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W. Chen, R. Filieri

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Institutional forces, leapfrogging effects, and innovation status: Evidence from the adoption of a continuously evolving technology in small organizations

Wenshin Chen, International Business MBA/Bachelor Program, National Sun Yat-Sen University,
70, Lianhai Rd, 804 Kaohsiung, Taiwan

Raffaele Filieri, Audencia Business School, Marketing Department, 8 Route de la Jonelière, 44312
Nantes, France

ABSTRACT

Although SMEs' innovation adoption has been widely studied, little research has explored how SMEs strategize a continuously evolving technology in a complex institutional context over time. Drawing from institutional perspectives, our case study, based on 44 interviews and field observation, seeks to analyze how institutional forces interact with the Wi-Fi adoption process at three small organizations with different innovation statuses. Results reveal the significance of institutional forces in shaping small organizations' technology adoption process. At the knowledge stage, institutional forces stem from the champion's advocacy and institutional pressures. At the persuasion and implementation stages, they are embedded in organizations' actions in following the institutional trend and complying with institutional norms. At the confirmation stage, they can be observed in organizations' shaping institutional changes or leapfrogging institutional trends. These insights challenge and extend the traditional linear perspective of innovation diffusion and contribute to the literature on technology adoption, digital transformation, innovation leapfrogging, institutional theory, and SMEs. Managerially, we propose three strategic responses (i.e., trend

reformulation, service differentiation, complete transformation) that urge SMEs to utilize leapfrogging effects of technologies to renovate their innovation status.

Keywords: SMEs; technology adoption; institutional forces; innovation status; leapfrogging; case study.

1. Introduction

SMEs (Small and Medium-sized Enterprises), defined as firms with fewer than 250 employees (European Commission, 2003), have been traditionally perceived as lacking various resources required for market competitiveness (Clauss et al., 2022). Compared to larger counterparts, SMEs and micro-enterprises often face more barriers, such as regulatory and competitive uncertainty as well as inadequate expertise, experience, and capital resources (Amankwah-Amoah and Hinson, 2019; Amouri et al., 2021). They are also more vulnerable to environmental uncertainty and global crises such as the COVID-19 pandemic (Clauss et al., 2022).

The contemporary technological environment characterized by rapid technological evolution, such as artificial intelligence (AI) (Pillai et al., 2023; Kshetri, 2021) has created even greater challenges for small organizations (Troise et al., 2022), particularly in emerging economies (Tamvada et al., 2022). Situated in such a competitive context with various constraints, small organizations would need to devote their limited resources to quickly understand which technologies may best meet their purposes for digital transformation (Gaglio et al., 2022), a process through which organizations undergo significant changes in their business model and core competence through digital technologies (Tijan et al., 2021). Since the significant impacts of digital transformation have been widely reported (Llopis-Albert et al., 2021; Guerra et al., 2023), failing to do so may lead to SMEs' disadvantageous positions in the industry (Rese and Baier, 2011). Given inherent constraints, how SMEs respond to various external forces and emerging challenges of digital transformation to better survive or thrive deserves more research attention.

Although empirical studies have investigated the drivers of SMEs' adoption of specific innovations, such as Industry 4.0 (e.g., Cugno et al., 2021; Horváth and Szabó, 2019; Tamvada et al., 2022), Big Data and AI (Bag et al., 2022), social media (Kwon et al., 2021), and digital marketing (Ritz et al., 2019), they are mostly quantitative with a narrow view in time and only

interested in the internal drivers of firms' technology adoption (e.g., Ahmed et al., 2022; Amouri et al., 2021; Bag et al., 2022; Cugno et al., 2021; Horváth and Szabó, 2019).

Little exploratory research has explored *how* SMEs manage their technology adoption process over time to better facilitate their digital transformation, especially when facing constantly evolving technologies and complex institutional factors (Albats et al., 2022; Donbesuur et al., 2020). Furthermore, little is known about how SMEs' technology endeavor might reshape their innovation status in their institutional context. As Hervás-Oliver et al. (2021) suggest, SMEs innovation differ considerably even within different regions of Europe. External forces and contextual factors play an even more significant role than internal R&D in shaping SME innovation.

As institutional theorists argue, organizations' technology adoption behaviors do not necessarily focus on innovations but primarily revolve around responding to various institutional forces in their competitive fields (Lawrence, 1999; Bag et al., 2022). Those institutional forces often create institutional pressures or industry trends that force or urge organizations' innovation initiatives (Villena and Dhanorkar, 2020; Jiao et al., 2022). An organization's innovation endeavor is, thus, not necessarily driven by internal assessment, a common view suggested by the existing innovation literature, but by complex external forces like network ties (Albats et al., 2022; Hervás-Oliver et al., 2021). Such internal and external dynamics can be even more challenging for small organizations that face rapidly evolving technologies (Klewitz, 2017; Kopka and Fornahl, 2024). In line with such institutional perspectives (DiMaggio and Powell, 1983), we argue that challenging dynamics in the institutional context could shape and reshape small organizations' technology adoption process in a complex manner that is beyond the understanding of the existing literature. As such, the first research purpose of our study is to explore how various institutional forces influence SMEs' technology diffusion process in a constantly changing technology environment. It seeks to answer the first research question (RQ): *what and how do various institutional forces interact with different stages of SMEs' diffusion process of a continuously evolving technology?*

Traditional innovation perspectives also emphasize that adopters' diffusion process follows a five-stage model sequentially (Rogers, 1995). Such perspectives are built upon implicit assumptions or biases that innovations should be adopted by all members (Haider and Kreps, 2004). All diffusion processes follow the same pattern (Mahajan et al., 1990), which implies that changing innovation status from latecomer categories (e.g., laggards and late majority) to forerunner categories (e.g., early adopters or innovators) will be nearly impossible. However, such perspectives have increasingly faced challenges (James, 2013; Hashim et al., 2014). Recent studies have shown that late adopters do not necessarily follow a sequential innovation process (Lee, 2021; Almagor et al., 2018; Lee and Lim, 2001). They could bypass the regular technological trend and choose the latest versions of technologies that help them compete (Lee, 2021; Hashim et al., 2014; Goldenberg and Oreg, 2007). In doing so, they could reduce excessive waste of business and technology resources (Fox and Richardson, 2017) or avoid bandwagon effects that lead to early adopters' implementation of ineffective technologies due to fads and fashion (Abrahamson, 1991). Such an emerging phenomenon has been increasingly observed in various industries (Yap et al., 2022; Fong, 2009), especially in developing or underdeveloped countries (Lim et al., 2021; Nawrot, 2014; James, 2013).

As Lee (2021) suggests, while the traditional linear view of innovation diffusion is consistent with typical product life cycle development, latecomers have more choices than simply following the technology trend. They can choose the stage-skipping strategy that allows them to move forward directly with the newer version of technological development or the path-creating strategy that enables them to explore a new generation of technology. These choices can help latecomers to better respond to investment dilemmas and technology challenges (Lim et al., 2021). In a continuously evolving technology environment, they can also provide opportunities that might help reshape latecomers' innovation status (Encaoua and Ulph, 2005; Lee, 2021). While such an emerging phenomenon might challenge the traditional view of innovation diffusion, some caution that latecomers' innovation status could be reshaped by such effects only under complex conditions

that involve various internal and external resources (Steinmueller, 2001; Fong, 2009). Certain technological environments might be only suitable for incremental progress rather than radical effects (Murphy, 2001). Given these emerging perspectives, the second research purpose of our study thus aims to examine whether SMEs' innovation status can be changed in a constantly evolving technology environment. To this end, we intend to answer the second RQ: *to what extent and under what circumstances can SMEs' innovation status be reshaped?*

In the following sections, we first review the literature, justify our theoretical lens and relate it to the research context in Sections 2 and 3, respectively. Section 4 explains our research methodology and the data collection and analysis process. We then present our findings in Section 5, which consists of within-case and cross-case analysis. In Section 6, we reflect on our findings and our theoretical and managerial contributions. Section 7 outlines major insights that emerged from our findings and provides concluding remarks for future research endeavors.

2. Literature review

2.1 Innovation categories and process

Diffusion of innovation is one of the most adopted frameworks to define adopter categories detailing their innovation status, the characteristics that shape adoption decisions, and the process that identifies different adoption phases (Rogers, 1995). One of its primary concerns that relate to our research is how a new idea, practice, or object spreads among members in the field, which is often explained by a better understanding of adopter categories and the diffusion process (Frei-Landau et al., 2022; Beausoleil, 2018).

Adopter categories. Rogers (1995, 2002) classifies five adopter categories based on their timing of innovation adoption: innovators (the first 2.5%), early adopters (the next, 13.5%), early majority (the next 34%), late majority (the next 34%), and laggards (the last 16%). Rogers's statistical

division of adopter categories is based on a linear model and normality assumption that innovation is spread among prospective adopters at an increasing rate that ultimately shapes a symmetrical, normal distribution (Martins et al., 2009). While such a linear model of innovation diffusion offers simplistic, mutually exclusive categorizations that have been widely cited in the innovation literature, it provides little justification for the percentage of each adopter category (Mahajan et al., 1990). In addition, its pro-innovation bias suggests that an innovation should be adopted by all members in the field (Haider and Kreps, 2004), and all innovations follow the same diffusion pattern (Mahajan et al., 1990). Furthermore, the model implies that changing innovation status from one category to another most likely follows a sequential fashion and that it would be inherently challenging, if not impossible, for laggards or the late majority to transform themselves into early adopters or innovators.

Diffusion process. As for how innovation is diffused over time, Rogers (1995, 2002) divides the innovation process into five phases: *knowledge, persuasion, decision, implementation, and confirmation* (Frei-Landau et al., 2022; Haider and Kreps, 2004). The knowledge phase is the initial step of the innovation process when a prospective adopter learns about an innovation. The persuasion phase is when a prospective adopter seeks further information and forms a strong attitude (positive or negative) toward the innovation. During the decision phase, a prospective adopter decides to either accept or reject the innovation, which is largely driven by innovation characteristics. If the decision is to adopt the innovation, the implementation phase occurs, where the innovation is incorporated into the adopter's existing systems, everyday routines, or business processes. Upon implementation of innovation, the confirmation phase ensues, where the adopter evaluates the results or the process of innovation adoption and seeks reassurance of the innovation-decision. Discontinuance of the innovation might follow if negative experiences or conflicting results are reported.

