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Is COVID-19 enough? Which underestimated conditions characterise the adoption of complex information infrastructures in small and medium-sized enterprises

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ABSTRACT

The COVID-19 pandemic crisis has forced firms to leverage information and digital technologies to resist its disruptive effects. The shift to digital, however, requires the availability of information infrastructure, such as enterprise resource planning (ERP), that can enable effective digitisation of processes and practices.

This paper investigates the role of the pandemic crisis on boosting intentions to adopt ERP systems in SMEs by mitigating the barrier factors that hinder their adoption.

To investigate the impact of the pandemic on ERP adoption decisions, we ran a quantitative study among 147 SMEs in the Veneto region in Italy and applied a fuzzy set qualitative comparative analysis model to study them. Our results show that the pandemic crisis has boosted this adoption, shaping the configuration of conditions that characterise ERP adoption.

1. Introduction

The recent COVID-19 pandemic crisis has imposed a dramatic worldwide lockdown of activities in favour of remote or smart working for many businesses (Breier et al., 2020). In just a few days, employees had to be able to collect, manage and share data, information and knowledge without any physical access to their offices and desktops. At the same time, companies had to be able to accelerate their transformation to digital by switching most paper-based processes to digital in one night (Carugati et al., 2020). Information and communications technology (ICT) became the pillar for their communication, and enterprise resource planning (ERP) systems—the backbone of firms’ information infrastructure—were the critical success factor that could guarantee the best organisational performance and enable a successful switch to digital processes (Kraus et al., 2020).

The strategic role of ERP in sustaining firm competitiveness is corroborated by the amount of investment in this area. According to the Gartner group, in 2019, ERP systems were one of the largest categories of enterprise software spending, with an estimated annual growth rate of 7.1% from 2018 to 2022 (Van Decker et al., 2019). However, if ERP systems represent a consolidated reality and a standard in large enterprises, many managers and entrepreneurs in small and medium enterprises (SMEs) feel that their complexity is not fully compatible with the agility and flexibility required by their firms and that their implementation is too challenging. Indeed, the adoption of an ERP system is a ‘real’ strategic decision. On the one hand, it entails competitive advantages (Jenson & Johnson, 1999; Porter & Millar, 1985; Seethamraju, 2015); on the other, ERP systems have a pervasive impact on company processes and practices, thus requiring a level of managerial expertise that many SMEs do not have (Marsudi & Pambudi, 2021). Indeed, SMEs, with their typical budget constraints and reluctance towards process standardisation, have mostly continued using standalone function systems, with little integration and limited remote access (Lewandowski et al., 2013). Although SMEs in worldwide economies represent about 90% of businesses and more than 50% of employment worldwide (World Bank, 2021), studies on ICT and ERP systems have focused mostly on large companies. Indeed, only a few studies have analysed SMEs specifically (Aldossari and Mokhtar, 2020; Alsharari et al., 2020; Buonanno et al., 2005; Kanchana & Sriranjini, 2018; Muscatello et al., 2003; Popli & Sarin, 2015; Seethamraju, 2015; Zach et al., 2014), mainly considering implementation or software as service (SaaS) issues. Nonetheless, in this stressful time, it is important to fill the gap in the management literature on the readiness of SMEs to set up the first stage of digitisation, by investigating the extent to which they are ready to
adopt complex information infrastructures such as ERP, the factors that have conditioned ERP implementation in SMEs and the extent to which COVID-19 has influenced their intention to use ERP systems.

Because of the typical overlap between managers and entrepreneurs, in SMEs ERP implementation is an entrepreneurial decision that reflects the head of the company’s propensity to move to digitalisation and new investments.

As suggested by recent studies (Yueh et al., 2016), the individual acceptance of technology is critical. Therefore, we decided to investigate the determinants that affect the intention to implement ERP through the lens of the unified theory of acceptance and use of technology (UTAUT), which suggests that the intention of an individual to use ICT is influenced by four factors—performance expectancy, effort expectancy, social influence and facilitating conditions—plus other factors related to the individual, such as age, gender and experience.

