Digital transformation and competitiveness in Peruvian small business

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CHRONICLE	ABSTRACT
	Digital transformation has become fundamental to improving the competitiveness of microenterprises worldwide, and Huancayo, Peru is no exception. By adopting digital technologies, microenterprises can improve their operational efficiency, expand their market reach and enhance their abilities to make informed decisions. They have therefore found innovative ways to adapt to changing market conditions, such as incorporating information technologies, online sales, use of social networks and home delivery. Despite this, many microenterprises struggle to survive due to lack of access to financing and adequate government support. This study aimed to analyze how individual, group and organizational factors influence the digital transformation of microenterprises and its impact on their competitiveness. The research was carried out in a sample of 80 multi-sector microenterprises, using a non-probabilistic and cross-sectional research design of a quali-quantitative and explanatory nature, using SEM-PLS. The results of the study indicate a positive relationship between individual, group and organizational factors and digital transformation, as well as with the competitiveness of microenterprises. The coefficients of determination (R^2) obtained were 0.8897 and 0.7931 for digital transformation and competitiveness, respectively, indicating a predictive ability in both cases. These findings are of great use to policy makers, business owners and researchers interested in fostering the growth and development of microenterprises in emerging economies.

1. Introduction

The reality of digital transformation in microenterprises in Peru is a mix; on the one hand, there are many microenterprises that have not yet adopted digital technologies, either due to lack of access to them, lack of knowledge on how to use them, or lack of financial resources to implement them. However, there are also a growing number of microenterprises in Peru that are adopting digital technologies to improve their operations and reach new customers. For example, many microenterprises are using e-commerce tools to sell their products online and are using social media and digital marketing to promote themselves.

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The interest in this synergy of factors, was expressed by Sánchez-Egea & López-De la Calle (2018) who stressed that industrial transformation should be oriented to generate autonomous and highly efficient productive processes with the support of robots, offering quality goods and services, high added value and within the established deadlines. Even so, many microenterprises in Peru still face challenges in adopting full digital transformation due to lack of access to technology, lack of training and lack of financing. This situation is widespread in Latin America, so Dini et al. (2021) analyzed the challenges and opportunities presented by the digital economy and the need for policies that balance support for businesses through the development of new technological areas.

Suryanto et al. (2023) identified the important factors that influence knowledge acquisition through technology in the public sector, suggesting strategies to improve its implementation. The findings of this study are useful for policy makers and practitioners in the public sector, as they can help improve training outcomes and thus improve performance and results in public institutions under institutional digital transformation; as user satisfaction is most important and that value generation through knowledge is critical to ensure sustained growth.

When talking about digital transformation, it is necessary to address the incorporation of different technologies and applications that are put at the service of companies; in this regard, Rawashdeh et al. (2023) analyzed the technological factors that influence the decision to implement solutions based on artificial intelligence (AI) in small and medium-sized enterprises, and examine the role of accounting automation in this process, confirming the relationships between predictive variables and the adoption of AI, and showed that accounting automation acts as a partial mediating factor in this relationship. At the same time, it is important to have a broad view of digital transformation, taking into consideration processes, people and technology (Chen & Popovich, 2003), while Sewpersadh (2023) indicates that the pandemic has made businesses more innovative and therefore creative in using technology to generate value through processes, products, services, etc., to such a level that makes them disruptive. What is clear is that the activities related to digital transformation need to be carried out from a systemic perspective and not a reductionist one.

It is important to note that Digital Transformation (DT) is not only the implementation of technology but requires a culture of innovation and a mindset of change in companies, so they must be willing to invest in education and training for their employees and foster a culture of continuous learning (Shehadeh, 2023). In this context, it is important to know how the micro enterprises of Huancayo have developed the factors that generate digital transformation and therefore their competitiveness, so the research question that was posed was: How are the individual factors, group factors and organizational factors related to the processes of digital transformation of micro enterprises in the province of Huancayo, while it is intended to know how is the relationship between digital transformation and competitiveness in these same business units.

The research is theoretically justified from the models proposed by Loucks et al. (2018) and Trenerry et al. (2021) where internal and external business factors contribute to digital transformation efforts and subsequently to their competitiveness.

2. Literature Review

2.1 Structural Equation Modeling

To analyze the connection between different variables in empirical research, structural equation modeling is commonly used. These models are based on the premise that the relationships between variables can be expressed through mathematical equations that explain how they are interrelated. The ability of these models to address complex causal relationships is critical, as it allows researchers to examine how one or many independent variables influence one or many dependent variables (Thakkar, 2020).

