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Exploitation and exploration of IT in times of pandemic: from dealing with emergency to institutionalising crisis practices

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ABSTRACT

When looking at changes in IT adoption and use in organisations, our theories rely – for the most part – on slow adoption timespans or – to a lesser extent – abrupt crises of short duration. We lack a model of IT adoption during a crisis of extended duration. This paper tackles this gap by looking at the IT-explorative and -exploitative teaching-related practices of university lecturers in response to the COVID-19 crisis. Based on qualitative data from three European higher education institutions and their responses to the COVID-19 crisis, we propose a process model of IT exploration/exploitation under a condition of extended crisis. The model shows that IT use and practices in response to a prolonged crisis go through phases, presenting predictable challenges that management can alleviate with a well-timed approach.

1. Introduction

How does an organisation react to a crisis? For many different types of crises, the answer is deceptively simple: through crisis management. Crisis management is effective when "operations are sustained or resumed, organisational and external stakeholder losses are minimised, and learning occurs so that lessons are transferred to future incidents" (Pearson & Clair, 1998, p. 60). As we write this article, in the summer of 2020, the COVID-19 pandemic continues to sweep through the world. While its consequences are still fresh, long-term impacts are also expected for individuals and organisations (Ågerfalk et al., 2020). Crisis management efforts have been implemented across all types of organisations. Among them, higher education institutions have been extremely quick to react and adapt by moving from classroom to online teaching (Dill et al., 2020). Indeed, for most lecturers, the step from teaching in a classroom to teaching online took only the span of a single night (normally we would call this zero-night but, in this particular case, we call it Zoom-night: contemporary colleagues will know why). By doing so, universities resolved the core crisis management problem: sustain operations and produce an output that minimises the losses of the stakeholders. A superficial answer to why that was possible would posit obvious reasons: because there was no other possible choice, because we have the tools, because the tools are easy enough to use, because the IT tools we have are better than nothing. However, when we look beyond these immediate reasons, at the reactions of institutions and lecturers over time to a prolonged crisis like COVID-19, the answer to our initial question becomes less obvious. Long-term crisis management efforts and impacts are much less clear, and real organisational learning may never occur. Our article addresses the learning issue. Studying the revolution in the use of IT in university teaching during this prolonged crisis allows us not only to investigate a quite unique contemporary phenomenon but also to investigate how IT-use behaviours unfold over time during changes mandated by an extended crisis. In the article we therefore address the following question: *How does the use of IT change over time, in reaction to a prolonged crisis that impedes normal operating procedures?*

We answer this question by relying on the literature on exploration and exploitation of IT during a crisis using the models of Weick (1996) and Barley and Tolbert (1997), which we enrich with insights from chaos theory (McBride, 2005; Thiétart & Forgues, 1995) and from Ciborra's concept of bricolage (Ciborra, 1992, 1997, 2002), using the context of university education. Our analysis reveals a five-phase process model of how organisations and individuals adapted their IT uses and practices when confronted with an abrupt shift from face-to-face to online teaching. This model contributes to the debate on exploration/exploitation of IT tools and practices by (1) showing how both are impacted across the five phases in a chaotic situation generated by a prolonged crisis, (2) combining the individual and organisational levels at which exploration and

exploitation occur and (3) showing the role of bricolage in both exploration and exploitation. Finally, managerial insights about IT-led crisis management during prolonged crises are provided.

2. Theoretical background: how and when to change IT practices

2.1. Adapting IT tools and practices in untroubled times: the role of exploration and exploitation

In untroubled times, organisations constantly strive to reap benefits from IT investments (Maruping & Magni, 2015; Tams et al., 2018) and both research and practice have looked for ways to increase performance through IT (e.g., Burton-Jones & Straub, 2006; Sun et al., 2019; Tams et al., 2018), with the intent to transform existing individual routines into more effective ones. To a great degree, in untroubled times, organisations aim at increasing IT uses that affect task performance (Hsieh & Wang, 2007; Straub & Del Giudice, 2012). Value-added IT-use behaviours, balancing IT exploitation and exploration, are considered essential to drive users' task performance (Tams et al., 2018, Ortiz De Guinea & Webster, 2013; Burton-Jones & Straub, 2006). While IT exploitation is meant to engage users in routine execution of practices and the fine-tuning of system use in the short term (Huang et al., 2017), IT exploration is supposed to engage users in finding new and innovative uses of IT systems to complete new tasks (Huang et al., 2017). Creating the right balance of exploration and exploitation is key to getting benefits from IT (Andriopoulos & Lewis, 2009; Greco et al., 2019; Gupta et al., 2006; March, 1991; Sun, 2012). Deviating from routinised use of IT is normally (i.e. not during a worldwide pandemic) considered a problem that managers must deal with (e.g., Cunha & Carugati, 2018; Ferneley & Sobreperez, 2006; Lapointe & Rivard, 2007). Achieving the correct balance between exploration and exploitation, knowing when and how to get in and out of routines, is thus essential (Burton-Jones & Straub, 2006; Ke et al., 2012). But while the literature has covered exploration and exploitation in normal, relatively untroubled times (Ortiz Burton-Jones & Straub, 2006; De Guinea & Webster, 2013), it offers only limited guidance to academics and practitioners in crisis situations.

2.2. How can IT exploitation and exploration be studied during a prolonged crisis?

2.2.1. IT adoption in crisis: a scarce literature

A crisis can be defined as a sudden, low-probability but high-consequence event that causes a major threat to one or several actors, individual or organisational (or even to society), leaving them with little time to respond and who then must face the resulting profound disruption of their practices and social norms (Mishra, 1996; Weick, 1988; Wenzel et al., 2020). Crises are also characterised by confusion and doubtful outcomes of certain actions, due to a lack of adequate resources to cope with the situation (Mishra, 1996; Pearson & Clair, 1998). Their level of intensity and their geographical and temporal scope may vary (Pearson & Clair, 1998). Considering these characteristics, the COVID-19 pandemic is a crisis, calling for extraordinary global, long-term measures such as social distancing at the same time as the implementation of crisis management efforts to ensure business continuity, mainly thanks to IT. Indeed, the sudden shift to telework and the increased use of IT resources to face the COVID-19 crisis seemed the only way for most organisations to keep their operations going (Naidoo, 2020; Thompson, 2020; Yost, 2020). By doing so in such a chaotic situation, firms aimed to reassure their stakeholders (e.g., employees, customers, providers) by showing their capacity to adapt, endure and survive. In other words, firms attempted to create what chaos theorists call "islands of rationality and certainty" (Thiétart & Forgues, 1995, p. 19) that "emerge[d] in a sea of chaos" (Thiétart & Forgues, 1995, p. 26). In addition to reassuring stakeholders, those islands also aimed to provide (the illusion of?) stability for firms' decisions and actions during the crisis.

The situation has simultaneously required existing IT practices and uses to be changed, and some to be dropped entirely in favour of completely new ones. Yet, the literature on IT use under crisis is rather scarce. In most recent crises like September 11 or the 2008 financial crisis, the world had other pressing problems to which IT was only partially the solution. Thus, IS-crisis literature mostly focuses on the use of social media and machine learning to aid crisis response (e.g., Reuter & Kaufhold, 2018), without providing theoretical frameworks and models that could help understand IT use in the face of such brutal transformations. Two models which deal with changes in tools and practices and analyse why, when, and how individuals and organisations enact these changes, can be of help here. These are (1) Weick's "drop your tools" model (Weick, 1996, 2007) and (2) Barley and Tolbert's "action-institution change" model (Barley & Tolbert, 1997).

