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# Diversity of Seniority in a Digital Innovation Challenge Experiment

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**Abstract**

Many system development organizations face difficulties in ensuring innovation in digital innovation processes. This paper reports from an interpretive case study of an experiment where two system development teams compete to design a novel application. The paper explores how variation in seniority can support digital innovations and hence improve organizational learning and practice. The experiment indicates how the rules of engagement play a key role in balancing the challenge within a busy work life and provide positive outcomes in the form of hard and soft skills for individuals and for the case organization. The paper concludes by suggesting a stepwise challenge design guide and conceptual model that illustrates how the challenges concept could be included in the practitioner fields of digital innovation.


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## 1. Introduction

The general trend of globalization in the era of Industry 4.0 [1] is that the inclusion of innovation with digital technologies has become a premise for survival [2]. The digital industry has succeeded in arguing that unless companies (organizations) change and acquire digital disciplines, disruption occurs. This may be from brand new competitors or technologies that have not previously characterized the industry [3]. The question is if companies will then gain the benefits of transforming innovation into digital innovation without approaching digital innovation methodically [2].

An increasing trend in digital innovation is the nuances between the partnership, competitors, and the competing element, for example, when "collaboration" and "competition" are put together as the word "co-opetition" [4] to gain greater creativity, or to look at their business or product context from new angles in the form of case competitions, hackathons, and digital challenges. We define challenges *as courses of innovation containing a competition element in a digital context*. For practical purposes, this could be hackathons, design sprints, design thinking, innovation sprints, open innovation, or co-creation. In relation to digital challenges, it is interesting to investigate whether, when comparing methods used for the innovation work, ideal or context-specific models in competition-based digital innovation can be uncovered [5-7].

In contrast to the present trend of research in digital innovation, which focuses on open innovation, this paper focuses in internal closed innovation in form of a real experiment [8].

Østergaard, Timmermans [9] suggest that employee diversity can have a positive effect on innovation and call for further studies to look into how factors other than demographic composition, can contribute to a firm's effectiveness. Special attention is paid to the concept of "challenge," which, with key characteristics in the form of a business challenge that is solved by several teams and which contains a competition element, has a special effect. This leads to the two research questions, where the first establishes a foundation for the second.

*How can challenges be used as means of digital innovation?*

*How does diversity in terms of seniority affect digital innovation in challenges?*

The structure of the remainder of this paper is as follows. We start by presenting the conceptual foundation followed by the research approach. Subsequently, we present the case setting and the analysis, followed by a discussion of the outcome of the research in the form of a model for challenges. Finally, we conclude our paper and highlight limitations as well as opportunities for future research, including implications for research and practice.

## 2. Conceptual foundation - digital innovation, competition and diversity

In some companies, **innovation** is best driven by incorporating external elements, partners, and ideas, while other organizations benefit from innovation driven from within. Hansen and Birkinshaw [10] suggest a three-phase framework: idea generation, idea development, and dissemination of the developed concept. Dobni [11] argues that the DNA of innovation lies in a risk-embracing and fault-tolerant innovation culture, and by empowerment, employees become the greatest source of innovation.

Where Hansen and Birkinshaw [10] regard innovation as a transformation of ideas into a commercial product, service, or new process (output), Westerman, Bonnet [12] state that digital masters successfully deploy technology to change three areas: customer engagement, internal processes, and business models. In addition, Fichman, Dos Santos [13] add a fourth element in the form of the innovation process itself with the phases of discovery, development, distribution, and impact.

Brynjolfsson [2] argues that technology allows for a new form of R&D: measuring real-time effects, conducting rapid experimentation with ideas, creating insights and sharing these widely, scaling up replication, and precisely changing the entire innovation process and speed. Westerman, Bonnet [12], supported by [13], argue that companies that excel in digital transformation are better at leveraging new (digital) technologies and creating new digital solutions based on needs. In this way an organization's innovation environment is shaped and operated top-down [11, 12].

Organizational attitude to digital innovation also involves team composition—both internal, interdisciplinary resources and external resources [10]. It also involves the sense that digital maturity is characterized by not only innovating more, but doing it differently, for example through greater innovation autonomy and organizational support, where digital maturity is characterized by established policies of cooperation, including a culture of less control, a higher willingness to invest, and earmarked time of up to 10% for innovation experiments that provide continuous improvement and delivery [14].

