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Interdisciplinary Digital Disruption Research Framework

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Abstract: Research on disruptive innovation is characterized by a scattered and conflicting nature. This paper suggests a new approach to raising important and interdependent research questions, theory integration, and methods across challenges and disciplines. The contribution is limited to the digital domain through the research question: What are research challenges in digital disruption research, and how do we frame them? Seven interdisciplinary research challenges and ten research perspectives are identified and cross-tabulated in an interdisciplinary digital disruption research framework. The framework is the contribution of the paper, and it is tested on an interdisciplinary workshop through a process of researchers working together in different interdisciplinary constellations. In conclusion, the research framework can be used as intended, but tests including a concrete case and industrial innovation managers are needed.

1 Introduction

Nearly all types of organizations must cope with potential disruption on several levels ranging from global to individual. In our experience, many industrial and governmental conferences are focusing on disruption, and examples are usually gathered from the digital domain. CEO's and innovation managers from a broad variety of organizations are pointing to FOBO (Fear Of Becoming Obsolete) as a reason for wanting to acquire practical knowledge. However, the only answer to this seems to be "disrupt or be disrupted".

The area of interest is disruption in the digital domain which we, in short, term digital disruption. Examples of disruption are often found in the digital domain. They include cases such as Netflix (Christensen 2015), Kodak (Lucas & Goh 2009), AirBnB, Google, Facebook, Amazon (Ismail 2014), and Nokia (Baiyere & Salmela 2013). However, there is no general theory on the relation between digitalization and disruptive innovation. Thus, we inductively argue that research in digital disruption might contribute with important findings to innovation management regarding the relation between digitalization and disruption.

2 A foundation for research

It is well known that theory of disruptive innovation is challenged, e.g. (Gans 2016, pp. 8-9). As an example, Christensen argues that Uber is not a disruptive case because it does not apply to the theoretical relation between performance and time (Christensen 2015, pp.159-162). Uber is, however, in a number studies and reports described as an example of disruptive innovation, e.g. (Chiaroni et. al. 2015). Additionally, in the original sense of the word disruption, Yellow Cap in San Francisco is somehow disrupted. Thus, we argue there is a need for a reframing of the theoretical framework.

A common consensus that Christensen's disruptive innovation theory is in need of development can be found across current published research (Christensen 2006; Markides 2006; Yu & Hang 2010; Baiyere & Salmela 2013). Similarly, several examples of expanding upon Christensen's theory can be found (Adner 2002; Adner & Zemsky 2005; Govindarajan & Kopalle 2006; Henderson 2006; Lucas & Goh 2009; Gans 2016).

Lucas and Goh (2009) suggest extending Christensen's model to analyze managerial challenges of transformational technology threats in the context of organizational change and culture. While the paper applies an inductive approach towards extending disruption theory and contributes with valuable considerations, it does not, however, provide a needed overview of where these extensions and clarifications might generally be useful. The same applies to other research contributions discussing extensions to disruption theory, e.g. (Markides & Charitou 2004; Henderson 2006).

Yu and Hang suggest, based on a review of disruption literature, a number of directions for future research (Yu and Hang 2010, pp. 445-450). Despite the relevance of this research to innovation management, it is a product of the extant literature and thus, rather

a contribution to the theory development than a question to the context of the theory. It does not raise the underlying question of how to frame the theory.

While it has been a decade since Christensen pointed to some of the pitfalls of disruption theory development, a number of publications are still focused on building descriptive theoretical additions to the existing model by putting disruptive innovation into a framework with other types of innovations such us incremental and radical innovation, e.g. (Baiyere & Salmela 2013). We find there is a blind spot in this theoretical discourse because disruptive innovation might be argued to encompass both radical and incremental innovation in the sense that disruptive innovation is a market penetration process in response to competitive circumstances while radical and incremental innovation are value generating processes.

Our ambition with this paper is not to contribute with a general theory on digital disruption, though we argue for this as an important research vision. Rather, we follow Christensen's research method suggestion: "… researchers, through careful observation, move beyond statements of correlation to define what causes the outcome of interest" (Christensen 2006, p. 42). The same theory development issue has later been noted by Yu and Hang who writes that "…the scattered and conflicting nature of the literature on disruptive innovation in the last decade may pose a state of ambiguity for future research" (2010, p. 435). This indicates a continuous challenge of inductively uncovering anomalies to the existing model. In accordance with Christensen's description of normative theory development, we suggest a method for uncovering circumstantial anomalies of disruption in the digital domain.

Because of the mentioned theoretical conflict in the literature; a scientific solution might not be to contribute with yet another suggestion within the same discourse. Rather, we suggest to reframe the research framework for (digital) disruption; and in order to make this manageable and relevant to many of the empirical examples of disruption, we have limited this to the digital domain. Thus, the goal is a digital disruption research framework.

In order to suggest a digital disruption research framework, the research question raised is: What are research challenges in digital disruption research, and how do we frame them?

