ICIEMC
Proceedings

No. 5, **2024**, 123-128
Universidade de Aveiro
ISSN: 2184-9102
10.34624/iciemc.v0i5.36844

Leveraging Artificial Intelligence Technologies for Digital Transformation in European Small and Medium Enterprises: A Case Study of PRINTRIA

Élio Santos Novo[1]

[1] Universidade de Aveiro, elionovo@ua.pt

Abstract

In recent years, digital technologies have significantly reshaped the economy and society, impacting all sectors of activity and the daily lives of Europeans. The digitalization of the European economy has compelled entities across the board to adapt their internal processes to address emerging needs. This paper explores how European SMEs can leverage recent advancements in Large Language Models (LLMs) or Generative Pre-trained Transformers (GPT), such as ChatGPT, GEMINI, or other tools of Artificial Intelligence (AI), to achieve this objective, considering their constraints in terms of human and financial resources compared to larger enterprises. Our focus is on PRINTRIA, a small Portuguese company that utilized these resources to overcome internal skill shortages and execute system migrations without external reliance. The findings highlight the practical steps taken, the benefits realized, and the challenges faced by PRINTRIA, demonstrating the potential of AI tools in supporting SMEs. Furthermore, the study concludes that investing in digital skills and leveraging AI technologies can significantly enhance operational resilience, efficiency, and competitive advantage for SMEs.

Keywords: Digital transition/transformation; Small and medium-sized enterprises; Artificial intelligence; ChatGPT; PRINTRIA

ICIEMC
Proceedings

No. 5, **2024**, x-xx
Universidade de Aveiro
ISSN: 2184-9102
10.34624/iciemc.v0i5.36844

1. INTRODUCTION

In today's rapidly evolving digital era, the integration of modern technologies into the European economy is crucial for organizations striving to remain competitive and relevant. The pervasive impact of digitalization is transforming all sectors, reshaping traditional business models, and necessitating changes in internal operations to meet emerging demands. Small and Medium Enterprises (SMEs) in Europe face the dual challenge of leveraging technology to drive growth while managing limited human and financial resources compared to larger corporations. This paper examines how European SMEs can address these challenges through the use of advanced technologies such as Large Language Models (LLMs) and Generative Pre-trained Transformers (GPT), exemplified by ChatGPT and GEMINI. These tools are the result of substantial investments that have accelerated advancements in artificial intelligence, leading to the development of robust applications (Brown et al., 2020; OpenAI et al., 2023). Specifically, these technologies can mitigate resource limitations by "complementing the lack of human labor" (European Central Bank, 2023).

We focus on PRINTRIA, a small Portuguese company, to demonstrate how these technologies can compensate for resource limitations and facilitate seamless system transitions without relying on external assistance. As some authors have theorized, "we anticipate that LLMs will serve as virtual teaching assistants in broader contexts" (Tu et al., 2023). By analyzing PRINTRIA's experiences, we aim to highlight how LLM and GPT technologies can help SMEs adapt and succeed in a digital environment. This study provides practical strategies and insights from real-world applications, offering valuable information for policymakers, industry stakeholders, and SME leaders about the critical role of technological innovation in fostering sustainable growth and competitiveness among European SMEs.

This paper is structured as follows: after this introduction, a literature review of the main concepts and context supporting the adoption of advanced AI technologies in European SMEs is presented. Next, it describes the innovative approaches to digital transformation and system migrations in the case study of PRINTRIA, including both the benefits and challenges encountered. The paper concludes with final considerations.