Digital technology and technology understanding are both a prerequisite and the result of digital innovation, and distribution of innovation ability should go through both external and self-organizing employee networks [15]. Innovation culture is similar to entrepreneurial culture but is a more network- and employee-driven process, and ingenuity in such a culture should be used in both routine and goal-based, technology-mediated activities, such as the co-creation process model of idea generation, screening (testing), experimentation, and implementation [15].

Ciriello, Richter [16] consider purpose-driven and "exploratory" activities such as design thinking, proof-of-concept/proof-of-value, prototyping, and experimentation as the transition from digital innovation process to practice. Initiators/specialists proactively participate with their domain knowledge, where participants who are more passive are referred to as catalysts. High abstraction is key in digitally thinking individuals. The employee (bottom-up) approach to innovation is a trend for digital innovation in practice and a move away from traditional, formal IT or R&D-driven innovation [1].

A key result (product) of digital innovation is artifacts that are used partly for the production of ideas and partly for the manifestation of the idea or concept itself, so that artifacts are both the means and the goal (product) [16].

A **competitive** element for innovation can be added by allowing participants to challenge each other and thus sharpen the final contribution [5]. Digital innovation competitions run from a few days to several months, and are targeted to develop or contribute a digital service where digital content is a prerequisite [17]. The competition element in the form of a digital innovation course is most commonly used in open innovations, and is not yet widely used in internal and closed innovation courses. Hjalmarsson, Juell-Skielse [17] point to the need to move toward open innovation using external resources, such as ideas, technologies, or people. However, primarily external developers make the difference between open and closed digital innovation, and the organization will have some level of loss of control for the process of open innovation.

The literature study identified four key concepts for digital innovation in practice: design thinking, design and innovation sprints, hackathons, and open innovation, which are the most prevalent in the IT industry, combining the format with the competition objectives and criteria. Innovation competitions can be particularly vulnerable to unclear objectives, such as a scope that is too broad or narrow, too few participants, unclear rules, or organizational support that is too low [17].

The difference between innovation and digital innovation is the utilization of technologies. There are many associations between an organization's culture, its fault tolerance, and the degree of explorativeness and inventiveness as well as the ability to develop and implement it. However, there are arguments that digital innovation can affect business models (disruption). One consideration, however, may be whether the speed at which we experiment and develop is different in digital innovation.

Earlier studies suggested a positive correlation between **diversity** *in* a group and the group's performance, e.g., in the form of gender diversity [18, 19], age, education, nationality, or experience. However, what about diversity *between* groups? Østergaard, Timmermans [9] suggest that employee diversity can have a positive effect on innovation and call for further studies to look into how factors other than demographic composition, for example, can contribute to a firm's effectiveness.

## 3. Research Approach

The interpretive case study had three phases: 1) preparation of a theoretical analytical framework via a literature analysis, 2) portraying the case company and its challenge course (reality phenomenon), and 3) reflection. This allowed us to investigate how two development teams (junior/senior) performed differently during an experimental challenge setup and thus open to several interpretations by organizational actors but also to us as researchers [20-22].

Thus, the study examines what happens in the challenge situation itself, including a profile of the participants' work, their organization, the digital innovation process, and the results. The study describes and seeks insight and understanding of the phenomena as well as the participants' understanding of the course context [23]. The specific case's deep knowledge and real practical experience is gained, and at the same time it is based on contextual experience and with a background in contextual theory, which gives rise to a high level of learning [24].

A literature analysis contributed with an analytical framework by comparing commonly used methods, thereby providing a conceptual and theoretical foundation for the subsequent case study research [25]. The search resulted in 203 articles found by searching in Scopus; this was reduced to 18 after a critical reading of the abstracts.

The Case Company (CC) is a young consultancy company specialized in providing customer-specific solutions based on SAP cloud extensions. CC consists of 20 technical consultants, located at three offices in two countries, who

work in virtual teams. The company's technical resources cover most areas of development related to a SAP environment, e.g. programming back end, front end, or solution design and architecture. In addition to providing technical resources, CC also deals with consulting on how clients handle the many aspects of the digital journey. The company acts as the external sparring partner of the customer's IT department, helping to establish the architectural foundation of a digital platform and to improve the customer's own learning and development of skills in the digital transformation toward a more service-oriented IT organization.