Based on Rogers's perspective, a potential adopter will undergo this five-phase process sequentially (Frei-Landau et al., 2022) to assess an innovation based on subjective evaluations of

near-peer experiences rather than scientific evidence. More specifically, in a step-by-step, progressive fashion, an adopter will need first to gain awareness of and set an agenda about an innovation, conceptualize and contextualize it, accept (or reject) the innovation, then incorporate the innovation into everyday practice, and routinize the innovation and evaluate the results (Beausoleil, 2018).

2.2 Knowledge gap

While Rogers's theoretical framework has made an invaluable contribution to the innovation literature (Haider and Kreps, 2004), its implicit assumptions of the linear innovation process and normal distribution of the adopter population have faced increasing criticism (James, 2013; Hashim et al., 2014). Recent empirical studies have found that the innovation process may not necessarily adhere to a progressive sequence. As Lee (2021) suggests, while the linear, sequential perspective of diffusion pattern is consistent with the traditional view of product life cycle, latecomers of technology development are not necessarily constrained by the technology trend, which is their first and traditional choice referred to as the path-following strategy. The other two emerging choices that might offer latecomers better competitiveness are the stage-skipping strategy and the path-creating strategy. The former "refers to the case in which latecomer firms follow the same path as that of incumbents but skip older-generation technology" (p. 126), while the latter "refers to the case of a latecomer exploring its own path of technological development by utilizing a new generation of technology" (p. 127).

Although such a phenomenon is still in its infancy (Heidenreich et al., 2022), its effects might shape an adopter's innovation decision and challenge the traditional diffusion process. In facing constantly changing technological development and consumer demands, an adopter can indeed consider different strategies to respond to the technology trend (Lee, 2021; Lee and Lim, 2001; Sudharshan et al., 2006). Many consumers intentionally reject new products and postpone their adoption until a superior alternative emerges from the market (Heidenreich et al., 2022) because

such a consumer decision might reshape adopter status (Goldenberg and Oreg, 2007). In other words, the dynamics of the diffusion process and adopter categorization might be much more complex than traditionally thought (Kopka and Fornahl, 2024). The respective roles of the forerunners (e.g., innovators and early adopters) and the latecomers (e.g., early and late majority as well as laggards) might be reversed (Encaoua and Ulph, 2005; Lee, 2021). Since rapid technological development in the competitive global market often showcases frequent upgrades or superior alternatives of existing technology (Goldenberg and Oreg, 2007; Heidenreich et al., 2022), it is highly likely that “the innovator acquires just a temporary leadership that can be contested by the laggard firm during the subsequent race” (Encaoua and Ulph, 2005, p. 6). However, empirical research on this phenomenon has only started to emerge (Heidenreich et al., 2022). Many issues related to why and how such phenomenon might take place are still relatively unknown, especially when the technology environment rapidly evolves. Our study can thus help bridge the knowledge gap and provide empirical contribution to the extant literature.

3. Theoretical lens

To better illuminate how complex internal and external factors play out in SMEs’ diffusion of a continuously evolving technology, we draw on the lens of institutional theory (Scott, 1987; Oliver, 1991), which provides a complementary perspective in understanding various factors that shape and reshape an organization’s adoption decision and diffusion process in its institutional context (DiMaggio and Powell, 1983). Institutional theory argues that in a competitive institutional landscape, there exist various institutional forces that organizations need to consider to better manage their innovation process (Chen et al., 2013). Those institutional forces collectively create influential institutional norms that dictate how its member organizations compete and survive (Minh and Hjortsø, 2015). Scott (1995) suggests that institutional systems of regulations, norms, and cultural-cognitive beliefs sustain and affect the evolution of other systems, including the economic

system. As such, competing organizations often adopt innovations not just for relative advantages or economic benefits but also, more importantly, for institutional recognition and legitimacy (Krell et al., 2016). Although technology advantages or economic benefits might not be immediately apparent, institutional legitimacy is equally important in an organization's competition and survival because it validates its competitive qualification (Hayes and Rajão, 2011) and conveys to stakeholders that an organization has responded to various institutional forces (Bag et al., 2022) and satisfied necessary industrial regulations or institutional expectations (Peters and Heuinkveld, 2010). Such a message is crucial in building stakeholders' confidence in organizations because failing to follow institutional norms often leads to competitive disadvantages, if not an immediate disqualification, in competitive marketplaces (Tsai et al., 2013).

As such, member organizations are often urged to adopt highly sanctioned industrial practices or technologies to pursue the institutional trend created by institutional norms so that institutional legitimacy can be obtained (Talib et al., 2016; Bag et al., 2022). In doing so, organizations can, on the one hand, benchmark against leading competitors and avoid risks and uncertainty that are often associated with environmental changes and technological development (Rosenblatt, 2011) and, on the other hand, obtain intangible social values that stem from various institutional practices such as inter-organizational cooperation, professional collaborations, and institutional networking (Martin et al., 2018). Although those intangible values might not be economically quantifiable (Barman and MacIndoe, 2012), they allow organizations to maintain their institutional appearance (Meyer and Rowan, 1977), be better recognized as qualified competitors (Bhakoo and Choi, 2013) and, in turn, obtain institutional legitimacy that is often essential for an organization's long-term survival (Hatch and Zilber, 2012).

Institutional pressures. One particularly influential institutional force that often dictates an organization's innovation decision stems from institutional pressures (Bag et al., 2022; Villena and Dhanorkar, 2020). As DiMaggio and Powell (1983) suggest, an organization's strategic choices in a competitive institutional field are often inevitable responses to *coercive, mimetic, and normative*

pressures that dominate the institutional landscape and lead to institutional members' collective isomorphic behaviors. These three typologies of institutional pressures are discussed below.

Coercive pressures are mostly related to internal and external political influences that are “exerted on organizations by other organizations upon which they are dependent and by cultural expectations in the society within which organizations function” (DiMaggio and Powell, 1983, p. 150). Coercive pressures arguably have the most direct influence on organizations because they are built into the institutional authority that grants institutional legitimacy. For example, international firms that intend to trade with the EU must comply with its strict regulations, such as REACH (Registration, Evaluation, Authorisation and Restriction of Chemicals). Without such institutional authorization, a firm's competitive prospect within the EU will be severely compromised. Similar examples can also be found in the medical sector, where healthcare providers in the US are often urged to comply with governmental regulations such as HIPAA (Health Insurance Portability and Accountability Act) so that unnecessary risks and penalties can be avoided (Sherer et al., 2016).

Mimetic pressures primarily stem from an organization's experiences of environmental uncertainties or technological ambiguity. In facing environmental uncertainties or technological ambiguity, an organization may not have clear solutions for emergent problems and thus tend to follow the example of similar organizations in their sector that they view as more legitimate or industry leaders (DiMaggio and Powell, 1983, p. 152). When a growing number of organizations in a competitive environment adopt a practice, other organizations will feel pressure to comply (Abrahamson and Rosenkopf, 1993). Such mimetic isomorphism can create standard responses with relatively minimal expense to institutional pressures with which an organization has no viable solution or adequate capabilities to cope. Empirical studies have found that mimetic pressures indeed significantly affect an organization's adoption of eco-labels in the hospitality industry (Leroux and Pupion, 2018), green product innovation in high-tech industries (Huang and Chen, 2022), and information systems and technology in hospitals (Nilashi et al., 2016). In so doing, an

organization is not necessarily concerned about innovation characteristics but more about replicating others' successful experiences and repositioning itself as a legitimate player in the field.

Normative pressures, by contrast, result from the professionalization process through which an organization is urged to comply with collective practices commonly sanctioned and legitimized for professional autonomy because of “the resting of formal education and legitimation in a cognitive base produced by university specialists” and “the growth and elaboration of professional networks that span organizations and across which new models diffuse rapidly” (DiMaggio and Powell, 1983, p. 152). The former is about academic credentials and standards that define institutional norms and professional practice, whereas the latter helps rapidly exchange professional information and diffuse institutional norms among institutional members across organizational boundaries. Those boundary-spanning members often act as innovation champions who advocate highly recognized innovative and professional practices in the field within their organizations (Parada et al., 2010). In an institutional field where academic credentials and standards are highly dependent upon professional networks, greater normative pressures will emerge from the field and urge member organizations to follow. In the healthcare sector, for instance, normative pressures have been found to significantly influence physicians' adoption of electronic medical records. When a physician can collaborate with other physicians or healthcare providers who practice with the same medical systems, their intention to adopt the systems significantly increases (Sherer, 2010).

To sum up, in the contemporary business world, institutional forces shape competitive marketplaces, and organizations increasingly face external and global forces (Bag et al., 2022). It is thus nearly impossible for an organization to survive without carefully acknowledging institutional norms and responding to institutional pressure (Kondra and Hurst, 2009). This can be particularly evident for small organizations that typically lack financial resources, technical expertise, and market experience (Hsu and Cheng, 2012). Undertaking a cautious strategy that urges them to follow the institutional trend might be an effective approach to survival (Krell et al., 2016).

3.1 Technology context

The process of SMEs' adoption of continuously evolving technology (i.e., Wi-Fi) might provide a unique context to understand how technology adoption reshapes SMEs' innovation status and the influence of institutional norms and pressures. For small organizations, competitive factors in their institutional field will be even more challenging because, internally, small organizations commonly lack various resources to help them tackle complex emerging issues (Hsu and Cheng, 2012). Externally, inadequate resources often urge small organizations to draw on outside expertise from the competitive environment (Tomlinson and Fai, 2013) or collaborate with other organizations for resources that could enhance their competitiveness and innovativeness (Vanhaverbeke, 2017). In the technology adoption process, small organizations' strategic decisions are often influenced by external factors (Tomlinson and Fai, 2013) that include, for example, cooperation with customers and the public sector as well as networking partnerships with suppliers and universities (Uhlener et al., 2013). Audretsch et al. (2019) further emphasize the importance of considering the business environment as an ecosystem where external actors, the environment, and agents act endogenously together as a system motivated by the need to create benefits from different forms of collaboration. Several studies show that external relations, particularly top management interactions with outside firms or R&D (Research and Development) units (Jenssen and Nybakk, 2009), and institutional networks (Saunders et al., 2014) all play significant roles in small firms' innovation endeavors. In other words, in a competitive institutional environment, small organizations' innovation decisions are likely based on standard responses to institutional pressures or institutional norms rather than self-assessment of innovation characteristics because, as DiMaggio and Powell (1983) suggest, such choices will be more cost-effective, given their inadequate resources and high environmental uncertainties.

