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Alberto Zanutto
University of Macerata, alberto.zanutto@unimc.it

Diego Ponte
University of Trento, diego.ponte@unitn.it

Marco Zamarian
University of Trento, marco.zamarian@unitn.it

Irene Gabutti
Università Cattolica del Sacro Cuore, irene.gabutti@unicatt.it

Enrico Maria Piras
Fondazione Bruno Kessler, piras@fbk.eu

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When Pandemic Strikes Hard:
Digital Diversity Makes Difference

Alberto Zanutto[1][0000-0003-1062-1508], Diego Ponte[2][0000-0002-4133-9882], Marco Zamarian[3][0000-0003-4656-0727], Irene Gabutti[4][0000-0001-5968-8223] and Enrico Maria Piras[5][0000-0002-6115-0577]

[1] Department Economy and Law, University of Macerata, Italy, alberto.zanutto@unimc.it
[2] Department Economy and Management, University of Trento, Italy, diego.ponte@unitn.it
[3] Department Economy and Management, University of Trento, Italy, marco.zamarian@unitn.it
[4] Università Cattolica del Sacro Cuore, Roma, Italy, irene.gabutti@unicatt.it
[5] Fondazione Bruno Kessler, Trento, Italy, piras@fbk.eu

Abstract: The Covid-19 pandemic, whose effects on the forms of social organization are still far from being fully explored, has opened the door to forms of experimentation unprecedented in their speed and extent. The pandemic outbreak has required immediate responses from organizations that have drawn on both intentional and unintentional repertoires. In particular, the use of IT architectures was characterized by unintended responses that nevertheless allowed organizations to respond to the demands of health systems and bureaucracy to document population protection activities. The work we present here confirms that in the case studied, the benefits manifested themselves most clearly when organizations were able to be flexibility-by-deviation by drawing on infrastructural projects considered by ordinary management to be non-strategic until the arrival of the pandemic.

Keywords: telehealth; ICT; organizational change; telemonitoring.

1 Introduction

The Covid-19 pandemic, whose effects on the forms of social organization are still far from being fully explored, has opened the door to forms of experimentation unprecedented in their speed and extent. The daily lives of a substantial part of the world's population have been re-shaped by the need to keep workplaces and services functioning, while respecting the constraints imposed by social distancing. In this context, the continuity of social and work activities has been ensured by the massive recourse to pre-existing, mature and widely available, but largely underused technologies, such as teleconferencing or data coordination and sharing platforms [1, 2].

At the same time, however, the pandemic crisis created the need to respond to problems that, by their nature or intensity, were largely unprecedented. These problems were challenging for institutions in general, which were often inadequately prepared for the emergency, but also, more specifically, for information systems deputed to support new processes for coping with the emergency.

This work intends to propose a theoretically grounded reflection based on a case-study which is particularly interesting due to its theoretical insights.

The empirical case study is centered around the examination of the institutional response provided by the Local Health Authority of a Northern Italian Region to its citizens and its bureaucratic obligations during the pandemic. This response involved the overhaul of existing information systems during the lockdown period. Through this field of analysis, we have been able to elucidate how prior projects and the organization's approach evolved, drawing from ongoing experiments, and leveraging digital systems as a crucial tool to address the emergency.

The empirical case study clearly demonstrates the evolution of various processes over time, leading to the co-creation of an internal, multi-professional, intra-organizational network. This network collaborated to develop a COVID management system, utilizing elements from a peripheral computer environment alongside core systems of the health authority. This system was designed to fulfill the requirements stipulated by regional and national administrative authorities, enabling effective participation in pandemic management and addressing the inherent complexities involved.

2   Related work

As has already been argued in the literature, the management of complex systems, usually encapsulated under the umbrella of Business Process Management (BPM) studies, has been concerned with understanding how organizational management is often subject to external shocks [3]. COVID-19 is certainly one of these but also other shocks have appeared on the international scene such as the financial crisis, Brexit, trade wars, climate change disasters and so on. These works confirm that in order to closely understand what is happening in organizations, one must adopt a research design that explores the pathways developed by individual organizations and the relationship between BPM rationality and the micro choices within these processes that are driven by contexts [4, 5]. In these contexts, the literature confirms that shocks are often due to natural disasters and that attempts to mitigate their effects is the key point of BPM systems. Hence, the work is on the one hand to catalogue the complexity of these events [6], an activity that is, however, not easy to conduct for exogenous events that are not dependent on natural disasters, such as financial crises. The latter phenomena are not easily predictable and require a multiplicity of organizational transformations to deal with them [7, 8]. The BPM approach then developed various taxonomies to distinguish the different choices of organizations following shocks, such as the one proposed by de Bruin and Rosemann [9], who identify six key strategic elements: strategic alignment, governance, methods, information technology, people, and culture. These types of taxonomies invoke the idea of intentionality in organizational response, while some works have also attempted to emphasize non-intentional dimensions that have focused on the concepts 'process resilience' and 'agility' [10, 11]. In particular, the agility strand is concerned with relating pre-shock situations to choices made following shocks. It is also concerned with studying the elements of flexibility-by-deviation that help to better understand how organizations react quickly by deviating from the ordinary processes