To address the research question, a design challenge (DC) was posed where two self-organizing teams competed to solve a business problem in the form of a running mock-up (in SAP Fiori UX) of an information system module to be integrated with the existing enterprise information system to create transparency between sales and delivery in the consultancy process. The challenge lasted six months on top of the normal daily routines. Except for a significant difference in seniority, the teams were quite similar. The CEO supervised and evaluated the contributions with a focus on the team's ability to understand the end users, and to convert requirements to a useful design and delivery of good solutions. Qualities such as "giving good data insight," "level of innovation," "simplicity," and "adherence to design guides" were part of the criteria.

We conducted exploratory interviews with managers and developers to get an overview and collected artifacts from the challenge. Then we developed an interview guide focused on the theoretical foundation. Each interview (40 to 60 minutes) was video-recorded and fully transcribed verbatim. To ensure correct information regarding aspects such as usage of technology and maintenance of good relations with the interviewees, the participants verified the transcriptions. Table 1 shows the collected data.

Table 1 Qualitative data collected.

| | Type | Explanation | Amount |
|---|---|---|---|
| 1 | Process documentation | DC instructions, evaluations including points given | Four documents |
| 2 | Participant interviews | Participant's experiences and feedback | Five interviews |
| 3 | Artifacts from the digital innovation process | Documentation, intermediate and final results | +30 sketches, figures, design |
| 4 | Interview with the supervisor | Gaining understanding of dynamics and frames | One interview |
| 5 | Perspective interview | Challenging the process and findings | One interview |

The experiment was analyzed using a qualitative approach to create insight from practical experience through in-depth interviews and dialogue. A flexible design study allowed the case parameters to change during the study, thus adopting real-world dynamics and complexity [23]. The two-step open coding identified 150 codes, which were consolidated into 11 dimensions with a focus on diversity.

## 4. Towards a Seniority Diversity-informed Challenge Design Guide

Below we reveal how the two teams act differently in the dimensions identified though the coding above and suggest a rough challenge design guide benefiting from this diversity. Aspects of Team Junior are shown in the left side and for Team Senior to the right in the structures below.

| ***Dimension*** | ***Team Junior*** | ***Team Senior*** |
|---|---|---|
| 1.Design Challenge | *JUNIOR:* Views the DC as a competitive leisure project. | *SENIOR:* Focuses on creating something real. |

The juniors viewed the DC as "a form of side project . . . not as serious as the projects we would normally take for clients . . . You always want to come out as number one" (Junior C). This is of less importance to seniors, who emphasize creating something real. This is also evident from the fact that juniors called for the project to become clearer in everyday life, and thus to be able to intensify competition. Team Senior is more oriented around scoring.

| | | |
|---|---|---|
| 2. Objective | *JUNIOR:* Focuses on learning, competence, and development of collaboration. | *SENIOR:* Focuses on learning the innovation process and behavior. |

Both teams had a clear idea that the DC objective was to create a real software product. Team Senior, in addition, identified an intention to learn about the innovation process and behavior. Team Junior had somewhat the same insight,

which, however, was more about identifying committed employees as well as more learning, competence, and collaboration-developing purposes.

| | | |
|---|---|---|
| 3. Approach | *JUNIOR:* Largely sets prerequisites, based on members' own knowledge, and quickly focuses on a role. | *SENIOR:* Wants to understand business processes and collects data for scoping and solution design. |

Team Junior largely sets prerequisites, based on members' own knowledge, and early on focused on a role "to challenge the problem itself. Trying to interview who are the people, who are the stakeholders. How do they see the problems?" (Senior A). Team Senior had several activities around understanding the business process (user involvement) and collected data for their scoping and solution design.