Wi-Fi technology might offer a fitting opportunity for small organizations for two reasons. First, it has increasingly become a ubiquitous technology that can fundamentally change workforce mobility, collaboration, and productivity (Singh et al., 2017). Its prevalent demand and global

influence in society will only continue to be expected in all industries or businesses. An empirical study further suggests that high-speed Wi-Fi can enhance SMEs' productivity and performance and, in turn, reduce the digital divide (Middleton and Chambers, 2010). Second, Wi-Fi has been a continuously evolving technology (Pahlavan and Krishnamurthy, 2021) in the last twenty-four years, from 2 Mbps to multi-gigabit speeds (i.e., Wi-Fi 6). It situates competing organizations in a technology race that faces continuous upgrades or development over the years and, in turn, enables potential shaping or reshaping of adopter status.

4. Methodology

4.1 Multiple case study

Since our study explores complex factors that might potentially affect SMEs in their technology diffusion processes, a case study methodology is adopted because it is widely known for being able to provide a rich, in-depth understanding of a research phenomenon (Eisenhardt, 1989; Albats et al., 2022) within well-defined boundaries where dynamic issues occur (Creswell, 2007). Case studies can involve either single or multiple cases (Yin, 1994). A multiple case study approach is preferred for our investigation because a comparative analysis between cases can offer a better understanding of how the technology adoption process evolves across industries and institutions. Epistemologically speaking, our approach leans toward the interpretive case study that relies on inductive reasoning to generate a theoretical understanding of the research phenomenon from participants' perspectives rather than to test a predetermined frame of references (Walsham, 1995; Albats et al., 2022).

The research context was based on the higher education and healthcare sectors in the Southwest region of the United States. We chose the higher education and healthcare sectors for their significant investment in technology and increasing endeavors to develop wireless campuses and

mobile technologies. These institutional fields also shared similar characteristics where the work practices of organizational members (namely, students, faculty members, doctors, and nurses) were largely shaped by their mobility (Lu et al., 2009), which was directly related to our Wi-Fi study. The higher education and the healthcare sectors were also highly regulated institutional fields where various institutional forces such as “public opinion, educational systems, laws, courts, professions, ideologies, regulatory structures, awards and prizes, certification and accreditation bodies, governmental endorsements and requirements” shape distinctive societal spheres and institutional structures (Scott, 1987, p. 498). These distinctive institutional characteristics were well suited for our research purposes.

4.2 Case organizations

Our investigation began by contacting organizations in the higher education and healthcare sectors in the same metropolitan area, and eventually, three small organizations, given pseudonyms Metropolitan University (MU), City Center College (CCC), and Suburban Hospital (SH), agreed to participate. These organizations can be considered small organizations because they meet the typical criteria of SMEs: small hospitals with fewer than 50 beds (Oregon Nurses Association, 2020) and small universities with fewer than 5000 students (Ross, 2016).

The first organization, MU, was a small private and prestigious research university. Despite its academic autonomy, MU had traditionally adopted a centralized structure for its IT services, mostly due to its small size. The second organization, CCC, was also a small private university, commonly known as a regional teaching school, with a completely centralized IT structure. The third organization, SH, was a small community hospital serving a growing residential area. After merging with a large hospital chain, SH’s business operations had been mostly centralized, and its IT services had been outsourced to its corporate IT partner.

The adoption of Wi-Fi technology at MU was classified as an *early adopter* because it quickly followed the technology trend. Unlike MU, CCC faced the typical constraints of small

organizations described in the literature. For Wi-Fi systems, we categorized it as the *late majority* because its timing of adoption occurred when wireless technologies had widely permeated higher education institutions. As for SH, we classified it as a *laggard* because it only experienced wireless networks after the industry had already faced several generations of technology development.

While identifying an organization’s innovation status might be a challenging task, we followed Rogers’s categorization, which offers comprehensive and mutually exclusive categories (Mahajan et al., 1990). More importantly, our categorization did not refer to these case organizations’ innovation statuses in general, which might be more difficult to conclude, but only to their specific adoption timing in relation to Wi-Fi technology, which was primarily revealed by interviewees. Table 1 shows these participant organizations’ backdrops and institutional positions.

Table 1
Organizational backdrops and Wi-Fi status.

Organizations	Business orientation	Organizational reach	Institutional prestige	IT structure	Wi-Fi status
Metropolitan University	Research University	National	High	Centralized	Early Adopter
City Center College	Teaching University	Regional	Low	Centralized	Late Majority
Suburban Hospital	Community Hospital	Communal	Low	Outsourced	Laggard

4.3 Data collection

Consistent with typical data collection methods of a case study methodology (Yin, 1994), our inquiry primarily relied on interviews supplemented by observations and document reviews. The entire data collection process spanned three academic semesters. Each organization’s data collection process began with arranging an interview appointment with its networking director because they were arguably the most instrumental person in the Wi-Fi implementation process. Subsequent

interviews with organizational members in the IT department and other units were arranged to gather various perspectives. All interviews were semi-structured, digitally recorded, and subsequently transcribed. The interview guideline inquired about when, why, and how the Wi-Fi was initiated and evolved, as well as the results of its implementation. Follow-up questions might be derived from interviewees' responses to clarify or elaborate on their viewpoints. As shown in Table 2, we interviewed 17, 14, and 13 participants with various positions and Wi-Fi involvement in MU, CCC, and SH, respectively. The total number of interviews was considered sufficient for reaching theoretical saturation (Glaser and Strauss, 1967).

Table 2
Number of interviewees in each organization.

Organizations\Units	Information technology	Faculty members	Students	Staff	Others	Total
Metropolitan University	5	4	2	3	3	17
City Center College	1	4	3	4	2	14

Organizations\Units	Information technology	Inpatient doctors	Outpatient doctors	Nurses	Staff	Total
Suburban Hospital	3	2	3	2	3	13

The interview duration varied considerably due to the different levels of interviewees' Wi-Fi involvement. For MU, the maximum, minimum, and average interview length was 148, 16, and 48 minutes. For CCC, those numbers in the same sequence were 45, 11, and 28 minutes. For SH, they were 77, 44, and 54. Those short interviews with MU and CCC were with students without knowledge about Wi-Fi's initiatives or its progress and could only respond to questions about their user experiences. The information gathered from all interviews resulted in 169, 84, and 124 pages of single-spaced transcripts for MU, CCC, and SH, respectively. Besides participants' perspectives from the interviews, we also reviewed public information to understand organizational backdrops

and conducted observations to help build a holistic understanding of the research phenomenon. At MU and CCC, we frequented libraries and student centers to observe and experience how students and community members utilized wireless networks. At SH, our observations were conducted in its emergency room to witness patients' and visitors' interactions with its Wi-Fi systems. Field notes were taken during observations, allowing us to better understand participants' experiences in their authentic contexts.

4.4 Data analysis

Our data analysis followed the holistic analytical style typical of sociology and anthropology research (Myers, 1999; Chen, 2016). The primary objectives were to develop an overall understanding of the researched context and allow authentic and plausible insights to emerge from each case organization's experiences (Marcus and Cushman, 1982). The process consisted of two parts. The first part involved two stages: initial coding and focused coding (Lofland and Lofland, 1995). During initial coding, we read transcripts line-by-line to make sense of participants' viewpoints, searched for relevant events or incidents, and highlighted meaningful statements. This iterative process allowed us to formulate initial codes that represented specific patterns of events or incidents. During focused coding, we then grouped initial codes with similar characteristics into more conceptual categories and identified patterned relationships among them. This process was assisted with NVivo (Butt and Ahmad, 2020) and allowed us to develop a more contextual understanding of each organization's experiences that resembled theoretical coding (Thornberg et al., 2014).

Upon completing the coding process, we then progressed to the second part of data analysis, which focused on within-case and cross-case analyses commonly practiced for multiple case studies (Yin, 1994). The within-case analysis sought to integrate the results derived from the analytic coding process with the contextual understanding gained from observations and document reviews

for each case organization. The cross-case analysis further examined their collective similarities and differences. However, unlike traditional cross-case analysis with an apparent positivist mentality that tended to seek construct validity (Dal Mas et al., 2020), our comparison between cases aimed at a contextual understanding of participant organizations' experiences about their collective characteristics of small organizations in the institutional context.

5. Findings

5.1 Within-case analysis

Throughout our analytic endeavor, the major milestones that shaped different phases of each organization's technology adoption process gradually emerged. Those major milestones usually denoted significant shifts in each organization's innovation intention or strategic plan. As shown in Table 3, we specifically selected pieces of evidence that corresponded to *knowledge, persuasion, implementation, and confirmation* phases as suggested in Rogers' framework (1995, 2002). We omitted the decision phase because the three case organizations' decisions led to acceptance (as opposed to rejection). While only one selected transcript quote was shown for each organization's adoption phases to avoid lengthy descriptions, further supporting evidence in relation to our categorization can be found in the Appendices.

5.1.1 MU: From early adopter to innovator

The Wi-Fi adoption process at MU could be considered an endeavor that shaped its Wi-Fi status from an early adopter to an innovator. Specifically, they might not be the first few universities to adopt Wi-Fi systems initially. Still, their next strategic movement would qualify them as one of the earliest universities to embrace full Wi-Fi services on campus.

Knowledge phase: responding to champions' pressure. One of the most unexpected situations at MU was how its Wi-Fi project was initiated. Given its centralized IT practice, one would expect the project to be driven by its IT department. Contrarily, it was unofficially initiated by a group of engineering professors (i.e., Ben, Jerry et al.) who acted as technology champions and experimented with different networks in 1999. Since MU had not yet developed any specific wireless plan at that time, those rapidly emerging networks faced little regulation. Consequently, the IT department detected many unauthorized access points that lacked technology compatibility. From the IT department's standpoint, its Wi-Fi plan was thus an apparent attempt to prevent a chaotic network interference on campus, and it was mainly a reactive movement, primarily a response toward the pressures created by its technology champions (Wesley's message, Table 3).