The present study, then, leverages the literature on ERP system adoption by companies and ICT usage by individuals from the perspective of the UTAUT (Venkatesh et al., 2016). By collecting data on a sample of SMEs in the Italian Veneto region, this study investigated the influence of the COVID-19 pandemic period on their intention to adopt ERP. In particular, our research questions focus on the strategic relevance of ICT, on the intention to adopt ERP systems and on their determinants. We collected the data before and after the outbreak of the COVID-19 crisis. By applying a fuzzy set qualitative comparative analysis (fsQCA), we also analysed the simultaneous conditions that characterised a company’s intention to use an ERP system.

Regarding SMEs, we posit the influence of the COVID-19 crisis on their intention to adopt ERP systems and on the configurational factors that characterise the firms that were in favour of their implementation.

We contribute to the extant literature in three ways. First, we highlight the importance of ICT in SMEs and how it has often become a strategic factor. Second, starting from the UTAUT to interpret the intention to use ERP, we extend the model by highlighting the relevance of external factors, such as the COVID-19 pandemic. Third, we include other internal variables, such as ERP risk control and digital skills in the set of common characteristics of SMEs that were in favour of ERP implementation. We believe that this contribution could leverage ERP adoption in SMEs, because of the practical implications for companies, solution providers and business consultants.

2. Theoretical background

2.1. ERP systems and their adoption in SMEs

ERP is at the heart of the firm. It holds the core activities of managing and integrating business processes in real time (Katuu, 2020). Its aim is to solve the fragmentation of information in large business organisations by integrating the data used throughout the entire organisation (Davenport, 1998). The emergence of ERP seemed to be a dream come true for many managers—to have all the data from all departments and functions in one place (Weng & Hung, 2014). The seeds of ERP systems sprouted in the 1960s when large American corporations developed centralised computing systems to automate their inventory control systems. The 1970s witnessed the expansion of material requirements planning (MRP) systems, and manufacturing resources planning (MRPII) systems were developed in the 1980s to extend the scope of the other systems to other activities, such as distribution, finance, human resources and project management. It was not until the late 1980s that modern ERP systems emerged, designed as integrators of business processes able to provide increased accessibility and unity across an organisation (Themistocleous et al., 2001).

The evolution of ERP systems can be grouped in four main periods: closed MRP/ERP systems (1960s–1990s), extended ERP systems that enabled interorganisational dynamics (1990s–2000s), ERP as application services providers (2000s–2010s) and ERP as cloud-based applications (since the 2010s), thus providing increasingly accessible governance and implementation modes to firms (Arena et al., 2020). An ERP system enables an organisation to automate and integrate the majority of its business processes, share common data and practices across the enterprise, and produce and access information in a real-time environment (Keong et al., 2012). A conceptual model of an ERP system has four components: (1) the software, which is usually the most visible part, often divided into many modules; (2) the process flow, which deals with the way information flows between the different modules; (3) the customer mindset, which influences ERP effectiveness; and (4) changing management—that is, the way the project is managed (Marnewick and Labuschagne, 2005). The adoption of an ERP system is an information system (IS) innovation that has strategic relevance because its integration into core business processes or strategies can directly influence a firm’s and the users’ performance (Ke & Wei, 2008; Ullah et al., 2020).

Nevertheless, implementing ERP in an organisation is not an easy task and it is not always a success (Ramayah and Lo, 2007; Scott & Vessey, 2002). Many times, ERP implementation fails to meet the expectations of organisations and their endusers (Davison et al. 2019; Rajan & Baral, 2015), thus becoming a risky and expensive exercise (Beatty & Williams, 2006). Moreover, despite widespread adoption, many companies struggle to achieve the expected benefits from ERP because, regardless of their initial successful implementation, in the post-implementation stage, they lack top management support, competency of the internal ERP team, user training, interdepartmental collaboration and communication, continuous process improvement and continuous systems integration or extension (Ha & Ahn, 2014).

In the last years, ERP vendors have worked on solutions to make the systems more suitable for the organisational constraints of SMEs, by introducing cloud or SaaS solutions (Kanchana & Sriranjini, 2018; Muscatello et al., 2003). However, despite the efforts of ERP vendors to simplify their offering, SMEs have struggled to develop the resources and experience needed to manage new technologies (Billi & Raymond, 1993; Ullah et al., 2020).