Where Team Junior was frustrated with the data model, Team Senior perceived this as a technical picture of the complexity and opted out of using the data model. Both teams identified technical dependencies for subsidiary systems, and organized teams together with a mix of developer and system design competencies.

| | | |
|---|---|---|
| 4. Learning | *JUNIOR:* Focuses on the process of learning and getting insight into the relation with customers. | *SENIOR:* Is very concrete and goes for acquiring and refreshing UX design competencies as well as advantages/disadvantages of using Build. |

Team Junior was aware of taking responsibility for getting clarification and for team composition, and had a very significant understanding of what insight can do for scoping and solution design as well as how useful the exercise is in relation to the reality of customers. In summary, this illustrates the difference in experience between the two teams, which provides vastly different learning. "[W]e are still very new in that industry here, so we couldn't get into everything that was." ". . . how to work with other people. Have learned better how to talk to my colleagues, now I have experience with how to plan time between projects" (Junior A). Team Senior was very concrete in its learning. It was mostly about acquiring and refreshing UX design competencies as well as advantages/disadvantages of using Build.

| | | |
|---|---|---|
| 5. Reflection | *JUNIOR:* Is looking for method support as well as more feedback during the process. | *SENIOR:* Dares to challenge the challenge and question the foundation of the challenge. |

Both teams found it relevant to uncover appropriate methods themselves, and Senior Team was happy to build experience with customer-relevant activities. Team Junior was looking for method support to control its behavior, as well as more feedback during the process. It was also most limited by time, as well as everyday balance. Team Senior had an important point in daring to challenge and thus lay a better foundation for solution design: "dare to stop and say hi what is the real problem is . . . it requires one to dare to question what the customer, in our case our director thinks. . . . Dare to challenge the customer in their view" (Senior A).

| | | |
|---|---|---|
| 6. Motivation | *JUNIOR:* Is motivated by the competition element and learning new things. | *SENIOR:* Is motivated by the challenge, the design aspect, and the potential product. |

The seniors were mainly motivated in the challenge, the design aspect, and the potential product; the juniors found more motivation in the competition element and learning new things.

| | | |
|---|---|---|
| 7. Methodological | *JUNIOR:* Moves to a purely ad hoc approach. | *SENIOR:* Stays longer in the so-called "problem space" before going into a "solutions space." |

Team Junior had a clear methodological approach in the beginning, which, however, ran into the sand, and it then moved to a purely ad hoc approach. Although team members attributed elements to both SCRUM and DT, they did not get the methods planned and applied, and therefore they did not obtain the process support from here. The seniors seemed more pragmatic in their application, as they selected specific elements from DT and implemented what they thought make sense and was realistic. It appears that Team Senior stayed longer in the so-called "problem space" before going into a "solutions space." Likewise, the seniors were happy to be able to improvise across different methods, where the juniors had a hard enough time maintaining and implementing a method. Both teams pointed to the possibility of a focused and time-limited course, compressed as sprints: "3–4 days like that completely concentrated. And made a design thinking process" (Senior A). "Design thinking can be insanely good method to address" (Junior B). "Because, that is, design sprints could have helped me get more into this thinking, what this is" (Junior C).

| | | |
|---|---|---|
| 8. Phases | *JUNIOR:* Ends up with two main phases (brainstorm and prototypes), and the consequence is that the team comes too early to the "solution mode." | *SENIOR:* Appears purposeful in the team's phase activities and carries out a process that in its entirety appears more complete, and with carefully divided activities implemented in the next phase. |

The juniors ended up with two main phases (brainstorm and prototypes), and the consequence was that they came too early to a "solution mode," which was not based on the users. It also appears that the juniors had the most work around the prototypes, where, however, they reached more iterations. Team Senior reviewed and documented its three phases (interviews, workshop, and prototypes), and the team clearly stated the reasons for its phase choice, which thus appeared deliberately selected, and the team appeared purposeful in its phase activities. The seniors carried out a process that in its entirety appears more complete, and with carefully divided activities implemented in the next phase.

| | | |
|---|---|---|
| 9. Artifacts | *JUNIOR:* | *SENIOR:* Has more sketches and seems to spend more time producing prototypes. |

Both teams produced prototypes (artifacts) at the sketch level in first versions, and then used SAP Build for the production of digital prototypes; the teams thus had a very similar approach to prototype development. However, the seniors had more sketches and seemed to spend more time producing prototypes in general, thus achieving a higher degree of detail: "[W]e made some sketches, and then we agreed on some common sketches. As we drew on the whiteboard . . . some slightly more high-fidelity prototype" (Junior A). "This is reflected in some designs on prototypes on paper . . . designing screenshots . . . a lot of Post-It notes, with relevant things from the minutes, and try to group them. . . . [G]et the prototypes in Build" (Senior B).