2.2.2. Changing IT tools and practices: two related models

Weick's model underlines how difficult – if not impossible – it is for individuals to abandon their tools in a crisis. He identifies ten reasons for not dropping tools, which can be grouped into three complementary categories: the perceived level of organisational support; individual knowledge, skills, and beliefs; and perceived social pressures. Firstly, when individuals perceive organisational support as low – i.e. people are not told to drop their tools; do not receive the

message; do not trust the source of the message, or are not given an explanation as to why they should abandon their tools – they are unlikely to do so. Secondly, individual knowledge, skills and beliefs also play a great role. Elevated knowledge of existing tools may result in people feeling that dropping them would equate to losing control over a situation in a way that might prove costly or fatal (even if the opposite is true). Similarly, their familiarity with existing tools may limit their ability to replace them, or objectively to foresee the potential gains of changing them. Interestingly, people may also not know how to drop their tools – not something we usually learn. Weick reports the case of a firefighter running for his life taking the time to lean a saw against a tree instead of just dropping it. People may also not drop their tools because they see them as part of their identity (e.g., the firefighter and his saw, or a teacher's chalk and blackboard). Finally, individuals may not drop their tools because of perceived social pressures. These include considering that dropping one's tools may mean admitting failure in the face of social dynamics (i.e. if nobody else is dropping these tools, why should I?) Considering how actors confronting a crisis might stick with their own tools, Weick's considerations about crisis management are aligned with the consideration of perseverance as one of the effective strategic responses to crises (De Carolis et al., 2009; Stieglitz et al., 2016; Wenzel et al., 2020).

The Barley and Tolbert (1997) model examines the effect of changes in IT tools on practices by bridging institutional and structuration theories. The model sheds light on the dynamics of a "social system" that may hinder or facilitate the adoption of innovative tool practices and consequently result in dropping established ones – a social perspective that contrasts with Weick's model centred on the individual. Their model is a recursive, continuous process where time plays a crucial role. Indeed, the model explains the evolution of institutions (i.e. shared rules and typifications that define and guide actors' activities and relationships – actors being "individuals, groups, organisations, or even larger collectives", p. 97) through the interplay between the constraints that these institutions place on actors' behaviours, and the pressure that these behaviours and their evolutions in turn put on the institutions. Actions and institutions are usually aligned: people go to work and perform their practices in accordance with the existing institutional structures. If some actors adopt innovative practices and uses of technology in a way that causes a temporary dissonance between actions and institutions, they are likely to encounter resistance from the system composed of other actors who collectively expect actions to conform to normal routines. That system will react with inertia to maintain the status quo (Oliver, 1992). Innovative actors may

achieve institutional evolutions, but only with great difficulty. Often, only an external event (which Barley and Tolbert call a "contextual change", p. 102) coupled with extreme perseverance may help them convince the system of the need to adopt new practices, resulting in adapted or revised institutions.

2.2.3. Current gaps in the understanding of IT adoption and uses during crises

While these models provide a good understanding of tools and practices dynamics in moment of crisis, both models also present some gaps in understanding IT adoption and uses in response to the COVID-19 crisis. Weick focuses on individual responses and downplays organisations, whereas Barley and Tolbert's model is more focused on organisational responses but downplays the role of individual agency (Orlikowski & Barley, 2001). Both models only hint at the interplay between individual and organisational levels which may be of great significance when studying IT usage during a prolonged crisis (Bélanger et al., 2014). This very lack of clarity about how tools and practices evolve during a crisis is a further limitation common to both models. Weick concentrates on dropping tools as a potential source of new practices in crises but does not consider picking up new tools. Yet, the sudden and massive shift to teleworking triggered by the lockdowns (Naidoo, 2020; Thompson, 2020; Yost, 2020) indicates that actors have apparently dropped old tools to adopt new ones nearly instantaneously. Conversely, Barley and Tolbert insist on the need for, and the role of, new practices arising from the introduction of new technologies to support the renewal of institutions. Finally, both models allude to exploration and exploitation activities and to the mechanisms that would influence them, still they do not use those concepts explicitly. When proposing that individuals who do not drop their tools may not survive, Weick hints that exploiting existing tools may impede exploration even when it is dramatically needed. Barley and Tolbert consider that exploration is accepted by the social system only if new practices are considered necessary, emerge slowly, are repeated over time, and become more and more frequent. If this happens, these new practices may become the "new normal" and may thus be exploited either by being incorporated in or replacing existing institutions. But the crucial role that time plays in their model is an impossible luxury when confronted to so violent and extended a crisis as the COVID-19. It seems that, for informative as these models can be to make sense of tools and practices changes under crisis, the COVID-19 pandemic has stretched both models to the boundaries of their applicability. We can enrich these models with other theories to help us understand individual and systemic responses.

At the individual level, Ciborra's (2002) model of bricolage indicates that future IT uses will involve situated bricolage, namely a "tinkering through the combination of resources at hand" (Ciborra, 2002, p. 48) that progressively diffuses through the whole organisation and tends to generate serendipitous results (Ciborra, 1992, 1997, 2002). Therefore, we can expect a combining of known practices and tools with new ones provided by management or procured by the individual via other means. The individual will create a system of IT use that combines both old and new. In a way, Ciborra's model of bricolage builds on Wieck's in that old tools are not so much dropped as they are extended by new means.

At the systemic level, chaos theory (McBride, 2005; Thiétart & Forgues, 1995) can help us to understand the evolution over time of a system that is subject to a shock. According to chaos theory, systems revolving around similar equilibrium situations (like universities before the crisis) that perceive a shock, will move from that equilibrium situation to a new one. Chaos theory would indicate that individuals will use technologies in such a way that their aggregate behaviours will bring the different universities into orbit around a new equilibrium point. The situations for the different systems will be similar, even if not identical. Chaos theory also shows that it is not possible to be more precise than that, since even small variations in behaviour can change the specific final state of the system. A final likely prediction is that after the shock and subsequent adjustment to the new situation, the system will never revert to the original state.

Drawing on the Weick and Barley and Tolbert models, and inspired by Ciborra's theory of bricolage and chaos theory, this article aims to develop an empirically founded model of IT use, exploration and exploitation, when individuals' and organisations' IT practices and tools must change because of a prolonged crisis – more specifically, the COVID-19 one.

3. Research method

This study analyses how three European universities, located in Italy, France, and Denmark, responded to the COVID-19 crisis. The three countries are almost evenly spaced across the digital economy and society index (European Commission, 2020) at the 25th, 15th, and 3rd place respectively, hence providing grounds for generalisation of the results. The three countries have also experienced different levels of COVID-19 infection, with Italy being the hardest hit, followed by France, with Denmark being the least hard-hit (in terms of population case-prevalence and fatality rate). The responses of the three universities share similarities but also highlight differences both in the managerial and the faculty responses. This section presents the contexts, followed by the data collection and analysis procedures.

3.1. Research context

The three institutions, presented in Table 1, usually provide campus-based teaching (for the detail on tools feature see Appendix C).

All three universities reacted to the crisis in a similar fashion. On Zoom-night, access to buildings was prohibited, lectures were moved online, and the lecture calendar remained the same. Italy was hit first, in mid-February, but the government was slow to react. France and Denmark were hit in early March. While French-uni and Danish-uni followed the timing and guidelines expressed by the political leadership, Italian-uni moved preventively, starting to take measures before the government acted. The immediate crisis management effort aimed to maintain operations, with all three universities implementing similar crisis management efforts: extensive communication by senior management; creation of a task force to take crisis-related decisions; creation of a forum for the faculty to communicate amongst themselves and with the task force, and creation of written and video training content hosted on their established learning management systems to guide the faculty in using the tools (e.g., Zoom, Panopto, Wooclap) and facilitate teaching.

There were also differences. For instance, French-uni was much quicker to select Zoom as their teaching solution. Danish-uni instead started by letting the

Table 1. Presentation of the 3 universities studied.

