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Driving Digital Adoption within Small Business: A Study Case of Indonesia Micro-Small-Medium Enterprises

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Abstract
The urgency of going digital increases due to mobility restrictions in many areas to retain market share, hence surviving the COVID-19 pandemic. The digital adoption process is not easy because it requires high cost and long-term commitment, so larger firms may lead in this case. Therefore, this study wants to identify what variables can affect the digital adoption process by MSMEs. We survey 2,169 MSMEs across Indonesia using clustered convenience sampling and investigate the determinants of digital adoption by MSMEs. Using the fixed effect model for estimation, we find that the severity of COVID-19 cases and the number of laborers have a significant positive correlation to the digital adoption process by MSMEs. We find that MSME in urban areas leads to the use of digital technology, and the service-based MSME has more urgency to do so. These results can help MSMEs, and the government makes policies related to digital adoption by MSMEs.

Keywords: Digital Adoption, Institutional Economics, Public Policy, Welfare

Mendorong Adopsi Digital dalam Bisnis Kecil: Studi Kasus Usaha Mikro Kecil Menengah di Indonesia

Abstrak
Urgensi untuk beralih ke digital meningkat karena pembatasan mobilitas di banyak daerah untuk mempertahankan pangsa pasar, sehingga bertahan dari pandemi COVID-19. Proses adopsi digital tidaklah mudah karena membutuhkan biaya tinggi dan komitmen jangka panjang, sehingga perusahaan yang lebih besar dapat memimpin dalam kasus ini. Oleh karena itu, penelitian ini ingin mengidentifikasi variabel apa yang dapat memengaruhi proses adopsi digital oleh UMKM. Penelitian ini mensurvei 2.169 UMKM di seluruh Indonesia menggunakan *clustered convenience sampling* dan menyelidiki determinan adopsi digital oleh UMKM. Dengan menggunakan model efek tetap untuk estimasi, studi ini menemukan bahwa tingkat keparahan kasus COVID-19 dan jumlah buruh memiliki korelasi positif yang signifikan terhadap proses adopsi digital oleh UMKM. Studi ini menemukan bahwa UMKM di daerah perkotaan mengarah pada penggunaan teknologi digital, dan UMKM berbasis layanan memiliki urgensi yang lebih besar untuk melakukannya. Hasil ini dapat membantu UMKM, dan pemerintah membuat kebijakan terkait adopsi digital oleh UMKM.

Kata Kunci: Adopsi Digital, Ekonomi Kelembagaan, Kebijakan Publik, Kesejahteraan

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INTRODUCTION

The emergence of digital technologies has substantially made business enterprises efficient and embraced new economic activities since the millennium era, especially with the involvement of internet technology in the business model. New marketing strategies, new

payment and administration procedures, new opportunities for business expansion, and enhancing product innovation are some of the current advancements as a result of the use of digital technologies (Acs et al., 2021; Alford & Page, 2015; Krotov, 2017). The use of digital technology seems to be increasing due to the COVID-19 pandemic, which has forced policymakers around the globe to impose a mobility restriction (Guo et al., 2020; Modgil et al., 2022; Trinugroho et al., 2022). Modgil *et al*. (2022) call a 'digital entrepreneurship' where new business opportunities have emerged after the significant increase in digital adoption due to the COVID-19 pandemic; i.e., financial technology, healthcare, entertainment and e-commerce.

Digital adoption is captured not only by larger businesses but also by micro and small businesses, who benefit from its efficiency in reaching a broader market and simplifying the forms of communication between sellers and buyers. However, the implementation of digital adoption by MSMEs is not easy; many variables can affect it. Therefore, it is essential to identify variables that can influence digital adoption so that we can know deeply the efforts that MSMEs must make to adopt digital better and easier. We also refer to the Schumpeterian model of economic growth, where we are now in the peak of the 5th wave of innovation (maturity of the digital network, IT software, and biotechnology), and it soon advances to be the foundation of the 6th wave focusing on renewable energy and nanotechnology (The Natural Edge Project, 2012). The Schumpeterian model of economic growth follows this path: a) long-run growth results from innovations, b) innovations result from entrepreneurial investment, and c) innovations replace old technologies.

