capabilities for the involved stakeholders. Drawing on a dynamic

capabilities view, we argue that acquiring new knowledge through external and internal sources stimulates firms engaged in digital innovation to integrate such knowledge with existing knowledge. Specifically, the SCDI's core activities create three different capabilities (i.e., matchmaking, organizational, and technical capabilities) in cultivating digital innovation with partner organizations (see Table 4). Together, these three capabilities form part of enhanced integrative capabilities for the involved stakeholders in the SCDI's heterogeneous network. We hope that this commentary will serve as inspiration for academic units and researchers interested in working with orchestrating digital innovation in heterogeneous networks. In Table 5, we present lessons we have learned and recommendations to academic units interested in taking an active role in orchestrating digital innovation.

Table 5. Lessons Learned and Recommendations

Capability	Lessons learned	Recommendations
Matchmaking	<ul style="list-style-type: none"> The value in creating artifacts that function as integration platforms for diverse stakeholders has proven to be substantial. The self-assessment service that the SCDI created has gained momentum and now connects actors both to the SCDI as such and to one another in sharing insights and data. 	<ul style="list-style-type: none"> Materialize research findings into artifacts, which creates matchmaking between old and new actors in the heterogeneous network on a continuous basis. Assure that the artifacts may function both as means for matchmaking and as data pumps and configure clear processes for using the resulting data. Strive for generative solutions.
Organizational	<ul style="list-style-type: none"> Executive education represents a cornucopia for funding and access, yet the benefits also include strengthening the collaboration in the academic unit per se. In working closely with practitioners in both the executive education and digital clinics, an academic unit will identify a multitude of opportunities. Realizing said opportunities requires significant effort. 	<ul style="list-style-type: none"> Engage in executive education to generate revenue and new research opportunities in a managed manner. Share insights from executive education sessions with the rest of the academic unit on a continuous basis and assure that other researchers than the ones who participated in the educational session act on opportunities.
Technical	<ul style="list-style-type: none"> Novel technologies such as blockchain and AI have attracted significant interest from stakeholders who wish to both increase their insight into the technologies, and participate in experiments that may not be possible to conduct in their own organizations. Staffing will be a problem since novel technologies remain under formation and expertise can be scarce. IP issues such as ownership and control will often pose a barrier to collaboration. 	<ul style="list-style-type: none"> Carefully balance technologies' theoretical height and technical depth. Be clear in posing questions that are not common-place and focused on foundational understanding of the implications of the technology without losing track of technical know-how. In order to assure access to technical competence, open up laboratories to associating practitioners (executive faculty) and research engineers.

We find our experiences especially interesting given that many universities in the world see research centers as an attractive organizational form. This growing interest reflects universities' expanded mission to encompass outreach activities that include knowledge and technology transfer (Cunningham & Harney, 2006). Today, university-based research centers "are prevalent as both policy mechanisms and industry strategies" (Boardman & Ponomariov, 2011, p. 76). At the surface level, the SCDI constitutes a success story, and, as directors, we feel proud about our growth and results. However, we find some successes' emergent nature and some barriers that have remained over time even more interesting.

First, we did not envision that we would establish the two laboratories—the Blockchain Lab and the AI Lab—when we started out. Both these initiatives emerged from our industry collaborations. Second, we did not envision that the three SCDI nodes and would build such niched competencies based on the collaboration with regional industries. We welcomed both these emergent results as SCDI evolutions but certainly did not plan them from day one. As such, our experience with managing the SCDI extends our knowledge about research center configurations by highlighting the importance of adaptations to regional characteristics. Specifically, our SCDI experience extends Maas and Jones' (2017) argument for institutions' need to consider (institutional and regional) contextual factors in creating and managing research centers.

Looking at the barriers that have sustained over time, we have a sustained challenge in balancing our goals. Publishing our research in top journals does not necessarily make our industry partners happy. We have continued to face challenges in catering for our industry partners' needs while maintaining high ambitions for our research. As such, our experiences illustrate Cassia et al.'s (2014) classification with respect to multi-service research centers. The SCDI has a research mission and a practical mission, which has also remained a challenge and also relates to the fact that we have been unable to allocate resources for the SCDI directors to have dedicated time for managing the SCDI. The SCDI has only conducted project-based activities; thus, to take the next step, we have worked hard with securing generic funding for managing the SCDI.

Furthermore, we have faced political challenges in managing a center that spans three universities. As directors, our role became more political than we initially expected as the SCDI grew in size and importance. We have had to ensure that key players across the three universities have advocated for and supported the SCDI. We had initial strong support from the dean at Umeå University, who later became deputy vice-chancellor, which helped the SCDI achieve its goals in the first couple of years. Today, we have strong support from all three universities but limited and uneven support related to funding.

Finally, we have faced geographical barriers, and the fact that we need to instill a feeling of one center even though all three nodes remain autonomous. We organize a PhD course for the PhD students at the center, and the directors meet on a regular basis, but not all faculty meet in person, which makes the geographical challenge real.

These challenges will not go away anytime soon, but the SCDI's journey from its inception to today has seen both successes and challenges. The capabilities that we outline above (see Table 5) along with the SCDO digital innovation orchestration model (see Figure 1) have served the SCDI well in orchestrating digital innovation processes in heterogeneous networks of actors. While we believe that these capabilities have served the SCDI well in reaching the success we have, we also want to point out that one cannot see the SCDI as a straightforward success story. As we note, we experienced many surprises along the way, and both successes and barriers to change have emerged as the SCDI has grown in size and scope.

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Appendix A: Vignettes

To illustrate the activities that the SCDI conducts, we present two recent and ongoing cases as vignettes. The vignettes represent how the SCDI orchestrates digital innovation as we present in the paper proper.