Persuasion phase: following the institutional trend. At the same time, MU's internal Wi-Fi development was situated in an external landscape where the institutional trend increasingly reshaped the universities' collective mentality about wireless technology. The institutional trend could be observed in the growing number of mobile devices used by students and the rapid development of wireless technology in higher education institutions (Table 3 and Appendix A). Facilitating all those institutional changes seemingly underlay a subtle but strong swift in a society where mobility had increasingly become an essential element in many people's lifestyles. In higher education, such mobility was embedded in campus routine because students and faculty members were frequently moving between classrooms. Eventually, mobile individuals naturally desire a persistent Internet connection to accommodate their needs (Lee's message, Appendix A). In other words, these factors collectively created an underlying institutional trend that reshaped the universities' mentality toward wireless infrastructure. As shown in Chief Information Officer (CIO) Kane's message (Table 3, MU), such an institutional trend firmly lays a foundation for its Wi-Fi movement.

MU's networking director (Wesley), network architect (Russ), and technology champions (Ben and Jerry) frequently referred to several institutional members in the city's medical center and other

universities as their inspiration for the Wi-Fi movement (Wesley, Russ, Appendix A). It was thus apparent that while MU's internal forces triggered its immediate action, the institutional trend created by multiple external forces also provided a backdrop that facilitated its plan. The former showed MU's direct reaction to better coordinate its Wi-Fi infrastructure, whereas the latter supported its overall Wi-Fi movement, as revealed by Jerry's message below. The institutional trend's collective force that was largely shaped by institutional networks and information exchanges by its internal (i.e., faculty and students) and external members (peer organizations or competitors) appeared to soundly persuade MU to follow the inevitable institutional trend.

Within the United States, there are probably 5 or 10 major research groups that we interact with. Those groups, particularly the groups at Caltech, the group at Berkeley, the group at San Diego, the group at UCLA, the group at Rutgers, all have wireless test bands they are working on. We interact with them collaboratively on some of these. We also make our test band available to some of them... We also have a lot of collaboration with Europe. [Jerry, Assistant Director]

Implementation phase: complying with institutional norms. Upon responding to the champions' pressure and the institutional trend, MU quickly conducted its Wi-Fi project with little strategic planning. It merely sought to prevent uncontrollable network interference on campus. As revealed by Wesley, the first two stages of their implementation process were simply quick fixes (in his terms, "landy grab") of potentially chaotic situations and stabilizing the initial implementation. The former began around 2000, and the latter continued until 2002 (Wesley, Appendix A). During those implementation stages, what MU accomplished was mainly complying with institutional norms about Wi-Fi technology in higher education. For example, in 2002, when MU's business school relocated to a new building, existing students might be able to witness the improvement of Wi-Fi systems. New students, by contrast, would consider the significantly improved Wi-Fi systems

comparable to normal institutional standards because the newly implemented 802.11b system was a widespread practice in the technology field and higher education at that time. The message from Darrel, IT Director of Business School, highlighted such institutional norms.

And when we moved into this building in 2002, the students were anxious about the wireless because it had involved, had become very reliable by the time we moved in the building, and we set 802.11b, so it was a very welcome change for the students that moved from the old building to the new building... For the students that came in and only knew this building, it was like, "Yes, that's the way it is supposed to be." So, they didn't see any improvement. They just met their expectations. People who moved over saw their expectations in their culture.
[Darrel, IT Director of Business School]

Confirmation phase: Leapfrogging institutional trend. Upon stabilizing the initial implementation of Wi-Fi systems, MU began to develop an advanced strategy to enable comprehensive Wi-Fi coverage across the entire campus and provide seamless mobile services to its members. This phase demonstrated MU's belief in societal changes, which have rapidly created a mobile workforce. It also showed MU's strategic proactivity to provide technology services that would accommodate such an emerging lifestyle, as suggested by Kane's message.

My strategy is that faculty and students should not be concerned about the infrastructure. Most of the infrastructure should be seamless... my thought process on strategy is that we put in this new network, wireless, we put in storage back-up, and a new e-mail system. What we want to do is be able to provide our faculty and students and staff with what they need... My rationale is to provide a better service to our faculty/staff and for students to provide better support.
[Kane, CIO]

The CIO's notion of 'seamless' wireless services could be further elaborated by Russ's message: *"The ultimate goal for the new network will be to have wireless coverage for the entire campus all the way to the borders of the MU property. Everywhere one hundred percent!"* (Russ, Network Architect). At that time, such a strategic movement of comprehensive Wi-Fi coverage was rare in colleges and universities (Lu et al., 2009). The CIO intended to transform its wireless infrastructure into utility-like services that users would take for granted. Such utility-like services should exist ubiquitously so users *"don't have to think about it"* like *"when you go to your home you can turn your lights on and you can turn as many as you want"* (Kane, CIO).

Although nearly half of the campus (i.e., stadium, gardens) was infrequently visited by its members, MU's strategic intention to move toward a comprehensive Wi-Fi zone was firmly built upon its new belief that the frequency of service provision should not be a major concern, but its ubiquitous existence should be. MU's wireless strategy at this stage showed similar intention, as Kane explained: *"You need to be able to be mobile around campus and have enough storage for your files. They need to get all these resources without much of a hassle."* In other words, at this phase, MU began its strategic changes of wireless endeavor that would proactively move toward ubiquitous services that analogized utilities in developed countries and far exceeded institutional norms at that time.

Continuing strategic changes made at the confirmation phase, MU further expanded its technology intention and proactively aligned it with business objectives. The intention was not just to provide seamless services anywhere on campus but also to make the campus more attractive to the new generation of students. As Wesley recalled, universities' marketing brochures often included many aspects of students' campus lifestyles. In selecting a potential university, the new generation of students would also seek an enjoyable environment, accommodating student needs such as sports facilities, library capacity, and technology infrastructure. MU's strategic upgrade to provide comprehensive Wi-Fi coverage was its proactive intent to differentiate itself from

competitors and, in turn, attract potential students who have Wi-Fi services as a criterion for their college choices.

So this next upgrade, the whole coverage, is really a more strategic move, a tactical one. So we can say, "You know what, MU is a fully wireless campus so that you can walk from one building across the campus and cover the whole way." It comes with objectives..... So, while it is not available, you don't have it and maybe other people don't have it, then it becomes strategic differentiators. Right now... we are one of few campuses in the country that can cover the entire campus... and that is a differentiating thing... And part of it is just marketing to students; students are looking for where to go to colleges, you know, check box. Metropolitan University, wireless access available throughout the campus, checked. That is the decision-making point for people. So, universities compete with their infrastructures. [Wesley, Networking Director]

Having demonstrated such a mentality of strategic differentiation, MU finally established a concluding milestone for its Wi-Fi endeavor. Its technology services were strategically aligned with its marketing endeavor. Such transformation indicated that MU was no longer passively complying with institutional norms but actually leapfrogging and leading the institutional trend. Since very few universities offered similar infrastructure at that time, MU's rapid development of Wi-Fi services could thus qualify itself in the category of 'innovators'.

5.1.2 CCC: From late majority to early majority

CCC's Wi-Fi adoption process could be considered an endeavor that shifted its status from late majority to early majority. As narrated in the knowledge, persuasion, and implementation phases below, CCC's Wi-Fi implementation only commenced after the technology had been widely

adopted in the field (i.e., late majority). However, its subsequent development, as shown in the confirmation phase, quickly followed the technological trend and allowed them to adopt newer systems that were becoming popular among universities (i.e., early majority).

Knowledge phase: capitalizing champion's initiative. CCC began its wireless project at a later stage when the technology had become widely popular. The project was initiated by its networking director, Felix, who apparently acted as CCC's technology champion. He perceived a need to comply with the industry's emerging trend and, in turn, led CCC's IT department to submit a grant proposal for wireless technology without formal approval from the university administration. Felix's message below shows that his rationale for initiating CCC's wireless project was largely because of the institutional trend that has increasingly reshaped an emerging competitive landscape.

We wrote the grant. We incorporated that into the grant. It was a pilot project and we got it started. That's how we got it initially started..... we never asked for the formal approval of the project, we just started doing that because we saw that other competitive universities were doing the same things, and that was the industry was going. [Felix, Networking Director]

Persuasion phase: following the institutional trend. Such an institutional trend could be increasingly observed in the growing demand and expectation of wireless services from students and the competitive landscape of higher education as a whole. As shown in Ronald's and Felix's messages, new generations of students had been accustomed to Wi-Fi services in their everyday lives. It was inevitable to expect similar services from the university, where they spent much time studying and socializing. From the IT standpoint, it might be easier for them to provide Wi-Fi services than wired Internet access since there was no need to install physical outlets for students to 'plug in'. Moreover, as the whole higher education sector was moving in the same direction, it would make sense for Felix and its department to follow such an institutional trend, internally and externally.

I think our students simply expect to have wireless access. If they have it at Starbucks, if they have it, you know, at places they frequent, I think they will expect it at the university as well... it is a new generation or just the absence of the wireless internet access, just sort of newer tech to our students. They just expect to have it if they don't have it they are not happy. [Ronald, Professor]

I want to give students the flexibility, to be able to connect pretty much from anywhere, we saw that students were congregating, they were always asking for "Can we plug in somewhere?" You sort of have the plug in muscle to be able wirelessly, and we can control the wireless network..... Other universities were doing at the same time... As whole other universities... higher education [Felix]

Implementation phase: Adapting the institutional trend. Once Felix and its department received the grant from the government, they began to experiment with some wireless access points and provide basic Wi-Fi services in two buildings. As revealed by Felix, their pilot project was quite rudimentary and experimental. Even by 2002, their Wi-Fi services were still rather limited. However, the implementation process could be considered an incremental endeavor and CCC, despite its relatively late adoption of Wi-Fi technology, was able to accelerate its Wi-Fi expansion. At the time of the interview, approximately 90% of the CCC campus, largely due to its small size, had been covered by wireless services. Such an accelerated endeavor showed CCC's ability to adapt to the institutional trend and joined a large group of universities that sought to provide a nearly campus-wide Wi-Fi service at a relatively early stage.

Wireless background started with 2 buildings. We started the office with a pilot project... and there were total of about 5 access points... the following year, 2002, we added two more buildings, and then it was kept on adding more building and

adding more wireless..... we currently have 14 buildings that have fully wireless, 14 locations, 90% of the academic mall is covered in wireless. [Felix]

Confirmation phase: Shaping institutional changes. Upon completion of near campus-wide Wi-Fi coverage, various institutional changes at CCU increasingly took shape. Internally, students appeared to aggregate more frequently on campus, particularly at the library and student commons, where our observations occurred. This was a significant change for CCC because it was a typical urban teaching university where most students were commuters who rarely stayed on campus. Interviewees confirmed that a growing sense of community began to emerge from CCC's campus, as revealed by Christian and Rachel.