Case	Students	Faculty	Learning Management System (LMS)*	Main tools* initially provided	Period in the academic calendar when the crisis hit
Italian-uni	6000	130 internal 120 external	Moodle	Zoom Panopto VPN	End of fall term – exam period
French-uni	6000	160 internal 750 external	Moodle	Zoom Panopto Wooclap	Beginning of the spring term – course period
Danish-uni	15,000	600 internal 100 external	Blackboard	Free choice Adobe Connect (existing licence) Zoom	Beginning of the spring term – course period

(*note: the links to the tool and platform vendor and a brief explanation is provided in appendix C)

faculty decide for themselves how to provide teaching online and it took about two weeks for the faculty to converge on Zoom. For Danish-uni and French-uni the changes happened while courses were ongoing while for Italian-uni the crisis started during the exam period. This means Italian-uni is alone among the three in having been through an entire cycle (exams, full term, exams). A more detailed explanation of the three cases is presented in the Appendix A. Common to all cases was that in a frantic effort to face a crisis of as-yet unknown proportions, the faculties of all three universities were catapulted from routine in-class teaching supported by an online-learning management platform, to fully online teaching with the same calendar, pace, and obligations as before. Their usual tools – blackboards, chalks, markers, desks, chairs – were literally yanked from their hands and a completely new set of (digital) tools was handed to them. As one faculty put it: "*It was like a soft opening for a restaurant that went really wrong. A soft opening from hell!*" (DK-PROF5).

3.2. Data collection and analysis

The study is based on multiple sources of data: interviews, emails, and discussion forums. Between the second half of March, when the COVID-19 pandemic spread across Europe, and mid-May 2020, we conducted 30 interviews (10 per university). For each institution, we interviewed the IT manager, the dean of study, and a programme manager, as well as seven faculty members affected by the transition from face-to-face to digital teaching (details in Appendix B). Some interviewees also shared with us emails that were very informative about how they had adapted to this peculiar period.

Due to social distance constraints and lockdown rules, we conducted the interviews via Skype, Zoom and Microsoft Teams. All interviews lasted between 15 and 60 minutes and were recorded following an explanation of the aim of the study, informed consent and data anonymity guarantee processes, and formal authorisation from each interviewee. The interview protocol was designed with open-ended questions to allow respondents to express themselves fully about their experience during the pandemic digital transition. The interview protocol is available from the authors upon request. The interviews were carried out in English, Italian, French or Danish, depending on the preference of each interviewee. They were recorded both in video and audio format. All interviewees were called to experience synchronous online teaching for the first time during the crisis. All were able to teach from home and had the technical equipment to do so. There was large variation in the course size, from courses with 16 students to large ones with 700 students taught in parallel by multiple lecturers. These courses encountered different challenges. For the small courses,

it was a question of keeping the interactive spirit going. For the large courses it was about "dealing with the void of talking to hundreds of black squares" (which is how Zoom.us represents someone with no video). A table with the details of the interviewees is available from the authors.

From the start of the crisis and until submission of this manuscript, we also collected and analysed data from the internal forums and institutional communications regarding the strategies, tactics and actions designed and executed to cope with the impacts of the pandemic. While we deem the interviews to be the core data in understanding the adoption and uses of new technologies and practices during the crisis, these institutional communications and forums contain important information that complement the interviews (for example, when management mentioned a practice adopted by a faculty member in an institutional mail as " a good example", it gave this practice a push towards institutionalisation). Data analysis followed the inductive approach recommended by Gioia et al. (2013), using three levels of coding (see Appendix D).

4. Findings: analysis and interpretation

As explained above, the three different countries faced the COVID-19 crisis at slightly different times. Albeit with different modalities, all three universities declared a "move online" procedure: once executed, it appears that users from the three institutions followed a common process. Our analysis of the use of IT as a consequence of the COVID-19 outbreak allowed us to identify a five-phase process model, respectively labelled: (1) survival, (2) socialisation, (3) normalisation, (4) strategizing, and (5) institutionalising crisis practices.

4.1. Phase 1: survival

On a certain day of March 2020, the crisis hit, with lecturers informed that university premises were closing but teaching had to continue undelayedly, and according to the existing plans. Their main teaching tools – classrooms, black/white boards, markers, desks, etc. – were literally taken away from them overnight. As one lecturer put it: "*When I go into the class I 'own' the floor, in Zoom it's just checkmate … it's scary, you have to rethink everything*" (DK-PROF2)

This common starting point aside, institutions gave different guidelines regarding the tools to use. French-uni immediately imposed the use of Zoom. All lecturers had to adopt the new tool (whether they liked it or not), but there was institutional support for the quick transition: "*It was Pedagogical Services that proposed [Zoom] with the support of IT. This was done because Zoom seemed to be the most effective and user-*

friendly tool; we did not give any choice to the faculty members" (FR-MAN2).

Danish-uni was less directive and let each lecturer choose how to meet the management demands. Most lecturers in Denmark leveraged tools that they already knew but they did so in innovative ways. As one lecturer put it: "*In the very beginning, I recorded sound over slides, and I used the Q&A forum in the LMS. I also created a way to hand in assignments online since we could not do case discussion in class. I really had to get deep into these tools to find out about these features*" (DK-PROF2).

IT departments quickly assumed a central role in the migration process. A common trait for all institutions was that lecturers started using the online tools almost without resistance. As the IT department of Italian-uni put it: "*We were ready. The IT infrastructure was ready. The licences were available. And the faculty was more than cooperative. Nobody tried to go against the switch. We did in few days what we have been planning for years*" (IT-MAN4). Likewise, in Denmark: "*We had never been under so much pressure and the pressure was coming from users wanting new tools. This is completely unprecedented for us*" (DK-MAN2).

This first phase was characterised by trial and error and a lot of users' frustrations in both the guided and the unguided scenario. As an Italian lecturer put it: "*The first session I recorded was horrible. I had to think about how to teach and how to manage the tool. Sometimes I clicked and nothing happened. If that happens, you get creative*" (IT-PROF3). This was echoed by a Danish lecturer: "*the first week, with the voice-over slides, was a bit of a mess. It was not really optimal. By my second lecture I was live on Zoom. But I must say there were glitches: I forgot to record the lecture; I didn't know how to mute the students, etc.*" (DK-PROF6). Concerns were similar in the more guided French context, where users limited innovation to a strict minimum to make sure that everything worked: "*Keep it simple has been my mantra for the first sessions. I was scared*" (FR-PROF2). However, students proved rather generous when lecturers encountered issues. They actually acknowledged and appreciated the efforts made by their university and lecturers alike. This helped to limit the pressure and uncertainty felt by lecturers: "*Many students I exchanged with told me that they were impressed by how responsive we had been. It was clear that they appreciated what we did and all their lecturers' efforts to keep the courses going. This proved very reassuring for lecturers*" (FR-MAN2).

Thus, in the first, emergency phase of the pandemic, survival involved ensuring continuity of the core practice, namely teaching. Supported by their organisation, users who had lost their main tools did their best to adapt to the situation. They favoured easy solutions, exploiting (or only minimally exploring) the new tools so as to replicate their existing practices, matching the organisational goal of continuing activity. This survival phase started immediately after the lockdown and lasted for a few teaching sessions.