Digital adoption probably requires high costs and knowledge compared to conventional approach which may discourage, especially, small business to adopt (Agrawal et al., 2019; Astuti & Nasution, 2014; Peltier et al., 2012; Räisänen & Tuovinen, 2020). The barriers are even more complex in the rural or remote areas. However, it has a fundamental problem, where lower-income groups are mostly located and limited infrastructure (i.e., internet network, electronic device ownership, and others related to capital expenses). Therefore, the digitalization process is mainly adopted by the large firms in the urban area and higher value-added sectors (Holl & Rama, 2023; Michel-Villarreal et al., 2021; Norris, 2020; OECD, 2021). The urgency of digital adoption increases due to COVID-19 pandemic since almost all areas across the globe face a mobility restriction so many business activities have moved from offline to online—which requires digital technology. It is essential to understand whether digital adoption by MSMEs is strategic to survive during an economic crisis—like COVID-19—so that both MSMEs and relevant stakeholders can learn and provide necessary action and policies to avoid the possible impact of the crisis in the future.

Other than the COVID-19 pandemic itself, the emergence of digital adoption by MSME has happened in emerging countries in Asia, Africa, and South America (Acs et al., 2021; Alzahrani, 2019; Ayob, 2021; Cao & Shi, 2021; Gono et al., 2016; Kyakulumbye & Pather, 2022; Mahroeian, 2012). In Indonesia, digital adoption within MSME mainly involves in e-commerce, where MSME does not necessarily need a high rent cost and is rather practical because it is available on mobile phone (Chen, 2017; Salim et al., 2019; Syuhada & Gambett, 2013). The use of digital technology is now also used in digital

marketing through social media, online payment, and code development (this is mostly for digital start-up businesses). Our investigation is motivated by the principle of the Technological Acceptance Model (TAM), which has been widely used in the literature. (Alzahrani, 2019; Ritz et al., 2019; Kyakulumbye & Pather, 2022; Davis, 1993). However, we have made a deeper measurement of the digital adoption of MSME by contextualizing the World Bank (2016) on internet-promoting development that consists of inclusion (through search and information of new approaches and strategies), efficiency (through automation and coordination in implementing approaches and strategies), and innovation (through increasing the economic scales and the digital platform coverage).

We investigate the determinants of digital adoption within MSMEs in Indonesia, especially during the Covid-19 pandemic. It aims to formulate a policy related to increasing digital adoption by understanding the positive determinants of digital adoption by MSMEs in Indonesia, as well as to avoid the negative impact of digital adoption in practices. We extend the internet-promoting development of the World Bank (2016) to construct our digital adoption index and estimate it using the firm's size, nature of business type, and Covid-19 pandemic severity from an economic perspective. There are some barriers to digital adoption by MSMEs in Indonesia, such as the characteristics of MSMEs (Falentina et al., 2021), characteristic of area (Yacob et al., 2021), and the severity of Covid-19 cases (Kurniawati et al., 2021). Therefore, this study applied some variables in the model that can affect the digital adoption. They are sales (Trinugroho et al., 2022), labours (Kyakulumbye & Pather, 2022), reinvestment decision (Legowo & Sorongan, 2022) and the barriers above that the MSMEs in Indonesia face. We model our estimation using the Fixed-Effect (FE) technique, assuming that the firm's size is endogenous to the digital adoption process by MSME.

