

On the dynamic interplay between formal and informal coordination mechanisms: evidence from three telemedicine services in Italy

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Abstract

Although the first telemedicine practices may be traced back to decades ago, their real potential has been recognized only recently. As the pandemic has abated, the implementation of telemedicine has shed light on many managerial implications, which are crucial for its optimal deployment. In particular, the rise telemedicine requires a radical rethinking of coordination mechanisms among healthcare professionals. This study aims at contributing to our understanding on the interrelationships between formal and informal coordination mechanisms, particularly how they work together in the deployment of telemedicine services. From a theoretical viewpoint, the significance of telemedicine lies in its capacity to embody the sociomaterial entanglement of technology and service, thus serving as peculiar case for understanding coordination. From a practical perspective, understanding how coordination mechanisms unfold in telemedicine services is of paramount importance for their effective design. Through a multiple case study, empirical evidence is provided supporting the dynamic relationships between formal and informal coordination mechanisms in telemedicine services.

Keywords: coordination, organization, telemedicine, healthcare

Introduction

Although the first telemedicine practices may be traced back to decades ago (Hjelm & Julius, 2005), their real potential has been recognized only in recent years. The Covid-19 pandemic acted as catalyst for the awareness and diffusion of telemedicine, which, during lockdown, had essentially become the only possible manner to provide non-urgent medical services (Lukas et al., 2020).

This unprecedented awareness on telemedicine has led to the introduction of related policies and investments, addressing issues such as public reimbursement, data privacy, infrastructures, etc. (Bokolo, 2021).

As the pandemic has abated, the implementation of telemedicine has shed light on many managerial implications, which are crucial for its optimal deployment. The complexity of integrating telemedicine within current practice is linked to the extension of the concept itself. In fact, telemedicine has been defined as the *provision of health services at distance*¹, which intrinsically encompasses its sociomaterial nature (Khodadad-Saryazdi, 2021). In particular, this “dual” nature has been shown to peculiarly affect the organization of work (Barlow, 2015; Khodadad-Saryazdi, 2021; Nicolini, 2006, 2007). Nicolini (2006) discusses how telemedicine affects *coordination*, through task shifting in the form of delegation of medical work towards non-medical roles (e.g. nurses) and affecting the “geography of care delivery”. Moreover, as argued by Georgiou et al., (2011), “one of the most challenging features of e-health systems is the effect they have on the temporal landscape (ie, how time is conceived, structured and organised) and the impact this may have on the prioritisation, allocation, synchronisation and *coordination of work*”.

Coordination in healthcare settings is typically complex, as it involves different types of professionals (e.g. doctors, nurses, etc) working on knowledge intensive procedures (D’Amour et al., 2008). Within telemedicine services, coordination causes a shift in both spatial and temporal dimensions, as they must be performed remotely, mediated through digital technologies and both synchronously and asynchronously.

Previous literature has discussed the significance of both formal and informal mechanisms in organizational coordination (see, for example, Lawrence & Lorsch, 1967; Mintzberg, 1979). The interplay between these formal and informal elements is where our study lies: this particular focus is due to the opportunity offered by the specific empirical context under investigation. The advent of the pandemic created a peculiar situation of “crisis” in which health professionals sought to continue their activities using the practical arrangements that were available to them at the time (Kapucu, 2006; Waugh Jr. & Streib, 2006). Consequently, policymakers’ and managers increased awareness started a process of systematization and definition of formal coordination mechanisms (Zucker, 1987), especially for chronic patients’ care.

Given these premises, this study aims at contributing to our understanding on the interrelationships between formal and informal coordination mechanisms, particularly how they work together in the overall process of coordination. Specifically, this objective is investigated within Italian telemedicine services.

¹ Available at: <https://apps.who.int/iris/handle/10665/357828>

From a theoretical viewpoint, the significance of telemedicine lies in its capacity to embody the sociomaterial entanglement of technology and service (Orlikowski, 2007), thus serving as peculiar case for understanding coordination. However, this potential has not been fully explored, with respect to studies related to other technological domains in healthcare settings (see, for example, Sergeeva et al., 2020).

From a practical perspective, understanding how coordination mechanisms unfold within telemedicine services is of paramount importance for their effective design. This is particularly significant given the growing prevalence of telemedicine services in various national healthcare systems. The Italian NHS, for instance, is working to redefine coordination mechanisms among healthcare professionals – including specialist doctors, general practitioners (GPs), and nurses – both within and across organizations, with the aim to provide care as near as possible to patients' homes, recurring to telemedicine services. In this regard, the responsibility of ensuring coordination also falls on new and specific roles and organizations established by new policies². To that end, policymakers explicitly stated that it is essential for healthcare providers offering telemedicine services to work toward “process and organizational convergence”.