4.2. Phase 2: socialisation

Due to the user-friendliness of the tools adopted, users quickly started learning how to use them: "*The first sessions were quite … what can I say … interesting … Then you realise that Zoom and Panopto are really easy to use*" (IT-PROF5). Some faculty felt the urge to share their experiences with others and typically communicated their experiences with management. As one lecturer said: "*I guess I can be considered kind of an advanced user of Moodle. So, it was natural to share some shortcuts with my colleagues who started to ask me for advice. And I also learned that you can always learn something …* " (IT-PROF6). Many of those socialising practices were spontaneous (emails exchanges between lecturers, organisation of shared Zoom sessions to learn about the tool and live applications). Users' exchanges received institutional support. French-uni created a discussion forum where faculty could run peer-to-peer discussions. Danish-uni used programme managers as hubs: experiences were shared with the managers, who then communicated back to the faculty. All this enabled the institutions to get information that was later used to adjust training with the tools and to reshape practices (e.g., online exams). For example, following one lecturer's post on the forum to inform others about how to activate a specific feature in Zoom, the Director of Pedagogy at French-uni joined the discussion to explain that this had enabled him to identify an issue in the institutional account settings and change them: "*Following your post, I checked, and it seems like the initial settings that we made had changed, maybe because of the rush and some of the changes we had to make. I've just activated that for [our] Zoom account. THANKS AGAIN!*" [French-uni, Forum].

In the first two weeks after the onset of the crisis, after the initial uses of IT aimed at survival, users began to explore new features of the technology both as a single tool (Zoom) and by combining tools to increase the quality of their service. "*I started to use Zoom features like the whiteboard much more. [I] needed to change the technological features, because just showing the slides was not sufficient*" (FR-PROF4). Others started considering the integration of additional tools. Some did so to remedy perceived missing features: "*I am trying to combine the different tools. Our platform looks terrible but gets the job done. But I am looking into integrating tools like Slack or*

Perusal" (DK-PROF5). Others aimed to improve teaching methods: "*In Zoom I have to 'own' the room in another way. So I used as much variation as possible to be 'present' in class in many different ways*" (DK-PROF2).

In this socialisation phase, users continued gradually to exploit the features of the tools, as they got more comfortable thanks to the support provided by their organisation and through social knowledge-sharing around the tools and related practices.

4.3. Phase 3: normalisation

Once the tools and the practices were socialised, many of the faculty started exploring the next level along different dimensions. For example, some were willing to go further: "*Suddenly some of the faculty started saying things like: I find I can do this and that … or … I am quite sure that I could try this, but I need some more specific training on Zoom*" (IT-MAN5). Other users were able to use the tools to refocus on the contents of the course and their constituency: "*The more I got comfortable with the new medium, the more I was able to 'get into the zone'. I think that my reflections on topics that I taught to the students this year are deeper than usual. I guess it is because you can concentrate more*" (DK-PROF7).

In parallel with technology savviness, some faculty members took advantage of the situation to introduce innovations in their lectures "*One of the challenges has always been having a manager or entrepreneur in class. This semester I started all my sessions with a video-interview with a manager or an expert discussing the topic of the lesson. I tried, and the feedback from the students was great*" (IT-PROF4). In France, Zoom was used to replace a learning trip, with primary support from the institution, which reorganised the agreement and provided additional technical guidance to simulate the same level of experience for both students and company representatives: "*My students had to do a study trip that was obviously cancelled. So we took advantage of the technology to organise some meetings and presentations with them, and also with some alumni. The best solution was to find something that they could not have done at all otherwise*" (FR-PROF1). For other lecturers it was a question of boosting pedagogy with new practices by combining Zoom and the LMS: "*At the beginning we were just presenting slides. Then we started to discuss cases, but in reality, the students discussed in groups and then we did the debriefing. Finally, we had the students discuss cases off-line and upload short answers in advance on the [LMS]. We then grouped the answers by themes and discussed the case from their*

perspective. The students' response has been amazing" (DK-PROF1).

Thus, in the normalisation phase, users better understood the new practice of online teaching. In contrast to the earlier phases, they were not satisfied with simply teaching through a camera anymore, but instead refocused on the quality of their performance. To that end, users simultaneously exploited and explored tools and related practices, often in creative ways. The institutions' roles were more limited, leaving users space to explore new practices with the new tools while providing occasional support.

4.4. Phase 4: strategizing

Most of the faculty had perceived the mandated switch to online teaching as a challenge that required extraordinary efforts. Hence, many of the interviewees expressed their willingness to build on this: "*I certainly won't throw away all the work done in those weeks. I can't use everything, but I already have some ideas about how to reuse some of the material that I created*" (IT-PROF5). Likewise, in France and Denmark: "*I think many colleagues will move more things online and face-to-face will be used more as a way to interact with students to solve their learning problems*" (FR-PROF4); "*I think we have an opportunity to do more blended learning. For example, we can alternate class lectures with Zoom lectures. The material is ready anyway*" (DK-PROF7).

The long-term effects of the pandemic were also clear for the universities, whose governance members saw what had been done since the crisis started as a strategic opportunity to develop innovative practices: "*In those weeks we learned – and are still learning – a lot. I'm not saying that 'online' is the future. Our students want to live the [campus] life. However, we need to think how to improve our pedagogical strategies*" (IT-MAN1). However, despite organisational and peer pressure, our data reveal some individual inertia and resistance to the possible changes. Some faculty members even expressed their desire to go back to the previous status-quo: "*I am not a YouTuber. Teaching at a high educational level cannot be reduced to a video or a webinar. As soon as the situation goes back to normal, I'll be the first into my classroom*" (IT-PROF3). Criticism also focused on alternative solutions: "*I don't see the use of Zoom as something that will last into the future. I have contacted my school's director of pedagogy and suggested using an asynchronous platform as well. Since lecturers are redesigning courses at the moment, let's take advantage of that for the future. If we can be in the same room, I am not going to be using Zoom in the future*" (FR-PROF7).

Through this phase of strategizing, users and institutions generally but not unanimously reflected on the

long-term benefits of the unexpected occurrence of moving online. For some it was the creation of specific content, for others, the structure of future classes. Having experienced multiple positive effects of the new practice, further entrenched exploitation and exploration intentions and actions were identified by users that would make the learning experience more effective and efficient for them and the students.

4.5. Phase 5: Institutionalising crisis practices

Finally, when it became clear to all that the COVID-19 pandemic was not a short-term emergency but would last and have consequences for at least the two following semesters, interviewees showed different attitudes.

First, there was a reaction to the fast decision-making and micro-management that had been set aside in the previous phases. If in February IT was leading the processes – whether managing online exams, online thesis defences, organisation of teaching – in May, the faculty kept reacting to the guidelines, forcing discussion of aspects of the process ignored thus far: "*the last seminar was crazy. 120 faculty asking 120 versions of the same question. How can I be sure that the students will not cheat … ? Come on! … you can't be sure that students won't cheat even when you are in the same room with them …*" (IT-PROF3). It appears that a feeling of less urgent pressure, and the nature of the task at stake (teaching *vs* evaluating), had a strong impact on the willingness of the faculty to use (exploit) the tools put at their disposal. In the later phases of the teaching term, faculty were less willing to accept anything coming from management without discussion. The attitude observed in Italy was echoed in Denmark. As the programme manager put it: "*Things are beginning to slow down. While before we could take decisions very fast, now all the regular decision-making bodies have to be involved even in crisis related decisions … like how to do online exams*" (DK-MAN3).

Second, there was a move from university management to standardise the sprawling IT uses and practices and align them with the previous configuration of the institutions. Both the Danish and the Italian institution produced – at faculty request – a defined code of conduct for the exams: "*for the online exam session students must have two Zoom sessions open, one on the PC where they do the exam and one on the mobile phone that shows the environment around them*" (IT-MAN4). Likewise, the management of French-uni put its mark on IT practices by mandating an institutional Zoom background for meetings and classes as well as adopted a specialized software (Wiseflow) for the running of exams.