METHOD

We explore the digital adoption by small businesses in Indonesia through a nationwide online survey that was conducted between July and August 2021 when the pandemic is still ongoing, and many sellers and buyers have changed their shopping and sales behavior according to the current pandemic conditions. We developed a survey questionnaire and hired surveyors in each region who have a connection with MSMEs, such as NGOs. The surveyors collect data via online survey or by phone to minimize social interaction due to the COVID-19 pandemic in Indonesia. Therefore, much information is to be well collected. We used clustered convenience sampling by dividing into 16 areas across the country and surveyed MSMEs that had run the business, at least, since 2019 in order to capture MSME's situation before the Covid-19 pandemic, leaving 2,169 MSMEs after the cleaning-up process. The 16 areas were: (1) Papua and West Papua, (2) North Maluku and South Maluku, (3) East Nusa Tenggara, (4) West Nusa Tenggara, (5) Bali-Madura-East Java, (6) Yogyakarta and Central Java, (7) Jakarta, Banten and West Java, (8) East Kalimantan and North Kalimantan (9) South Kalimantan, (10) West Kalimantan and Central Kalimantan, (11) North Sulawesi and Gorontalo, (12) Central Sulawesi and Southeast Sulawesi, (13) West Sulawesi and South Sulawesi, (14) Riau Islands, Riau, and Jambi (15) Aceh, North

Sumatera and West Sumatera, (16) Lampung, South Sumatera, Bengkulu and Bangka Belitung. There are three main aspects of digital adoption in our survey as derived from World Bank (2016) into our exploration: 1) electronic devices used, 2) financial platforms used, and 3) digital marketing.

Digital adoption is measured by the digital adoption index. We then develop the digital adoption index by specifying a concave function that indicates the diminishing marginal utility of using more digital devices or technologies as follows.

$$DA_{it} = \frac{1-exp(w_{it}\sum_{n=1}^{4} AD_{nit})}{1-exp(w_{it}max[\sum_{n=1}^{4} AD_{nit}])} \quad \text{..... (1)}$$

Where $0 \leq DA \leq 1$ is the (concave) digital adoption index, $0 \leq w \leq 1$ is the weight of the digital adoption that is specified by the endorsement expenses for marketing and the availability of the business in the *Google Map*, $0 \leq AD \leq 1$ is the score of digital adoption in each of our *n* digital adoption factors, *i* and *t* are the MSMEs identification and year period respectively. Our digital adoption factors consist of the number of active electronic devices used, the number of active digital platforms used for marketing, monthly internet expenses, and the number of active digital platforms used for finance.

We then assume that the MSME's digital adoption is a function of the firm's size (measured in the average monthly sales) and the nature of the firm's business type (providing food and beverage, providing non-food and non-beverage, and providing services) given its location, Covid-19 pandemic severity (measured in the number of positive cases by province), the number of labors, investment, and other factors related to the firm's environment that serve as control variables (business activities, supported infrastructure, owner's characteristic and owner's household situation). We assume a fixed effect here since there is no change in business type nor the business model of the MSME during the observation, though the COVID-19 pandemic has struck during the time of observation. Given this, we use a fixed effect model to estimate the MSME's digital adoption as follows:

$$DA_{ijt} = \alpha + \beta_1 Sales_{ijt} + \beta_2 BusClass_{ij} + \beta_3 Covid_{jt} + \beta_4 Labour_{jt} + \beta_5 Inv_{jt} + \sum_{m=1}^{m} \delta_m Z_{mijt} + \mu_j + v_{it} \text{ ..... (2)}$$

Where *Sales* is the average monthly sales, *BusClass* is MSME's classification given its business type and location (dummy variable: 1 if it is non-service-based and in rural area, 2 if it is service-based and in rural area, 3 if it is non-service-based in urban area, and 4 if it is service-based in urban area), *Covid* measures provincial Covid-19 pandemic severity, that is the number of Covid-cases compare to the amount of population in area *j* and year *t*, *Labour* is MSME's number of labours in area *j* and year *t*, *Inv* measures proportion of investment to profit by MSME in area *j* and year *t*, *Z* is the set of control variables related to the MSME's environment, $\{\mu, u\}$ is the set of idiosyncratic error capturing provincial and individual-time variation, and *j* identifies province of the MSME is located. We check our model consistency by permutating the control variables in our model.