2.2 Digital transformation

According to Kleinert (2021), it refers to the process of adopting digital technologies to improve and transform business processes and models; this includes automating repetitive tasks, optimizing decision making with data and improving interaction with customers through digital channels. DT leverages the opportunities provided by technology to improve business efficiency and effectiveness. At the level of microenterprises, it can be a key tool to improve their efficiency, increase their reach and strengthen their online presence, adopt automation tools, technify processes, improve relations with strategic partners, etc.

It can also be considered as "the application of technology to build new business models, processes, software and systems that become more profitable revenue, competitive advantage and more efficiency" (Schwertner, 2017), in that sense Inga-Ávila et al. (2022), Inga-Ávila (2022) and Del Rowe (2017) agree that one way to ensure business continuity, is to develop processes, people and technology, framing them within the business strategy, which in this case can be the adoption of digital transformation.

2.3 Competitiveness

Competitiveness in microenterprises is understood as the ability to compete effectively with other similar companies, attracting and retaining customers, generating profits and growing in the market. According to Porter (1990), this includes several factors, such as efficiency in operations, quality of products and services offered, customer satisfaction and the ability to adapt and innovate in the face of market changes. However, Stiglitz (2002) points out that competitiveness is not only about reducing costs, but also about adding value and generating welfare, which is crucial for the survival and long-term sustainability of business success.

3. Research model

Figure 1 shows the conceptual model proposed by Trenerry et al. (2021) to guide organizations in their process of preparing for digital transformation. This model is based on a comprehensive review of both theory and practice, identifying the factors that influence organizations' readiness to address digital transformation. The result of this analysis is a framework composed of three levels: individual, group and organizational.
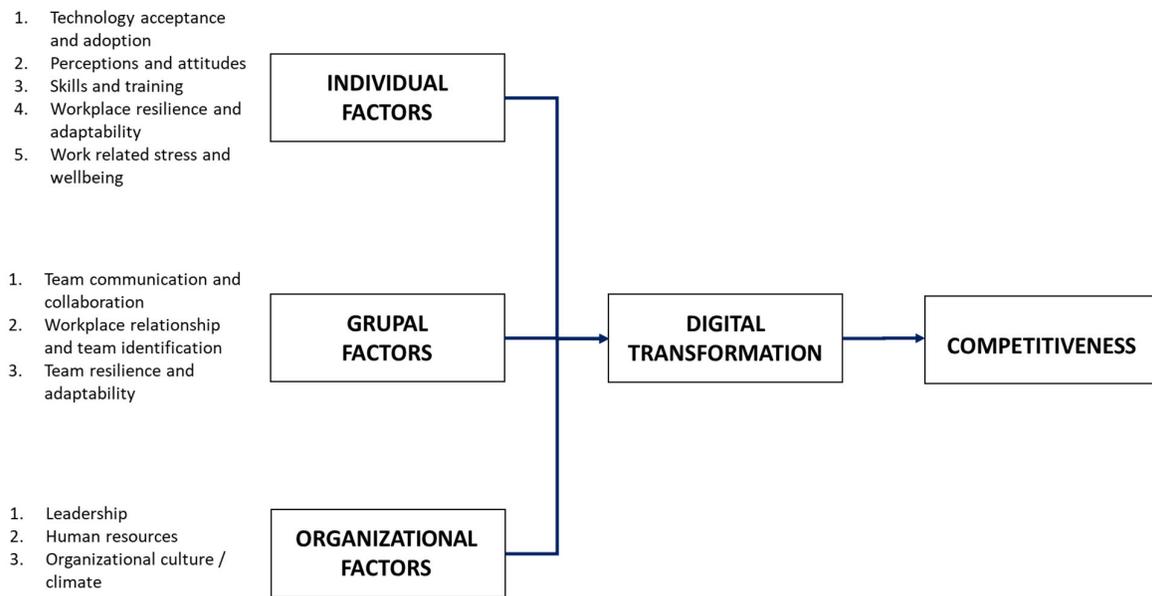

Fig. 1. Proposed research model (Based on Trenerry et al., 2021)