When people think about what attracts students to campus and what keeps our students because we have a lot of commuter students who come to school and leave, and I think if they can stay here, cruising the Internet, checking their emails, or IM, or whatever they are doing, do their homework or whatever, that gives them more flexibility. When I walk around campus, I do see students, a lot of students with laptops, sitting out at different part of campus. [Christian, Department Chair]

I don't have any evidence to back this up, but I get the impression we have fewer interactions with students, but they are spending more time here [library]. I think the students like to work in an area that feels "welcoming" to them. They want the solitude of being able to work, but they also want an area where there is a social order of people around them. [Rachel, Librarian]

Another important aspect of institutional changes could be observed in the student's learning process and campus lifestyle. With the support of Wi-Fi infrastructure, the students increasingly

took advantage of technology services and started relying on their laptops as new tools for their learning. With the newly implemented wireless services, the students were no longer constrained by wired network availability. They could access the Internet conveniently on campus. Students on campus expressed that Wi-Fi services substantially enhanced their mobility and productivity.

It's very helpful to have a laptop with you. Sometimes you have a paper, say, for instance, due at 5 pm or in a few more hours... if you have it on your USB, you can just put it in and fix it up and find a printer somewhere and just attach it and print it out fast. It is very useful when you're a college student, I think. The wireless connection we have here is very helpful and allows us to use our laptops as well. [Mandy, Student]

It's very convenient for me, you know. I can sit back here without worrying about a cord or a line that I can connect to my computer and the modem, you know. That's how I like it. I find the wireless network very good for that. [Aurora, Student]

Beyond its organizational adaption facilitated by wireless services, an emerging phenomenon was driven by CCC's open Wi-Fi access. Due to its proximity to the city center, many young residents and professionals started to frequent CCC because of its free, open Wi-Fi access. Its library had increasingly become an academic and social center not just for its students but also for residents in the urban neighborhood, as revealed by Jim and Gerald below.

Yes, while I'm here at their facility, I use their wireless network. It's part of the reason I come here. It's a quiet area to concentrate on studying so the main benefit is that they do have wireless access here, which is why I come primarily. [Jim, Local Resident-Physician]

I'm a dentist. I graduated in South America. I'm here at CCC's library, study to take my national boards and that's what I'm trying to do here right now... I just came here to use their wireless network..... Well, I can bring my computer anywhere. I have my study material on my laptop and I can take it anywhere I want to and I have a connection. Any site I would like to go to; I have a connection. [Gerald, Local Resident-Dentist]

Although such an emerging phenomenon might be an unintended consequence of CCC's open access to wireless services, the presence of young professionals on campus subtly shaped an emerging community that extended CCC's physical boundary, as revealed by Christian's message below.

I think they come here for wireless. It is not advertised community resource but it is kind of nice that people do come around here. I guess that builds some community, I would like to think that it gives back to the local community. [Christian, Department Chair]

These institutional changes that were observed in students' growing communal belongingness as well as in emerging invisible institutional boundaries were essentially enabled by Wi-Fi services. In other words, even though CCC's initial Wi-Fi adoption was considerably later than the institutional trend, its swift expansion of Wi-Fi coverage not only allowed CCC to join the early majority group in the wireless race but also enabled it to experience various institutional changes and, in turn, reshape its institutional relations.

5.1.3 SH: From laggard to innovator

While SH's intention for Wi-Fi services was non-existent until the industry underwent several phases of technological evolution, its extremely late adoption saw its rapid incorporation of numerous cutting-edge technologies that had rarely been adopted by its peer organizations in its institutional field. Such a radical Wi-Fi implementation process could thus be considered an endeavor that moved SH from a laggard to an innovator status.

Knowledge phase: responding to institutional pressure. As traditionally recognized as a community hospital, SH had been content with its regional status and never considered wireless technologies a necessity for its business operations. The reason that its wireless initiative would eventually materialize was mostly because SH could no longer escape from the institutional expectations within and beyond the healthcare industry. As Site Manager (Tanya) revealed, within the healthcare industry, the federal government's HIPAA (Health Insurance Portability and Accountability Act) "*is forcing everything to go digital as well. I think every hospital's goal is to get compliant with HIPAA... that's a big push in getting everything electronic versus paper.*" Wi-Fi services would thus need to be considered because they provided the backbone infrastructure that enabled medical staff's mobile access to its electronic systems. ER (Emergency Room) Director Dr. Dale's message below further elaborated on why compliance with HIPAA was a necessity.

Well, the government has one very significant power: money... Since you have that significant percent, in fact, more than 25 percent of patients admitted to the hospitals are government funding. So they have control over who they are gonna pay, so they have control over what guidelines we are gonna follow. You can choose not to do it, but then you don't get the funding. [Dr. Dale, ER Director]

Beyond the healthcare industry, as pointed out by Dr. Fernando, "*the Internet is no longer an option. It is a requirement for patients, for doctors*" like basic utilities taken for granted in society.

As such, “*the hospital will have to implement some sort of access, and wireless is the only reasonable choice for them.*” His message was echoed by Dr. Dale, who suggested: “*since even the city government had planned to implement a municipal Wi-Fi network, wireless technology and mobile services are gonna be universal..., which is amazing. It is gonna happen... it is gonna be a norm.*” Such an increasingly permeating norm in society and the healthcare industry provided strong institutional pressures that implicitly urged, if not mandated, SH to adapt quickly to the institutional trend.

Persuasion phase: capitalizing champion’s initiative. At that time, SH began experiencing radical changes in its business and IT direction due to a sudden shift in ownership and leadership. The ownership change occurred through an acquisition, which incorporated SH into a part of the largest healthcare providers in the country. Since then, SH has no longer operated its IT department but has outsourced it to the corporation’s centralized IT partner. Its former competitors in the local community had suddenly become its sister hospitals, competing for patient services as usual but cooperating on healthcare issues for the greater community and industry simultaneously. The ownership transition obliged SH to reconsider its previous mentality that was simply content with its community hospital status and, in turn, comfortably lagged behind the industry standard.

The newly appointed CEO (Chief Executive Officer) further facilitated radical upgrades in SH’s business and IT services. As CEO’s assistant revealed, “*he [CEO] has been instrumental in encouraging and asking [the headquarter] to get... the latest and greatest of these things [new technologies].*” Such radical transformation in leadership quickly paved the way for SH’s Wi-Fi implementation and advancement.

Implementation phase: Exceeding institutional practices. With an enthusiastic CEO, the latest Wi-Fi infrastructure and various mobile services began mushrooming on SH’s hospital complex. Although Wi-Fi services had not yet covered SH’s entire campus at that time, its incorporation of wireless systems into its healthcare operations had been essentially realized, as indicated in Earl’s message.

Right now, it's limited to the ER and the classrooms and the board room and various common areas. It's not totally house wide. We currently have ten access points deployed and it's growing as we develop and can show the advantages of mobility and mobile users wherever we can justify adding to the wireless infrastructure. [Earl, Senior Networking Manager]

Due to the corporation's outsourcing IT strategy, every hospital in the corporate chain implemented the same types of technologies and systems that matched the latest industry standards. This standardization approach allowed SH to quickly experience and compare its newly implemented Wi-Fi systems and relevant mobile technologies with the industry standard and its sister hospitals. Since SH had been lagging behind the industry's Wi-Fi and mobile standards, when the new systems came to light, they were apparently the newest upgrades of their competitors or sister hospitals. For example, as Earl suggested, even though their sister hospitals were 4 or 5 times larger in size and had used wireless networks and ER Patient Tracking Systems for years, *"ours will be newer than theirs and we will have all the functionality that they have plus a little bit more."* Another example could be observed in the VoIP (Voice over Internet Protocol) phone that hospital staff used to communicate with one another while they were away from their workstations. With all these radical upgrades of Wi-Fi infrastructure and mobile devices, SH had increasingly moved away from its previous laggard image and exceeded institutional practices that had become relatively outdated compared to SH's newly deployed systems and devices.

Confirmation phase: leapfrogging the institutional trend. As SH rapidly expanded its Wi-Fi services, the newest systems were quickly integrated into its business processes and, in turn, helped transform its internal and external communities. Internally, substantial improvement was observed in SH's core businesses, such as clinical treatment and patient services. Notable examples of wireless systems and mobile technologies that helped achieve such improvement included guest

Wi-Fi networks, mobile diagnosis systems, electronic medical record systems, and portable language translation systems.

- The guest Wi-Fi networks provided free access for SH's patients to schedule appointments, search for their clinical information, or enjoy social media entertainment.
- The mobile diagnosis system allowed SH's physicians to examine patients remotely.
- Electronic medical record systems collect digital patient information and medical history.
- The portable language translation system replaced traditional interpreters with mobile systems that help translate dialogs between physicians and patients in multiple languages.

As Nursing Director Marina revealed, SH would be the first in the state to incorporate portable language translation systems into its healthcare services. In addition, compared to most hospitals' partial scale, its electronic medical record systems were one of few in the state that was implemented with complete functionality. In other words, SH was no longer content with its previous laggard position but instead demonstrated innovative intentions far exceeding the institutional trend. Externally, with better clinical treatment and patient services enabled by all those newly implemented wireless technologies, a healthier community had steadfastly emerged, as illustrated by Toby's message.

So the value for our community is we are gonna be able to help our patients diagnose, treat, and prevent medical issues that we weren't able in the past or weren't able to proactively. So I think that is gonna impact our community, a healthier community, once they become more engaged in the health care where it wasn't before, ultimately, be affected by some illness or diseases because they did not have a more efficient, proactive approach to that management, so I think the value is our healthier community. [Toby, Director of Patient Services]

In relation to wireless systems in particular, due to their work nature that required constant mobility and instant connection to medical results in the systems, physicians like Dr. Bowie

instinctively perceived “*the more wireless technology, the better, just because then we are able to make our days more efficient.*” As Dr. Fernando revealed, “*the more technologically advanced will draw more physician interest, make physicians more likely to commit to that hospital.*” With all those radical upgrades of wireless systems, SH had increasingly provided better clinical tools for physicians “*to do their diagnosing and treating*” and an “*expedite, more customer friendly approach to the whole hospital experience for their patients, so ultimately their patients are happier with them [physicians] bringing them to the facility*” (Toby, Director of Patient Services).