FINDING AND DISCUSSION

In the last two or three decades, we have seen the emergence of mobile phones, which almost everyone uses for daily activities and connectivity. Mobile phones are the most popular device across business types, especially in areas with adequate internet networks. However—other than mobile phones—the use of PC/laptop and internet/WiFi modems are much more popular within service-based MSMEs compared to goods-based MSMEs. This is likely due to the nature of service-based business, which instead requires complex design, data analysis, code development, marketing communication, and digitalization of work; hence, it is very close to the use of digital technology and, on the other side, non-service MSMEs mostly use the internet to communicate with customers and simple digital marketing (Kraus et al., 2022; Manyika et al., 2015; Wicaksono & Simangunsong, 2022).

Table 1. *Business process and digital adoption of MSME by its business type*

Aspects	Business Type		
	Services	**Goods (Food & Beverage)**	**Goods (Non-Food & Beverage)**
Business model:			
• Selling to end user (retailing)	84%	57%	80%
• Processing raw into final product and sell it to end user	6%	19%	8%
• Processing raw into intermediate product and sell it to whole seller	4%	3%	5%
• Processing raw into final product and sell it to both whole seller and end user	6%	22%	8%
Marketing coverage:			
• Within district	71%	82%	61%
• Within province	19%	13%	28%
• Nationwide	7%	4%	10%
• Global	3%	<1%	2%
Using internet-based device	87%	79%	83%
Using business digital app(s)	41%	28%	32%
Using digital finance app(s)	58%	43%	48%
Hiring endorser for marketing	19%	15%	14%

We classify architecture, interior design, web/digital/visual communication design, product design, film-animation-video, photography, delivery, laundrette, administration support, music, app and game development, publishing, advertising, art, and digital content business into service-based MSME. Interestingly, there is a slight difference in the owner's educational background between service-based and goods-based MSMEs, which might be the key for this (median educational background for both a certificate diploma and senior high school, respectively). Goods-based MSME includes food and beverage and non-food and beverage business. Many kinds of literature show that knowledge plays a vital role in

digital adoption. However, the knowledge gap in digital technology might be narrow in our case between certificate diplomas and high school graduates.

Most MSMEs in our survey are retailers with district-level coverage, though food and beverage MSMEs also have quite a high percentage to produce and sell to both wholesalers and end users. The digital adoption process by service-based MSMEs shows a higher percentage than that of goods-based MSMEs, as previously shown, with WhatsApp and M-Banking being the two main digital apps used for marketing and financial purposes by each business type of MSME.

Moving on to the Covid-19 pandemic severity, smaller MSMEs—measured in the average monthly sales—have seen the most damage from the COVID-19 pandemic. These MSMEs are the main target of the government's economic stimulus due to the COVID-19 pandemic, which has been found to help them enormously to survive. It surely becomes a huge constraint for smaller MSMEs to adopt digital technology since it is costly, though there was a high urgency to keep their market coverage. On the other hand, bigger MSMEs might persist during the Covid-19 pandemic and have a higher chance of adopting digital technology compared to the smaller ones. Table 2 below shows the shift between smaller MSMEs during the COVID-19 pandemic in all business types, where the second and third groups profoundly moved down to the first group (the lowest average monthly sales group) due to the COVID-19 pandemic.

Table 2. *Change in the average monthly sales 2019-2022*

Average Monthly Sales	**Business Type**								
	Services			**Goods (Food & Beverage)**			**Goods (Non-Food & Beverage)**		
	2019	**2020**	**2021**	**2019**	**2020**	**2021**	**2019**	**2020**	**2021**
1. ≤USD 849	62%	68%	78%	66%	74%	79%	61%	70%	75%
2. USD 850 – USD 1,698	17%	16%	12%	19%	13%	11%	17%	11%	10%
3. USD 1,699 – USD 4,414	10%	7%	4%	9%	8%	6%	9%	8%	6%
4. USD 4,414 – USD 8,490	3%	5%	3%	4%	4%	2%	8%	7%	6%
5. USD 8,491 – USD 13,584	3%	1%	<1%	1%	<1%	<1%	3%	2%	2%
6. USD 13,584 – USD 27,169	1%	<1%	<1%	<1%	<1%	<1%	1%	<1%	<1%
7. > USD 27,169	2%	1%	2%	<1%	<1%	<1%	2%	1%	1%

We then try to estimate the MSME's digital adoption process following our descriptive findings above. We assume that digital adoption is determined by the firm's size, business type, and COVID-19 pandemic severity and that the firm's size is an endogenous factor in digital adoption. Table 3 summarizes our estimation results for the digital adoption process by MSME using the FE model.

