PROJECT, DESIGN AND MANAGEMENT

https://www.mlsjournals.com/Project-Design-Management

ISSN: 2683-1597

How to cite this article:
Briceño Méndez, T. & Arambarri, J. (2023). Modelo holístico para la innovación tecnológica en la pequeña empresa en Panamá. *Project, Design and Management, 5*(2), 100-119. doi: 10.35992/pdm.5vi2.1671.

HOLISTIC MODEL FOR TECHNOLOGICAL INNOVATION IN SMALL BUSINESSES IN PANAMA

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Abstract. The main mover to conduct this research was the urgent need to give answer to the inadequate level of automation and technological innovation in small companies in Panama. This issue is of great relevance in the country, as it is part of the efforts to remain competitive in both the local and global environment. The approach of the research is explanatory, since it concentrates on identifying the cause of the problem, and so tackle it with the proposed solution. After an extensive literature review on the subject, state of the art, diagnostics and data analysis, the focus was on exponential technologies, which offer the greatest potential to achieve a more sustainable solution over time. The results primarily show weaknesses in relation to digital literacy and skills. Due to the urgency to solve the problem, and considering the existing gaps, the proposal focuses on cloud-based packaged solutions, which can provide all the necessary elements to offer a solution to the problem. All this should be paired with a training plan to get the most out of the proposal, and allow the small companies to be more competitive.

Keywords: SaaS, Packaged software, Ecommerce, digital literacy, small enterprises.

MODELO HOLÍSTICO PARA LA INNOVACIÓN TECNOLÓGICA EN LA PEQUEÑA EMPRESA EN PANAMÁ

Resumen. Se decidió realizar esta investigación, para intentar resolver una problemática muy actual y muy real, y a la vez urgente, en relación a la innovación tecnológica y nivel de automatización en las pequeñas empresas en Panamá. Este tema es de gran relevancia en el país, al formar parte de los esfuerzos para mantenerse competitivos en el entorno tanto local como global. El enfoque de la investigación es explicativo, pues se concentra en identificar la raíz o causa del problema, para entonces así, atacarlo con la propuesta de solución ofrecida. Luego de una extensa revisión bibliográfica en torno al tema, estado del arte, análisis de datos y diagnósticos, el enfoque estuvo en las tecnologías exponenciales, por ofrecer el mayor potencial de lograr una solución más sostenible en el tiempo. Los resultados principalmente arrojan debilidades en relación a conocimientos de alfabetización digital y competencias digitales. Debido a la urgencia para dar solución a la problemática, y tomando en cuenta los vacíos

existentes, la propuesta se enfoca en soluciones empaquetadas en la nube informática, que provean de todos los elementos necesarios para dar respuesta a la problemática. Todo esto deberá ir acompañado de un plan de capacitación para sacarle el mayor provecho, y situar a la pequeña empresa en un lugar de mayor competitividad.

Palabras clave: SaaS, Software empaquetado, e-commerce, alfabetización digital, pequeña empresa.

Introduction

There is a need for digital transformation, not only at the global level, but especially at the regional and local level in the Republic of Panama. It is a reality that companies are competing globally, so it is necessary to innovate in order to prosper and grow. This has been a known fact for several years, and continues to increase; especially marked by the current circumstances due to the Covid-19 pandemic.

Small businesses are key in the development-generating transformation of a country, as shown by figures from the study developed by the Economic Commission for Latin America and the Caribbean (ECLAC) in 2020 (Dini & Stumpo, 2020). However, they have not yet managed to accelerate their innovation process; they continue to operate with obsolete technology or manual processes and contribute only 25% of GDP. Most small companies do not have the resources to develop technologically and achieve the required and desired competitiveness.