Based on the extended model of Trenerry et al. (2021), the respective latent variables and indicators are designed using SmartPLS v.4.0.9.1 (Ringle et al., 2022); as well as the relationships between them.
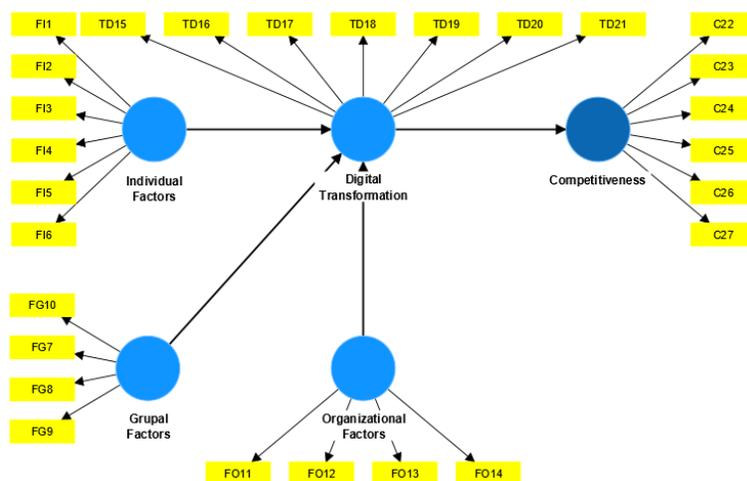

Fig. 2. Research Model Design with SmartPLS

Hypothesis 1 (H1): *Individual factors (IF) are related to Digital Transformation (DT) of micro enterprises in Huancayo.*

Hypothesis 2 (H2): *Group factors (GF) are related to the Digital Transformation (DT) of micro enterprises in Huancayo.*

Hypothesis 3 (H3): *Organizational factors (OF) are related to the Digital Transformation (DT) of micro enterprises in Huancayo.*

Hypothesis 4 (H4): *Digital Transformation (DT) of micro enterprises in Huancayo are related to their respective competitiveness (C).*

4. RESEARCH METHOD

4.1 Participants

As mentioned by Hair et al. (2017), a sample of at least ten times the number of connections between latent variables is required. Based on this recommendation, the study was conducted with a sample of 80 individuals, including owners, managers and collaborators of microenterprises in Huancayo. See Table 1.

Table 1
Distribution by labor position

Employment status	Number	%
Owner	27	33.75%
Supervisor	43	53.75%
Employee	10	12.50%

On the other hand, the sectoral activity to which the respondents' companies belong is shown in Table 2.

Table 2
Sectoral distribution of the microenterprises in the sample.

Sector	Quantity	%
Commercial and services	29	36.25%
Productive - Industrial - Manufacturing	32	40.00%
Extractive - Mining	19	23.75%

To ensure that the companies evaluated have carried out activities related to Digital Transformation (DT), those whose period of operation in the market is greater than 1 year have been considered.

4.2 Research instrument

The authors of the study created a questionnaire based on the model proposed by Trenerry et al. (2021). This questionnaire consists of 27 questions or indicators grouped into 4 categories: individual factors, group factors, organizational factors, digital transformation and competitiveness. A Likert scale with values from 1 to 5 (from "strongly disagree" to "strongly agree") was used to evaluate these categories. The questionnaire was distributed to study participants via Google Forms and they were given an average time of 5 minutes to complete it. Prior to use, the questionnaire was reviewed and approved by experts for wording, objectives, relevance, and consistency.

5. Results

5.1 Principal Component Analysis (PCA)

PCA is a statistical technique that allows simplifying the information contained in the data and extracting that which is relevant. In the field of structural models, PCA is used to reduce the dimensionality of the data, especially when they include multiple variables that could be correlated. When PCA is applied, new variables are generated, known as "principal components", which combine information from the original variables in such a way as to reduce the complexity of the data without losing too much information (Jolliffe, 2002).

In the present case, the PCA was applied through the review of the factor loadings, which showed a strong correlation between the variables and the respective indicators. All factor loadings obtained were greater than 0.80, which indicates a high correlation between the variables and suggests that the principal components generated from them offer a good representation of the data.

5.2 Confirmation of the measurement model

The evaluation of the measurement model is performed by calculating reliability (Cronbach's alpha and composite reliability), convergent validity and discriminant validity. See Table 3.