Finally, a third approach was to keep exploring how the lesson learnt in the previous six months could help with innovating and rethinking their way of working: "*We are working to make an online version of the PhD methods course. It will run in parallel with the physical course, but it will be different and appeal to other audiences*" (DK-PROF5). Similarly, the Italian Head of Pedagogy reflected on the fact that there will be a pre- and post-COVID-19 era: "*We don't know how we will work in the future, but for sure we will not work like we did in the past*" (IT-MAN1). The French-uni strived to anticipate the later consequences of the crisis, or a potential second wave of the pandemic, by investigating the implementation of "hybrid teaching" (i.e. mixing remote and in-class students) for the start of the following academic year and investing massively for the longer term.

These behaviours mark the start of an institutionalisation process: new practices and tools arising from the crisis are not institutionalised, but some are in the process of being so. Organisations strive to incorporate the practices and tools that have emerged during the crisis in new practices for further exploitation, partly supported by users who are interested in pushing the tools even further. However, they are also slowed down by users who have moved past the emergency mindset and who see the prolonged crisis as a new normality in which regular practices and traditions must be respected.

5. Conceptual framework: exploration and exploitation of IT in times of prolonged crisis

5.1. Theoretical contributions

This study investigates the impact of the COVID-19 crisis on the explorative and exploitative uses of IT and the relative practices that IT tools support, to answer the following question: *How does the use of IT change over time, in reaction to a prolonged crisis that impedes normal operating procedures?*

Unlike other research projects, this unprecedented situation means there is very little theory to underpin an answer. Dynamics of IS-adoption and use are indeed classic IS topics. Still, the IS literature typically focuses on voluntary (e.g., Maier et al., 2015; Venkatesh & Davis, 2000) or mandated adoptions and uses (e.g., Kwahk et al., 2018; Spierings et al., 2017; Venkatesh & Davis, 2000) leading to theorisation of practices like resistance, image management, work-arounds, collusion, and negotiation. This literature does not inform us about adoptions and uses in response to a crisis (especially not one as prolonged as the COVID-19 one), which is to say, a situation that creates a discontinuity that halts evolution and creates disruptive changes (Wenzel et al., 2020). We have therefore worked to include this disruption in the understanding of how organisations and individuals use, adopt, innovate, and create practices around old and new IT tools.

Given the dearth of literature on the topic, we drew on the works of Weick (1996, 2007) and Barley and
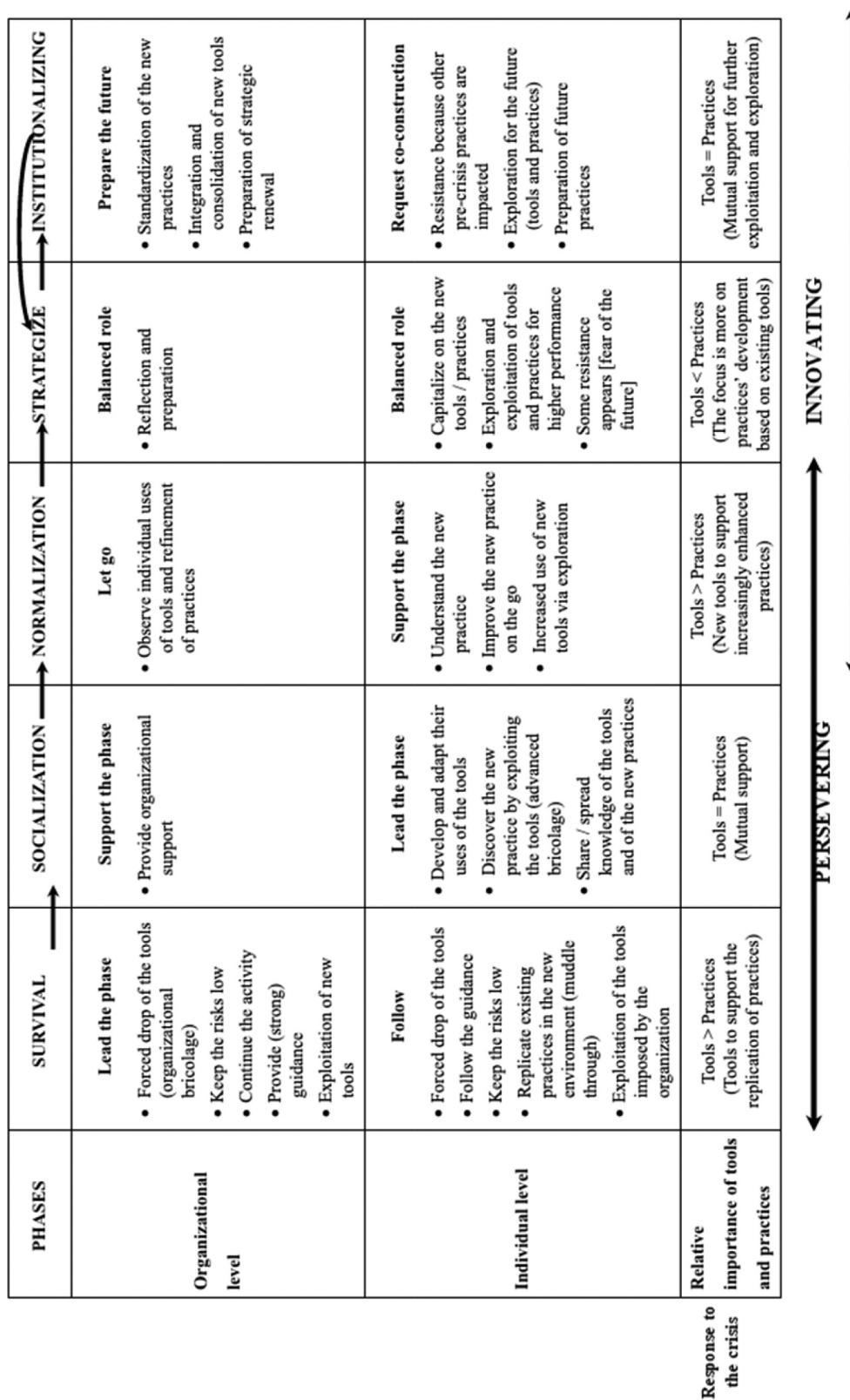
PHASES	SURVIVAL	SOCIALIZATION	NORMALIZATION	STRATEGIZE	INSTITUTIONALIZING
Organizational level	**Lead the phase** • Forced drop of the tools (organizational bricolage) • Keep the risks low • Continue the activity • Provide (strong) guidance • Exploitation of new tools	**Support the phase** • Provide organizational support	**Let go** • Observe individual uses of tools and refinement of practices	**Balanced role** • Reflection and preparation	**Prepare the future** • Standardization of the new practices • Integration and consolidation of new tools • Preparation of strategic renewal
Individual level	**Follow** • Forced drop of the tools • Follow the guidance • Keep the risks low • Replicate existing practices in the new environment (muddle through) • Exploitation of the tools imposed by the organization	**Lead the phase** • Develop and adapt their uses of the tools • Discover the new practice by exploiting the tools (advanced bricolage) • Share / spread knowledge of the tools and of the new practices	**Support the phase** • Understand the new practice • Improve the new practice on the go • Increased use of new tools via exploration	**Balanced role** • Capitalize on the new tools / practices • Exploration and exploitation of tools and practices for higher performance • Some resistance appears [fear of the future]	**Request co-construction** • Resistance because other pre-crisis practices are impacted • Exploration for the future (tools and practices) • Preparation of future practices
Relative importance of tools and practices	Tools > Practices (Tools to support the replication of practices)	Tools = Practices (Mutual support)	Tools > Practices (New tools to support increasingly enhanced practices)	Tools < Practices (The focus is more on practices' development based on existing tools)	Tools = Practices (Mutual support for further exploitation and exploration)
Response to the crisis	PERSEVERING			INNOVATING	

Figure 1. A 5-phase process model of IT drop, exploitation, and exploration during a prolonged crisis.