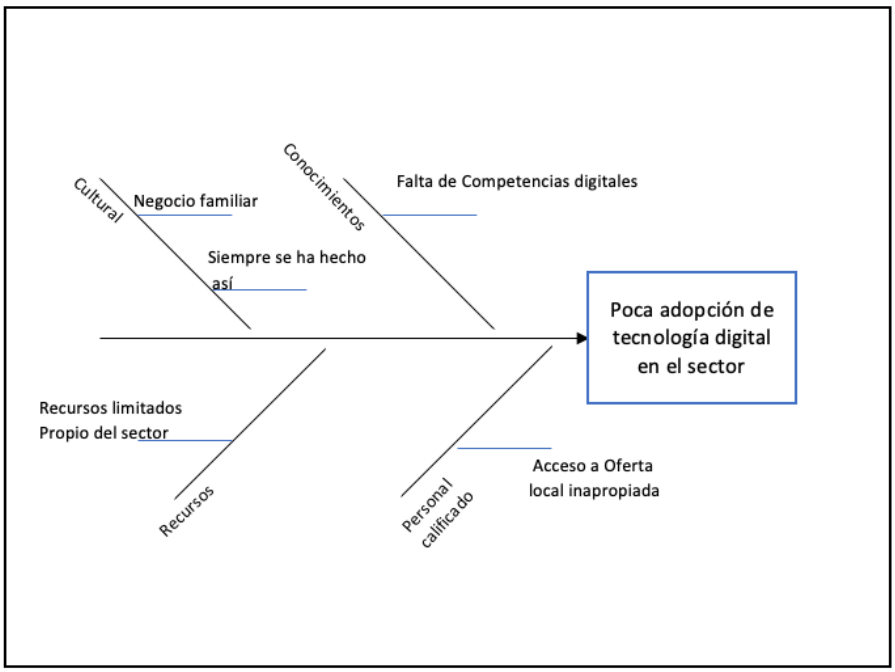
Innovation today is not a luxury; it is a necessity. It is no longer a question of reaching the technological level where we should be, but rather, that this be achieved in a sustainable and adaptable way to the changes to come.

All this has been the motivation to try to fill the existing gap, being the first question: "what causes the low adoption of information technologies in small businesses in Panama?". In addition, being aware of the limitations of small businesses in terms of resources and knowledge to cope with the situation, it is necessary to seek or design solutions that are closer and more accessible to them. Technology today offers options never before envisioned, which promise possible solutions to the problem (*Future Today Institute's 2021 Tech Trend Report - Artificial Intelligence (AI) | World Bank Group*, n.d.).

On the other hand, this scenario does not only imply challenges in terms of digital transformation. It also entails important changes related to the human capital of organizations. The challenge lies in the training of people. It is necessary to promote education policies that allow for comprehensive training so that small and medium-sized companies can compete adequately in this area. (*Latin America, Fertile Ground For Ecommerce - Forbes Colombia*, n.d.) (Vargas-Ortiz et al., 2019).

So far, the problem has been identified, but no solutions have been developed at the practical or research level, in a manner similar to that offered in this study. So far, there is data on how much automation exists in small companies, general guidelines are offered, but no alternatives are provided to turn ideas into concrete actions to solve the problem. (National Competitiveness Center, 2021b), (Fundación País Digital & Inter-American Development Bank (IDB), 2020). A summary of the identified causes of the problem is shown in Figure 1.

Figure 1
Ishikawa diagram showing the main causes of low technology adoption in the sector under study



Note. Own elaboration with data from Socioeconomic Impact Study, UNPYME.

Using the need for technological improvement as a spearhead, a proposal is presented through a holistic approach, which takes into account digital technology, but not in isolation or independently, but as part of a whole that also includes business strategy and digital competence. It is committed to emerging or exponential technologies, to achieve the adoption of technology and digital business models, in an accessible and viable way.

Once the research question was formulated, the hypotheses that attempt to answer it have been:

- The complexity and difficulty of the development and implementation of IT solutions
- Little knowledge of the subject
- Little interest in the subject
- Cost

As stated by (Manuel & Lovelle, n.d.) complexity is inherent in the development and implementation of solutions and/or software applications, which hinders the adoption of digital technology. This complexity derives from four elements: (Booch, cited by Manuel & Lovelle, n.d.).