Results from Table 3 show a clear message that the severity of the COVID-19 pandemic in a particular province drives the use of digital technology by MSME (across six models used). It is expected that MSME will shift its business strategy by utilizing digital technology (i.e., online ordering, payment, and marketing) when the lockdown policy is implemented in order to regain market coverage. This finding is in line with other literature

focusing on Indonesia that, during the Covid-19 outbreak, MSMEs in Indonesia rely on e-commerce and social media marketing to survive (Fridayani et al., 2021; Ssenyonga, 2021; Legowo & Sorongan, 2022). With physical storefronts shuttered and online consumer engagement surging, businesses had to adapt quickly to digital platforms to reach their customers, and this transformation involved not just establishing an online presence but also redesigning business models to incorporate e-commerce and digital marketing strategies effectively. Another important finding to note is the positive correlation between the number of laborers and the digital adoption process of the MSME. It tells us that the MSME requires more operators to operate their digital technology—related to its business activities—and it is likely to open more jobs.

Our finding indicates that MSMEs actively direct their newly hired employees to operate with digital technology, as having more digital-skilled employees can ensure effective use of digital tools and platforms and create anti-fragility amidst changing market situations (Corvello et al., 2023; Kallmuenzer et al., 2024; Legowo & Sorongan, 2022). However, we need to investigate further whether the digital adoption of MSMEs lasts for a more extended period rather than being seasonal due to mobility restrictions so we can determine whether there is a structural change in MSME's business model and strategy post-COVID-19 pandemic following the digital adoption.

We also find that MSMEs in urban areas (both service- and non-service-based) significantly have a higher level of digital adoption. However, this is limited in models with more samples. Significant differences in infrastructure between urban and rural areas play a key role in this matter, where urban areas typically have better internet connectivity and broadband availability, which are critical for leveraging digital tools effectively (Yacob et al., 2021; Holl & Rama, 2023; Räisänen & Tuovinen, 2020). Furthermore, urban businesses often experience greater consumer demand for digital services—which accelerates their digital transformation—and better access to financial resources and digital literacy among entrepreneurs and employees compared to the situation in rural areas. However, the effect of our findings is higher for service-based MSMEs than for non-service-based MSMEs in urban areas, which confirms the finding in descriptive analysis. We may conclude that this has become an urgency for service-based MSMEs in urban areas to keep up with the pace of business and vast changes in urban areas.

Finally, as a developing country with a vast population (fourth largest in the world), Indonesia is considered to have a considerable chance to advance its economy by taking advantage of the digitalization (Fridayani et al., 2021; Rumata & Sastrosubroto, 2021; Ssenyonga, 2021). The COVID-19 pandemic can be a significant moment to push digital adoption in the small business sector, as shown by our estimation of the results. The development of digital adoption within small businesses should focus on two main concerns: 1) reducing spatial inequalities in digital technology infrastructure and 2) improving human capacity to operate with digital technology. The first concern aims to widen the market share and competitiveness of rural MSMEs, while the second concern aims to absorb the labor force by MSMEs.