2. LITERATURE REVIEW

2.1. IMPORTANCE OF SMEs IN THE EUROPEAN ECONOMY

Small and medium-sized enterprises (SMEs) have a considerable impact on economic growth and employment globally (Prasanna et al., 2019). Within the service sector, SMEs play a particularly critical role, as they provide a wide range of essential services to individuals and businesses. They are also essential to ensuring both economic growth and social cohesion in Europe. Moreover, SMEs in the service sector are critical drivers of innovation in Europe. SMEs are often at the forefront of new developments in the service sector, developing new products and services, and creating new business models (Cui, 2023). In Portugal, throughout 2022, SMEs employed 78.5 percent (3,523,806) of active workers (4,487,322), generated 60.1 percent (259,056 thousand euros of the total 430,888 thousand euros in 2021), and 57.1 percent of national turnover. They were also responsible for 54.2 percent (84,400 thousand euros) of gross value added (GVA). Instituto Nacional de Estatítca (INE ,2023) indicates that the average size of companies in Portugal is very small: each SME employs an average of 2.5 workers (and 631 workers in large companies). The characteristics of SMEs allow them to supply individualized products and act as a supporting fabric for large companies since most of these larger companies rely on subcontracting smaller firms to carry out services or operations that, if done in-house, would result in higher costs (Estrela, 2016). With a relatively low average number of employees, it is challenging for Portuguese SMEs, and likely for European ones as well.

2.2. DIGITAL TRANSITION/DIGITAL TRANSFORMATION

With a relatively low average number of employees, it is challenging for Portuguese SMEs, and likely for European ones as well, to cultivate the necessary computer skills in-house to manage the digital transition/transformation effectively. This transition often involves upgrading hardware to accommodate the growing volume of data and the increasing complexity of computerized processes that have evolved over the years. The European Commission (2020) stated, "Data is the lifeblood of economic development: it is the

No. 5, **2024**, x-xx
Universidade de Aveiro
ISSN: 2184-9102
10.34624/iciemc.v0i5.36844

basis for many new products and services, driving productivity and resource efficiency gains across all sectors of the economy, allowing for more personalized products and services and enabling better policymaking and upgrading government services. It is an essential resource for start-ups and small and medium-sized enterprises (SMEs) in developing products and services." Managing large volumes of data and transforming it into useful information, as well as detecting anomalies in digital transition processes, are critical levers for accelerating decision-making.
However, the complexity of hardware migration and its potential to disrupt ongoing operations can be daunting for company managers. This anxiety is particularly acute because such updates often coincide with critical operational periods, such as year-end, a time when companies are also committed to crucial tasks like inventory management.
Matt and colleagues (2015) stated, "Digital transformation is a continuous and complex undertaking that can substantially shape a company and its operations. Therefore, it is important to assign adequate and clear responsibilities for the definition and implementation of a digital transformation strategy."

3. THE PRINTRIA CASE

3.1. THE COMPANY'S PROFILE

PRINTRIA - EQUIPAMENTOS e SOLUÇÕES, LDA. is a commercial and services company that started its activity on the 7th of September 2009, located in Arada-Ovar, Aveiro District, Portugal. The company operates under the Portuguese sector of activity code, (CAE) 47781 - "Retail sale of machinery and other office material in specialized shops", with is today head office at Av. 16 de Maio, lote 6, 3880-102 Ovar. It is a limited liability company with a social capital of 11,250 euros and is currently composed of 3 partners and 11 employees. Its main activity is that of an official dealer of the Xerox brand, promoting the sale and rental of copying and printing equipment, in a Business-to-Business (B2B) environment, associating each new installation with a service contract, which is subsequently managed periodically. Additionally, it promotes the sale of office consumables, such as paper and other stationery. Currently, the invoicing of the services it provides results from the management of approximately 1,000 technical assistance contracts, representing 60% of turnover. The remaining 40% comes from direct sales of equipment and other consumables.

3.2. THE CHALLENGE: HARDWARE AND SOFTWARE UPGRADES TO MANAGE DATA GROWTH

The company's invoicing process, as outlined by the author of this study, relies on an internal infrastructure utilizing two independent servers, each maintaining separate databases. These servers communicate with each other to process the amounts invoiced to customers and to issue invoices. The invoicing process, which generates the highest volume of documents, commences on the first working day of each month. However, there is a necessity to issue documents daily, thereby requiring the system to be operational at all times.