Tolbert (1997) to analyse and understand the individual and social dimensions of changing, adopting and using IT tools and practices in extended crises. In doing so, our study contributes to the literature on IT exploration and exploitation, as it focuses on the process that emerges during a crisis that implies management decisions and employees' actions when familiar tools and practices are obliterated while core activities must be maintained. This five-phase process (survival, socialisation, normalisation, strategising and institutionalising) is modelled in Figure 1. It is discussed below, relying on insights from chaos theory (McBride, 2005; Thiétart & Forgues, 1995) and Ciborra's concept of bricolage (Ciborra, 1992, 2002)

that have proved helpful in expanding and refining the Weick (1996, 2007)) and Barley and Tolbert (1997) models, while also bridging them.

5.1.1. Organisational vs individual dropping of tools

First, our model confirms Weick's "dropping the tools" model as it shows that individuals do not drop their tools spontaneously. More precisely though, and this is in itself a first extension of Weick's model, it is the organisation, not the individuals, that decides to drop the tools – a decision dictated by the chaotic (crisis) situation. This decision resembles organisational bricolage insofar as it is an organisational unplanned move that leverages the combinational use of diverse resources at hand (Ciborra, 2002). While dropping the tools usually generates high uncertainty, the organisational drop of the tools has favoured individual acceptance because this bricolage was simultaneously accompanied by structured guidance and training. In these chaotic circumstances, the mix between bricolage and structured decisions has paradoxically created "islands of rationality and certainty" (Thiétart & Forgues, 1995, p. 19) that have provided a relative stable ground for the individuals confronted with the crisis.

5.1.2. From muddling through to new IT tools and practices

We also extend Weick's model by adopting a longer-term perspective: while Weick focuses on intense, short-term crisis events, COVID-19 is a crisis that, at the time of writing, spans several months and seems far from over. This apparently generates two successive coping behaviours that go beyond Weick's binary "drop vs keep" model and could be assimilated to a two-step bricolage. Firstly, at the moment they drop their tools and adopt new ones, individuals tend to limit uncertainty by replicating their existing practices. They try and do the same thing (here, teaching online the way they teach in class) with the different tools put at their disposal, with little or no exploration of the tools' possibilities in the new context. In other words, they just "muddle through" – a bricolage behaviour that seems particularly adapted to cope with chaos, as both bricolage theorists (Ciborra, 1992, 1997, 2002) and chaos theorists (Thiétart & Forgues, 1995) agree on the same terminology. Secondly, the immediate replacement of the tools later gives way to exploration of new practices and possibilities. This is a more advanced bricolage, that aims to start renewing and adapting practices to suit the new conditions. The new tools are used and progressively shaped to bridge old and new practices. In the end, the crisis has favoured, or even triggered, organisational and individual bricolage, with the latter enabling the former. Thus, in more extended crises, individuals and organisations use the relatively longer time to adapt their behaviour and start exploring. This may serve to anticipate further developments (e.g., extension or renewal) of the crisis. This contradicts and complements Weick's model, which implicitly suggests that in intense, short-term crises, exploitation may impede exploration because individuals are unable to adapt their practices, even if that is what is intensely needed.

5.1.3. An accelerated but potentially unstable institutionalising process for new IT tools and practices

While our model is aligned with that of Barley and Tolbert (1997), who note that institutionalising new practices is likely to encounter resistance by people who do not want to change the working rules, it also challenges and extends it. Indeed, we show that new uses of IT tools and new practices (i.e. exploration) do not necessarily need to emerge slowly and be repeated over time to be exploited in the long run. The spectacular nature and duration of the COVID-19 crisis – two dimensions the original model did not consider – apparently accelerated an institutionalising process for new IT tools and practices (although this is still ongoing at the end of our study). To that extent, bricolage in a prolonged crisis does not seem to require a long time for its outcomes to start institutionalising, which goes against the cases studied by Ciborra in non-crisis periods (Ciborra, 1992, 2002). However, a pending question is whether the span of the crisis may provide enough time for more resistance towards some specific new uses or practices. Indeed, the crisis temporarily alters formal relational structures and opens a window of opportunity for organisational members to rethink the direction and strategy of the organisation (Wenzel et al., 2020), while that can still be opposed by other members. The current, chaotic situation is therefore akin to a liminal state (Powley, 2009) marked by a stability that is only temporary, and at the end of which the organisations will find a new equilibrium point (McBride, 2005; Thiétart & Forgues, 1995). Still, chaos theory informs us that organisations are subject to bifurcations, namely "points at which qualitative changes between two states occur, leading to an irreversible organisational transformation" (McBride, 2005, p. 238). In the context of a prolonged crisis, we suggest that an organisation may remain in this stable intermediate state for a longer time, with two potential outcomes: either individuals get accustomed to the situation and start resisting more and more, preventing institutionalisation of the new practices from actually occurring; or the persisting uncertainty due to a potential renewed peak of the crisis may conversely facilitate this institutionalisation, which according to chaos theory would then become irreversible (McBride, 2005; Thiétart & Forgues, 1995). In passing, this suggests

that sequential activity in an extended crisis (alternation of peaks and off-peaks in the crisis), in addition to its duration, would be likely also to play a role in the organisational and individual reactions and resistances to institutionalisation.

5.1.4. A five-step model of IT drop, exploitation, and exploration during a prolonged crisis

Finally, our model allows bridging of Weick's and Barley and Tolbert's models by combining the individual and organisational levels and investigating the roles of exploration and exploitation of IT across the levels and the different phases. The process shows that the five phases form a temporal sequence (top row) over which there are both an organisational and an individual level of crisis response (second and third rows). Phases are not demarcated by clear start and stop moments but rather morph one into another, in accordance with Orlikowski (1996). They also match two complementary types of overlapping responses to the crisis (Wenzel et al., 2020): persevering and innovating. Persevering "relates to measures aimed at sustaining a firm's business activities in response to crisis" (p. V9) and comprises survival, socialisation, and normalisation in our model. Innovating refers to "the realisation of strategic renewal in response to crisis", and includes normalisation, strategising and institutionalising (p. V11).

We observe that when the crisis starts, management and employees are aligned towards the same goal, namely maintaining the organisation's essential functions (here, teaching) to minimise disturbance to the stakeholders. The alignment seems to be strengthened when (1) the organisation and its members share the same perception of pending disaster; (2) the organisation demonstrates to its members that it is doing its best to guide them and remove most of their uncertainty in troubled times and (3) the users note and understand that the new IT uses are both relatively easy and appropriate to their practice, something that is reinforced when (4) other stakeholders directly or indirectly concerned by the change deliver positive feedback (e.g., students). This alignment facilitates the adoption and quasi-immediate exploration and exploitation of new tools during the survival phase, confirming that it is easier to make decisions and changes when confronted with a crisis (Bryson, 1981). Our model, however, proposes a more fine-grained analysis as we identify different IT exploration and exploitation activities at individual and organisational levels. At the same time, it also sheds light on the dynamics of shifting between different types of responses to crisis (here, persevering and innovating), answering the call of Wenzel et al. (2020) for longitudinal studies. There is a dialogical evolution of exploration and exploitation as they alternate and complete each other across the five steps and the two levels of the process. This occurs when the use of IT tools on the one hand and practices (in our case, online teaching) on the other hand evolve concomitantly: sometimes the IT tools are more relevant, sometimes it is the practice and some other times both go hand to hand (bottom row). For instance, in the survival phase, faculty members had to drop the classic teaching tools (classroom, black/white boards etc.) to start nearly instantaneously exploiting the new tools provided by their organisation to maintain business continuity. On the contrary, in the strategising phase, they had a better control of the tools and started exploring how they can be used to nurture more advanced practices that will be strategically pertinent after the crisis. Thus, while the crisis created a discontinuity requiring IT exploration in the short term, both organisation and individuals worked to minimise the disruption as much as possible in the long run. According to chaos theory, once the disturbance is normalised, organisations find themselves in a new situation that includes both old and new practices. While our data, for obvious reasons, do not show us the future situation, our model points to the fact that organisations in general, and universities in particular, will never go back to exactly where they were before the crisis. This potentially sheds light on how actors' behaviours evolve relative to new IT tools and practices, something that Barley and Tolbert (1997) did not consider in their model.