adopted in the past. This analytical plan, from the perspective of the BPM, refers to a Cartesian plan where certain key elements are brought into dialogue with intentionality and non-intentionality [3: 673].

The experience we have explored with the shock generated by the COVID-19 pandemic has highlighted several unexpected challenges within healthcare systems around the world [12]. One of these challenges was the rapid and overwhelming surge in patient demand for healthcare services. The sudden influx of infected individuals placed immense strain on hospitals, clinics, and healthcare workers, leading to overcrowding, shortages of essential medical supplies, and increased waiting times. This unexpected surge highlighted the vulnerability of health systems and the need for robust contingency plans to effectively manage such crises [13]. Additionally, the severity and rapid transmission of the virus caught many health systems off guard, necessitating urgent adaptations in treatment protocols, infection control measures, and resource allocation. Our scope is to explore the unintentional answers put in place by the organization to identify how resilience processes and the ability to generate drift with respect to already activated BPM programs enabled them to easily respond to environmental stresses [14]. The work aims to discuss data from the observation of a single divisional healthcare organization in a Northern Italian Region. Within this organization, a coordination group was active during the pandemic, which, like all the units set up to deal with the emergency, did not know what it was and what it would generate in terms of organizational complexity. Awareness was fueled by an ecology of practices that developed among the individuals involved at both the local and governmental levels. Therefore, the typical dimensions of rationality and predictability were excluded from the field. With this paper we try to understand how the previous digital infrastructure and ongoing experiments fed into the system of responses and the relationship between organization. The aim is to understand if the IT infrastructure can be read as a hybridization of typical BPM processes.

3   Methodology

The aim of the empirical research was to capture the materiality, skills and meanings of an emergency situation that heavily influenced both organizational and information systems management [15]. We paid attention to how alongside this story a whole series of arrangements were crucial in enabling the organizational formation and adaptation of information systems. Our attention has remained on the organizational level and the level of practices adopted by professionals to cope with the pandemic situation and its heavy effects on the healthcare organization. The direct observation of these dynamics was approached partly with retrospective work based on the testimonies of the actors, and partly with work on websites, documents and published material. We adopted a qualitative research design according to the case study approach [16] and then used a grounded approach that allowed us to gather, from the narratives of the interviewees, useful elements for the identification of the set-ups at different moments in the development of the digitization of the department.

As envisaged by the methodological dynamics of grounded processes, the researchers worked independently to identify labels that could link the various narratives to highlight the processes at work. We worked in three phases. A first phase involved the generation of labels independently by the researchers, a second phase in which the labels were shared and combined based on the synthesis of the different sensitivities. Finally, the labels were reused in the third phase to bring them to saturation, reanalyzing the texts and eliminating those that did not apply.

In this contribute, in the selection of the interview extracts, we favored the narrative lines of the actors at the start of the project and along the chronological development of the pandemic. The retrospective qualitative research design allowed us to reconstruct the stages of the evolution of the health authority experience in the rearticulation of the organizational process during the pandemic. We focused on the start of the pandemic; on the birth of the coordination group and the progressive involvement of various organizational figures; on the relationship established between organizational changes and the composition of IT tools for process management. These areas provided the basis for the interviews. To this end, we involved the institutional stakeholders; the process initiators responsible for responding to the complexity generated; the referents for the school sector, the referents for the territorial medicine sector and the person responsible (product owner) for managing the information systems to be used in the pandemic emergency. A total of 10 interviews were conducted:

- 1 Former Director General Health Authority
- 1 Doctor on staff of the Health Authority Directorate General for COVID emergency management
- 1 The Director of the Prevention Department
- 1 Nurse, Central COVID Coordinator
- 2 Doctors, Head of Schools Sector of Central COVID
- 3 Physician, COVID Central COVID component
- 1 Head of Health Authority technological services software development and integration
- 1 Focus group with 5 people involved in Central COVID.