3 Developing an interdisciplinary research framework

Because all types of organizations must cope with potential disruption, it can be argued that disruption is relevant to most and perhaps all scientific disciplines. As a consequence of this real world complexity, we have chosen an interdisciplinary approach to digital disruption. Danneels has previously noted that "...research has not quite been interdisciplinary – truly integrating ideas from several disciplines to form a comprehensive and rich understanding of the phenomenon [disruption (ed.)]" (Danneels 2006, p. 3). While he argued in favor of this, he also acknowledged that "Interdisciplinary work puts a great burden on the scholar in terms of breadth of required reading and thought" (Danneels 2006, p. 3).

To address the interdisciplinary complexity of digital disruption, a research group for digital disruption has been formed by researchers across five faculties and ten research environments from Aalborg University, Denmark: Business Model

Design Center (I), Center for Applied Ethics and Philosophy (II), Center for Industrial Production (III), Center for Interactive Digital Media and Experience Design (IV), Center for Socio-Interactive Design (V), Danish Institute of Humanities and Medicine (VI), Industrial Design Group (VII), Mass Customization Research Group (VIII), and Techno-anthropology Research Group (IX), and Center for Comparative Welfare Studies (X).

On a two day seminar in the research group for digital disruption, we discussed and raised questions to the field from different research perspectives. After reducing redundancy in the questions, the group had put forward 41 research questions. Two of the authors of this article clustered the questions afterwards in a half-day session, structured from Taussol & Buis (2007), resulting in the identification of six challenges on different levels.

The six challenges identified on digital disruption by the interdisciplinary research group range from general characteristics of digital disruption (1), digitalization as global mega trend (2), societal conditions (3), network conditions (4), strategic conditions (5), and organizational & procedural conditions (6). When this was listed, it became clear that the level of personal conditions was missing (7). Thus, seven challenges were identified, and the following 7 questions for an interdisciplinary research framework were formulated:

What is digital disruption (1)? What drives digital disruption (2)? What are the macro conditions for digital disruption (3)? How to collaborate across organizations on digital disruption (4)? How do we manage digital disruption in organizations (5)? How to implement and execute digital disruptive strategies (6)? How does digital disruption influence people's lives (7)?

These questions are cross-tabulated with the inherent disciplinary perspectives of the research environments: business models (I), digital ethics (II), innovation management (III), interactive experiences (IV), interactive design (V), general practice (VI), design thinking (VII), manufacturing engineering (VIII), and techno-anthropology (IX) (welfare (X) was added at a later stage). See Table 1 for an overview of the framework.

Table 1 Digital disruption research framework

	I	II	III	IV	V	VI	VII	VIII	IX	X
1										
2										
3										
4										
5										
6										
7										

The cross-tabulated framework of the seven challenges and ten disciplinary perspectives resulted in 70 intersections for research investigation, though this is arguably not empirically exhaustive. The framework is scalable in terms of levels to be uncovered (1-7) and flexible in terms of challenges and inherent disciplinary perspectives (I-X). As such, the framework and the number of intersections is generic.

Table 1 raises interesting discussions between the levels and disciplinary perspectives; e.g. what is the relation between social conditions (3) and personal conditions (7); and how is that relation investigated through the disciplinary perspectives of innovation management (III) and a design thinking (VII)?

In December 2016, eight researchers from the digital disruption research group performed a workshop where the interdisciplinary digital disruption research framework was tested for the first time. The hypothesis was that the framework could be used to generate relevant cross-disciplinary research questions if researchers across disciplines were 'forced' to debate the relation between two of the seven questions in Table 1 based on their own individual research perspective.

In order to test this hypothesis, two of the authors of this paper prepared the workshop. The main purpose of the workshop was to investigate the use of the framework as a structured research approach to uncovering potential interdisciplinary research challenges on digital disruption regarding problems (research questions), theory, methods, and data collection.

To push interdisciplinary reflection, the workshop was divided into four phases where participants worked from a cross between two research questions from Table 1. For this particular workshop, question number 2, "What drives digital disruption?", and question number 5, "How do we manage digital disruption in organizations?" were randomly chosen in the beginning.

An A0 print of the digital disruption research framework was placed on the center of a big oval meeting table in order to for the researchers to more easily receive an overview; see Figure 1 for the printed version.
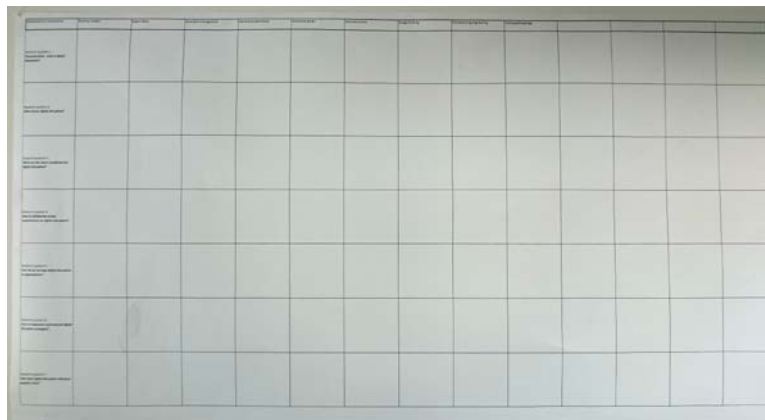
Figure 1 A printed version of the digital disruption research framework.