An overview on the main relevant issues concerning the empirical setting is hereby provided and the main theoretical issues are discussed. As our understanding related to the objective of the study is limited, a multiple case study methodology was adopted to gather data from the actors involved in the phenomenon under investigation (Gioia et al., 2013) “within its real-life context” (Yin, 2013). Results are presented and discussed, along with conclusions and limitations of the study.

Background

2.1 Telemedicine

One of the currently most acknowledged definitions of telemedicine is provided by the World Health Organization, which delineates it as the *provision of health services at a distance*³. The key feature of telemedicine consists in the physical distance between the actors involved within the telemedicine service, which is typically enabled by digital technologies.

Although the very definition of telemedicine is debated, the taxonomy proposed by Bashshur et al. (2011) clarifies a set of issues that are relevant for this research. The taxonomy is based on three intersectional dimensions: technology (synchronicity, network and connectivity),

² More information available at: <https://www.quotidianosanita.it/allegati/allegato1655970392.pdf>

³ Available at: <https://apps.who.int/iris/handle/10665/357828>

functionality (diagnosis, consulting, monitoring and mentoring) and applications (treatment, specialty, disease and site).

The authors wished for the recurrence to a coherent and unified taxonomy not only for scholars, but also for practitioners and policymakers. This taxonomy is in fact still far from being achieved (Harst et al., 2022), as it can also be noticed by different definitions given to specific telemedicine services among international policies (Edmunds et al., 2017). However, the proposed taxonomy conceptually shows the multi-faced structure of telemedicine, which can be intrinsically considered as a set of technologies, functionalities and applications integrating traditional healthcare service delivery (Bashshur et al., 2011). In other terms, telemedicine can be meant as an “integrated system of healthcare delivery” , both in presence and at distance, through the deployment of digital technologies (Bashshur, 1995).

Therefore, telemedicine comprises a plethora of different specific typologies of services, such as teleconsultation and telemonitoring. Practical definitions of different common types of telemedicine services are provided in Annex 2 (Glossary).

Although telemedicine has become pivotal in the policy and practitioner debate only recently, due to the Covid-19 pandemic (Wosik et al., 2020), it has been discussed in the scientific debate for decades. Benefits deriving from the implementation of telemedicine services have been described in terms of: i) equity and accessibility: providing care from remote can contribute to assisting patients from rural or remote areas who would typically not have access to specialist care (Kolluri et al., 2022); ii) cost-effectiveness, due to savings in travels and infrastructure use (Wade et al., 2010); iii) quality of care and patient experience, enabling continuous patient care during the pandemic, reducing patient wait times, and increasing patient engagement (Bashshur et al., 2020).

2.2 Coordination mechanisms

The concepts of coordination and coordination mechanisms⁴ have been discussed for decades, resulting in a “messy theoretical picture” (Okhuysen & Bechky, 2009).

Scholars of the first 20th century such as Weber (1922) based their understanding of coordination on formalization, according to the bureaucratic model. In his work, Fayol (1949) elaborated on formal coordination mechanisms as one of the main functions of management. However, Mayo (1933) highlighted that informal mechanisms have a substantial role in

⁴ Coordination mechanisms can be meant as “the most basic elements of structure” (Mintzberg, 1993), enabling for the organizational arrangements that allow individuals to realize a collective performance through coordination.

understanding organizations. Contingency scholars considered adaptive alignment of formal and informal coordination mechanisms with respect to the organizational context (Lawrence & Lorsch, 1967). Mintzberg's work on organizational structure (Mintzberg, 1979) extended this view, proposing that organizations are composed of not just formally defined hierarchies, but also, for instance, "professional bureaucracies" (notably, as it is typically the case of healthcare organizations).

Recent multidisciplinary approaches interpret coordination as a "natural" phenomenon, rather than the "solution to a problem", stemming from the mere fact that organizational agents *must* in fact coordinate. From the latter vision, coordination may be meant as "the integration of organizational work under conditions of task interdependence and uncertainty" (Faraj & Xiao, 2006). Approaches considering organizational "social networks" have become increasingly popular in the last decades, emphasizing relationships among actors and informal coordination rather than the formal definition of organizational structures (Kilduff & Brass, 2010).