One of the servers, containing data since 2014, was already experiencing processing difficulties as reported by users, while the other server had reached its storage capacity. Consequently, the migration of these servers became imperative and had to be completed in the initial working days of 2024 to avoid compromising the company's viability.

Since the company's inception in 2009, the maintenance and updating of its internal systems have been managed by one of the executives, who lacks formal computer training. This arrangement was necessitated by the company's limited financial resources in its early years and in recent times, the need to maintain the confidentiality of information, and the absence of a partnership with another organization for this purpose.

While the acquisition of hardware and installation of used software could be conducted in advance without significant constraints, the migration of database data had to be executed only after the last business day of the year, once operations had ceased, to ensure no information was lost. Although the billing software remained unchanged, the version in use had been updated over the years. During the migration, it was discovered that this version contained different tables and database fields compared to the new version. This

No. 5, **2024**, x-xx
Universidade de Aveiro
ISSN: 2184-9102
10.34624/iciemc.v0i5.36844

discrepancy necessitated direct manipulation of the database, requiring skills that were not available within the company and would take considerable time to develop—time which the company did not have.

3.3. THE SOLUTION: USE OF AI TOOLS

Artificial Intelligence (AI) has significantly impacted organizations, societies, and individuals. It offers systematic capabilities of reasoning based on inputs and learning from differences between expected and actual outcomes, enabling it to predict and adapt to changes in its ecosystems and stimuli received from its external environment (Dwivedi et al., 2023).

In the case of PRINTRIA, the detected incompatibility required IT skills that neither the manager nor any other team member possessed. The timing of the migration, coinciding with the end and beginning of the year, further complicated efforts to secure external support to address these issues. As a solution, the company leveraged ChatGPT technology to articulate the specific requirements and obtain the necessary code snippets to adapt the old database tables to the new ones. Below is an example of an instruction obtained from one of the AI tools consulted, which provided guidance that ensured the integrity and update of all the required fields. This example is illustrated in Figure 1. (see Figure 1).

```
="UPDATE customer SET TaxablePersonType = '" & C2 & "' WHERE partyid = " & A2 & ";"
```

Figure 1. Example of instruction to manipulate data in database.

Source: From the author's archive

Field by field, the various fields of the tables from one server were successfully adapted to the other server using these tools alone. This approach eliminated the need for external support, enabling the migration to proceed without delays and ensuring that the company's operations and viability remained unaffected, “workers and workplace AI augment each other’s strengths”. The successful migration demonstrated the potential of AI tools like ChatGPT in addressing complex technical challenges without the need for specialized IT personnel. By providing accurate and context-specific code snippets, these AI tools can bridge the skill gap often found in SMEs, allowing them to implement critical technological updates independently. Moreover, this experience underscored the importance of investing in AI literacy and training within the organization. Employees who can effectively interact with AI tools and interpret their outputs can significantly enhance the company's ability to respond to technological demands and improve operational efficiency, but “workers still need a combination of technical, human and conceptual skills, for example, to understand AI system outputs” (Zirar et al., 2023). This capability is particularly crucial for SMEs, which may lack the financial resources to hire external consultants or dedicated IT staff.

4. CONCLUSIONS

While large companies have the resources to secure assistance and consultancy at various stages of their digital transformation journey, the same is not true for most SMEs. From the case of PRINTRIA, we can conclude that SMEs can utilize AI tools as reliable assistants, available 24/7, to support the digital transformation of their internal processes and business operations (Gupta, 2024). These tools can also assist in resolving any anomalies that arise during these processes. As Roumeliotis and Tselikas (2023) noted in their study, ChatGPT technology can enhance customer service across various sectors by providing more effective and personalized responses. In this context, AI serves the manager's daily needs and potentially other management areas, as the same authors suggested.