| | | |
|---|---|---|
| 10. Technological | *JUNIOR: had more innovative tech ideas* | *SENIOR: used standard technologies* |

The teams were very similar in their technological approach, where the Build tool was used for prototype production. Both teams also used SAP UI5/Fiori to concretize the product, and both contributions were expected to be placed on SCP. However, Team Junior initially had several thoughts about digital technologies that could add process improvements (voice and agents).

| | | |
|---|---|---|
| 11. Organization | *JUNIOR:* Started well but also quickly loses momentum and does not maintain organization and plan for the DC course. | *SENIOR:* was very pragmatic. |

Where Team Senior was very pragmatic in terms of organization and the participants bided with different competencies, organization, and communication via teams, the juniors started well but also quickly lost momentum and did not maintain their organization and plan for the DC course. Both teams had an unspoken role and division of labor among the participants.

Table 2 Summary of findings

| *Team* | **Observations from interviews** | **Observed from the produced artifacts** |
|---|---|---|
| Team Junior | Was spurred on by the competition element but had difficulty with the complexity. Failed to maintain its applied method, and wanted the addition of an experienced participant or mentoring scheme. The team was able to understand the other purpose of the course, not only the product, but cooperation, competence development, and learning. | Developed a few process artifacts and quickly entered "solution mode". Delivered a competent final contribution with good solution proposals, however, with very little description of the prototype's functionality |
| Team Senior | Proceeded systematically and pragmatically. The team's motivation stem from the fact that it was something concrete and something to be used. The team opted out of the complex data service and created a user focus. It choose to challenge the core of the problem, and gained greater insight that was used for solution scope. | Performed many process artifacts in connection with the team's research and user involvement. Several artifacts were used in the "problem space" before making a competent final contribution. The prototype was presented with a presentation and video that sets out the preconditions and an explanation of the functionality. |

It was surprising that neither team adopted a specific method or was aware of what stages nor elements it wants to go through. The juniors were overwhelmed by their everyday lives and were unable to keep control, and perhaps therefore they wanted to follow a classic approach with overweight and focus on the solution itself.

The seniors seemed more "pragmatically lazy" in their approach. They were also affected by everyday life but were perhaps more affected by the fact that they embrace the entire business chain by not being narrowed into role level; the team thus ends up with a broader solution and higher complexity.

## 5. Conclusions, limitations, and future research

Our theoretical basis set out parameters for what organizational competence looks like when it requires digital innovation. In this, we see innovation autonomy, expertise in technology, and the business domain as important. Organizationally, this is supported by an entrepreneurial culture and routine experiments (the innovation autonomy), which are concretized via artifacts as the outcome and an important part of the digital innovation process itself. The case study looks at the specific application for an internal (closed) course and what experience the case company has gained. First of all this suggested how challenges can be used as a means of digital innovation and how the challenges can nurture learning and continues deliveries. As indicated by the theoretical fundamentals, digital innovation is an important part of modern organizational setup and could potential foster a new form of R&D, and this could be enabled in the company's DNA through culture. We also know that the approach to digital innovation is a discipline that could be adopted by organizations and their employee, and that employees in fact are a primary source of digital innovations. However, this requires a formal framework for fostering and nurturing this new form of R&D moving away from a traditional IT R&D mindset, including concepts to do the innovation differently and to achieve an innovation culture and autonomy. Therefore, since understanding technology and technology itself is a prerequisite, then technology knowledge is combined with the expertise of what and how to create the artifact or the outcome of the digital innovation. Therefore, the digital innovation journey of an organization is the stairway to enable the employees to further explore, how to do things differently, within the sphere of digital innovation.