In addition, SMEs have a spectrum of unique characteristics, such as ownership, structure and culture (Wong & Aspinwall, 2004), that are likely to determine whether these organisations may or may not consider setting up an ERP system (Zach et al., 2014).

Buonanno et al. (2005) highlighted that structural and organisational factor are the main reasons for non-adoption of ERP systems by SMEs. Moreover, the decision process regarding the adoption of ERP systems within SMEs is affected even more by exogenous reasons or ‘opportunity of the moment’ than business-related factors, in contrast to large companies, which are more interested in managing process integration and data redundancy or inconsistency through ERP implementation. Indeed, small enterprises experience more knowledge constraints compared with large enterprises (Laukkanen et al., 2007). This also holds true for cloud ERP, which has been found to be successful in some SMEs in reducing upfront investments and costs, and in improving efficiency and flexibility (Vidhyalakshmi & Kumar, 2016).

2.2. UTAUT and ERP implementation

In the IS literature, a growing group of studies have focused on factors that drive users to accept and use information technology (IT) (Venkatesh et al., 2003). Undoubtedly, technology plays a dominant role in our daily life, habits and work activities. Nevertheless, technology, to be useful in improving our activities, must first be accepted (Samaradiwakara & Gunawardena, 2014).

In 1989, Davis et al. proposed a model to interpret technology acceptance (the technology acceptance model (TAM)) in which perceived usefulness (PU) and perceived ease of use (PEU) were core determinants of the intention to use technology, which in turn influenced the usage behaviour of individuals.

Currently, the most relevant and recognised model for interpreting the acceptance of technology is the UTAUT (Samaradiwakara &
After a review of eight previous models, Venkatesh et al. (2003) identified four core determinants of intention towards and usage of technology, and up to four moderators. The determinants of the use of IT were performance expectancy, effort expectation, social influence and facilitating conditions. Four moderators were also present in the model: gender, age, experience and willingness to use. Performance expectancy (PE) is related to individual beliefs that technology may help to improve performance and is ideally linked to PU in the TAM model. Effort expectancy (EE) is the degree of ease associated with the use of a certain system and pair with TAM’s PEU. Social influence (SI) is related to how each individual perceives that other (particularly at a higher level) expect them to use technology. Facilitating conditions (FC) are the organisational and technical infrastructure without which the system could not be implemented. In the original version of the UTAUT model, the first three constructs with the four moderators (gender, age, experience, voluntariness of use) influence the behavioural intention to use IT, whereas the behavioural intention plus facilitating conditions and the moderators determine the usage behaviour (Venkatesh et al., 2003; Venkatesh et al., 2016).

Even if originally designed to interpret voluntary individual acceptance (in the UTAUT model a specific moderator addressed this issue), both TAM and UTAUT models were used to analyse the decision to adopt certain IS technologies in companies, such as computer assisted audit tools (CAATs) (Mahzan & Lymer, 2014), generalised audit software (GAS) (Ahmi & Kent, 2013) and even ERP systems (Andvikà and Wik-Jaksono, 2020; Amoako-Gyampah & Salam, 2004). In particular, Keong et al. (2012) posited that the three determinants of the intention to use technology according to the UTAUT model were able to predict the intention to use an ERP system jointly with some ‘organisational factors’ related to facilitation conditions, such as shared beliefs, training and project communication. In their model, the moderator related to the mandatory use of the technology for individuals has been removed, because they posited that once an organisation has decided to adopt ERP, its use becomes mandatory for all members, since otherwise the system itself would not be able to pursue the objectives for which it was implemented. More recently, Uddin et al. (2020), using partial least squares structural equation modelling, validated a model that, starting from the UTAUT, found that firm size and education are not valid moderators for interpreting intention to implement ERP systems. In summary, focusing on the interpretation of the intention to use ERP systems, the UTAUT plays a dominant role that has recently been confirmed in many other different contexts (Alsharari et al., 2020; Rajan & Baral, 2015).