- The complexity of the problem domain
- The difficulty of managing the development process
- The detail that can be achieved through the software
- The problem of characterizing the behavior of discrete systems

This value, the level of interest and knowledge of the subject in the study sector were analyzed in order to develop a model that attempts to respond to the problem.

After defining the subject and the problem, the general and specific objectives of the study were defined.

General Objective

Designing a holistic model for the adoption of technology and e-commerce in small businesses in Panama".

To achieve this objective, it was necessary to carry out intermediate steps to test the proposed hypotheses. These intermediate steps then become the specific objectives of the study:

Specific Objectives

- Elaborate a local diagnosis of the degree of automation of the study's target population
- Elaborate a local diagnosis of the reasons for the non-adoption of information technologies and/or e-commerce
- Demonstrate and project the benefits of e-commerce and information technology adoption through analysis of actual data from standardized surveys
- Substantiate the benefits and urgency of adopting emerging information technologies
- Delineate a digital culture teaching plan for the study's target population

Table 1 shows how the hypotheses are related to the general objective and

Table **2** summarizes the reasons and contributions of the different specific objectives. Both tables show how the research question, general and specific objectives and hypotheses are related.

Table 1

Relationship between the research question, the hypotheses they attempt to answer, and the overall objective

Research Question	*Hypothesis*	*General Objective*
What causes the low adoption of information technologies in small companies in Panama?	H1. The complexity of the process H2. Lack of knowledge H3. The lack of interest H4. Cost	Design a holistic model for the adoption of technology and e-commerce in small businesses in Panama

Table 2

Relationship between general and specific objectives, the hypotheses, the reason for the specific objective, and the contribution to the study

General Objective	*Specific objectives*	*Reason for seeking target*	*Result contributed to the study*
Design a holistic model for the adoption of technology and e-commerce in small businesses in Panama	SO1. Elaborate local diagnosis of the degree of automation	Verify that there is indeed little automation in the sector	The research question is tested and answered
	SO2. Elaborate a diagnosis of the reasons for non-adoption	Test the hypotheses for non-adoption of technology in the sector	The hypothesis is tested through field work
	SO3. Demonstrate adoption benefits	Substantiate why it is beneficial	Support for proposal development
	SO4. Supporting the adoption of emerging technologies	Substantiate why the use of emerging technologies is necessary	Support for proposal development
	SO5. Delineating a teaching plan for digital competencies	Necessary to get the most out of automation	Plan aligned to the general objective that seeks to achieve SO5

The sector under study, presents a number of needs and gaps in relation to the adoption of digital technology, e-commerce, business strategy issues, and other topics, as explained in the previous paragraphs. Table 3 summarizes these main shortcomings, with the proposed solution, leading to the presentation of the model.

Table 3

Summary of gaps and needs of the sector of study in relation to the adoption of digital technologies

Identified gap	*Proposal to fill a gap*
Little knowledge	Digital skills training program
Low resources	Free solutions, CSR[1], academic, research and governance support
ICT lagging behind	Use of exponential technologies

Note. Own elaboration with data from (UNPYME & AMPYME, 2022)

Proposed Solution

The proposed model for technological innovation for the sector is based on the triple helix model (Pedraza et al., 2014), and is presented from three approaches: conceptual, logical and implementation.

In order to achieve the proposed objectives, products or services available in the market are used, leaving custom designs in the background.

In order to obtain applications that allow access to the full range of digital innovation possibilities, it is proposed to rely on free, open source or scalable licensing software, with implementation in the cloud for better access to resources. This type of solution automatically includes aspects that must be considered in a comprehensive e-commerce solution.

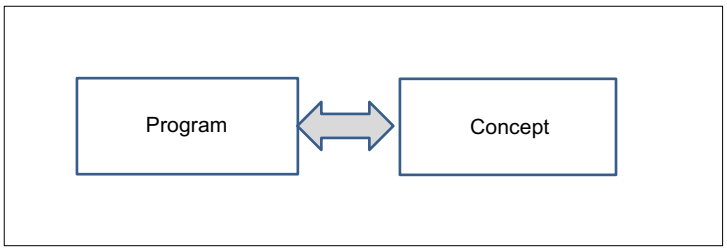
- Business functionality
- Ecommerce
- Computer security
- Backups
- Serverless computing
- Software updates
- Incorporation of exponential technologies

The applications, especially the suites, are used to introduce the concepts and fundamentals of business and business strategy. Packaged solutions usually include instructions, not only on the tool itself, but also on the concepts and fundamentals necessary for its use. See Figure 2.