Current research has pointed out the relevance of formal structure, which it may not be meant as holding a mere symbolic role. For example, Puranam (2018) considers informal structure as "divergence" from formal structure, but not independent: "Informal structure can be seen as a "correlated error term" in the regression of realized on formal structure. Put differently, the data generation process is one where realized structure is the result of the formal structure and the informal structure (which is itself partly a function of the formal structure)." (Puranam, 2018). McEvily et al. (2014) discussed the interactions between formal and informal elements in organizations, stemming from the configuration of the historical debate on the matter, which has ultimately resulted in a form of "theoretical dualism" on organizational structures. As organizations are characterized by patterns of interaction, the formal and informal aspects are inevitably intertwined elements that contribute to explain organizational functioning. The authors go beyond arguing that it is for our understanding it is not sufficient to consider these interdependences, but also to articulate "the logic by which formal and informal elements are co-organized and co-determinant of outcomes" (Soda & Zaheer, 2012). Finally, McEvily et al. (2014) identify a set of scenarios by which formal organization and informal social structure may affect organizational outcomes, resulting in different "logics" (namely, supplementary logic, augmentative logic, excessive logic, inversive logic, subversive logic). For instance, the *supplementary logic* occurs when formal and informal elements are combined such that one basis of interaction compensates for the other. For example, Tortoriello et al. (2012) showed that informal social networks can hamper the barriers to knowledge acquisition across different formal organizational boundaries.

In linking together these perspectives of formality and informality, specifically concerning coordination mechanisms in organizations, empirical evidence is still needed – specially to deepen our understanding on their intertwining (McEvily et al., 2014). Or research contributes in addressing “the conditions under which formal and informal elements interact [and] the conditions under which certain forms of interaction occur” (McEvily et al., 2014), with respect to coordination mechanisms (as organizational structures) within telemedicine services.

Materials and methods

To address the research question, a multiple case study methodology was employed, focusing on coordination mechanisms in telemedicine services as units of analysis.

Following the recommendations for multiple case study theory building (Eisenhardt 1989; Eisenhardt and Graebner 2007), within- and cross-case analyses were performed (Yin, 2013). The analysis was guided by an abductive logic (Tavory & Timmermans, 2014), continuously engaging between data and theory and allowing for the emergence of unforeseen elements (Dubois & Gadde, 2002).

In Italy, telemedicine has been central in the process of reform of the Italian National Health System (NHS), mainly through the National Recovery and Resilience Plan⁵. This ongoing process of transformation makes this specific empirical setting relevant for the purposes of this research.

Cases were selected through empirical sampling, considering the geographical area and legal nature of the organizations where services are provided. Moreover, Regions have considerable autonomy in defining the organizations of health services delivery, and healthcare provision takes place at various institutional levels, such as Local Health Authorities (LHAs) and hospitals, which follow partially different institutional criteria. All cases were selected in the Italian context to control for policy, political, and regulatory factors that might affect the provision of telemedicine services.

Three cases (which were anonymized and renamed as North-East, North-West, and Centre - NE, NW and CE), were chosen to limit potential biases (Eisenhardt and Graebner, 2007) and gather stronger insights (Eisenhardt 1989). Each service includes teleconsultation, telemonitoring and tele-expertise.

The three selected cases were chosen among the projects which were monitored over three years (2020-2023) by the Digital Health Observatory⁶, an applied research centre of Politecnico di

⁵ Available at: <https://www.governo.it/sites/governo.it/files/PNRR.pdf>

⁶ More information available at: <https://www.osservatori.net/it/ricerche/osservatori-attivi/sanita-digitale>

Milano. The authors' extended engagement involved regular observations and confrontation with the key actors of the three services (managers and health professionals), which enriched the understanding of the context and background, therefore contributing to the credibility and trustworthiness of the findings (Lincoln & Guba, 1985).

Their main features are shown in Table 1. More information is available in Annex 1.

Table 1: Features of the three case studies

Feature/Case	NE	NW	CE
Geographic Area	Northern Eastern Italy	Northern Western Italy	Central Italy
Juridical nature of the organization	LHA	Hospital within LHA	LHA
Dimension	300 patients involved	300 patients involved	4,000 patients involved
Type of patients	Patients with (low risk) heart failure	Diabetics	Various (cardiology, endocrinology, psychology, etc.)
Interviewees⁷	Project Manager (interviewed twice), Doctor (interviewed once) and Nurse (interviewed once)	Doctor (interviewed once)	Doctor (Head of Digital Transformation) (interviewed twice)

To ensure robust data collection, multiple sources of evidence were relied upon, including primary data, such as semi-structured interviews, and secondary data, such as reports, online news articles, and websites, as well as the information gathered from informal engagement with the actors involved. The convergence of evidence, which emerged from data triangulation, has strengthened construct validity (Jick, 1979).