Table 2 shows the workshop outline after a short introduction. The number of research perspectives increased as the workshop progressed. For each iteration, 5 minutes per researcher was scheduled.

Table 2 Workshop layout

Iteration	Grouping – numbers in brackets refer to specific researcher	Duration
1	8 individuals (1; 2; 3; 4; 5; 6; 7; 8)	5 minutes
2	2 researchers in 4 groups (1&2; 3&4; 5&6; 7&8)	2x5=10 minutes
3	4 researchers in 2 groups (1&2&3&8; 4&5&6&7)	4x5=20 minutes

For each iteration outlined in Table 2, the same instructions were used. They were formulated in a shared workshop template outlined as in Table 3.

In each iteration, data was collected in a digital copy of the template accessible from an online sharing platform. Carrying out the workshop digitally also allowed for easier documentation of the results. When working, the researchers worked together in their respective copies of the template in a shared convention of the filenames.

Table 3 Workshop template

Research question: Carefully formulate a research question that summarizes the essence of the relation between the two research questions from the framework
Research method: Describe main research methodology
Who should be involved in the study (stakeholders, partners, etc.)?
What is the research object?
How will you produce and document data (empirical studies, experiments, action research, etc.)?
How will you analyze and conclude?
Research theory: What are the main theoretical perspectives relevant to the research question and why?
Research results: What is the predicted/expected outcome of this research project?

The following describes the three iterations with data examples from the conducted workshop which can be seen in Table 4.

Table 4 Examples from the dataset focusing on research questions.

	Iteration #	Researcher #(s) (cf. Table 2)	Research Perspective(s)
	1	1	Innovation management
RQ:	What are the advantages and disadvantages for organizations to utilize constrained, systematic search to recognize new opportunities for digital disruption?		
	1	2	Interactive experiences
RQ:	How can real-time data-driven design improve the interactive experience of digital systems?		
	2	1&2	Innovation management Interactive experiences
RQ:	How can organizations utilize data-driven design and system development to generate digital, disruptive market opportunities?		

3	1&2&3&8	Innovation management (technology science)
		Innovation management (social science)
		Interactive experiences
		Design thinking
RQ:	How to develop and sustain disruptive, digital solutions through data-driven design?	

Iterations

The first iteration required each participant to work with the template in Table 3 without outside interference for 5 minutes. With this approach, each participant's individual disciplinary perspective became the starting point and thus a conscious reflective point of departure for the process.

The second iteration lasted for 10 minutes. In this phase, researchers were grouped in pairs of two. This doubled the complexity of disciplinary perspectives.

Iteration three lasted for 20 minutes and was constituted by two groups of four researchers with different research perspectives. This meant that the interdisciplinary complexity was doubled for the second time with four different inherent yet consciously reflected-on research perspectives in each group.

In Table 4, a selection of data (research questions) is presented. It shows the development of interdisciplinary problem-oriented research questions formulated throughout the workshop. It should be mentioned that, in the filled-out templates, the questions were generally nuanced with a subset of questions, nuancing the research questions.

4 Discussion

The workshop closed with a shared discussion where the participants concluded that the interdisciplinary digital disruption research framework had been useful framework for uncovering potential interdisciplinary research challenges on digital disruption regarding problems (research questions), theory, methods, and data collection. All researchers agreed that the process had been fruitful regarding this. However, a workshop with a specific industrial case is needed in order to test its applied value. In this case, it might be valuable to include industrial innovation managers.

A number of research questions and related theory and data collection method was produced and gathered during the workshop. In relation to this, the participants agreed that an extension of time and iterations might be fruitful. Furthermore, a higher number of iterations in pairs of two researchers could arguably have cultivated a better group dynamic in the final iteration.

Another point is that including more researchers would extend the workshop to iterations of larger group discussions, ideally concluding in one group discussion with all inherent research perspectives included.

An unexpected result of the workshop, stated by participants, was the fact that the process had enlightened them on theoretical and methodological perspectives from researchers of other disciplines.

5 Conclusion

The generic interdisciplinary digital disruption research framework is a way to frame research challenges and relevant problem areas in digital disruption research.

The contribution regards current theory within the field of disruption characterized as a scattered and conflicting field. We suggest a new approach to raise important and interdependent research questions across challenges and disciplines. This contribution is limited to the digital domain.

The contribution of this research is directly useful to innovation researchers taking an interest in disruption theory in the digital domain. The framework can be used when qualifying research projects focusing on specific levels or relations between levels (cf. Table 1). Additionally, it encourages researchers to explore other relevant challenges in the field through various disciplines.

Indirectly, the framework has implications to the work of innovation managers. The purpose of further research in this field is to help innovation managers innovate organizations for sustainable, exponential growth at all levels.

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