However, despite the impressive advancements in AI tools, the presence of experienced experts remains essential, as highlighted by Al Zaabi et al. (2023), because AI is not free from errors or limitations (Kurian et al., 2023). In contrast to the negative aspects identified by many authors regarding business management, plagiarism is not a concern. Instead, best practices should be emulated with appropriate adjustments to fit each entity's specific context, facilitating decision-making, cost-effectiveness, and business expansion (Pujari

No. 5, **2024**, x-xx
Universidade de Aveiro
ISSN: 2184-9102
10.34624/iciemc.v0i5.36844

et al., 2024). As Szilágyi and Tóth (2024) asserted, GPT and other large language models have significant potential to promote economic growth and competitiveness.

Reflecting on PRINTRIA's experience, the adoption of AI tools not only addressed immediate technical challenges but also underscored the critical need for developing in-house competencies. The ability to leverage AI technologies for system migrations without external dependency provided substantial operational resilience and efficiency gains. This case demonstrates that investing in digital skills is paramount for SMEs to fully realize the benefits of digital transformation, ultimately enhancing their competitive edge in the market.

The daily advances in AI technologies reaffirm, in our opinion, the perspective of Bharadwaj and colleagues (2013): "the time is right to shift our thinking about IT, not as a functional-level response, but as a fundamental driver of business value creation and capture."

As emphasized by Acemoglu and Restrepo (2019), "artificial intelligence is set to influence every aspect of our lives". However, as Brynjolfsson and McAfee (2016) point out, "artificial intelligence might bring with it some troubles, but fundamentally, the development of thinking machines is an incredibly positive one."

BIBLIOGRAPHICAL REFERENCES

Acemoglu, D., & Restrepo, P. (2019). The Wrong Kind of AI? Artificial Intelligence and the Future of Labor Demand (w25682; p. w25682). National Bureau of Economic Research. https://doi.org/10.3386/w25682

AlZaabi, A., ALAmri, A., Albalushi, H., Aljabri, R., & AalAbdulsalam, A. (2023). ChatGPT applications in Academic Research: A Review of Benefits, Concerns, and Recommendations. https://doi.org/10.1101/2023.08.17.553688

Bharadwaj, A., El Sawy, O. A., Pavlou, P. A., & Venkatraman, N. (2013). Digital Business Strategy: Toward a Next Generation of Insights. MIS Quarterly, 37(2), 471–482. https://doi.org/10.25300/MISQ/2013/37:2.3

Brynjolfsson, E., & McAfee, A. (2016). The second machine age: Work, progress, and prosperity in a time of brilliant technologies (First published as a Norton paperback). W. W. Norton & Company.

Brown, T. B., Mann, B., Ryder, N., Subbiah, M., Kaplan, J., Dhariwal, P., Neelakantan, A., Shyam, P., Sastry, G., Askell, A., Agarwal, S., Herbert-Voss, A., Krueger, G., Henighan, T., Child, R., Ramesh, A., Ziegler, D. M., Wu, J., Winter, C., … Amodei, D. (2020). Language Models are Few-Shot Learners. https://doi.org/10.48550/ARXIV.2005.14165

Cui, L. (2023). Exploring Growth Strategies of European Small and Medium-sized Enterprises in the Service Sector using ChatGPT. European Integration Studies, 1(17), 175–198. https://doi.org/10.5755/j01.eis.1.17.33726

Dwivedi, Y. K., Kshetri, N., Hughes, L., Slade, E. L., Jeyaraj, A., Kar, A. K., Baabdullah, A. M., Koohang, A., Raghavan, V., Ahuja, M., Albanna, H., Albashrawi, M. A., Al-Busaidi, A. S., Balakrishnan, J., Barlette, Y., Basu, S., Bose, I., Brooks, L., Buhalis, D., … Wright, R. (2023). Opinion Paper: "So what if ChatGPT wrote it?" Multidisciplinary perspectives on opportunities, challenges and implications of generative conversational AI for research, practice and policy. International Journal of Information Management, 71, 102642. https://doi.org/10.1016/j.ijinfomgt.2023.102642

Estrela, S. (2016). A gestão da informação na tomada de decisão: Estudo em PME da Região Centro. Silabas e Desafios.