Table 3. *Estimation results*

Digital Adoption Index	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**
1. Constant	-0.0106	-0.1513**	-0.0291	-0.0989***	-0.0106	-0.2968***
2. Average monthly sales	0.0076	0.0038	0.0164	0.0074	0.0106	0.0034
3. *Service- and/or urban-based MSME (none as base)*:						
3.a Service-based in rural	0.0266	0.0179	0.0389	0.0249	0.0207	0.035
3.b Non-service-based in urban	0.029*	-0.016	0.0416*	0.0272**	0.0304*	-0.0284
3.c Service-based in urban	0.044*	0.022	0.0568*	0.041*	0.0453*	0.0341
3. Log monthly average Covid-19 cases	0.009*	0.0082*	0.0109*	0.009*	0.0091*	0.0086*
4. No. of labors	0.0061*	0.0057***	0.0054**	0.0057**	0.0063*	0.0066***
5. % of reinvestment	-0.0004***	-0.0001	-0.0000	-0.0004***	-0.0003	0.0000
4. Involving business core activities aspects	No	Yes	No	No	No	Yes
5. Involving supporting infrastructure aspects	No	No	Yes	No	No	Yes
6. Involving owner's characteristics	No	No	No	Yes	No	Yes
7. Involving household characteristics	No	No	No	No	Yes	Yes
Adj. R-sq.	0.0797	0.1738	0.0948	0.0889	0.0874	0.1926
No. of Observation	5,025	1,197	3,859	5,025	4,804	965

(*, **, ***) significant at 1%, 5% and 10% level respectively. We use fixed effect for all models with robust estimator of variance.

CONCLUSION

In this paper, we investigate how to drive digital adoption within MSME in Indonesia following the emergence of digital technology across the globe in the last two decades. We find that the severity of COVID-19 cases has increased the likelihood of MSMEs going digital to maintain their market and, at least, to survive during such difficult times. It would be true that the owner's characteristics (knowledge, entrepreneurship, gender, etc.), infrastructure, and business environment drive digital adoption of the MSME, as many literatures have talked about. However, the MSME should have a broad market (higher sales) and be profitable in implementing digital technology in its business activities because digital devices and platforms are rather costly. In addition, digital technology would be seen as a long-term investment, so the MSME has to commit to relying on this investment; therefore, the larger MSME will have the privilege to implement this. Therefore, there is a likelihood that the MSME's employment will be addressed in order to operate its digital technology and enhance its business activities. We also find that MSMEs in urban areas are more likely to adopt digital technology compared to the ones in rural areas and that the service-based MSME has more urgency to do so. They inevitably lead the digitalization process within MSME in Indonesia, given their business nature and environment.

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REFERENCES

Acs, Z. J., Song, A. K., Szerb, L., Audretsch, D. B., & Komlósi, É. (2021). The evolution of the global digital platform economy: 1971–2021. *Small Business Economics*, *57*(4), 1629–1659. https://doi.org/10.1007/s11187-021-00561-x

Agrawal, P., Narain, R., & Ullah, I. (2019). Analysis of barriers in implementation of digital transformation of supply chain using interpretive structural modelling approach. *Journal of Modelling in Management*, *15*(1), 297–317. https://doi.org/10.1108/JM2-03-2019-0066

Alford, P., & Page, S. J. (2015). Marketing technology for adoption by small business. *The Service Industries Journal*, *35*(11–12), 655–669. https://doi.org/10.1080/02642069.2015.1062884

Alzahrani, J. (2019). The impact of e-commerce adoption on business strategy in Saudi Arabian small and medium enterprises (SMEs). *Review of Economics and Political Science*, *4*(1), 73–88. https://doi.org/10.1108/REPS-10-2018-013

Astuti, N. C., & Nasution, R. A. (2014). Technology Readiness and E-Commerce Adoption among Entrepreneurs of SMEs in Bandung City, Indonesia. *Gadjah Mada International Journal of Business*, *16*(1).