Table 3
Results of the measurement model

Constructs	Reliability		Convergent Validity	Discriminant validity				
	Cronbach's alpha	Composite reliability	Average Variance Extracted	C	DT	GF	IF	OF
Competitiveness	0.9877	0.9878	0.9422	0.9707				
Digital transformation	0.9812	0.9814	0.899	0.8906	0.9482			
Group factors	0.9729	0.9735	0.9249	0.8194	0.8905	0.9617		
Individual factors	0.9915	0.9916	0.9593	0.8645	0.8704	0.7831	0.9794	
Organizational factors	0.9703	0.9707	0.9182	0.85	0.8919	0.8898	0.7847	0.9582

Based on the results and following the guidelines described by Nunnally (1978), good internal consistency is noted in all cases, since the value of Cronbach's alpha is greater than 0.9, as are the values of the composite reliability coefficients, making it extremely satisfactory (Nunnally & Bernstein, 1994).

For the evaluation of the validity of a construct, convergent validity and discriminant validity are reviewed; according to Cepeda & Roldan (2004), convergent validity is measured by means of the Average Variance Extracted (AVE), determining whether the different items measuring a construct effectively measure the same thing. According to Fornell & Larcker (1981), the value of the AVE coefficient must be greater than 0.50 to be considered adequate. In the present study, AVE values greater than 0.89 were obtained, indicating adequate convergent validity.

In the case of discriminant validity, this indicates the extent to which a given construct is different from others (Cepeda & Roldán, 2004). For its evaluation, the square roots of the corresponding AVEs are compared with the correlations between the latent variables, as described by Fornell and Larcker (1981). In the study, the results show that the square roots of the AVEs are greater than all the latent correlations, indicating that there is adequate discrimination between the measured constructs. Based on the results in Table 3, it is concluded that all items are reliable indicators of the hypotheses raised.

5.3 Structural equation model analysis

The analysis of the structural model involves the use of path coefficients to determine the relationship between the independent and dependent variables, as well as the coefficient of determination (R^2), which indicates the percentage of variance of the dependent variable that is explained by the independent variables. In addition, the post-bootstrapping t-value is used to evaluate the statistical significance of the model coefficients. Fig. 3 presents the results of the structural model analysis, including the path coefficients and corresponding t-values. This rigorous statistical approach to hypothesis testing is useful for interpreting the results and writing up the findings accurately and reliably, as noted by Hair et al. (2017).
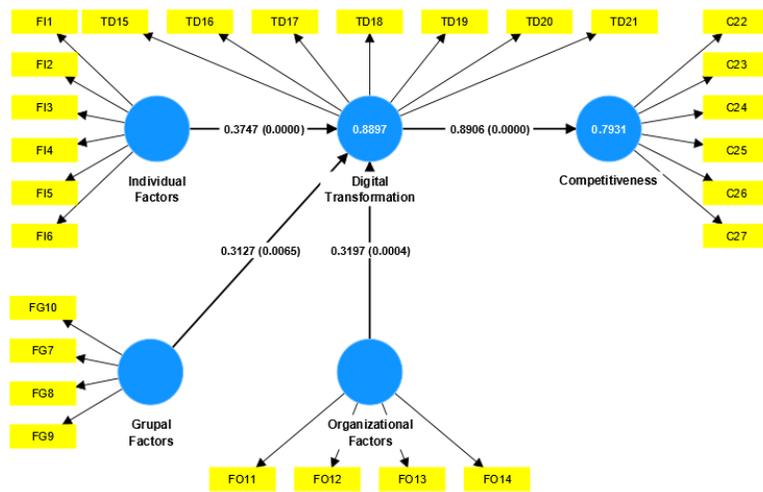

Fig. 3. Confirmatory structural model for the business strategy

Based on the results shown in Fig. 2, the hypotheses are evaluated to establish their acceptance or rejection. Table 4 includes a summary of data and incorporates the p-value and value judgment to the hypothesis formulated respectively.

Table 4
Results of the structural model analysis

Hypothesis	Simple mean	Standard deviation	Value Path Beta	Statistic t Student	p value	Decision	R²
H1: IF → DT	0.139	0.117	0.3747	1.044	0	Accepted	
H2: GF → DT	0.262	0.092	0.3127	2.815	0.0065	Accepted	0.8897
H3: OF → DT	0.563	0.121	0.3197	4.827	0.0004	Accepted	
H4: DT → C	0.563	0.121	0.8906	4.827	0	Accepted	0.7931

t > 1.96; p < 0.05

Based on the results shown, all hypotheses are accepted. Internal Factors (IF) maintain a direct relationship with Digital Transformation (DT) (β=0.3747, p<0.0000); Group Factors (GF) have a direct relationship with Digital Transformation (DT) (β=0.3127, p<0.0065); Organizational Factors (OF) are directly related to Digital Transformation (DT) (β=0.3197, p<0.0004). Finally, Digital Transformation (DT) and Competitiveness (C) (β=0.8906, p<0.0000) maintain a strong positive relationship.