Upon satisfying physicians’ and patients’ medical and technological expectations, SH further attempted to reshape its image in the suburban community that had rapidly extended the boundary of the metropolitan area. According to Toby, SH’s new marketing campaign would seek to advertise its emerging technological advancement that could diagnose and treat medical issues that were unsolvable previously. Such a proactive approach is intended to attract not just patients’ attention to SH’s renovated capabilities but also residents’ engagement in the healthcare industry in general. In other words, upon completing its wireless endeavor, SH eventually experienced noticeable internal changes and community transformation. Given that numerous mobile devices and systems adopted were the most advanced in the metropolitan area and the state, SH appeared to have extricated itself from the long-lasting laggard image and leaped forward to lead the institutional trend.

5.2 Cross-case analysis

While each case’s background might have shaped its wireless adoption process, certain similarities that might be due to the context of small organizations and wireless technology could be observed. First, institutional forces appeared to have strongly influenced all case organizations’ Wi-Fi adoption. Second, radical changes immediately emerged from all three case organizations upon

completion of wireless implementation. Third, leapfrogging effects could eventually be observed in all case organizations' Wi-Fi experiences.

Table 3

Case organizations' innovation phases and selected evidences.

Case\Phase	Knowledge	Persuasion	Implementation	Confirmation
MU	Responding to champions' pressures	Following the institutional trend	Complying with institutional norms	Leapfrogging the institutional trend
Selected evidence	<i>The first wireless network on campus was I believe it was a research project..... I think two people used it deployed in one building. I think that is probably around 1998, 99 kind of time frame. Nobody used it..... Then, the whole 802.11b appears on the scene the whole Apple producing the airport like Lucent produces new stuff.... We are kind of looking at people started buying their stuff at home. Our decision was... this will be a total chaos if we don't get ahead of curve. If we don't deploy the infrastructure, then everybody is kind of deploying their own. That will never work... we quickly put together a little proposal, says, 'hey, look, we got to get ahead of school of engineering individual faculty members.'</i> [Wesley, Networking Director]	<i>At the same time, most of the universities in the US were also going to wireless. There has been a pretty significant change on our campus and I think a lot of it has been driven not just by our faculty but also students. Students, for example, are, at least the students here, work 80, 90 percent off their computers. People are more mobile and they are travelling more. They have laptops so they are just looking to connect to the Internet. A lot of the students also have PDAs [personal digital assistants] and I think that is driving it also.</i> [Kane, CIO]	<i>That is landy grab. The first thing is if we don't do something, it will be a disaster. I will call that a landy grab. We used to rush out there, so we are doing this. So we do the land grab. The second one is really just kind of extending that model and expanding it to keep ahead of the demands. The third model is really to engineering it. In this third model, we are actually doing site survey. We can tell you the physical properties, the holes; you put an access point here, it will cover so much space; it takes account into windows, things like that. So it is more scientific, thoughtful process.</i> [Wesley, Networking Director]	<i>So this next upgrade, the whole coverage, is really more strategic move, a tactical one. So we can say, "You know what, MU is a fully wireless campus so that you can walk from one building across the campus and cover the whole way." It comes with objectives..... So while it is not available, you don't have it and maybe other people don't have it, then it becomes strategic differentiators. Right now, we are one of few campuses in the country that can cover the entire campus... and that is a differentiating thing... And part of it is just marketing to students; students are looking for where to go to colleges, you know check box. Metropolitan University, wireless access available throughout the campus, checked. That is the decision-making point for people. So universities compete with their infrastructures.</i> [Wesley, Networking Director]
CCC	Capitalizing champion's initiative	Following the institutional trend	Adapting the institutional trend	Shaping institutional changes
Selected evidence	<i>We wrote the grant. We incorporated that into the grant. It was a pilot project and we got it started. That's how we got it initially started..... we never asked for the formal approval of the project, we just started doing that, because we saw that other competitive universities were doing the same things, and that was the industry was going.</i> [Felix, Networking Director]	<i>I want to give students the flexibility, to be able to connect pretty much from anywhere, we saw that students were congregating, they were always asking for "Can we plug in somewhere?" You sort of have the plug in muscle to be able wirelessly, and we can control the wireless network. Other universities were doing at the same time... As whole other universities... Higher education [Felix]</i>	<i>We're gonna continue expanding larger buildings where students and faculties are aggregating. We are keeping places wireless in these buildings. When I said 52 [buildings], we also have some small houses, they are not classrooms, there is no faculty offices... we also have houses for storages, so you choose the buildings that faculty and students are, make them able wireless.</i> [Felix]	<i>Yes, while I'm here at their facility, I use their wireless network. It's part of the reason I come here. It's a quiet area to concentrate on studying so the main benefit is that they do have wireless access here which is why I come primarily..... since I have access to the wireless network it's much easier for me to feel like I'm more productive because the wireless network is available and I think I can get more done in one sitting than I would have if I had to go somewhere else.</i> [Jim, Local Resident-Physician]
SH	Responding to institutional pressure	Capitalizing champion's initiative	Exceeding institutional practices	Leapfrogging the institutional trend
Selected evidence	<i>HIPPA has a bunch of security mandates or whatever that is forcing everything to go digital as well. I think every hospital's goal is to get compliant with HIPPA and I'm not sure exactly what all those rules are but I know that's a big push in getting everything electronic versus paper.</i> [Tanya, Site Manager] <i>Since you have that significant percent, in fact more than 25 percent of patients admitted to the hospitals are government dependent funding. So they have the control who they are gonna pay so they have the control what guidelines we are gonna follow. You can choose not to do it but then you don't get the funding.</i> [Dr. Dale, ER Director]	<i>He (CEO) has been instrumental in encouraging and asking [the headquarter] to get... the latest and greatest of these things [new technologies] such as the latest guest Wi-Fi infrastructure, ER Patient Tracking Systems, VoIP (Voice over Internet Protocol) phone, mobile diagnosis system, full scale of electronic medical record systems, portable language translation system.</i> [Ginger, Executive Assistant]	<i>As we build on to this hospital, we will add wireless to the new areas and that sort of thing. The same drivers for the ER and for the bedside registration in the ER exists in both facilities. They use the same registration systems and they use the same ER Patient Tracking System. At the moment, they are on a slightly newer ER Patient Tracking System that uses this nursing charting system. By the time we go live with ours next month, ours will be newer than theirs and we will have all the functionality that they have plus a little bit more. We upgraded the wireless infrastructure three weeks ago in anticipation of and as a result of these new features that are coming next month because so much more is going to go on the wireless network, we elected to do the upgrade.</i> [Earl]	<i>we are gonna have in neurology there is not enough doctors to go around, that specially do neuron for strokes for example. So this computer on wheel that we will be able to roll to the patient's bedside is actually gonna communicating with neurologists. We will put it in front of you, and our doctor will sit next to you, and this doctors is gonna tell that doctor what to do.</i> [Marina, Nursing Director] <i>Well, this computer works very similar way to neurologist, we call them, we tell them what we need, they will get that person that can speak technical medical jargons and we will bring it right to the bedside, with the doctor, with the nurse, and the patients, and we will be able to communicate. I believe there is 500 languages, all kinds of dialects, as well as sign languages, different levels of sign languages. We are very excited for that.</i> [Marina]

5.2.1 Institutional forces

Institutional forces, either from internal members or the external environment, evidently played an influential role in all these cases. At MU, the strong influences of institutional forces could be observed internally in its boundary-crossing champions and externally in the institutional trend increasingly expected in the higher education sector. While the internal forces created the demand, the external forces further drove MU's strategic responses. At CCC, similar internal demand from students and external expectations commonly observed in the higher education sector also motivated its wireless initiative. Although these internal demands and external expectations might differ from those of MU, they served essential justifications for its wireless endeavor. At SH, while the initial influence of institutional forces could also be observed in the institutional trend such as HIPAA that created a high degree of institutional authority and institutional pressure that inevitably mandated SH's wireless endeavor, the most critical driving force might be attributed to its merger with a larger corporation and, more importantly, its changes in leadership that was instrumental in initializing subsequent wireless transformation.

5.2.2 Radical changes

Despite being in different innovation categories for adopting Wi-Fi systems, all three cases quickly experienced radical changes within or beyond the organization. For MU, radical changes could be observed in its prompt actions toward a centralized Wi-Fi infrastructure and particularly in its comprehensive upgrade to elevate its technology services and wireless experiences. The elevated technology services were incorporated into its business objectives to better compete in the industry and lead the institutional trend. For CCC, radical changes manifested themselves in students' work patterns and academic lifestyles and an emerging invisible community that might have reshaped its institutional relations with the local community. With numerous cutting-edge wireless systems and

mobile devices rapidly implemented at SH, radical changes could be easily observed in physicians' clinical processes, patients' healthcare experiences, and the community's transformation.

5.2.3 Leapfrogging effects

Eventually, all three cases experienced specific leapfrogging effects that enabled them to lead the institutional trend or reshape institutional relations. At MU, leapfrogging effects could be observed in its strategic differentiation that helped MU to lead rather than follow the institutional trend. At CCC, we observed the emergence of an invisible community facilitated by its open Wi-Fi access. Such newly transformed institutional relations might have allowed CCC to reposition itself as the academic and social center not just for its urban commuting students but also for its local neighborhood. For SH, the effects were arguably the most noticeable. This was primarily because SH's wireless systems and mobile devices were significantly newer than its competitors' versions. Its remarkable attempt to adopt leading-edge systems such as portable language translation systems further exemplified such leapfrogging effects.

Fig. 1 provides a summative illustration of these leapfrogging effects. Initially, implementing all those technologies in the case organizations was expected to follow a straightforward process resembling a linear movement, i.e., the 'expected process' typically shown in incremental adaptation. Instead, after experiencing radical changes, all these case organizations' implementation results leaped forward, as shown in the 'experienced path'.