2.3. Current gaps in the understanding of ICT and ERP adoption and uses during crises in SMEs and research questions

In untrodden times, organisations strive to maximise the benefits that ICT investments can offer them (Maruping & Magni, 2015; Tams et al., 2018), and both researchers and practitioners have searched for ways to increase firm performance through IT (e.g., Burton-Jones & Straub, 2006; Tams et al., 2018), with the objective of transforming existing practices into more effective ones. To a great degree, in turbulent conditions, such as those caused by the COVID-19 pandemic, organisations aim to increase ITC uses and investments to sustain their performance (Hsieh & Wang, 2007; Straub & Del Giudice, 2012). This holds true both for large firms, which have invested in IT technologies mostly to manage their business processes over the past decade, and for SMEs, which conversely have often been reluctant to make such investments.

The ongoing pandemic has forced firms to rethink, transform and, in some cases, revolutionise their practices and processes by leveraging IT tools to preserve the business’s continuity and survival, despite the lockdown (Carugati et al., 2020; Mykytyn, 2020). Indeed, the sudden shift to telework and the increased use of ICT resources to survive the COVID-19 crisis have appeared to be the only way for most organisations to keep their operations going (Naidoo, 2020; Yost, 2020). In shifting their practices in such a chaotic situation, firms have aimed to reassure their stakeholders (e.g., employees, customers, providers) by showing their capacity to adapt, endure and survive.

Moreover, the adoption of distance or remote working practices requires the ability to access a firm’s data and information promptly. Therefore, we expected a boost in the intention to adopt ERP systems as the core of the information infrastructure of firms that enable a real digital transformation, particularly in SMEs. The innovation introduced with the ERP adoption and the consequent changes in SMEs’ business models should lead to new business continuity, more resilience, new operational strategies and, consequently, a renewed competitive advantage. In this context, the research gaps that we would like to address in relation to the outbreak of the COVID-19 pandemic are knowledge about the increased awareness of the strategic importance of ICT for business, and the end user’s intention to use ERP systems and strive for business continuity and success, which are now critical issues. We believe that external factors have acted as a trigger in the decision process regarding adopting structured and complex information infrastructures such as ERP systems. Summarising our previous considerations, we posit the following three research questions:

- (RQ1): Has the outbreak of the COVID-19 pandemic increased the awareness of the strategic importance of ICT?
- (RQ2): Has the 2020 COVID-19 pandemic period boosted the intention to adopt ERP systems in SMEs?
- (RQ3): Has this pandemic year changed the combining factors that support ERP implementation in SMEs?

3. Research method

3.1. Research design

This study adopted a survey methodology to collect empirical data from SMEs located in the Veneto region in Italy that have been engaging in major changes in their daily business processes and practices because of the constraints imposed by the COVID-19 pandemic. A quantitative questionnaire based on the UTAUT model was developed to highlight the factors that support the intention to adopt ERP systems in SMEs, particularly before and after the outbreak of the COVID-19 pandemic crisis. We adopted this theory because it is the one most used in studies on behavioural issues related to the intention regarding and effective use of ICT and ERP systems. We also searched for other common elements present in SMEs that intended to adopt ERP systems. We based our analysis on statistical tests and on the fsQCA method.

3.2. Measurements

In a preliminary phase of the present study, we interviewed two directors of SMEs with the purpose of gathering information on their ERP systems, on the determinants for their adoption (and intention to use), and on the COVID-19 impact on their businesses (Woodside & Wilson, 2003). In a following step, we prepared a web-based questionnaire that asked respondents to declare whether they agreed to a set of sentences particularly before and after the outbreak of the COVID-19 pandemic. The questions to 10, posing only one question for each of the factors previously identified. We also prepared a section for collecting some
demographic information regarding respondents and their companies. The list of variables considered is reported in Table 1.

Our variable list considers all four of the factors proposed in the UTAUT (performance expectancy ERP.PE, effort expectancy ERP.EE, facilitating conditions ERP.FC and social influence condition ERP.SI) regarding the acceptance of technology, plus another three variables related to digital skills, ability to manage ERP risks and relevance of ICT for the business model of the organisation. We were aware that because of the short period considered (January–May 2020), effective use of ERP systems could not have resulted in significant changes, because of the lockdown of many services’ activities; therefore, we focused mostly on the intention to adopt them.