The challenge concept can enable organizational learning in doing digital innovation and building an organizational innovation culture. By nurturing experiments, employees can learn to adapt the digital innovation process and the outcome in the form of artifacts and thereby get the practice into the hands of employees with business domain knowledge, with the potential to spiral the effect. The case shows that challenges can be a source of innovation and a safe harbor to nurture the culture and the organizational innovation DNA to achieve the autonomy, but it also shows the importance of seniority, knowledge, know-how, and thereby the importance to thorough consider the composition of teams and how this will affect the outcome. The study shows how challenges can act as a tool for organizations to learn how to practice digital innovation. From the experiment and the analyzed dimensions, we learned about the importance of designing the challenge in the context of the participating teams including the dimensions of seniority, and how motivation is fostered from the competition and the real-world relevance within the challenge. Clearly, expertise is necessary to set the teams' horizons and their working approach. The diversity in seniority creates a clear differentiation in terms of the learning objective, plays a remarkable role in how the teams navigate the innovation process and how they use artifacts as the phased deliveries. The fact that the senior team performs a deep dive into the core of the business challenge, instead of just rushing into solution mode, gives the senior team an outcome in both the artifact itself and in learning from the process. Despite the fact that the junior and senior teams seem to have the same technological knowledge, the junior team loses track of the phases and misses the guidance a methodical framework could provide, and thus it enters early into the solution space (prototyping). This is also clearly evidenced in the analyses looking into the artifacts, where the juniors have very limited process artifacts and as a consequence no deliveries per phase. The senior team, even though pragmatic in its approach, works more methodically and has specific deliveries in the idea and exploration phase (problem space). Reflecting on the case study and the theoretical outset, the "Design Guide" provide practitioners with a conceptual framework to design innovation challenges, inclusive the design of team composition, that foster and enable continued organizational learnings an potential fundament to secure digital innovation DNA within the organization culture.

The paper contributes to practice by showing how companies can work with digital innovation in a time-limited and purpose-driven format, and by selecting a suitable method for this. At the same time, the experiment has laid the ground for a potential new software product, for internal use and perhaps with external potential. The paper contributes to theory by exploiting the junior/senior difference. The case experience on the difference in diversity (Team Junior & Team Senior) shows how the attitude, behavior and activities varies based on seniority. Where the

**Stepwise Design Guide**

1. Uncover the challenge context (the business environment) and the prerequisites (the experience and attitude) of the participants/organization.
2. Levels of knowledge and know-how provide opportunities to mix the teams diversity (seniority).
3. Define the objective (learnings, products, services).
4. Describe the purpose (expected outcome).
5. Determine concept/format (fixed or free) design associated with the prerequisite of the participants.
6. Set parameters for measurement (what/when).
7. Set the rules of engagement.
8. Set the process design methodology, or innovation concept, including phases and deliveries.
9. Determine feedback and mentoring.

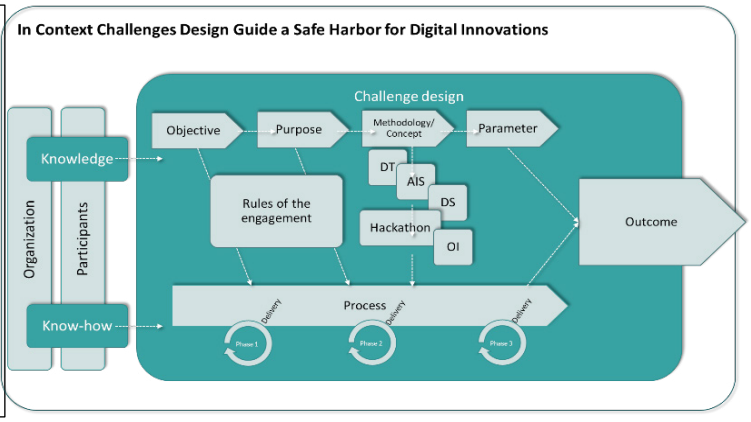


Figure 1. The Challenge Design Guide

juniors set out (2. Objective) to learn hard skills in form of specific competences, the seniority aims for learning process and soft skills, interestingly this is completely reverted when it comes to "4. learning".

Perhaps the biggest finding on the diversity, is that the junior team "gets lost" and do not navigate in the process, where experiences gives the senior team "steady nerves" to trust running the process, and patients about the outcome of their effort.

A deep insight into the challenge course is presented, and a clear picture emerges of the participants' experiences, through their reflection and learning from the course. When this is compared with the client's views, the challenge course appears as a "safe harbor" environment that has given participants and the organization a good learning platform for continues growing the organizations capabilities. We dare to suggest a Stepwise Challenge Design Guide as shown in figure 1. The case study is an example of how the challenge concept can be applied and the benefits that can be achieved around collaborative relationships, where the participants know how to use each other's competencies. We gained insight into the methods they consciously chose as well as those they unconsciously ended up using. The largest gaps in connection with the execution of the challenge were found around the competition's rules, which made it difficult for the participants to place the project in everyday life. Finally, the competitive element had a positive effect, perhaps not markedly, but clear enough to have value.