Ayob, A. H. (2021). E-commerce adoption in ASEAN: who and where? *Future Business Journal*, *7*(1), 4. https://doi.org/10.1186/s43093-020-00051-8

Cao, Z., & Shi, X. (2021). A systematic literature review of entrepreneurial ecosystems in advanced and emerging economies. *Small Business Economics*, *57*(1), 75–110. https://doi.org/10.1007/s11187-020-00326-y

Chen, L. (2017). *Developing Asia in the Era of Cross-border E-commerce.*

Corvello, V., Verteramo, S., Nocella, I., & Ammirato, S. (2023). Thrive during a crisis: the role of digital technologies in fostering antifragility in small and medium-sized enterprises. *Journal of Ambient Intelligence and Humanized Computing*, *14*(11), 14681–14693. https://doi.org/10.1007/s12652-022-03816-x

Davis, F. D. (1993). User acceptance of information technology: system characteristics, user perceptions and behavioral impacts. *International Journal of Man-Machine Studies*, *38*(3), 475–487. https://doi.org/10.1006/imms.1993.1022

Falentina, A. T., Resosudarmo, B. P., Darmawan, D., & Sulistyaningrum, E. (2021). Digitalisation and the Performance of Micro and Small Enterprises in Yogyakarta, Indonesia. *Bulletin of Indonesian Economic Studies*, *57*(3), 343–369. https://doi.org/10.1080/00074918.2020.1803210

Fridayani, H. D., Iqbal, M., Chiang, C., Pratama, M. A., & Atmojo, M. E. (2021). Opportunities and Challenges of Digital Economy for Micro, Small, and Medium Enterprises Facing Pandemic Covid-19 in Indonesia: A Case Study. *Proceeding of the International Conference on Public Organization*.

Gono, S., Harindranath, G., & Berna Özcan, G. (2016). The Adoption and impact of ICT in South African SMEs. *Strategic Change*, *25*(6), 717–734. https://doi.org/10.1002/jsc.2103

Guo, H., Yang, Z., Huang, R., & Guo, A. (2020). The digitalization and public crisis responses of small and medium enterprises: Implications from a COVID-19 survey. *Frontiers of Business Research in China*, *14*(1), 19. https://doi.org/10.1186/s11782-020-00087-1

Holl, A., & Rama, R. (2023). Spatial patterns and drivers of SME digitalisation. *Journal of the Knowledge Economy*, *15*(2), 5625–5649. https://doi.org/10.1007/s13132-023-01257-1

Kallmuenzer, A., Mikhaylov, A., Chelaru, M., & Czakon, W. (2024). Adoption and performance outcome of digitalization in small and medium-sized enterprises. *Review of Managerial Science*. https://doi.org/10.1007/s11846-024-00744-2

Kraus, S., Durst, S., Ferreira, J. J., Veiga, P., Kailer, N., & Weinmann, A. (2022). Digital transformation in business and management research: An overview of the current status quo. *International Journal of Information Management*, *63*, 102466. https://doi.org/10.1016/j.ijinfomgt.2021.102466

Krotov, V. (2017). The Internet of Things and new business opportunities. *Business Horizons*, *60*(6), 831–841. https://doi.org/10.1016/j.bushor.2017.07.009

Kurniawati, E., Idris, I., Handayati, P., & Osman, S. (2021). Digital transformation of MSMEs in Indonesia during the pandemic. *Entrepreneurship and Sustainability Issues*, *9*(2), 316–331. https://doi.org/10.9770/jesi.2021.9.2(21)

Kyakulumbye, S., & Pather, S. (2022). Understanding ICT adoption amongst SMEs in Uganda: Towards a participatory design model to enhance technology diffusion. *African Journal of Science, Technology, Innovation and Development*, *14*(1), 49–60. https://doi.org/10.1080/20421338.2020.1802843

Legowo, B. M., & Sorongan, F. A. (2022). Accelerating digital transformation during the COVID-19 pandemic: A Model Design for Indonesian MSMEs. *Binus Business Review*, *13*(2), 203–211. https://doi.org/10.21512/bbr.v13i2.8447

Mahroeian, H. (2012). A study on the effect of different factors on e-Commerce adoption among SMEs of Malaysia. *Management Science Letters*, *2*(7), 2679–2688. https://doi.org/10.5267/j.msl.2012.08.021