3.3. Respondents

The questionnaire was sent to approximately 5000 limited liability SMEs (number of employees between 10 and 249) actively operating in Verona and Vicenza provinces in the manufacturing, construction, and distribution macro-sector, plus some professionals and a few companies active in the service sector. According to the Italian Institute of Statistics (ISTAT), in 2019 these two provinces of the Veneto region were at the top levels in terms of per capita number of firms, value of exports and employment rates in Italy. In the same year in this area, 5421 limited liability SMEs, employing around 167,000 workers, were active in the manufacturing, construction and distribution macro-sector, and were a homogeneous subset of Italian SMEs. We sent the questionnaire to directors or chief financial officers because in SMEs they are the most qualified people to explain to us the drivers of the intention to adopt ERP systems by the organisation and because they are also the main decision-makers in this regard. The questionnaire explained the purpose of the research and provided instructions on how to answer. We received 170 questionnaires, but for homogeneity purposes, we limited the analysis to the 147 responses from limited liability companies operating in manufacturing, construction and distribution macro-sectors that had between 10 and 249 employees.

4. Data analysis and results

Table 2 contains the descriptive statistics, including minimum, maximum, mean and standard deviation for the replies from SMEs included in our sample at both t0 and t1. Over the four-month period considered, the variable that measured the intention to use ERP (ERP.I) rose from 5.09 to 5.20 (p < 0.01), with a stable standard deviation of 0.1. Conversely, the ERP usage (ERP.U) remained stable at around 5.14–5.13 (p < 0.01), with standard deviation close to 2.1. As expected, after the outbreak of the COVID-19 crisis, SMEs increased their intention to implement ERP systems, probably realising their benefits. Over the same period, performance expectancy from the use of ERP systems (ERP.PE) rose from 5.00 to 5.16 (p < 0.01), similarly to social influence (ERP.SI), which increased from 4.02 to 4.11 (p < 0.1). Effort expectancy (ERP.EE) and facilitating conditions (ERP.FC) remained stable around 4.1 and 4.9 respectively (p < 0.01). The other three variables (digital skills, ICT strategic importance and control of ERP risk) all increased, varying from 4.51 to 4.61 (p < 0.05), from 4.06 to 4.24 (p < 0.01) and from 4.55 to 4.66 (p < 0.01) respectively. With the outbreak of COVID-19, SMEs rose their digital skills (D.SK), realised that ICT could be more strategic for their business (ICT.B) and improved their ability to manage ICT risks (ERP.MR). The increase of the ICT.B variable over the period considered confirms our positive response to RQ1. The pandemic has changed the respondents’ opinions regarding the strategic importance of ICT in their business. After four months, they realised that it affects SME processes much more than they believed.

The correlation matrix (Pearson) of the variables considered in our study is available upon request. Both the intention to use ERP systems (ERP.I) and their effective use (ERP.U) have positive and statistically significant correlations with most of the variables considered in the UTAUT, both before and after the onset of the COVID-19 pandemic period.

Table 1 Variables used in our model.

| No. | Variable name | Description | Values |
|-----|---------------|-------------|--------|
| 1   | ERP.I         | An ERP system should be intensively used in my company. | 1: fully disagree – 7: fully agree |
| 2   | ERP.U         | In our company an ERP system is NOT used. This variable has been recoded inversely in the following data analysis. | 1: fully disagree – 7: fully agree |
| 3   | ERP.PE        | ERP systems improve our work. | 1: fully disagree – 7: fully agree |
| 4   | ERP.EE        | Efforts to use ERP systems are high. | 1: fully disagree – 7: fully agree |
| 5   | ERP.FC        | We have adequate resources to have an ERP system. | 1: fully disagree – 7: fully agree |
| 6   | ERP.SI        | Other people expect us to use ERP systems. | 1: fully disagree – 7: fully agree |
| 7   | D.SK          | Our digital skills are high. | 1: fully disagree – 7: fully agree |
| 8   | ICT.B         | In our business ICT is a strategic factor. | 1: fully disagree – 7: fully agree |
| 9   | ERP.MR        | We know how to manage ERP risks. | 1: fully disagree – 7: fully agree |

Table 2 Descriptive statistics of variables.