The research work was developed for about a year, from the end of 2022 through the first meetings with the management offices of the Health Authority and then by meeting the people involved in order to understand the narratives and practices that characterized the introduction of the various IT solutions. Subsequently, in Spring 2023, when these general evaluations were partly analyzed, we held a focus group with the same people interviewed, to discuss some dynamics of the processes observed.

The next section describes the results of the analysis. The results section will provide some extracts from relevant actors in the research field.

4   Findings: an unintentional story

The arrival of the pandemic in the Italian health context as in that of the whole world took everyone by surprise. It was a disruptive experience that put health systems, administrative systems, and the network for managing the complexities of population health to the test. The pandemic experience disrupted every possible expectation in many ways, including the magnitude of the event, the development of the different waves, the management of contamination or recovery certificates, and finally the cultural approach to the administrative choices made.

The context of the region considered here has experienced these complexities with some slight reduction in its size due on the one hand to the limited number of people managed by the regional administration, and on the other hand to the presence of a single health authority and management systems already available and well advanced in their development for the purpose of managing health pathways.

Three events, among others, are useful to indicate the thresholds that the pandemic required health and administrative organizations to cross. The first event concerns the difficulty of imagining waves following the first one characterized by drastic measures aimed at reducing the spread through lockdown; the second event concerns the magnitude of the contagions generated in the overall development of the pandemic; and the third event concerns the management of vaccines introduced about a year after the first cases of contagion developed.

The system we are trying to study and present here must therefore be considered both as an ordinary sequence of development and qualification of its functions habitually determined by the confrontation between developers and administrators of health and citizens' services, and as the outcome of this unpredictability determined by these three successive developments in the confrontation with reality.

As explained to us during the fieldwork phase, the first objective of the system was to compose:

"... two great souls: one part basically linked to the management of citizens and therefore to information towards people, towards GPs, towards sick people, towards contacts, towards institutions such as schools, but therefore with, let's say, a focus well centered on the territory, therefore on the population; another core, on the other hand, which has been in place from the outset and still survives today, is that linked to the reporting of the covid pandemic, with rules that have been practically established from the outset at national level, and which in fact have as their interlocutors the institutions, understood as the ministry, the civil protection, at national level, the higher institute of health, rather than the province at local level, and therefore a core, let's say, a little more of numbers and data and not so much of information and people." (Clinical Manager 1)

This duality can be observed, first of all, in the diversity of practices undertaken at the beginning of the pandemic in a scenario of total fragmentation and uncertainty. The main characterization is the use of information from an analogical point of view that reflected the idea of a temporary and exceptional situation because it was immediately

addressed with lockdown and thus a limited spread of contagion. The first framework for routing the different work routines was an emergency addressed in a parallel manner on the clinical profile of the patients and the administrative reporting of the clinical and epidemiological dimensions of the phenomenon. Following this initial bewilderment, an attempt was made to stabilize the work processes by responding first and foremost through the hospitals and the information they provided for the clinical sphere, while on the other hand, a permanent working group had to be organized to provide the information at regional and national level capable of returning the map of the spread of the pandemic from an administrative point of view.

This phase was characterized above all by the need to intercept new positives to the virus and to set up a small system that would also administratively certify that they had been cured. However, the idea was that we had passed the critical phase and were able to manage an ordinariness that, thanks to the Summer of 2021, suggested the idea of a circumscribable phenomenon.

"At the time, the perspective was that nothing would happen in September and that the reduction in cases would be definitive, so we tried to work on setting up a system, but somehow trying to work on two levels, this means that the first was to respond to the minimum needs that covid could have in such a way that if that tool could not be used for covid due to lack of need, it could then be reused for other contexts." (Clinical Manager 1)

In addition to the complexities of such management involving a plurality of clinical and administrative subjects, including law enforcement agencies, it became clear from the outset that pandemic contamination required interfacing with the uniqueness of each citizen, so that the specific conditions of subjects with respect to being infected, monitored, located in certain territories, and reported to law enforcement agencies during quarantine could be immediately clarified through digital systems. Initially, this type of digitization involved the use of simple Excel sheets.

The second pandemic phase arrived in the Autumn of 2020 with a management structure for information flows and treatment pathways that was in fact unprepared to handle such large numbers as those generated by that wave. The first phase was insufficient to cope with the new flows. In those months, the most complicated element was the time that could elapse between the reporting of positives and the taking in of subjects and proximity networks to have both the clinical routing of people and the timely documentation of the spread of the phenomenon.