[1] *CSR: Corporate Social Responsibility*

Figure 2

Proposed Solution. The programs or packages include the necessary concepts and fundamentals



The Academy or the union institution in charge of training would support this approach, providing guidance and follow-up to the different executive levels within the organization.

Digital culturalization. It is necessary to make a leveling / homologation of basic concepts of digital competences. This can be achieved through programs and/or video tutorials produced by the academic sector. (an example could be selected students guided and/or face-to-face (cycles) or blended learning, promoted and moderated by the trade association (UNPYME[2]).

Figure 3 shows the diagram of the proposed conceptual model. It is based on the triple helix model, which incorporates teaching, e-commerce, strategy and exponential technologies.

Figure 3

High level diagram of the main components of the proposed model

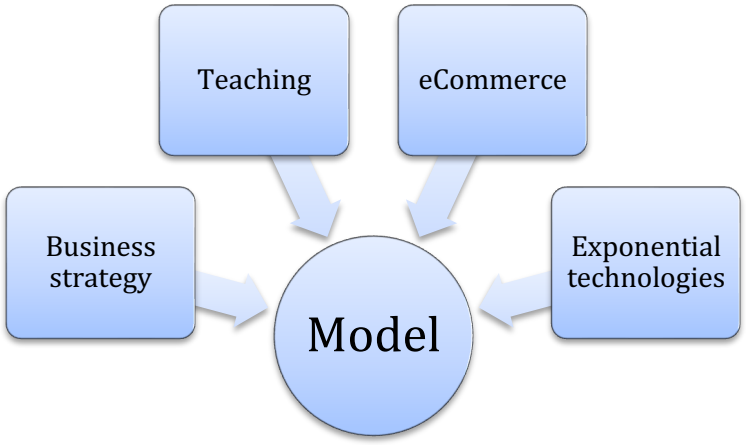
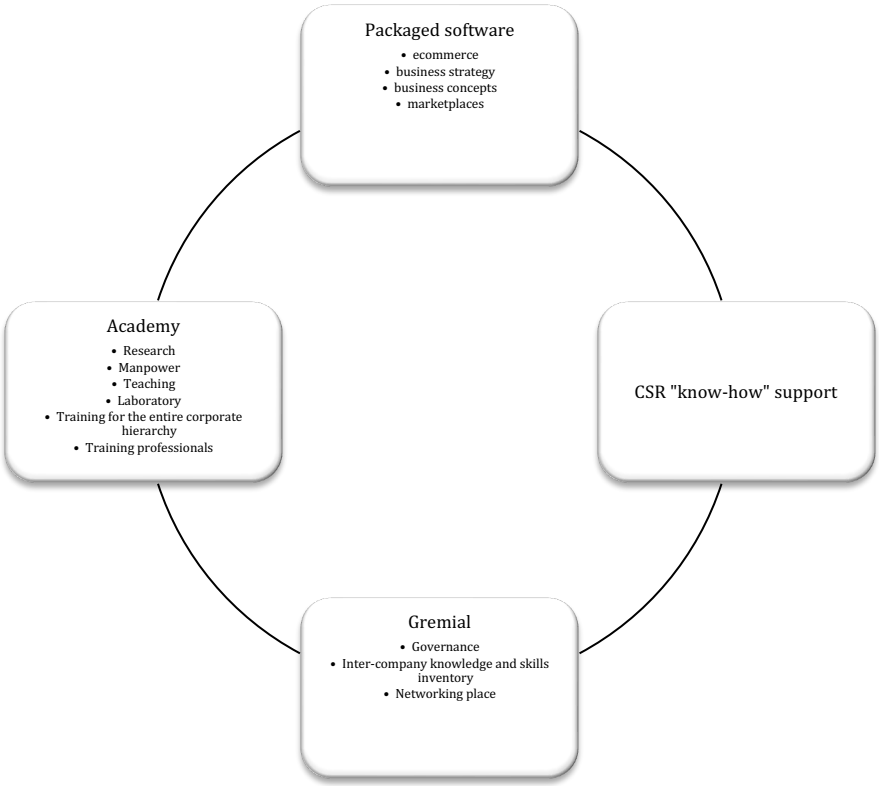