On the other hand, given that the first R2 value is 0.8897, this indicates that the IF, GF, OF and FT model expresses collectively and in interaction a predictive capacity of 88.97%; while the second R2 value (0.7931) expresses that the DT and C relationship has a predictive capacity of 79.31%.

5.4 Model fit

The task of fitting the model was performed in order to minimize discrepancies between the observed and predicted values of the data and to ensure that they are not biased. To assess the quality of the fit, SRMR (Standardized Root Mean Square Error), which is an absolute measure of fit that normalizes the difference between the observed correlation and the predicted correlation, was taken into consideration. According to Hu & Bentler (1999), SRMR values should be less than 0.08 to be considered good and 0 to be considered perfect. In this study, both the saturated model and the estimated model have obtained SRMR values of 0.0347 and 0.0457, respectively, indicating a good model fit.

6. Discussion of Results

6.1 In relation to Internal Factors and Digital Transformation

Davison et al. (2023) analyzed the role of a chief digital officer (CDO) in leading digital transformation initiatives within an organization, highlighting the importance of having a professional who can drive digital transformation by aligning technology with business goals, creating a digital culture, and fostering innovation. They also provide information on the key skills and competencies that a CDO should possess, such as strategic thinking, leadership and digital expertise. There are overlaps between the findings of this research and the present one, in the sense that knowledge and leadership are important to drive digital transformation and help organizations stay competitive in today's digital era. Gilli et al. (2023) emphasize the importance of proactivity and creativity of workers to achieve goals in digital transformation projects.

6.2 In relation to Group Factors and Digital Transformation

AlMujaini et al. (2021) indicate that there is a relationship between digital transformation, organizational learning and innovation, establishing the importance of adaptive capacity in organizations. Likewise, Hizam et al. (2023) validated the impact of several factors on employee engagement during digital transformation, such as knowledge sharing, employee mobility, training and development, and psychological empowerment. These factors are related to teamwork and how employees work together in a digital scenario.

In this regard, Dragan (2021) discusses the need for companies to transform the way they deliver value to their customers through new technologies. He also mentions the need for a comprehensive digital transformation roadmap for companies wishing to make the leap to Industry 4.0.

6.3 In relation to Organizational Factors and Digital Transformation

Kokot et al. (2023) found that digital leadership and the organization's level of digital maturity were positively correlated with the success of digital transformation projects. They also established that the key competencies and skills that digital leaders should possess are strategic thinking, innovation and collaboration. In the same vein, Malodia et al. (2023) conclude that a combination of digital self-efficacy and professional leadership is essential for SMEs to successfully navigate their digital transformation journey. Also, Gilli et al. (2023) indicated that companies need leaders who can seize the opportunities of digitization and transform them into new business models. They also indicate that technical skills and IT expertise are less important than skills in collaboration, strategic thinking, leadership, customer orientation, and communication. Gilch & Sieweke (2020) examined the role of recruitment in the digital transformation of organizations, finding that hiring digital talent generates change within the firm. They highlighted the strategic role that digital transformation imposes on the renewal

of an organization's human resources, which is crucial to its success in digital transformation. These results are consistent with the study, given that organizational factors maintain a direct and strong relationship with digital transformation.

6.4 In relation to Digital Transformation and Competitiveness

According to Oleh et al. (2021), the adoption of digital transformation can enhance the competitive capability of firms through the use of new technologies to improve efficiency, reduce costs, improve customer experience, and adapt to market changes. In line with these findings, Michela et al. (2021) found that digital transformation can enhance the competitiveness of small and medium-sized enterprises (SMEs), as digital tools contribute to business model innovation, create new distribution channels and innovative ways to create and deliver value to customers, results that coincide with those obtained in the research. However, a study by Inga-Avila (2022) found that although technology is not a direct factor in determining competitiveness, companies in the textile sector use it to improve their marketing and sales strategies.

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