"The positive citizens were terrified, they didn't know what to do, they also needed practical indications regarding home isolation to be kept from their families, so at that point the situation very quickly degenerated and the cases also increased exponentially with an unpredictable speed. At that point, we sort of agreed on the need to start working on some automatisms, simplifying the rules that had come out in the meantime, and therefore on the fact that two swabs at a distance of at least 48 hours were no longer necessary." (Clinical Manager 1)

This second phase put a lot of pressure on all the working groups, which at the time were decidedly undersized and struggling with inadequate tools. The complexity was increased during this period by a new element of complexity, this means the legislative regulations issued by the national government that introduced new elements all the time. The "Legislative Decrees of the President of the Council of Ministers" (DPCM) were continually oriented towards making specific choices consistent with scientific and clinical evidence, but also aimed at adapting national rules to the choices made by the European Commission. This set of norms had finally to find synthesis in the health policy choices that are the responsibility of the regions. This situation generated a context of great uncertainty and confusion in the flow of information that heavily characterized the entire social management of the pandemic and made it decidedly complex for citizens to understand how to move in compliance with the rules in force when they became infected. This complexity was obviously amplified by problematic phenomena and labels such as the concept of 'outbreak' or 'class quarantine' in which the profiling work involved removing all classmates from school if they were diagnosed as positive.

"At that point what happened... what happened was that as we got up to speed, we tried to provide the citizen with all the information that basically could prevent him from anxiously waiting for the call from the covid center." (Clinical Manager 1)

From this point onwards, the third phase of pandemic management began, which allowed for the management of vaccines and related certifications, always using the individual citizen as the unit of analysis. For each one, automated procedures were put in place to manage the time required for the various fulfilments in the case of testing positive, coming into contact with positives, or in the case of a person vaccinated in the various rounds.

In this third phase, regulatory management was particularly complex because over time the combination of the vaccines released in the different rounds, the severity of the covid variants, and the management complexity itself, meant that there were frequent variations in the management of timeframes and quarantines, with a certain complexity due to the vaccination certificates defined as green passes at the European level.

"If we really wanted to be precise, [the organizational work put in place] should have three souls: two territorial souls, one in charge of the prevention department for the management of cases, contacts with schools, mayoral orders, and one linked to the home management of covid-positive patients.
The third core, which instead (...) remains that of reporting the COVID data, and therefore, if you wish, there is also this very structured core, which in itself was not developed, it was only connected to the COVID management system, because in fact it already existed, it was already the fulcrum on which the development of the COVID management system was based." (Central Covid Coordinator)

4.1   Software arrangements in the shadow

The complexities just described are entirely reverberated in the narratives collected from the operators involved in what was called covid central and established during the

summer of 2020. At that time, after the first wave and the lockdown of spring 2020, people began to become aware of the complexities associated with the pandemic and the importance of beginning to set up a more solid articulation, with adequate software support, of the management of positive persons and the consequences of this from a therapeutic point of view and of contamination with other subjects.

In fact, some small initiatives had already been taken during the lockdown to document the flow of positives and to build up the databases that were needed to document the scale of contamination recorded in the region. These initial attempts, which were managed in a totally isolated manner, were in fact represented by automated Excel spreadsheets that were to enable operators to report on daily trends and certain information related to the contaminated individuals. The recipients of this data were both the local offices of the various administrations and the national offices responsible for monitoring the pandemic. On the sidelines of these initiatives, a proper management system was slowly but quickly devised for this type of activity, precisely because of the complexity of the management resulting from each individual contamination.

"The COVID management system was created in the first instance to keep the pandemic under control, monitored, and on the other hand to contain it through contact tracing. It was created precisely for this reason, we used to register cases on the platform and, through epidemiological investigations carried out by our colleagues in Prevention, we would call the positive case at home, investigate its state of health (i.e., symptoms, cough, fever, etc.) and we would identify those who were in close contact, that is, the people who had had contact with these people in the last 48 hours, because they were then placed in isolation." (IT Division Manager)

As the flows gradually changed in the autumn of 2020, there had to be a very onerous reorganization both organizationally and technologically to cope with the second wave. As noted in the previous section, this type of activity was also strongly characterized by government regulations that gradually changed the rules with respect to inter-regional or inter-municipal mobility as well as quarantine and contact obligations. It should be remembered that at this time a number of national initiatives were also launched with the task of supporting the monitoring of contaminated persons who later found success in the IMMUNI app, which, however, from the outset seemed inadequate to support the complex diversity of organizations adopted by the regions and the specific complexity of the information systems on which the health work of monitoring contaminated persons and any contacts they had had in the days of the outbreak of the disease depended at local level. Another important source of these flows was the performance of diagnostic tests, which on the one hand had to be processed at the level of the healthcare facility, and on the other hand progressively provided for a systematization of the flows in order to build around the contaminated persons an information network suitable for managing quarantine and possibly the passage through inpatient and home care. After the very first artisanal phase, it was realized that the question of software would become strategic, as would the attempt to digitize all the processes concerning the pandemic. With the increase in numbers, it was important, for example, to have certain user IDs in order to be able to initiate all the consequent administrative

and health procedures with maximum security. The first response was to retrieve what was already available from the software used by the Health Authority:

"We were lucky enough to have an agile development platform in house on which we were developing the home care information system, and so this platform was an enabler, a rapid development even of the information system to support the management of the pandemic, which, being a totally new thing even for us in health care, was subject to constant change. A continuous collection of requirements that had to be implemented with an absurd speed from one day to the next: already the day after the requirement of the day before was old, it was a race and had we not had a platform of this type in house and had we had to go to Java rather than to development environments where you also have to do code conversion and whatnot, we would not have managed to maintain this speed." (IT division manager)

This work was also accompanied by a series of organizational choices that made it possible to identify the responsibilities put in place to deal with the pandemic emergency point in particular on the information technology side for everything that needed to be adopted in terms of interrelation between software or the acquisition of applications from outside, and an internal 'product owner' was identified who was as competent as possible on the information technology equipment already available. The first choice adopted by this manager was to identify the home care platform as the most suitable IT support to manage the reports of positives detected in the territories. This software was put in a position to interact with the registry, the laboratory that processed the swabs, with the citizen's medical record (portal patient), with the connected app that was invaluable at the beginning because it allowed direct access to individual citizens, with the Health Authority's website, with the schools' information system, with the single booking center (CUP), with the flows towards the Ministry, with the flows towards the GPC (Green Pass Certificate) system and the company's repository of reports.

Integration with these systems proved to be the most complex challenge due to the continuous effects that the regulatory plan, linked to the prophylaxis plan, required in the management of citizens affected by the virus. Many elements of complexity arose because of the different nature of ownership that these systems had and the effects that each adjustment could generate in the day-to-day management of flows:

"You have to take into account that everything that is reported in the repository arrives in the file to the general practitioner, so when we want even now to communicate to a doctor the taking in charge of a patient at home, we don't invent an integration with his file software, we know that if we put that information there in the repository, it automatically goes to the doctor. Knowing a little bit about this ecosystem of products and how they talk to each other, we try to convey data, information and documents on already existing channels, this means we exploit the channels we have already built in the past years." (IT Division Manager)

The contact person for the construction of the covid management software, which was then in essence an interaction software with a whole series of services taken as needed

from different software, tried to keep track of all these variations and the complexities that had to be addressed in order to include them in new information processes.

From figure 1, we can get an idea of how many changes this process required. All the post-it notes in the figure remember these variations and yet do not sufficiently communicate how much complexity, pressure and tension the team was experiencing in those days. This pressure and urgency that each of these variations brought to the work team strained their ability to respond to requests.

One of the complexities, perhaps the most significant, was that of establishing a working method capable of not envisaging the classic 'requirement-development-verification' flow, but of relying on a methodology that was fortunately already in use in the IT departments, defined as Agile, which allowed an initial solution to be provided in a very short time and then, in the days following its release, to activate a series of processes that would make it increasingly efficient in the light of the problems that emerged.

Fig. 1. The sequence of software changes required for the management system in 2021 and 2022

The Agile method was therefore a system that was not always efficient but tended to always be effective in providing the necessary answers in a short timeframe to covid management software design requests. A nice metaphor picked up from the narrative offered by the 'product owner' illustrates this kind of dynamic well:

"So the agile person says: you have to go to Milan and you're in Trento, I can give you the bicycle by this evening; you go to Milan with the bicycle and I, who am not a cyclist, will take three days; in a week's time I'll give you the electric bicycle and so maybe instead of taking three days to go to Milan I'll take one; in 20 days I'll give you the motorbike and so it will take even less time but I'll give you a usable product immediately, this means that we didn't wait to give the COVID center a tool, we gave them what we had immediately." (IT Division Manager)

This organization of work from the point of view of the preparation of the COVID management system did not solve all the problematic dynamics of that period due to a whole series of problems, both organizational and technical, which were nevertheless addressed each time with the idea of proposing the quickest solution in terms of time given the complexities involved. The flows during the autumn, as everyone remembers, were far higher and more massive than any forecast or observed in the spring. In that context, all the healthcare organizations involved were completely overwhelmed by requests for information and answers, and all the original ideas of flow management became particularly complex and difficult. This also affected the automation processes that had to be ensured between the different systems due to the large number of swabs to be processed each day, which in the most intense phases exceeded even 10,000 records. It was thus impossible to provide linearity and processes, but it was equally difficult to harmonize the organizational needs that required the information systems to produce their results within the required timeframe. On all this flux, of course, weighed each and every regulation issued by the local national governments and in interaction with the regulations that were then gradually pointed at the European level with the introduction of the GPC.