| Variable | No. | Min. | Max. | Mean | Std. Dev. |
|----------|-----|------|------|------|-----------|
| ERP.I    | 147 | 1.00 | 7.00 | 5.09 | 5.20      | 1.74  | 1.75 |
| ERP.U    | 147 | 1.00 | 7.00 | 5.14 | 5.13      | 2.08  | 2.10 |
| ERP.PE   | 147 | 1.00 | 7.00 | 5.00 | 5.16      | 1.87  | 1.87 |
| ERP.EE   | 147 | 1.00 | 7.00 | 4.04 | 4.09      | 1.75  | 1.74 |
| ERP.FC   | 147 | 1.00 | 7.00 | 4.93 | 4.91      | 1.81  | 1.85 |
| ERP.SI   | 147 | 1.00 | 7.00 | 4.02 | 4.11      | 1.96  | 1.97 |
| D.SK     | 147 | 1.00 | 7.00 | 4.51 | 4.61      | 1.59  | 1.60 |
| ICT.B    | 147 | 1.00 | 7.00 | 4.06 | 4.24      | 1.93  | 1.96 |
| ERP.MR   | 147 | 1.00 | 7.00 | 4.55 | 4.67      | 1.69  | 1.66 |

4.1. Fuzzy set qualitative comparative analysis methodology and calibration

Considering the purpose of this research, to answer RQ2 we decided to use a comparative configurational approach. Indeed, our goal was to identify which conditions were present or absent in SMEs that intended to use an ERP system. We adopted the fsQCA methodology (Ragin, 2014; Woodside, 2015), which is suitable for identifying, under certain conditions, homogeneities among respondents in relation to a specific outcome variable. In particular, we used this method to investigate the relationship between the outcome variable and all the possible combinations of binary states (i.e. presence or absence) of its predictors (Ragin, 2000). For our purposes, we used our reduced set of variables from the UTAUT model integrated with three other variables that monitored digital skills, ICT strategic importance for the business and ability to mitigate risks associated with ERP use. Therefore, the outcome variable was set to the intention to use ERP systems (ERP.I), whereas the input variables were related to the four factors proposed by the UTAUT (ERP.PE, ERP.EE, ERP.FC, ERP.SI) plus the level of digital skills of the company variable (D.SK), the importance of ICT for the business variable (ICT.B) and the ability of the company to manage ERP risks (ERP.MR). Because our variables were not dichotomous, we transformed them into fuzzy set membership scores, calibrating the measures by specifying three anchors: the threshold for full membership (0.95), the one for full non-membership (0.05) and the crossover point (0.5). Regarding the outcome variable, we kept the seven-scale variable (1 = 0.05 null membership, 4 = 0.5 crossover, and 7 = 0.95 full membership).
Regarding the input variables that had a seven-point Likert scale, we set the 0.95 full membership to the value of 7, the null membership to the value of 1 and the crossover (0.5) to the value of 4. In this study, the truth table was constructed by fsQCA3.0 software, and the Quine–McCluskey algorithm was used for statistical analysis. After generating fuzzy set measures, we refined our true table setting frequency cut-off to consider at least three cases for ERP intention to use. Consistency was set to at least 0.85, whereas coverage had to exceed 0.01.

4.2. Fuzzy set qualitative comparative analysis findings

Table 3 shows the results of the fsQCA applied to our sample SMEs regarding their intention to use ERP. The left side of the table refers to \( t_0 \) (1 January 2020), whereas the right side refers to \( t_1 \) (1 May 2020). Our findings indicate that three solutions led to high intention to use ERP at \( t_0 \) and \( t_1 \), respectively.