The interviewees for this study included individuals who were both healthcare professionals and managers. For the region of NE, the three professionals interviewed were a Project Manager, a doctor, and a nurse. In NW and CE, the interviewed doctors held prominent managerial positions, which are commonly referred to as "hybrid" roles in previous studies (see, for example, Mcgovern et al. (2015)).

After transcribing the interviews verbatim, they were analysed following the Gioia Methodology (Gioia et al., 2013), identifying theory-driven codes, categories, and themes.

⁷ Number of interviews includes the interviews recorded, transcribed verbatim, and analyzed using the Gioia methodology. Informal interaction opportunities with the actors involved in the project are not counted in this item.

Finally, findings were interpreted within the “practice theory” framework (Nicolini, 2013). This perspective allowed to interpret coordination mechanisms as stemming from practice, intrinsically linked with the socio-materiality of telemedicine services (Orlikowski, 2007), therefore yielding a *dynamic* understanding of the relation between formal and informal coordination mechanisms.

Findings

1. *Survival amidst crisis: the “swim or sink” logic*

The pandemic presented an extraordinary challenge for healthcare systems, organizations, and professionals. In each of the three case studies, it became apparent that non-traditional methods were needed to manage non-urgent medical activities, particularly to prevent a critical increase in waiting lists. This was especially significant for chronic patients, such as those with diabetes and heart disease. Teleconsultation and telemonitoring in all studied services enabled the continuation of follow-up visits for many of these patients. Notably, in the CE case, telemedicine was at first deployed to monitor patients with mild Covid-19 symptoms at home. Even before pandemic, the three cases demonstrated attempts at deploying telemedicine, but faced various obstacles. First and foremost, a national level, telemedicine services were not eligible for reimbursement by the public healthcare system. In a publicly funded system, like Italian one, this discouraged organizations from offering such services as well as patients from using them, due to out-of-pocket costs.

Nonetheless, the unpredictability and sudden onset of the Covid-19 pandemic caught the healthcare systems off-guard. Although the advantages of telemedicine were acknowledged, the necessary technological, organizational, and policy enablers were insufficient for immediate implementation:

"When the epidemic curve is on a sharp rise and the numbers exceed a certain threshold, different mechanisms are activated...You need to figure out how continue therapy." - *Doctor, CE*

Consequently, health professionals, often supported by management and staff, needed to employ unconventional measures in the absence of existing formal structures:

"During the major crisis of transforming the NW hospital into a center for the care of complex Covid patients, we had to invent a system to stay in contact with patients who had emergencies." – *Doctor, NW*

However, managing chronic patients or patients with long-lasting medical conditions typically requires a multidisciplinary approach, involving different medical specialties and health

professions, such as nurses and therapists. Such a situation of task interdependence necessitates efficient coordination for effective collective performance. Prior to the pandemic, *proximity* served as a key coordination mechanism, particularly when health professionals operated in site-based teams:

"We have always worked closely with the ward nurse who is very close to the patient... It's certainly the coordination between the nurse and the doctor and the work of the doctor who prescribes and the nurse who carries it out." – *Doctor, CE*

The pandemic disrupted the status quo, necessitating consistent remote contact not only with patients, but also with other health professionals. Initially, standardized procedures were lacking, which are generally significant coordination mechanisms, as they contribute to generating accountability, predictability, and common understanding. Localized peer-to-peer contact and informal training served as provisional organizational touchpoints for healthcare professionals:

"Even for us healthcare professionals, it wasn't initially clear how this new approach would be implemented. The adaptation process involved both formal and informal mechanisms." – *Nurse, NE*

From a technological perspective, a considerable amount of initial telemedicine work was executed through consumer platforms. In the NW case, a platform for teleconsultation was already in use. However, even in this case, consumer chat apps and group chats were frequently employed for tele-expertise and scheduling. Although telemedicine platforms are now valued for their privacy, security, and functional benefits, the use of informal tools for coordination was seen as practical and convenient at the time:

"If you just perform a visit through a video call [...] there's nothing difficult about it!" – *Doctor, CE*

Additionally, new roles emerged, primarily shifting medical work informally towards nurses, driven by necessity and enabled by trust:

"To address the difficulty in getting the patients to understand how the new system works, we are developing informal methods. For instance, we are involving staff members who are not directly a part of the health care service to guide and assist patients." – *Manager, NE*

This initial phase spanned from March 2020 to December 2020. In the meantime, regional and national policymakers engaged in debate about telemedicine's relevance and its demonstrated benefits. Regulatory documents began to establish formal criteria for telemedicine procedures. In November 2020, national legislation granted reimbursement for teleconsultation, removing a significant barrier that had historically obstructed widespread telemedicine implementation. This "swim or sink" phase, as it transpired in response to the pandemic shock, exemplifies the supplementary logic (McEvily et al., 2014), where the "detrimental" effect of formal coordination mechanisms is in fact represented by their absence, or rather the presence of

inadequate formal arrangements. This was not a matter of subverting or challenging the established order, but rather an instinctive adaptation to survive uncertain circumstances. Overall, the evidence suggests the following hypothesis:

Proposition 1. A situation of “crisis”, forcing the abrupt adoption of digital technologies, leads to the enactment of informal coordination mechanisms in lack of formal structures, with a “supplementary logic”.