"We couldn't keep up with a dynamic flow, so we decided on this approach at the beginning with the central office, and then we realized that if we imported them at 5 o'clock (increase today's rule, increase tomorrow's rule, 5 types of antigens, "n" types of salivary, "n" types of molecular, also covers vaccinations, green pass, etc.) we couldn't keep up any longer." (IT division manager)

In extreme situations, the operators who were called upon to build the management system had to make choices at the limit because otherwise they would not have been able to respond to the requests for information useful for processing the stages following the verification of a positive finding following a swab. At a certain point overwhelmed by a mountain of swabs to be processed and the bureaucratic necessity for these swabs to be eh signed by the head of the laboratory service, which however is a procedure that is not relevant to the content, it was decided to take the data directly once it was made available by the laboratory management before it was even signed by the manager in charge.

"It is that maybe in the repository [of the hospital management system] the signed and validated document comes in; maybe from the swabs we used to take them even before they were reported because the report of a swab made by the laboratory is a formal act not a substantial one. We used to take many swabs even if they were not reported, before the doctor signed them. [This was fundamental because] to the flow of swabs you anchor all the healing algorithms, new positive, I have to isolate you/not isolate you, you are positive but I don't have to contemplate you and a whole series of things.... [so] operators can start working after 9 o'clock'." (IT division manager)

5   Discussion: organizational choices and digitalization

The work developed by health workers involved in local authority responses to the spread of the pandemic highlights a non-linear time development. Like many other situations, events are not predictable by organizations but, more importantly, our experience confirm that organizations fail to respond to the emergency when it arises. This may be due to a number of factors such as specific unpreparedness on certain issues, difficulty in understanding how to distribute roles of responsibility to intervene, the communication challenges that every emergency brings and finally the limited resources available [17].

In particular, the narratives collected confirm that resilience processes are activated in a disjointed manner and none of the stakeholders have a stable picture of the scenario. As pointed out in the BPM literature during the shock phase, organizations develop process agility to mitigate the effects of the shock and the conditions are created for the recovery of the generated problems. As pointed out by Röglinger and colleagues (see Table 1), the process is broadly identifiable as a process drift in the initial stages. The exogenous shock led to the "destruction" of existing processes in the local health authority [3].

Table 1. Exemplary types of process change [3, 673]

	Intentional	Unintentional
Incremental	Continuous process improvement	Process agility; flexibility-by-deviation
Radical	Process reengineering, process innovation	Exogenous shock, process disruption

Here, our interest was more focused on the unintentional choices that made it possible to recover the infrastructure on which the organization had never considered strategic. On the contrary, the continuous reference to this software confirmed that in the pandemic the unit of analysis is people and their relationships with relatives and the territory and not the pathologies. Usually, the healthcare organization aims to classify its patients and its services on the basis of pathologies. This definitional scheme turned out to be useless in the case of the pandemic because the aim was from the outset to identify

the infected patients and the relationships, they had in the contexts in which they became infected.

According with to Röglinger et colleagues [3] we identified three phases of this movement: working blind; walking on a tightrope and finally working on the new normal (Table 2). The first aspect recalls when, not knowing the problem, any response as long as it can be produced may be sufficient. This is the immediate effect of the exogenous shock, which leads to lockdown and suspension of all activity. Our field of observation revealed that the expectations were all about the short term and 'return to normal', which could not happen given the severity of the phenomenon.

A second moment is identified with the more serious complexities that have been faced in which the initial inadequacy gradually gives way to a series of initiatives, increasingly articulate and competent. These activities were capable of pointing the way for the construction of the answers to bring to synthesis situations that are very complex in terms of resources, operational constraints and the resulting bureaucracy. It is, however, a job in which the people involved, especially those with leadership and management roles in the operational centers, work under great pressure and it is as if they were always on a razor's edge in which risks are perpetually taken and choices are made with very little ability to control all the variables present.

Our field of observation has shown how, in this phase, every support became useful in facing the emergency and the choices made put a non-strategic infrastructure back at the center, but one that had the patient and the services built around her/him at its center. In this way it was possible to make the process totally digital despite the complexity of the actions to be performed and the health and bureaucratic urgencies identified. The approach of Hinings and colleagues [18] on digital transformation in healthcare is useful in this regard. These changes have been possible because through non-mainstream organizational trajectories, an infrastructure, designed for citizens, has been developed over the past ten years that is particularly fit for purpose. This arrangement has been very valuable in providing an infrastructure-supported response to Covid-19.