European Central Bank. (2023). New technologies and jobs in Europe. Publications Office. https://data.europa.eu/doi/10.2866/85560

European Commission. (2020). Communication 'A European Strategy for Data' (2020) COM/2020/66 final. European Commission.

Gupta, V. (2024). An Empirical Evaluation of a Generative Artificial Intelligence Technology Adoption Model from Entrepreneurs' Perspectives. Systems, 12(3), 103. https://doi.org/10.3390/systems12030103

Henkel, A.P., Bromuri, S., Iren, D., Urovi, V., 2020. Half human, half machine augmenting service employees with AI for interpersonal emotion regulation. J. Serv. Manag. 31 (2), 247–265. https://doi.org/10.1108/JOSM-05-2019-0160.

INE. (2023). Ano 2022 marcado pela aceleração da atividade económica do setor empresarial. https://www.ine.pt/ngt_server/attachfileu.jsp?look_parentBoui=642192001&att_display=n&att_download=y

Kurian, N., Cherian, J. M., Sudharson, N. A., Varghese, K. G., & Wadhwa, S. (2023). AI is now everywhere. British Dental Journal, 234(2), 72–72. https://doi.org/10.1038/s41415-023-5461-1

No. 5, **2024**, x-xx
Universidade de Aveiro
ISSN: 2184-9102
10.34624/iciemc.v0i5.36844

OpenAI, Achiam, J., Adler, S., Agarwal, S., Ahmad, L., Akkaya, I., Aleman, F. L., Almeida, D., Altenschmidt, J., Altman, S., Anadkat, S., Avila, R., Babuschkin, I., Balaji, S., Balcom, V., Baltescu, P., Bao, H., Bavarian, M., Belgum, J., … Zoph, B. (2023). GPT-4 Technical Report. https://doi.org/10.48550/ARXIV.2303.08774

Matt, C., Hess, T., & Benlian, A. (2015). Digital Transformation Strategies. Business & Information Systems Engineering, 57(5), 339–343. https://doi.org/10.1007/s12599-015-0401-5

Prasanna, R., Jayasundara, J., Naradda Gamage, S. K., Ekanayake, E., Rajapakshe, P., & Abeyrathne, G. (2019). Sustainability of SMEs in the Competition: A Systemic Review on Technological Challenges and SME Performance. Journal of Open Innovation: Technology, Market, and Complexity, 5(4), 100. https://doi.org/10.3390/joitmc5040100

Pujari, P., Arora, M., Kumar, A., & Pandey, A. (2024). Understanding factors influencing technical inertia in family-run SMEs: A study on technology adoption challenges. Journal of Statistics and Management Systems, 27(1), 155–168. https://doi.org/10.47974/JSMS-1208

Roumeliotis, K. I., & Tselikas, N. D. (2023). ChatGPT and Open-AI Models: A Preliminary Review. Future Internet, 15(6), 192. https://doi.org/10.3390/fi15060192

Szilágyi, R., & Tóth, M. (2024). Use of LLM for SMEs, opportunities and challenges. Journal of Agricultural Informatics, 14(2). https://doi.org/10.17700/jai.2023.14.2.703

Tu, X., Zou, J., Su, W. J., & Zhang, L. (2023). What Should Data Science Education Do with Large Language Models? (arXiv:2307.02792). arXiv. http://arxiv.org/abs/2307.02792

Zirar, A., Ali, S. I., & Islam, N. (2023). Worker and workplace Artificial Intelligence (AI) coexistence: Emerging themes and research agenda. Technovation, 124(February), 102747. https://doi.org/10.1016/j.technovation.2023.102747