Following Ragin and Fiss’s (2008) guidelines, we used black circles (●) to indicate the presence of the condition, and the circle with the cross (⊗) to indicate its absence. Necessary conditions are indicated by the round helix bullet (●). Large bullets indicate core conditions (that we found in the complex solution and in both the intermediate and the parasimilHonous solutions); small bullets were used for peripheral conditions (present in both the complex and the intermediate solution). At both \( t_0 \) and \( t_1 \) we found performance expectancy (ERP.PE) as the necessary condition (at \( t_0 \): consistency = 0.91, Coverage = 0.927; at \( t_1 \): consistency = 0.935, Coverage = 0.937) for a strong intention to use an ERP system: ERP systems were undoubtedly believed to be a source of operational performance. We identified three sufficient configurations (S1, S2, S3) for high intention to use ERP systems. Solutions S1 and S2 (unique coverage effects: both 0.15) required a significant presence of facilitating conditions (ERP.FC), high digital skills (D.SK) and ability to manage ERP risks (ERP.MR). At both \( t_0 \) and \( t_1 \), the solution (S1) did not consider the social influence of the decision (ERP.SI), meaning that the intention to use ERPs was not driven by the expectations of other subjects (customers, suppliers, et.) regarding the decision. It is worth noting regarding solution S1 that whereas in \( t_0 \) a high intention to use ERPs was associated with low levels of efforts for their use, in \( t_1 \) the configuration was completely different because efforts to use them (ERP.EE) were no longer relevant. After the onset of the COVID-19 crisis, a high intention to adopt ERP systems was present even in companies that had to spend a great deal of effort in adopting them. Indeed, in this solution (S1), the only factors of the UTAUT present were performance expectation (ERP.PE) (which was a necessary condition) and facilitating conditions (ERP.FC). Note that the unique coverage of S1 passing from \( t_0 \) to \( t_1 \) increased from 0.15 to 0.21. The pandemic COVID-19 crisis drove some SMEs to this last configuration. Regarding the second solution (S2) over the same period, it had a remarkable drop in its unique coverage (from 0.15 to 0.04). Finally, solution (S3) regards a small group of SMEs (unique coverage around 0.05) that, both before and after the onset of the COVID-19 pandemic period, declared a high intention to use ERP even in the presence of strong efforts required for their adoption and despite the fact that they had limited resources, low social influence, low digital skills, low relevance of ICT for their business and low control of ERP risks. In summary, these last SMEs were the ones that had to use ERP even if they were not ready for it. They numerically remained stable over the four-month period (from \( t_0 \) to \( t_1 \)).

5. Discussion, implications and conclusions

During the first months of the COVID-19 pandemic period (2020), SMEs faced incredible disruption to their business processes. Digitalisation of information, integration of data, use in remote access and typical characteristics of recent ERP systems have become a priority even for small organisations in order to keep their operations alive (Mkytyyn, 2020).

In line with the extant literature (Buonanno et al., 2005), our data show that the complexity and the investments remain a barrier to the adoption of complex IT systems such as ERP. Indeed, even if ERP systems have lowered their access threshold, they still require a major effort in terms of financial resources, business process reengineering, training and digital skills that used to be considered a barrier by many SMEs. The disruptive shock caused by the pandemic brought up some major questions for SME decision-makers, such as: Are we ready to go? Is this the right time for new ERP implementation decisions?

To investigate how SME entrepreneurs and managers interpreted those questions, we surveyed a sample of Italian SMEs and investigated ERP system adoption before and after the outbreak of the COVID-19 crisis.

5.1. Strategic importance of ICT and relevance of ERP for SMEs

As previously observed, respondents reported a growing strategic importance of ICT for their business, supporting a positive answer to our first research question (RQ1). Whereas for large companies it was almost given, in SMEs the relevance of ICT is very interesting and challenging, because it contrasts with the supposed limitations of investments in these technologies.

Regarding the intention to adopt an ERP system, SMEs revealed a medium–high propensity, which grew again after the outbreak of the pandemic. This confirms a positive response to our second research question (RQ2) and stresses the importance of ERP systems even in this smaller context. The pandemic has introduced in SME management a higher awareness of the importance of the backbone of the information architecture and the need to introduce interdepartmental collaboration and communication, continuous process improvements and continuous systems integration or extension (Ha & Ahn, 2014).

5.2. Modification of configurational factors affecting the intention to implement ERP

In relation to the presence of certain common characteristics among the SMEs that intended to adopt ERP systems, our results fully support the relevance of the main factors highlighted by the UTAUT (Yueh et al., 2016). In addition, our analysis introduces the relevance of three other common characteristics: digital skills, ability to manage ERP risks and ICT strategic importance for the business. These characteristics affect the company organisation and how it is able to manage these elements. Comparing fsQCA results before and after the outbreak of the pandemic, we also found a change in the requirements to decide on ERP implementation because firms have now reduced the initial four requirements.