2. Transitioning to order: the rise of “design-ification”

Following the "swim or sink" phase, healthcare organizations transitioned into what we term as the "design-ification" phase, characterized by the emergence of formal arrangements designing coordination mechanisms. In our empirical setting, a conceptual turning point is constituted by the provision of the national guidelines concerning telemedicine services and establishing reimbursement for teleconsultation:

"Progressively, we moved towards implementing real telemedicine... From that, we moved to doing consultations by phone, maybe downloading data and having them sent back to us by email... I would say the last implementation was done a month ago, functional to expanding such activity even in a solvency regime... It used to work quite simply as a system, and then it adopted these characteristics provided by the ministerial regulation, which is access with public digital identity systems." – *Doctor, CW*

The progression from rudimentary phone consultations to an organized system compliant with ministerial regulations underlines a phenomenon of “dragging” towards formal coordination mechanisms.

In this context, while formal structures increasingly supersede the “improvised” practices of the "swim or sink" phase, they still draw on, and are influenced by, the informal coordination mechanisms that were consolidated before.

In this evolving scenario, the healthcare professionals' need for a structured approach to manage change becomes apparent:

"To manage complex change, you need a vision, competencies, incentives, and resources, and an action plan. Without a vision, there is confusion. [...] And finally, without an action plan to guide the way, people start but don't reach the end." – *Doctor, CE*

Importantly, healthcare professionals seek to actively partake in this formalization process, as they recognize their role in defining the framework for telemedicine services, illustrating the importance of stakeholder engagement in the design-ification of formal mechanisms:

"The crucial point is that when we talk about how this stuff is prescribed, it can be done correctly only if clinicians reach an agreement, a clear definition, and of course, ask the Regions to set up the corresponding framework... The regions will define, but based on the clinicians, the appropriateness of telemonitoring, teleconsultation, and therefore the subsequent reimbursement." – *Doctor, CE*

The "design-ification" phase is characterized by the creation and adoption of new procedures and *integrated care pathways* that shape specific coordination mechanisms. The establishment of such mechanisms provides structured moments for confrontation, data sharing, and explicitly delineates professional responsibilities, thus facilitating predictability and accountability in the system:

"We are in the process of outlining explicit internal processes and aim to make them public. This is to ensure that each healthcare professional understands their particular duties." – *Project Manager, NE*

In NW, two distinct care pathways have been crafted, one for patients with hyper-glycemia initially treated with urgency, and another for patients with insulin infusers who are also monitored via telemedicine services:

"We have defined two integrated care pathways: an immediate treatment process for patients with hyper-glycemia and a process for patients using insulin infusers, which includes the use of telemedicine services." – *Doctor, NW*

The availability of patient data through dedicated telemedicine platforms has transformed these artifacts into coordination mechanisms. The shared and regular access to such data has made it easier for nurses and doctors to decide when to intervene, thereby enhancing the predictability and accountability of patient care:

"Having continuous access to the patient data within the project makes it straightforward for nurses and doctors to decide the opportune moment for intervention."- *Doctor, NW*

The increased focus on structured pathways and procedures has also led to improved communication amongst healthcare professionals, breaking down the silos that characterized previous work arrangements:

"Previously, there was a notable lack of direct communication among hospital doctors. This project was initiated with the purpose of eliminating these silos in communication."- *Project Manager, NE*

This "design-ification" stage, evolving from the initial response to the pandemic, powerfully illustrates the reverse direction of the supplementary logic described by McEvily et al. (2014). The development of detailed internal procedures, establishment of integrated care pathways, constant monitoring of patient data, and efforts to dismantle silos in the healthcare settings, highlight the conscious design of these formal coordination mechanisms. Thus, we conclude that:

Proposition 2. During a stabilizing phase, after the initial crisis, a formalization of coordination mechanisms can be observed, acting again according to a (reverse) supplementary logic.