A third phase, finally, highlights how turning off the spotlight on acute phases triggers a mechanism of oblivion that no longer makes several expertise resources accessible, even though IT solutions continue to be de facto accessible and usable. This aspect is what most challenged the authors. Despite a growing reading on resilience issues, which should draw on a number of organizational learnings, the observed field does not emphasize this aspect. Several months after the acute phase, every strategy adopted is progressively abandoned and even digital transformations are no longer nurtured for two reasons. On the one hand, there is the interest in returning to pathways of normality, in which the healthcare structure and its pathology approach is central. On the other hand, there is the attempt to bring organizational power back into the typical arenas of confrontation such as boards or co-ordinations between middle management.

Even the heavy investment in engaging GPs has now been abandoned in favor of returning to the usual dialectic where the relationship is rendered inefficient due to the private nature of the engagement.

However, even in this case, the central database already connected to their software daily made it possible to monitor the pathways of individual patients in detail. There was then a whole section of information management from the point of view of security

and administrative bureaucracy that was able to benefit from these systems and that, thanks to the interoperability put in place by the IT services of the Health Authority, was able to manage an enormous amount of information data that had to be conveyed from time to time to the police forces, the ministerial offices, and the National Institute of Health.

Table 2. The three phases of development of pandemic responses

	First phase: working blind	Second phase: walking a tightrope	Third phase: working on new normality
Coordination	No coordination only increasing pressure	Construction of the Central Covid Group	Concern about managing the new normal
Leadership	Confidence of temporariness	Uncertainty on all aspects: clinical, social and bureaucratic	Investment in skills
IT tools	Handcrafted	Tinkering	Tools in the shadow
Building blocks	Retail software	Unexpected hidden tools and re-engineering	Tools in the shadow ready to connect
Narratives	Strong limited event	Strong and unmanageable pandemic	Waiting for an uncertain future
Visibility	Hidden work	Very intensive and visible work	Back in the shadow

An important element of complexity who played a strategic role in the management of the pandemic and the territorial dislocation of the services was the territorial control. Historically, the Health Authority had invested mainly in hospital software with almost no connection with territorial levels, as we have seen in the case of general practitioners and pediatricians. But these limitations also affect other sectors such as home services, elderly houses, pharmacies, schools and so on. All of these sectors have proprietary software that had to be linked with the hospital system built under the responsibility of the central covid and this required a continuous investment in the diversity that this software presented and which was a fundamental resource for managing the pandemic complexity. In other words, this case seems to clearly demonstrate that myopia in the management of centralized software for treatment activities are extremely fallacious when infectious diseases such as COVID-19 reach the territories and require decentralized management of diagnosis and treatment. The stories collected indicate that the workaround put in place by IT services can overcome many limitations imposed by this diversity like composing a kind of efficient mosaic for the management of complexities as important as the pandemic.

At the same time, the work challenges the conception of the 'new normal' where intentional choices manage to integrate and utilize the arrangements put in place during the pandemic. Rather, traditional bureaucratic power networks slowly resume operating according to the old patterns. The knowledge of the operators is divergent, but the end of the pandemic causes the emergency coordination centers to close down, and you are left with very little. Even the digital infrastructures revert to their old uses without any

further possibility of acceleration that favors new strategic positioning. The observed reality seems to indicate that the trajectories in the health sector are not linear or even incremental. The power structures and stakeholders, once the critical phase of urgency is over, which allows the dissolution of pre-existing organizational constraints, must return to the original 'political' arena where the 'politics of objects and the politics of humans return to count in traditional ways [19].

6   Conclusions

The observed field seems particularly significant when compared with more linear readings on the development of IT systems that see only in the poverty of resources the limits of the Italian case [20]. Rather, this work confirms that organizations often act in an unintentional manner, especially in the presence of exogenous shocks that may block traditional ways of working.

Historically, the response of systems is to centralize infrastructures thanks to the technological development of IT services, but at the same time shocks do not seem to be able to bring real innovation in the short term. Values and technologies find their way into working practices that are, however, driven by the power patterns of organizational governance. Centralization may be the best answer if there are no contingencies in the management of information flows [21]. At the same time, with disruptive situations such as the pandemic, and the consequent development of unintentional actions, peripheral infrastructures and areas of commitment that have been disused by the organization come into play. During the pandemic the center of gravity shifted to the territory and unfortunately no governance would have been able to deal with those complexities if there had not been a diversity of IT investments that in this case had built territorial user identification strategies that proved to be strategic.