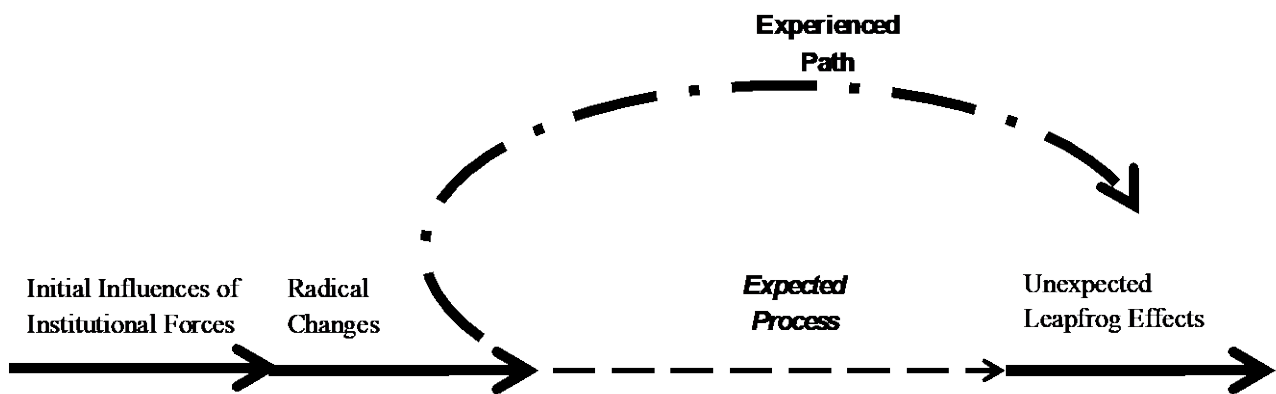


Fig. 1. Small organisations' leapfrogging experiences.

6. Discussion

With respect to knowledge gaps, insights gained from our case analysis illustrate that, despite unique organizational backdrops that may shape different experiences, various institutional forces play significant roles in all phases of small organizations' technology (Wi-Fi) adoption process. At the knowledge phase, institutional forces are often triggered by, internally, technology champions and enthusiastic leadership and, externally, by institutional authority. At the persuasion phase, an inevitable institutional trend increasingly emerges from institutional norms and institutional pressures created by those internal and external institutional forces. In the higher education sector, students' demands, faculty's expectations, and other universities' practices manifest such institutional trends. In the healthcare industry, the institutional trend can be best observed in physicians' and patients' requests, competitors' practices, and societal norms. As the existing literature suggests, those institutional trends strongly urge or force small organizations to respond to prevalent institutional norms and pressures, eventually leading to technology adoption (Adjei et al., 2021; Donbesuur et al., 2020). During the implementation phase, small organizations may adapt to the institutional trend differently. Although all three case organizations adopt a centralized approach, likely due to their size, those with abundant resources (i.e., MU) and corporate support (i.e., SH)

experience a radical implementation that quickly leads to rapid upgrade or immediate transformation of Wi-Fi systems. In contrast, those with financial or technical concerns (i.e., CCC) tend to rely on an incremental implementation through which progressive expansion of Wi-Fi systems on campus is carried out. At the confirmation phase, the institutional trend shaped by growing institutional norms and institutional pressures in higher education and healthcare sectors further firmly urges small organizations' future Wi-Fi endeavors. More specifically, once the technology is internalized, the organization begins to demonstrate radical changes in organizational adaptation or communal transformation, either technologically or managerially. Technologically, newly implemented systems are often incorporated into business processes rapidly and, in turn, significantly change how business activities are conducted. Managerially, business operations and strategies also often experience fundamental changes. In other words, the Wi-Fi implementation provides an opportunity for small organizations to not just comply with the institutional trend but also sometimes reshape it.

As for innovation status for SMEs, our study shows new insights that when small organizations manage to adopt emerging technologies well, technologies often, in turn, significantly shape organizations' innovation status, frequently in an unexpected leapfrogging fashion. As popular technologies evolve continuously, the version of the technology implemented by early adopters may become outdated when latecomers decide to adopt (Venkatraman et al., 2022). Leapfrogging effects are subsequently observed for later adopters who logically skip intermediate development and enjoy the latest version of technologies (Lee, 2021). Consequently, as shown in all three case organizations' experiences, Wi-Fi adoption could provide an opportunity for small organizations to renovate their business operations, customer services, or even strategic planning. Depending on how small organizations capitalize on the opportunity, their technology status can be subsequently elevated, changing from laggards to innovators (e.g., SH), late majority to early majority (e.g., CCC), or early majority to innovator (e.g., MU). Although these categorizations might not be in strict precision, a positive improvement in small organizations' technology status can be confirmed.

6.1 Theoretical contribution

Reflecting on theoretical perspectives, our study contributes to innovation diffusion theory (Donbesuur et al., 2020), institutional theory (Bag et al., 2022), as well as other research areas of digital transformation (Troise et al., 2022), innovation leapfrogging (Venkatraman et al., 2022), and SMEs (Amouri et al., 2021) (Table 4). Our findings indicate that the technology adoption process is not linear, as Rogers (1995) proposes. Small organizations' decisions to adopt new technology are not necessarily driven by technical characteristics but often to respond to institutional trends created by institutional forces such as institutional norms and institutional pressures. In complying with the institutional trend, small organizations can quickly gain institutional legitimacy, allowing them to compete at a similar level as their competitors. All three case organizations' Wi-Fi experiences seem to support such perspectives of institutional theory.

Moreover, our case analysis shows that organizations' innovation status is not a static position but a continuously evolving situation that can be renovated with the technology that they adopt. These results extend Rogers's Diffusion of Innovation model (1995). When a technology (e.g., Wi-Fi) continues to progress over time, it provides a temporal opportunity for latecomers to transform themselves with the most advanced systems or devices available in the marketplace (Lee, 2021). Those most advanced versions of technologies will enable organizations to surpass their competitors and experience leapfrogging effects that help reshape an organization's technology status, becoming an innovator of the most recent version of a technology.

Table 4

Our study in relation to the existing literature.

Research area	Major findings	References	Note
Technology adoption	Organizations' technology adoption can be significantly explained by institutional pressures faced	Adjei et al. (2021)	Our findings support the significance of institutional forces in the technology adoption process
	Technological innovation improves SMEs' international performance but is moderated by the institutional environment	Donbesuur et al. (2020)	
Digital transformation	The contemporary technological environment has created even greater challenges for small organizations, particularly in emerging economies	Troise et al. (2022); Tamvada et al. (2022)	Our findings show how SMEs may take advantage of digital transformation and reform their competitive positions
	SMEs would need to devote their limited resources to quickly understand which technologies may best meet their purposes for digital transformation or face competitive disadvantages	Gaglio et al. (2022); Rese and Baier (2011)	
Innovation leapfrogging	As popular technologies evolve continuously, the version of the technology adopted by early adopters may become outdated when late adopters or laggards decide to adopt	Venkatraman et al. (2022); Lee (2021); Goldenberg et al. (2007)	Our findings empirically support leapfrogging effects in the innovation process, especially for SMEs
	Consumers may reject new products and await superior innovation development in the next product generation	Heidenreich et al. (2022)	
Institutional theory	Institutional forces often create institutional pressures or industry trends that force or urge organizations' innovation initiatives	Bag et al. (2022); Jiao et al. (2022)	Our findings are in line with suggestions made by institutional theory where complex institutional factors are influential for SMEs' innovation process
	An organization's innovation endeavor is not necessarily driven by internal assessment but by complex external forces like network ties	Albats et al. (2022); Hervás-Oliver et al. (2021)	
SMEs	SMEs and micro-enterprises often face more barriers, such as regulatory and competitive uncertainty as well as inadequate expertise, experience, and capital resources	Amankwah-Amoah and Hinson (2019); Amouri et al. (2021)	While SMEs face greater obstacles and constraints, our findings reveal that they can utilize leapfrogging effects for their innovation status
	SEMs are more vulnerable to environmental uncertainty and global crisis	Clauss et al. (2022)	

Our findings also contribute to the leapfrogging literature (Venkatraman et al., 2022), highlighting how leapfrogging effects might shape an adopter's innovation decision and challenge the diffusion process proposed by Rogers's model. In facing constantly changing technological development and consumer demands, an adopter can indeed choose to imitate or leapfrog the technology trend (Lee, 2021). In other words, the dynamics of the diffusion process and adopter categorization might be much more complex than traditionally thought, and the respective roles of the forerunner (e.g., innovators and early adopters) and the latecomer (e.g., early and late majority as well as laggards) might be reversed, depending on how the leapfrogging effects play out. Since rapid technological development in the competitive global market often showcases frequent upgrades or superior alternatives to existing technology (Goldenberg and Oreg, 2007; Heidenreich et al., 2022), it is highly likely that the leader in innovation acquires just a temporary leadership that can be reached by the laggard firm later on (Encaoua and Ulph, 2005). However, in extending the literature on leapfrogging effects, our findings suggest that not all innovation endeavors of laggards or late adopters will result in significant improvement in innovation status. Only those with abundant resources can incorporate radical changes into their business processes and, in turn, for leapfrogging effects to function most effectively.

This study also contributes to institutional theory (Bag et al., 2021; Geels, 2020; Huang and Chen, 2022; Leroux and Pupion, 2018; Nilashi et al., 2016). In relation to institutional theory, while our case analysis shows support for how institutional forces influence organizations' technology adoption process, insights gained from our findings further suggest that in the context of Wi-Fi technology, small organizations' adoption process may not always simply comply with institutional norms and institutional pressures. The competitive institutional trend is often created by complex factors such as institutional norms and institutional pressures that emerged from the field (DiMaggio and Powell, 1983; Scott, 1987; Oliver, 1991). Institutional norms tend to urge competitive members to follow, whereas institutional pressures often coerce them to comply with the institutional trend (Glover et al., 2014; Huang and Chen, 2022). In responding to the

institutional trend, an organization's innovation decision and diffusion process are thus shaped not just by organizational or innovation characteristics but also by greater institutional forces and external factors (Zorn et al., 2011). Although institutional forces strongly influence small organizations' decision-making process, once a new technology is implemented, they no longer need to simply imitate or follow other organizations' practices. There exists a possibility that small organizations can strategize new technology in their own preferences and leapfrog their competitors with proper implementation. Such leapfrogging effects allow them to lead the institutional trend rather than respond to or comply with it. In other words, technology scenarios where small organizations typically tend to imitate other organizations or follow institutional norms might be commonly observed, as suggested by institutional theory. With proper strategic planning, small organizations can possibly reshape the institutional trend instead. Given such leapfrogging processes, an organization's innovation status might be a fluid concept constantly *in fieri*.