Manyika, J., Ramaswamy, S., Khanna, S., Sarrazin, H., Pinkus, G., Sethupathy, G., & Yaffe, A. (2015). *Digital America: A tale of The Haves and Haves-Mores.* https://www.mckinsey.com/industries/technology-media-and-telecommunications/our-insights/digital-america-a-tale-of-the-haves-and-have-mores

Michel-Villarreal, R., Vilalta-Perdomo, E. L., Canavari, M., & Hingley, M. (2021). Resilience and digitalization in short food supply chains: A case study approach. *Sustainability*, *13*(11), 5913. https://doi.org/10.3390/su13115913

Modgil, S., Dwivedi, Y. K., Rana, N. P., Gupta, S., & Kamble, S. (2022). Has Covid-19 accelerated opportunities for digital entrepreneurship? An Indian perspective. *Technological Forecasting and Social Change*, *175*, 121415. https://doi.org/10.1016/j.techfore.2021.121415

Norris, L. (2020). The spatial implications of rural business digitalization: case studies from Wales. *Regional Studies, Regional Science*, *7*(1), 499–510. https://doi.org/10.1080/21681376.2020.1841674

OECD. (2021). *The Digital Transformation of SMEs*. OECD. https://doi.org/10.1787/bdb9256a-en

Peltier, J. W., Zhao, Y., & Schibrowsky, J. A. (2012). Technology adoption by small businesses: An exploratory study of the interrelationships of owner and environmental factors. *International Small Business Journal: Researching Entrepreneurship*, *30*(4), 406–431. https://doi.org/10.1177/0266242610365512

Räisänen, J., & Tuovinen, T. (2020). Digital innovations in rural micro-enterprises. *Journal of Rural Studies*, *73*, 56–67. https://doi.org/10.1016/j.jrurstud.2019.09.010

Ritz, W., Wolf, M., & McQuitty, S. (2019). Digital marketing adoption and success for small businesses. *Journal of Research in Interactive Marketing*, *13*(2), 179–203. https://doi.org/10.1108/JRIM-04-2018-0062

Rumata, V. M., & Sastrosubroto, A. S. (2021). The paradox of Indonesian digital economy development. In *E-Business - Higher Education and Intelligence Applications*. IntechOpen. https://doi.org/10.5772/intechopen.92140

Salim, M., Alfansi, L., Darta, E., Anggarawati, S., & Amin, A. (2019). Indonesian millenials online shopping behavior. *International Review of Management and Marketing*, *9*(3), 41–48. https://doi.org/10.32479/irmm.7684

Ssenyonga, M. (2021). Imperatives for post COVID-19 recovery of Indonesia's education, labor, and SME sectors. *Cogent Economics & Finance*, *9*(1). https://doi.org/10.1080/23322039.2021.1911439

Syuhada, A. A., & Gambett, W. (2013). Online marketplace for Indonesian micro small and medium enterprises based on Social Media. *Procedia Technology*, *11*, 446–454. https://doi.org/10.1016/j.protcy.2013.12.214

The Natural Edge Project. (2012). *The Natural Edge Project*. The Natural Edge Project. https://www.naturaledgeproject.net/

Trinugroho, I., Pamungkas, P., Wiwoho, J., Damayanti, S. M., & Pramono, T. (2022). Adoption of digital technologies for micro and small business in Indonesia. *Finance Research Letters*, *45*, 102156. https://doi.org/10.1016/j.frl.2021.102156

Wicaksono, T. Y., & Simangunsong, A. (2022). *Digital Technology Adoption and Indonesia's MSMEs during the COVID-19 Pandemic*. https://www.eria.org/research/digital-technology-adoption-and-indonesias-msmes-during-the-covid-19-pandemic

World Development Report 2016: Digital Dividends. (2016). https://www.worldbank.org/en/publication/wdr2016

Yacob, S., Sulistiyo, U., Erida, E., & Siregar, A. P. (2021). The importance of e-commerce adoption and entrepreneurship orientation for sustainable micro, small, and medium enterprises in Indonesia. *Development Studies Research*, *8*(1), 244–252. https://doi.org/10.1080/21665095.2021.1976657