The focal organizations are both large organizations from the private (AutoCorp) and public (Muni X) sectors. Both these organizations initiated collaboration with the SCDI due to an identified need to enhance their digital capabilities. However, they first contacted the center in a different manner: AutoCorp established contact after the SCDI conducted a keynote, while Muni X established contact after it adopted the SCDI digital maturity assessment without prior personal contact. In both organizations, the executive level served as the primary point of contact from the beginning.

In both cases, we used a clinical inquiry approach (Schein, 1987) of engaged scholarship to work closely with the key stakeholders in addressing clear, jointly identified challenges related to digital capabilities. In both organizations, we used internally focused reports and external academic publishing in combination to facilitate impact.

The two cases differed in two main respects. First, the research team from the SCDI embedded itself in Muni X at a higher level than it did in AutoCorp—a direct consequence of the differences between the automotive and public sectors in terms of transparency and confidentiality (i.e., the automotive industry represents a more difficult setting to work in given researchers' focus on publishing findings). Second, the cases differed in terms of diffusion aspects: findings from the Muni X case had a higher chance to scale to the national level and, thus, for other municipalities to adopt them and for them to lead to new policy. We briefly present the two cases as vignettes below.

Vignette 1: AutoCorp

A top-ten global automotive firm in terms of market share, AutoCorp reached out to the SCDI in 2018 following first contact at a keynote on ambidextrous governance. The organization had noticed an issue with rapid growth and its chosen governance configuration in that governance was hampering both its growth and the aspired flexibility in a highly competitive and transforming market (Grieger & Ludwig, 2019; Pavlinek, 2020). After three initial meetings, the SCDI and AutoCorp established a clinical research agreement (Schein, 1987).

In designing the clinical intervention, the SCDI and AutoCorp jointly agreed on a scope that comprised four underlying subprojects: the shadow (the risks and rewards of shadow IT), the portfolio (combining traditional portfolio management with a scaled agile approach), the debt (strategies for increasing the value of the digital heritage), and the balance (ambidextrous governance design through digital maturity assessment).

We operationalized the projects using students in a master's course in governance and control for digital capabilities. The research team invited the students into the research project after initially designing the subprojects. The students then worked as research assistants/interns in AutoCorp for a four-week period: they had full access to the facilities, meetings/stand-ups, and staff members. In order to handle confidentiality aspects (the research team conducted the projects in close vicinity to the research and design functions in the organization), the SCDI and AutoCorp established non-disclosure agreements, and a limited liability company that the university owned employed the students without wages to handle this type of collaboration on a business-to-business basis. This agreement allowed for the SCDI and AutoCorp to relatively swiftly handle the project's legal matters.

The expanded research team conducted 26 interviews and four workshops in total to collect data to complement the observation field notes. The students and researchers shared all data, which resulted in a substantial repository of data for supporting the consequent analysis.

We reported each subproject through both an academic and a consultant report, the latter providing clear recommendations for improving AutoCorp's operations and governance for increased digital capabilities. We also presented all subprojects to the executive management team in AutoCorp; as of 2020, the organization has adopted a majority of the recommendations.

The initial project has resulted in a continued collaboration where researchers from the SCDI work with executives from AutoCorp in additional studies, such as designing value-based management in relation to IT (Firk, Schropp, & Wolff, 2016), examining ITSM capabilities' strategic misalignments (Winkler & Wulff, 2019), and examining blockchain applications of usage data. As of 2020, we have begun integrating these

new projects into courses so that upcoming student cohorts can hopefully work in a similar fashion as in the first round of collaboration. In addition, the work has resulted in one accepted publication in the *Communications of the Association for Information Systems* (Magnusson, Polutnik & Ask, forthcoming) and two other pending publications.

Vignette 2: Muni X

Muni X is a large municipality in the middle of Sweden. It is one of the first municipalities to work with the digital maturity assessment that the SCDI developed. In 2019, it expressed an interest for a deepened collaboration. The municipality expressed a need for increased insight into how it could manage its digital transformation. After the SCDI and the municipality designed a joint program, they established a contract in 2020 with full funding for a PhD student for two years. The project focused on increasing digital maturity in the municipality and comprised eight subprojects that ranged from funding models, governance configurations, IT organization, digital strategy, digital infrastructure, and impact.

The project began after SCDI faculty gave lectures on digitalization to the upper echelons of management in the municipality. The SCDI faculty conducted these lectures to establish their clear visibility in the organization and to establish a joint vocabulary surrounding digitalization. Subsequently, the research team started working on the subprojects; as of late 2020, it has conducted more than 60 interviews and collected a large set of secondary data in the form of steering documents, budgets, and so on. The project involved traditional data collection, lectures, and inspirational keynotes for the staff in addition to digital clinic sessions with the executives in the organization.

We saw the research collaboration's first direct effect in the municipality investment budget in June 2020. Following a report in February the same year from SCDI researchers about the short-sightedness of strictly funding digital infrastructure through operating expense and not capital (i.e., not treating it as an investment) (Magnusson et al., 2020c), the municipality shifted from investing €200,000 in digital infrastructure from 2016 to 2019 to investing approximately €20 million from 2020 to 2024. The report has received significant interest from both media and other municipalities with strong indications that more municipalities will follow suit and invest more in digitalization. The report and Muni X's adoption of recommendations has also spiked interest from policy makers with invitations to joint seminars.

The collaboration has also resulted in several academic publications about digital government (Magnusson et al, 2020a; Kishro, 2020; Magnusson et al., 2020d; Magnusson, Kishro & Melin, 2020b), several course integrations, and substantial interest from other public sector actors about establishing similar collaborations.

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