Figure 4 shows the implementation model, with the actors through which the implementation of the proposal would be carried out. It includes packaged software, academia, Corporate Social Responsibility (CSR) support, and the intervention of the trade sector as a guiding thread and facilitator.

[2] National Union of Small and Medium Enterprises

Figure 4

Implementation model showing the actors and their functions



Method

This research followed a non-experimental, correlational, cross-sectional design.

The research sought to find the relationship between the non-adoption of digital technology and its possible causes, in a sample of the population, selected non-randomly, taken at the current time, or time of data collection.

The research does not include observations over a period of time, so it is a cross-sectional investigation.

No variables were manipulated to observe their effects; therefore, this was not an experimental investigation.

The aim was to test or confirm the hypotheses described in a measurable way, initially by checking that the reasons were the ones assumed, and then by relating these responses to data from other tests and/or surveys and documentary analysis of research sources.

Scope of the investigation

This study attempts to solve a problem by looking for solutions in emerging and exponential digital technologies. Such technologies, by their very nature and innovative character, constitute a highly dynamic field, for which there are not enough scientific studies to demonstrate their effectiveness. As these are new or novel concepts, they are relatively new to the market and have not yet had sufficient time to demonstrate their effectiveness or failure. This study relies on accepted industry standards, such as trend markers like the Gartner Hype Cycle and the Future Today Institute's predictions, and their recommendations to best ensure a successful outcome. With this innovative element, this research has an exploratory component, focusing on the limits of the frontier of technological trends. On the other hand, the scope of the research is also of a correlational, explanatory nature.

First, we have sought to confirm that there is a correlation between two or more variables (the reason for non-adoption of technology, and software complexity), and subsequently, we have explored the possible reasons or whys of such correlations.

All this was necessary to confirm (or discard) the hypotheses on which the conclusions and proposed solution model are based.

It can be considered an intervention project, in that it seeks to solve a specific problem (poor digitization) within an area (small business) and a specific sector (Panama). In this particular case, only the design is covered; neither the execution nor the evaluation is included. However, the suggestions for carrying them out are left as a guideline. On the other hand, the research project must follow certain standards established in the community of business projects with digital technology. (PMI, CMMI, modeling, teaching, strategy, digital literacy). From this point of view, the research was carried out under the model designs established in the industry.