However, when the response of resilience processes was articulated, the best resource was found in the presence of non-mainstream 'accessory' projects [22, 23]. From this work emerges an exhortation not to forget this contribution brought by peripheral projects that can become strategic in the face of unforeseen shocks.

References

1. Trondal, J., Pinheiro, R., Keast, R., & Noble, D.: Governing complexity in times of turbulence. In Governing Complexity in Times of Turbulence, 2-12. Edward Elgar Publishing (2022).
2. Wolbers, J., Boersma, K., Groenewegen, P.: Introducing a fragmentation perspective on coordination in crisis management. Organization Studies, 39, 11: 1521-1546, (2018).
3. Röglinger, M., Plattfaut, R., Borghoff, V., Kerpedzhiev, G., Becker, J., Beverungen, D., vom Brocke, J., Van Looy, A., del-Río-Ortega, A., Rinderle-Ma, S., Rosemann, M., Santoro, F. M., & Trkman, P.: Exogenous Shocks and Business Process Management. Business & Information Systems Engineering, 64(5), 669–687 (2022).
4. König, U. M., Linhart, A., Röglinger, M.: Why do business processes deviate? Results from a Delphi study. Business Research, 12, 425-453 (2019).

5. Pentland, B. T., Liu, P., Kremser, W., Hærem, T.: The Dynamics of Drift in Digitized Processes. MIS quarterly, 44(1), (2020).
6. Björck, A.: Crisis typologies revisited: An interdisciplinary approach. Central European Business Review, 5(3), 25-37 (2016).
7. Trkman, P., McCormack, K.: Supply chain risk in turbulent environments—A conceptual model for managing supply chain network risk. International Journal of Production Economics, 119(2), 247-258 (2009).
8. Li, S., Tallman, S.: MNC strategies, exogenous shocks, and performance outcomes. Strategic Management Journal, 32(10), 1119-1127 (2011).
9. de Bruin, T., Rosemann, M.: Using the Delphi Technique to Identify BPM Capability Areas. ACIS 2007 Proceedings. 42 (2007).
10. Chen, Y., Wang, Y., Nevo, S., Jin, J., Wang, L., Chow, W. S.: IT capability and organizational performance: the roles of business process agility and environmental factors. European Journal of Information Systems, 23(3), 326-342 (2014).
11. Rosemann, M.: Explorative Process Design Patterns. In D. Fahland, C. Ghidini, J. Becker, & M. Dumas (Eds.), Business Process Management (pp. 349–367), Springer International Publishing (2020).
12. Remuzzi A, Remuzzi G.: COVID-19 and Italy: what next? 395(10231):1225-1228. The Lancet (2020).
13. Ting, D. S. W., Carin, L., Dzau, V., Wong, T. Y.: Digital technology and COVID-19. Nature medicine, 26(4), 459-461 (2020).
14. Haldane, V., De Foo, C., Abdalla, S. M., Jung, A. S., Tan, M., Wu, S., Legido-Quigley, H.: Health systems resilience in managing the COVID-19 pandemic: lessons from 28 countries. Nature Medicine, 27(6), 964-980 (2021).
15. Blue, S., Shove, E., Carmona, C., and Kelly, M. P.: Theories of Practice and Public Health: Understanding (Un)Healthy Practices. Critical Public Health 26, no. 1 (1 January 2016): 36–50 (2016).
16. Bryman, A.: Social Research Methods, 4th Edition (4th edition). Oxford University Press (2012).
17. Canton, L. G.: Emergency management: Concepts and strategies for effective programs. John Wiley & Sons (2019).
18. Hinings, B., Gegenhuber, T., Greenwood, R.: Digital Innovation and Transformation: An Institutional Perspective. Inf. Organ. (2018).
19. Latour, B.: Politics of nature: How to bring the sciences into democracy. Harvard University Press (2004).
20. Paterlini, M.: On the front lines of coronavirus: the Italian response to covid-19. Bmj, 368 (2020).
21. Eccher, C., Gios, L., Zanutto, A., Bizzarri, G., Conforti, D., Forti, S.: TreC Platform. An Integrated and Evolving Care Model for Patients' Empowerment and Data Repository. Journal of Biomedical Informatics 102 (2020).
22. Lengnick-Hall, C. A., Beck, T. E., Lengnick-Hall, M. L.: Developing a capacity for organizational resilience through strategic human resource management. Human resource management review, 21(3), 243-255 (2011).
23. Kruk, M. E., Myers, M., Varpilah, S. T., Dahn, B. T.: What is a resilient health system? Lessons from Ebola. Lancet 385, 1910–1912 (2015).