Discussion

The findings of this study shed new light within the existing debate on the relationship between formal and informal organizational arrangements, with respect to coordination mechanisms in the context of telemedicine services. The empirical detection of "swim or sink" and "design-ification" phases substantiate the "supplementary logic" proposed by McEvily et al. (2014), which posits that formal and informal mechanisms supplement each other according to circumstances.

During the "swim or sink" phase, in line with studies on emergency response (Kapucu, 2006; Waugh Jr. & Streib, 2006), we found that healthcare organizations relied heavily on informal coordination mechanisms to navigate the unprecedented challenges brought on by Covid-19. These findings echo the process of "bricolage" described by Weick (1993), wherein organizations do what they can with whatever resources are immediately available to them during a crisis. This phase, although characterized by the absence of adequate formal structures, underscores the value and effectiveness of improvisation and emergent practices in crisis response.

As we transition to the "design-ification" phase, we see an increasing reliance on formal coordination mechanisms, coherently with the institutionalization process described by Zucker (1987).

Yet, the transition to formality does not entirely replace the informal mechanisms established in the "swim or sink" phase. Instead, it integrates and builds upon them, underscoring the symbiotic relationship between formal and informal mechanisms, as described by Adler & Borys (1996) and McEvily et al. (2014).

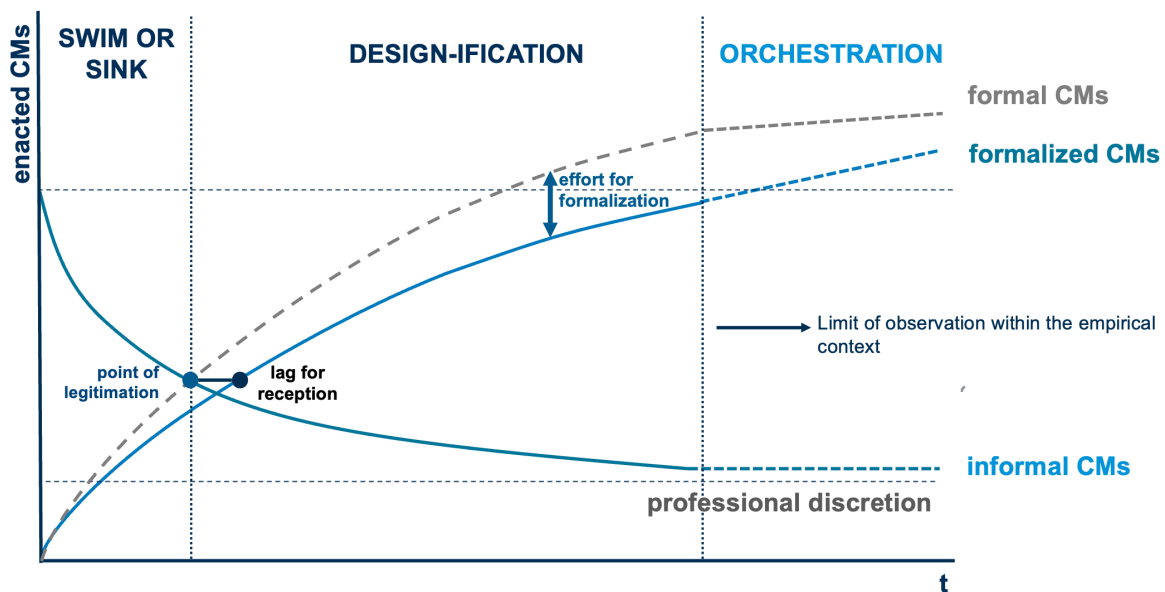
The dynamism of formal and informal coordination mechanisms and their interplay, as unveiled through the case of telemedicine, is widely applicable across various empirical grounds. This is especially true for areas undergoing rapid technological transformations and sociomaterial shifts, similar to what we have observed in telemedicine.

For instance, the accelerated adoption of remote working due to the pandemic, triggered by both necessity and digital advancements, represents a parallel case. Organizations had to adjust abruptly, reshaping work procedures, communication, and collaboration structures. Like

telemedicine, remote working required the rapid implementation of digital tools and strategies, and the subsequent formalization of these processes once the initial crisis phase passed.

Figure 1 proposes a graphical conceptualization of findings.

Figure 1: A model for the interpretation of the relationship between formal and informal coordination mechanisms within telemedicine services



This graphical representation aims to convey the idea of what has been discovered in the findings. The model integrates a temporal dimension, yet does not attribute an objective or absolute value to time, as well as a dimension of enacted coordination mechanisms implemented by organizational agents - observable phenomena in the course of our research. However, time is both relevant for our understanding of this phenomenon as contextual conditions drastically changes through the process of observation and because it intrinsically constitutes a basic dimension for the unfolding and assimilation of coordination mechanisms (Georgiou et al., 2011).