6.2 Managerial implications

Insights gained from our findings suggest that the technology adoption process in the institutional context, particularly for small organizations, is not as clearly defined and straightforward as suggested in the literature. The significance of institutional forces and leapfrogging effects on the technology adoption process evidently implies that it is imperative for small organizations to manage the potential impacts of competitive threats and opportunities in the marketplace. For the earlier phases of technology adoption, nurturing boundary-crossing technology champions might be most effective because they are typically instrumental in bringing new ideas and technologies into organizations and, in turn, triggering an organization's strategic responses toward technological changes (Renken and Heeks, 2019). For small organizations, it is also essential not to merely focus on internal needs and business operations and subsequently isolate themselves from the institutional landscape. Various institutional forces within its institutional

landscape, such as institutional norms and authority, might have shaped competitive standards and the institutional trend that validate legitimate practices that meet industrial expectations (Bag et al., 2022). Small organizations should consider actively engaging in institutional forums and professionalization activities to better face such institutional forces and maintain their competitive positions. Those forums and activities provide cost-effective opportunities for small organizations to gather information about emerging business or innovation practices, to share experiences about how to better face environmental and technology uncertainty, and to establish institutional memberships that connect them to policymakers, industry leaders, and academic researchers who typically play influential roles in shaping the institutional trend.

For the later phases of technology adoption, leapfrogging effects found in our case analysis lead us to diverge our suggestions from traditional views of Diffusion of Innovation and Institutional Theory. In a technology context like Wi-Fi, where leapfrogging effects are highly possible, small organizations do not necessarily need to follow sequential phases of technology adoption as suggested in Diffusion of Innovation or merely imitate innovators' or early adopters' strategies as implied in Institutional Theory. Instead, they can take advantage of leapfrogging effects and devise better strategic responses that meet their contextual needs. Fig. 2 illustrates the three strategic responses interpreted through our case analysis where it is possible for small organizations to change their status from earlier adopters to innovators, from late majority to early majority, or even from laggards to innovators.

6.2.1 Trend Reformulation Strategy

As shown in MU's experiences, the strategic response of reclaiming a leading position and reformulating the institutional trend (i.e., moving from early adopters to innovators) can be accomplished when the organization possesses the necessary technology capital and managerial support. In the context of Wi-Fi technology, what differentiates an early adopter and an innovator might be the technologies and devices adopted and their integration with business planning. As an

early adopter, the network infrastructure must have been largely in place. The remaining movement to achieve an innovator status would be the consideration of comprehensive Wi-Fi coverage and the most current technologies and devices. Integrating technology strategy with business planning requires active communication and collaboration with stakeholders so that unique technology accomplishments can be marketed to proper audiences and, in turn, create anticipated business values. For small organizations, all these requirements are not as complicated as for large organizations and thus could be viable strategic considerations.

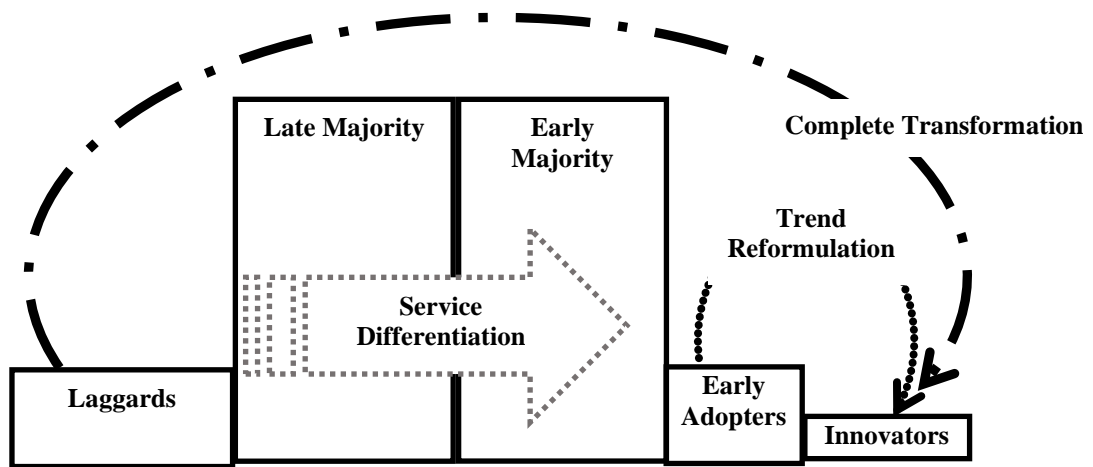


Fig. 2. Small organizations' leapfrogging strategy.

6.2.2 Service differentiation strategy

Small organizations can also utilize Wi-Fi and mobile technologies to differentiate their business services, as experienced in CCC. Although many aspects of wireless benefits realized by CCC can also be observed in other universities, one unique service unexpectedly creates an invisible community that revolves around its open access policy. For higher education organizations, this invisible community could trigger potential collaboration between the wider business and local community and the university, which could, in turn, benefit students and the university. For small organizations in other sectors, such as bed and breakfasts, family restaurants, or other service providers, friendly Wi-Fi access could similarly attract customers who seek services that meet their

needs. However, in a society where Wi-Fi access has become so prevalent that it may no longer provide service differentiation, small organizations may need to consider incorporating customized entertainment or social media services into Wi-Fi access so that differentiating business services can be achieved.

6.2.3 Complete transformation strategy

Finally, the leapfrogging benefits of a popular technology like Wi-Fi can also transform small organizations' innovation status from a laggard to an innovator. It depends on how an organization incorporates it into its business strategy. The main reason can be largely attributed to the technology's constantly evolving nature and relatively cost-efficient infrastructure requirement, which makes new projects feasible for small organizations. For a laggard organization to become an innovator, its Wi-Fi project would simply begin with the most current version of technologies since there is no need to upgrade the existing infrastructure. Given the constantly evolving nature of technology, what a laggard organization needs to be aware of is how to choose suitable versions of technologies that best meet its business strategy and operations. A clear alignment between its wireless solutions and business objectives will potentially enable a laggard organization's radical transformation into an innovator. However, this would require substantial managerial support and organizational determination to commit to a long-term campaign. In addition, to sustain those leapfrogging advantages, small organizations would need to continuously manage various institutional forces that play significant roles in the innovation process.

6.3 Limitations and future research directions

Given the nature of the case study, insights gained from our inquiry cannot serve a generalizable conclusion. In addition, the technologies chosen and case organizations investigated are limited in their specific context. How small organizations face challenges brought by different technologies

can link our empirical insights to contemporary technological development. The rapid development of artificial intelligence (AI) (Kshetri, 2021; Pillai et al., 2023) and the Internet of Things (IoT) (Chen, 2019; Chang et al., 2020) can be of particular interest. Alternatively, how will small organizations in other institutional contexts than higher education and healthcare sectors manage their innovation process? Insights for these questions will require future comparative studies. Coincidentally, all three cases analyzed resulted in improvement in their innovation status. This might be due to the cost-efficient nature of Wi-Fi technology and its prevalent expectations in society and the business world. However, organization theorists have suggested that following the institutional trend or imitating others' practices may lead to adopting inefficient technologies (Abrahamson, 1991) that might not necessarily improve an organization's capabilities or competitiveness. Future studies can thus explore contrasting cases that show the negative consequences of technology adoption and extend insights gained from our findings. Furthermore, future research could use a different lens to explain the adoption of continuously evolving technologies such as management fashion (Piazza and Abrahamson, 2020), emphasizing the non-linearity of adoption patterns based on fashion rather than variance models.

7. Concluding remarks

While inherent constraints faced by SMEs often lead to their disadvantageous competitive positions (Amouri et al., 2021), the rapidly changing technological environment creates even greater uncertainty and investment dilemmas for their digital transformation (Troise et al., 2022; Tamvada et al., 2022) where SMEs will need to tackle more complex issues in their internal business assessment and external institutional forces that play significant roles in their innovation process (Gaglio et al., 2022). Situated in such a complex competitive environment, traditional perspectives of innovation diffusion (Rogers, 1995) that focus on innovation characteristics and adopter categories in a linear, sequential pattern can no longer fully explain SMEs' technology

adoption process, let alone help them to respond to various external forces and emerging challenges of digital transformation and, in turn, seek better approaches to survive and thrive (Albats et al., 2022; Hervás-Oliver et al., 2021). Drawing from institutional theory, our study thus sets out to examine (1) the interactions between various institutional forces and different stages of SMEs' diffusion process of a continuously evolving technology and (2) the circumstances and the extent to which SMEs' innovation status might be reshaped in the technology adoption process.

Insights gained from our findings suggest that our study can help integrate several research areas (Table 4). The literature on technology adoption and institutional theory supports the significance of institutional forces in the technology adoption process and details how different institutional forces interact with each phase of the innovation process. From the knowledge, persuasion, and implementation to the confirmation phase, complex institutional factors influence each step of SMEs' innovation endeavors. For the digital transformation and SME literature, our study also shows how SMEs may take advantage of digital transformation and reform their competitive positions. While SMEs inevitably face greater obstacles and constraints, they can deliberately utilize the leapfrogging effects of technological innovations to transform their innovation status. To this end, we propose three strategic choices (i.e., trend reformulation, service differentiation, and complete transformation) that can help accomplish SMEs' objectives. Finally, for the leapfrogging literature, which is still in its infancy (Heidenreich et al., 2022), our findings empirically support leapfrogging effects in SMEs' innovation process. Evidently, with proper strategic planning, latecomers can indeed transform their innovation status, unlike what traditional innovation perspectives suggest, and better reposition themselves in the evolving competitive race (Lee, 2021).

On a concluding note, in further pursuit of knowledge contributions, future studies can consider investigating the influences of other types of institutional forces beyond institutional norms and pressures highlighted in this study in the technology adoption process. Will different types of institutional forces play different roles in small organizations' strategic making and/or innovation

process? More importantly, how other organizations that temporarily fall behind in the competitive race will react to the leapfrogging effects enjoyed by latecomers who transform themselves into forerunners? In other words, how can small organizations sustain leapfrogging benefits emerging from evolving technologies and, in turn, achieve an innovative culture and/or sustained reputation in the institutional field? Numerous research opportunities can thus be expected to continuously contribute to the leapfrogging literature and beyond.

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