### Table 3

| Variable | Solutions in \( t_0 \) | Solutions in \( t_1 \) |
|----------|-------------------------|-------------------------|
| ERP.PE   | ☀️ ☀️ ☀️ ☐ ☐ ☐ ☐ ☐ ☐ ☐ | ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ |
| ERP.EE   | ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ | ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ |
| ERP.FC   | ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ | ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ |
| ERP.SI   | ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ | ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ |
| D.SK     | ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ | ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ |
| ICT.B    | ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ | ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ |
| ERP.MR   | ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ | ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ |
| Consistency | 0.97 0.97 0.87 0.98 0.99 0.86 | 0.97 0.97 0.87 0.98 0.99 0.86 |
| Raw coverage | 0.38 0.39 0.22 0.57 0.39 0.20 | 0.38 0.39 0.22 0.57 0.39 0.20 |
| Unique coverage | 0.15 0.15 0.05 0.21 0.04 0.04 | 0.15 0.15 0.05 0.21 0.04 0.04 |
| Solution consistency | 0.91 0.93 | 0.91 0.93 |
| Solution coverage | 0.60 0.66 | 0.60 0.66 |
| Frequency cut-off | 4 3 | 4 3 |
| Consistency cut-off | 0.867 0.857 | 0.867 0.857 |

Notes: ☐ necessary condition; ☐ causal condition present; ☐ causal condition absent; circle size: large = core condition, small = peripheral condition.
suggested by the UTAUT. In particular, what now matters for a decision on ERP implementation is the expectation in terms of efficiency regardless of the efforts required. Therefore, we also have a positive answer to our last research question (RQ3).

5.3. External factors as a trigger for the decision to adopt

Finally, our results suggest that on average the ongoing pandemic period has acted as a trigger in the process of deciding to adopt structured and complex information infrastructures such as ERP systems. However, if on the one hand, the crisis mitigated the relationship between the intention to adopt and the expected effort required, on the other, the perception of the disruption caused by the pandemic was not sufficient to fully overcome the organisational implications of this type of IS. The data seem to suggest that if external events are the main motivation for ERP adoption in SMEs (Buonanno et al., 2005), those external events must be specific to the company or organisation, rather than to the industry or environment. Knowledge constraints, as well as the new competencies required (Laukkanen et al., 2007), cannot be fixed overnight.

5.4. Implications for practice

From a practical standpoint, our findings have some important implications for managers and entrepreneurs in SMEs who aim to enhance the competitiveness of their organisation by modernising the foundations of their IT infrastructure through implementing an ERP system. Indeed, the data show the relevance of external factors for strengthening the intention to use ERP, and considering the persistence of the effect of the pandemic, this seems the right moment for investments in a new enterprise system.

On the technology vendor side, the findings of this study echo previous studies and suggest that ERP vendors should pay special attention to the needs and characteristics of SMEs to increase the diffusion of such information systems. On the one hand, they should highlight the strategic benefits provided by the use of ERP, and on the other, make their solution more affordable in terms of both complexity and financial investments.

5.5. Limitations and future research

Our study has some limitations. First of all, the sample considered could have been larger and more representative of the SME universe. Second, the four-month period considered could have been extended to be larger and more representative of the SME universe. Third, the pandemic, this seems the right moment for investments in a new enterprise system. On the one hand, they should highlight the strategic benefits provided by the use of ERP, and on the other, make their solution more affordable in terms of both complexity and financial investments.

5.6. Conclusion

Despite the above-mentioned limitations, we believe that this study contributes to the ongoing debate on implementation of complex information systems such as ERP systems in SMEs at a time when many irreversible situations are occurring, and new challenges are arising even for small companies. We titled this paper ‘Is COVID-19 enough?’ to highlight how the pandemic has affected managerial and strategic decisions on technologies in SMEs, which are long overdue. Our data tell us to answer ‘Yes’; at the very least, it was enough to enhance the awareness of the strategic role of a robust ICT backbone, such as an ERP system, to keep businesses alive in turbulent times. ‘Whatever it takes.’

CRediT authorship contribution statement

Paolo Roffia: Writing – review & editing, Formal analysis, Conceptualization, Methodology, Data curation. Lapo Mola: Writing – review & editing, Conceptualization.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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