5.2. Managerial implications

As we write, the world is still in a state of high uncertainty. Europe is experiencing a second wave, the pandemic tide keeps rising in South America, the US and Africa, and it may be resurging in some parts of Asia. Nobody, so far, can predict when we will come through this pandemic. In this context, managers need help to face and respond to the uncertainty. We believe that our model can be helpful in this regard, even though it originates from the analysis of a specific context.

Firstly, our model may help managers anticipate the different phases that their organisation will go through in terms of IT usages and practices – or identify in which phase it currently sits. By diminishing uncertainty, this may help them foresee and understand the most appropriate strategic response to survive the crisis and recover quickly (Alvarez et al., 2018).

Secondly, the awareness of the magnitude of COVID-19 allows managers to speed up digital transformation processes by leveraging the survival phase. There, users tend to put resistance aside, focusing on only a few priorities. However, managers must carefully decide which tools are taken away and which are put in. Dropping tools is always traumatic even if the rationale is clear (Weick, 1996). So, managers need to carefully guide employees in picking up new tools while still holding on to some of the old ones. Finding this balance seems all the more crucial since the crisis itself is likely to force the removal of some tools/practices, strongly limit

their use or force the use of new tools/practices (see for instance, how the most severely impacted sectors, such as transport or retail, have been powerfully compelled to review their tools and practices).

Thirdly, managers should adopt an active listening approach throughout the whole process. Favouring bottom-up appropriation and reciprocal adaptation between practices and technology will help reinforce the use of the new organisational technological environment. Since this crisis represents a new situation for managers too, they need inputs from the trenches to take decisions that resonate with fast-emerging, new, local practices. Managers should also leave some freedom to explore and fail without consequences. Bottom-up exploration notably contributes to the innovative and adaptive capability of a firm without requiring additional resources (Thiétart & Forgues, 1995).

Fourthly, managers should nurture the long-term effects of crisis-born innovations. As it is, the immediacy of crisis-born changes may be quickly lost when people revert to old patterns of behaviour (Barley & Tolbert, 1997). Identifying the transition to the strategising phase helps reinforce the integration of IT-based innovation within organisational processes and practices, enhancing the IT effects. Moreover, the still ongoing COVID-19 pandemic should prompt managers to anticipate its future potential consequences by further exploiting those innovations, while simultaneously exploring potential solutions for if the situation worsens.

5.3. Conclusion

This study shows surprising behaviours around IT adoption and use during a crisis that impedes normal operating procedures. Resistance to change does not really appear, users drop certain tools and engage themselves with IT exploration and exploitation practices, users and managers have an open and constructive communication channel, IT and business are aligned, decisions are taken fast, institutions react slow. The combination of these behaviours allows us to present a process model of IT use under crisis that is very different from the traditional models of IT adoption. While the current situation may be atypical and our model a black swan (Taleb, 2007) regarding IT use, its very existence leads us to conclude that a true and complete model of IT adoption and use must explain it both in normal and in crisis times. While, for the time being, our model may be sufficient to guide management action, future research on IT use will need to address the existence of a model that explains both the white swan and the black.

Disclosure statement

No potential conflict of interest was reported by the authors.

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Appendix A. Case descriptions

Italian-Uni is located in Northern Italy. The School of Business and Economics counts 6,000 students and 130 permanent faculties. The Italian Government mandated the closure of all schools and universities on March 2 2020. Then the country entered the "lockdown mode" on March 10. Due to the uncertainty about the duration of the lockdown and the fact that the School was transitioning from the fall to the spring semester, the university management decided to suspend all the activities in order to prepare the appropriate response. In the meantime, the university board and the academic council (Senato Accademico) started working with the IT department in order scan the ability of the IT infrastructure to guarantee the business continuity. "*The IT infrastructure was ready. We had only to buy some additional licences for Zoom and for the VPN software. We were able to serve all the 28.000 users of the university (faculty, administrative staff, students). The real challenge has been the availability of IT personnel required to coach and support all users. It was challenging … but eventually we made it*" [ITA-MAN4]. Thanks to the readiness of the IT side, the University decided to move to on-line all the academic activities, from the exams, to the thesis defences, to the courses. To keep the complexity under control, the board decided to mandate the use of few tools: Zoom for the synchronous sessions, Panopto (a tool integrated in Moodle) for the asynchronous sessions. Both asynchronous and synchronous sessions had to be released according to course schedule already defined for the spring semester.

French-Uni is located in Northern France and in Paris. It is a business school of 6,000 students and 160 permanent faculty members. The French President announced in the evening of March 12 that all the schools and universities would be closed from Monday, March 16. The lockdown of the country, announced on March 16, started on March 17and ended on May 11, but universities remained closed for students. The faculty management had anticipated a closure of its two campuses. Thus, late February 2020, the Director of Pedagogy had chosen the tools and contents that would be used if all courses had to move online. The team of the educational internal centre had also been mobilised to create and organise training resources made available on the School's learning management system. Among the tools, Zoom was chosen for synchronous online sessions, chosen for its simplicity. It was completed by Wooclap, an advanced online polling system that allows more complex online interactions. The centre also reframed its existing training resources to provide the faculty with an easier access and use of solutions that were already available to use asynchronous contents and activities. Therefore, professors could either use Panopto to create their own audio-visual resources hosted on their course website, or rely on existing contents and activities. Advice about how to behave when teaching online were also provided, so that faculty members could strengthen not just their technical skills, but also their online teaching skills. All this enabled the Director of Pedagogy to inform the faculty and the students' officers of what would happen in case of closure even before the French President's announcement: "*[…] we must be ready to face a situation similar to other countries (Greece, Italy, Iran, Japan, etc.), namely a local or national closure of schools and universities. In the countries where that has happened, universities have started teaching online to answer the issue. We will do the same if [we] must close one or both of [our] campuses. Indeed, it is crucial that courses are still delivered even if the premises are not accessible to students […]. To that end, [we have] prepared a set of online resources that will help you teach online. These resources are available on this page on [our Learning Management System]*" (email from the Director of Pedagogy, March 11 2009:41 AM). The email also quickly presented Zoom, informing professors that webinars would be organised to train them the week after. Yet, immediately following the President's decision, another email was sent on March 12, at 10:31 PM, to notify professors that a total of eight webinars would be organised on March 13 and on March 16. The lengthy email also provided additional information about what the School knew and could do, and what would still necessitate further investigation (e.g., course evaluations). It also made clear that all the sessions, whether synchronous or asynchronous, had to stick to the initial planning to facilitate the courses' organisation. Finally, given the uncertainty of the lockdown's length, the School decided within the week to keep all the courses online until the end of the semester, even if the government decided that universities could reopen later (which has not been the case anyhow).