It can be noticed that in the first phase, termed as "swim or sink", informal mechanisms appear to compensate for formal ones until a critical pivot point is reached. This shift may be subjectively identified within the specific empirical context under investigation, corresponding with the introduction of specific regulations pertaining to telemedicine. While informal mechanisms continue to decline over time, they never fully approach a theoretical zero, for two primary reasons. First, this reaffirms a previously made point: formal coordination mechanisms are constructed upon the foundation of informal ones. Secondly, this trend is especially coherent to the medical and healthcare professions, which are characterized by distinctive values systems

and cultures (Nicolini, 2007). A sort of plateau is reached that can be defined as "professional discretion", as it indicates that health professionals still claim discretion in defining coordination mechanisms according to the specific circumstances of their professional practice. Moreover, it is notable that enacted behaviors do not immediately align with formal ones, but instead undergo a process of "formalization", progressively converging with the formal mechanisms. In the concluding stages of this model, the authors postulate the existence of an additional, albeit unobservable phase, termed "orchestration". In this phase, the balance between formal and informal coordination mechanisms is in a sort of "equilibrium", in which formal and informal elements reinforce each other in an augmentative logic (McEvily et al., 2014). However, in theory, this phase could also be undermined by the emergence of a subversive logic (McEvily et al., 2014), for example due to contrasting organizational cultures. Our study further illuminates the intricate interplay between formal and informal coordination mechanisms, providing empirical evidence that supports and extends the propositions set forth in the supplementary logic by McEvily et al. (2014). We support their argument providing evidence on how informal mechanisms, born out of necessity, can provide a basis for survival and innovation in turbulent times, before giving way to formalized structures that orchestrate and stabilize these emergent practices.

By doing so, we contribute to the broader debate on the dynamic interdependencies between formal and informal structures (Puranam, 2018; Soda & Zaheer, 2012). Our study suggests that this relationship is not just complementary, but also temporal and circumstantial, as formal and informal coordination mechanisms take precedence at different stages in time or service maturity.

Finally, we underscore the role of digital technologies in the enactment of coordination mechanisms (Leonardi, 2011), providing empirical evidence of how technology may act as both a trigger and enabler of change.

Our study highlights several key considerations for managers and policymakers. Firstly, although relying on organizational resilience may be effective survival strategy in the face of uncertainty, managers must be cautious about the sustainability of this strategy in the longer term. While the ad-hoc measures deployed in the "swim or sink" phase can help organizations stay afloat, they are typically insufficient for managing the complex task interdependencies in the long term, which typically characterize the healthcare organization of work (Crowston, 1997).

Moreover, the transition from informal to formal coordination mechanisms should not discard the lessons learned and innovations derived from the "swim or sink" phase. As our study shows,

these informal practices still inform the design of more formal structures and can play a relevant role within the overall organizational dynamics.

From a policy perspective, our findings suggest the importance of having flexible regulatory frameworks that can adapt to fast-evolving scenarios. Policies that rigidly define and limit the adoption of new practices (such as the initial restriction on telemedicine reimbursement) can hamper the ability of organizations to adapt to external change. Policymakers should strive to create more agile regulatory environments that allow for innovation and adaptation while maintaining necessary safeguards.

Conclusions and limitations

This research aimed to elucidate the interplay and evolution of formal and informal coordination mechanisms within telemedicine services. It identified the critical phases of "swim or sink" and "design-ification", providing empirical validation for the supplementary logic proposed by McEvily et al. (2014). The dynamism of this interplay, especially in the face of rapid technological and sociomaterial shifts, broadens our understanding of the coordination process and its crucial role in telemedicine services.

Looking ahead, this study contributes to a promising stream of research: more needs to be achieved by scholars to understand the relationship between formal and informal coordination mechanisms, and in general, organizational structures. The empirical setting of this study, characterized by the observation of "digitally-enabled" services in healthcare, constituted a relevant opportunity to observe peculiar yet explicative dynamics.

Several intrinsic limitations can be envisioned in this study. Firstly, the evolving political and regulatory landscape of telemedicine at the time in which this research is being carried out constitutes both an opportunity and a limitation. Telemedicine services are evolving rapidly, therefore more solid considerations will be possible to the extent in which the research will catch a "steady state" of mature implementation.

Secondly, as telemedicine is an umbrella definition, the choice was made in this study to consider only three sub-services (teleconsultation, telemonitoring and tele-expertise). However, even these three sub-services are so different in both material and social characteristics that it can result misleading to consider them at once. In practice, it is very complex to focus on one sub-service at the time as they are usually provided through single platforms and typically organized according to clinical area rather than functionality.