The study faces a set of limitations, especially a need to test the approach and the Design Challenge Concept in different contexts. The study also calls for further studies, e.g. to explore the identified aspects of soft and hard skills. In addition, there is need to re-visit earlier research on digital innovation to be inspired from this.

## References


1. Kumar, K., D. Zindani, and J.P. Davim, *Design Thinking to Digital Thinking.* 2020. **16**(2).
2. Brynjolfsson, E., *ICT, innovation and the e-economy.* EIB papers, 2011. **16**(2): p. 60-76.
3. Christensen, C.M., M.E. Raynor, and R. McDonald, *What is disruptive innovation.* Harvard business review, 2015. **93**(12): p. 44-53.
4. Bridgwater, A., *Why Partners Partner: 7-Reasons IT Organizations Collaborate*, in *Forbes*. 2019.
5. Avital, M. and B. Singh. *The impact of collaboration and competition on project performance*. in *ICIS 2007*. 2007.
6. Alawamleh, M., et al., *The influence of open/closed innovation on employees' performance.* International Journal of Organizational Analysis, 2018.
7. Nicolajsen, H.W. and A. Scupola, *Creating a New Innovation Orientation Through Idea Competitions*, in *Digital Business Transformation*. 2020, Springer. p. 93-104.
8. King, A. and K.R. Lakhani, *Using open innovation to identify the best ideas.* MIT Sloan management review, 2013. **55**(1): p. 41.
9. Østergaard, C.R., B. Timmermans, and K. Kristinsson, *Does a different view create something new? The effect of employee diversity on innovation.* Research policy, 2011. **40**(3): p. 500-509.
10. Hansen, M.T. and J. Birkinshaw, *The innovation value chain.* Harvard business review, 2007. **85**(6): p. 121.
11. Dobni, C.B., *The DNA of innovation.* Journal of Business Strategy, 2008. **29**(2): p. 43-50.

12. Westerman, G., D. Bonnet, and A. McAfee, *Leading digital: Turning technology into business transformation*. 2014: Harvard Business Press.
13. Fichman, R.G., B.L. Dos Santos, and Z. Zheng, *Digital innovation as a fundamental and powerful concept in the information systems curriculum.* MIS quarterly, 2014. **38**(2): p. 329-A15.
14. Kane, B., et al., *Accelerating Digital Innovation Inside and Out*, in *MIT Sloan Management Review*. 2019.
15. Ciriello, R.F., *Digital innovation: people, practices, tools*. 2017, University of Zurich.
16. Ciriello, R.F., A. Richter, and G. Schwabe, *Digital innovation.* Business & Information Systems Engineering, 2018. **60**(6): p. 563-569.
17. Hjalmarsson, A., G. Juell-Skielse, and P. Johannesson, *Open Digital Innovation*. 2017: Springer.
18. Zhang, L., *An institutional approach to gender diversity and firm performance.* Organization Science, 2020. **31**(2): p. 439-457.
19. Van der Vegt, G.S. and O. Janssen, *Joint impact of interdependence and group diversity on innovation.* Journal of management, 2003. **29**(5): p. 729-751.
20. Klein, H.K. and M.D. Myers, *A set of principles for conducting and evaluating interpretive field studies in information systems.* MIS Quarterly, 1999. **23**(1): p. 67-93.
21. Walsham, G., *The Emergence of Interpretivism in IS Research.* Information Systems Research, 1995. **6**(4): p. 376-395.
22. Walsham, G., *Doing interpretive research.* European Journal of Information Systems, 2006. **15**(3): p. 320-330.
23. Runeson, P. and M. Höst, *Guidelines for conducting and reporting case study research in software engineering.* Empirical software engineering, 2009. **14**(2): p. 131.
24. Brinkmann, S. and L. Tanggaard, *Kvalitative metoder: en grundbog. 2. udgave ed.* Kbh: Hans Reitzel, 2015. **633**.
25. Webster, J. and R.T. Watson, *Analyzing the past to prepare for the future: Writing a literature review.* MIS Quarterly, 2002. **26**(2): p. xiii-xxiii.