Danish-Uni is located in Denmark. The business school has 15,000 students and about 900 faculties. The prime minister "locked down" the country on March 11 and gradually reopened it from mid-May. The lockdown implied a close down of all public offices including universities, and prohibition to assemble more than 5 people at the time while keeping a two-metre safety distance from others not in the family circle. The university management immediate response was first cancelling all non-necessary activities: "*Effective immediately and until further notice, events such as conferences and seminars will be postponed until further notice*" (mail from the management department, March 11, 9:02am). This was followed by a complete shutdown of all physical presence on the university grounds: "*The senior management team at Danish-Uni has decided that you should not come to work starting tomorrow March 12 2020*" (mail from Rector, March 12 2000:00am). Nonetheless, the faculty was commandeered to uphold all activities without interruption: "*Danish-Uni is physically closed, but our activities remain the same. This means that we will continue to offer the same high-quality teaching, however using another set of tools. We ask all of you to plan your teaching accordingly. In this way, we can maintain a high standard in our teaching and support the students' learning in the best possible way under the given circumstances using a set of digital tools. We know that many of you are already busy finding solutions, and we really appreciate your efforts. All employees are asked to perform their normal duties from home and to conduct virtual meetings using Skype, the telephone or other digital solutions*" (mail from the management department, March 13, 8:55pm).

Appendix B. Data Collection

The table below presents the list of informants and their role in the three institutions.

#	Code	Interviewed code	Job Title	# of students	Level of program
1	Italian-Uni	IT-MAN1	Head of pedagogy	28,000	Uni
2	Italian-Uni	IT-MAN2	Head of communication	28,000	Uni
3	Italian-Uni	IT-MAN3	Program Leader	500	Program
4	Italian-Uni	IT-MAN4	CIO	28,000	Uni
5	Italian-Uni	IT-MAN5	IT support	1,500	Department
6	Italian-Uni	IT-PROF1	Faculty	114	MSc
7	Italian-Uni	IT-PROF2	Faculty	184	Bachelor
8	Italian-Uni	IT-PROF3	Faculty	95	MSc
9	Italian-Uni	IT-PROF4	Faculty	26 ± 125	M± MSc
10	Italian-Uni	IT-PROF6	Faculty	139	MSc
11	Italian-Uni	IT-PROF7	Faculty	74	Msc
12	Danish-Uni	DK-MAN1	Dean of Study	15,000	Uni
13	Danish-Uni	DK-MAN2	CIO	15,000	Uni
14	Danish-Uni	DK-MAN3	Head of pedagogy	15,000	Uni
15	Danish-Uni	DK-PROF1	Faculty	150	MSc
16	Danish-Uni	DK-PROF2	Faculty	65	MSc
17	Danish-Uni	DK-PROF3	Faculty	230	MSc
18	Danish-Uni	DK-PROF4	Faculty	85	MSc
19	Danish-Uni	DK-PROF5	Faculty	28	MSc
20	Danish-Uni	DK-PROF6	Faculty	700	Bachelor
21	Danish-Uni	DK-PROF7	Faculty	700	Bachelor
22	French-Uni	FR-MAN1	Director of pedagogy	6,000	all programmes
23	French-Uni	FR-MAN2	Head of pedagogy	2,000	PGE
24	French-Uni	FR-MAN3	CIO	6,000	all programmes
25	French-Uni	FR-PROF1	Faculty	42	MSc
26	French-Uni	FR-PROF2	Faculty	22	MSc
27	French-Uni	FR-PROF3	Faculty	50	MBA
28	French-Uni	FR-PROF4	Faculty	33 + 29	MSc+MSc
29	French-Uni	FR-PROF5	Faculty	18–30	MSc
30	French-Uni	FR-PROF6	Faculty	39 + 17 + 19	BSc+MSc+EMBA
31	French-Uni	FR-PROF7	Faculty	19	EMBA

Appendix C. LMS and IT Tools

Tool	Website	Type	Functions
Zoom	www.zoom.us	IT Tool	video communications, video and audio conferencing, chat, and webinars.
Panopto	www.panopto.com	IT tool	online video platform
Perusall	https://perusall.com/	IT Tool	Tools that socialises the experience of reading academic articles
Teams	www.teams.microsoft.com	IT tool	online communication and collaboration platform
Wiseflow	https://europe.wiseflow.net/	IT tool	digital exam and assessment. platform
Moodle	www.moodle.org	LMS	learning platform
Blackboard	www.blackboard.com/en-eu	LMS	learning platform

Appendix D. Coding process

Data analysis followed the inductive approach recommended by Gioia et al. (2013) in three levels of coding. First, the authors read (or listened to) the interviews, the content of the forums, and institutional communication (mails and websites) in order to identify emerging themes (timings, tools, practices, reactions), which were also shared and compared to verify consistency (first order themes). Second, the authors who had carried the interviews re-analysed the data to find a certain level of alignment through the identification of recurring themes and grouped them based on similarities and differences (second order concepts). In the third round, we looked for time-event chains (Cunha & Carugati, 2018) where we identified classes of actions and reactions, tools used, and practices evolution over time. This allowed us to identify 5 phases characterising the reaction to the crisis where similar crisis management practices had been employed.
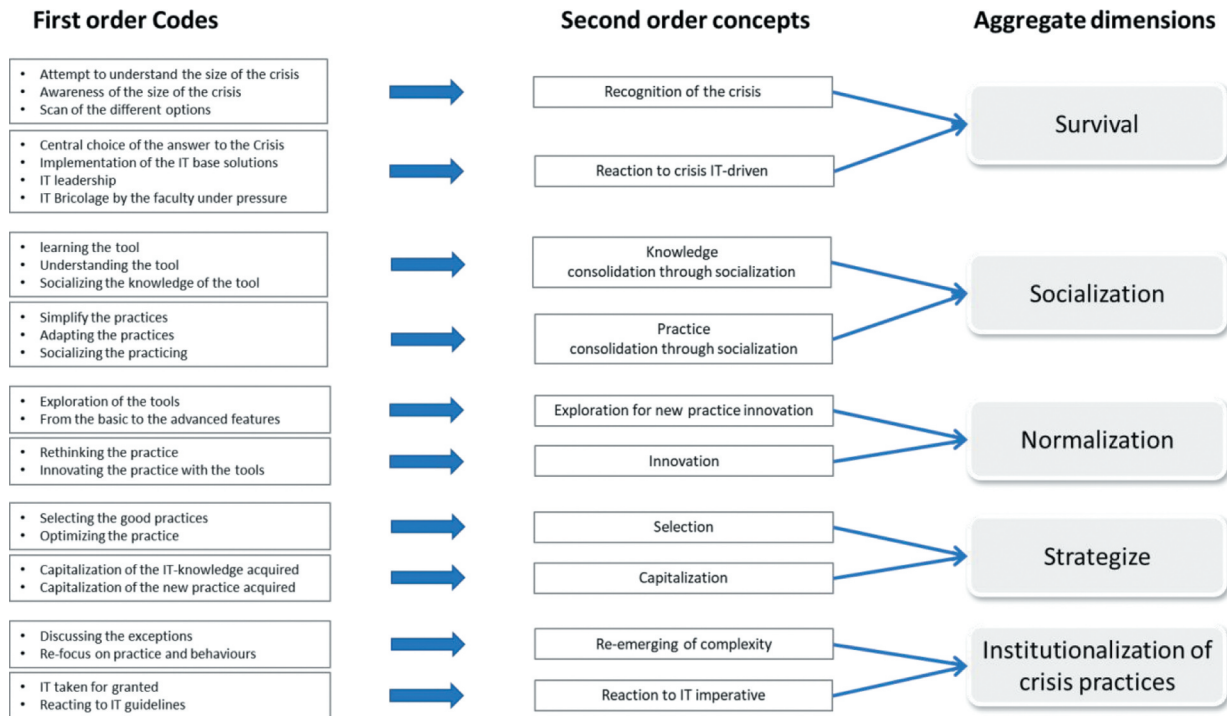

Figure A1. Coding structure.