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Annex 1: The three selected case study

Case study 1: North-East (NE)

"North-East" (NE) is a publicly funded Local Health Authority (LHA) that serves as the sole healthcare provider within its designated regional territory, which renders it an essential entity of the region itself. Its mandate is to manage and coordinate healthcare and social welfare activities throughout the Region. Notably, the Region holds unique regulatory autonomy within the constraints of the Italian constitution. The regional territory is predominantly mountainous, and there are numerous scattered settlements throughout the area. The LHA and the region have a longstanding focus on digital transformation in healthcare, as evidenced by their creation of dedicated strategic support entities.

Project-NE is a service provided by NE, a healthcare organization operating in collaboration with the region and other supporting bodies. This service is specifically designed to address the growing number of chronic heart failure patients, which poses a significant challenge to the healthcare system for the coming years.

The project enables healthcare professionals, such as cardiologists and cardiology unit nurses, to conduct teleconsultations and telemonitoring of chronic heart failure patients. A web-based clinical dashboard provides healthcare professionals with comprehensive data while patients

are provided with a smartphone app that includes specific functionalities prescribed by the cardiologist. The platform integrates digitally connected devices, such as implantable devices and smartwatches, to provide healthcare personnel with real-time patient data for a complete clinical overview. The dashboard allows healthcare professionals to monitor patient data and registered parameters, schedule and initiate video calls, and share multimedia files.

Currently, three local healthcare hospitals and clinics manage over 300 chronic heart failure patients within this telemedicine service.

Case study 2: North-West (NW)

"North-West" is a publicly funded LHA situated in the most densely populated Italian Region. It encompasses one of Italy's largest hospitals, in terms of hospital beds, and provides comprehensive clinical and surgical specialties organized across more than 50 departments. As an LHA, NW also encompasses territorial clinics that provide both health and social care services, with the mission of integrating specialty and social care.

Project-NW is a service designed for patients with diabetes, both type I and II, and it is delivered via a telemedicine platform, allowing teleconsultation and telemonitoring. Teleconsultations are meant for follow-up consultations to monitor therapy and receive specialist prescription. Telemonitoring enables continuous gathering of data related to diabetes-related parameters from sensors. The service was initially developed in NW hospital in collaboration with the Region and has the potential to expand to other healthcare providers. Over 300 patients are currently involved in this project.

The platform used for these services is integrated with the regional Electronic Health Record (EHR), providing access to the patient's entire clinical history. The platform also allows for real-time uploading and viewing of attachments, including documents, images, and videos exchanged between the doctor and the patient.

Case study 3: Centre (CE)

"Centre" is a publicly funded LHA located in one of the most populated Regions of Centre Italy, which provides medical care to over 500,000 citizens. The region encompasses a vast territory of over 3,000 square kilometres, with less than 100 towns and a population density of less than 150 individuals per square kilometre.

The Project-CE has been implemented in the primary hospital of "Centre" as well as in smaller public clinics specialized in specific medical practices within the territory. Telemedicine

services have been integrated into various clinical specialties, including cardiology, psychology, dermatology, and endocrinology.

Teleconsultations are commonly used for follow-up appointments and recurrent meetings with chronic patients across various specialties, while telemonitoring is spread for detecting specific parameters, such as glycaemia. To increase accessibility to specialized physicians in remote and isolated areas, such as small towns, a tele-expertise project has been initiated. This project enables GPs to discuss their patients with specialized physicians located in the primary hospital, receiving feedback and suggestions without the need to travel long distances.

Finally, an ECG telerefertation service is provided, which involves a nurse visiting a patient's home and using specialized equipment to transmit the results of the electrocardiogram to a cardiologist at the hospital in real-time. The cardiologist can then request further tests from the nurse as needed.

Annex 2: Glossary

Telemedicine service	Definition
Teleconsultation	Medical consultation to a patient taking place remotely through the employment of digital technologies. In the Italian context is referred to as “televisit” and it may be provided under specific circumstances, e.g. periodical consultations for chronic patients
Tele-expertise	Consultation between doctors who are not in the same physical location concerning the status of a patient, via digital technologies. In the Italian context it is referred to as “teleconsultation”
Telemonitoring	Patient monitoring service involving the use of devices (sensors, wearables, etc.) to gather data from patients concerning clinical parameters
Telerefertation	Provision of a clinical medical report, involving a healthcare professional supporting the patient in performing a specific clinical exam in presence and a doctor providing a medical report based on gathered data