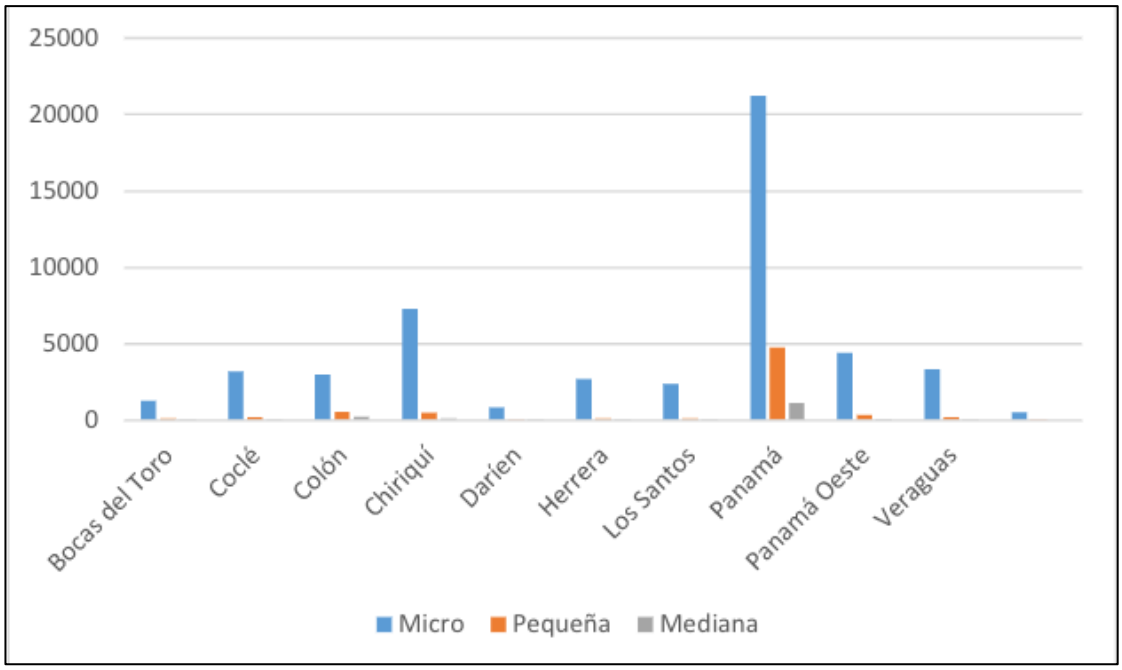
Population and sample

The unit of analysis for the research is the small companies in Panama. According to Panamanian legislation, the definition of small business through law 33 of July 25, 2000, are those that have annual sales between B/.150,000.00 and B/.1,000,000.00. The total number of small businesses in Panama, as of 2018 were a total of 7,065 registered, according to data from the Office of the Comptroller General of the Republic, data cited by (Centro Nacional de Competitividad, 2021a).

These small companies are distributed by size and province, as shown in Figure 5.

Figure 5

Distribution of micro, small and medium-sized enterprises by size and province, 2018



Note. Source: National Competitiveness Center (CNC), with data from the National Institute of Statistics and Census (INEC)

Working with the entire population of small businesses is impractical and not desired in this study. Not only because of their unmanageable number, but also because of the broad scope of the sector, which includes many different economic sectors. For this reason, it is necessary to delimit this population in order to achieve the greatest possible precision in the results. To this end, the criteria for delimiting the population should be aimed at successfully answering the research question. Taking this into account, the population delimitation criteria were determined:

- Small companies that want to access global markets, use digital technologies and e-commerce, but cannot (due to lack of resources), or do not know how to do so.
- Small companies that are not interested in participating in global markets, e-commerce or digital technologies, and find out why.

A non-probabilistic sample was defined, by means of volunteers for each stratum or group of interest studied, and case-types selected according to criteria of interest for the research. We worked in collaboration with UNPYME[3] and CNC[4], who, understanding the objectives of the research, guided the achievement of the case-types.

Sociodemographic characteristics of interest in this study are the age of the directors or managers of the companies or the person answering the survey, and the geographic distribution within the republic, in the different provinces, as well as the distribution by sector of economic activity of the company.

The age of the person actually constitutes an intervening variable in the sample, and is relevant because of the generational characteristics in relation to the predisposition to adopt new digital technologies.

[3] National Union of Small and Medium Enterprises
[4] National Competitiveness Center

The distribution by province and economic sector of the sample is used to characterize behavior from a cultural and environmental point of view, as well as economic activities. That is to say, a province dedicated mainly to agriculture, or another to the industrial sector, will have different needs than a business in the capital.

In all research, measurements are needed. What needs to be measured is dictated by the hypotheses, since it is what you want to prove or disprove. These hypotheses, stated in the form of prose or statements, should be expressed by means of measurable and verifiable variables. To this end, we return to the research question and hypotheses.

By means of the process known as the operationalization of the variables, it is possible to express the hypotheses in a measurable form. The process consists of breaking down the general definitions into the particulars of the study, and then expressed in a measurable way, as shown below.

Variable 1: "Complexity of software development" (What you want to measure)

Conceptual definition:

- Complexity: Complex quality. Something that is made up of different elements that are interrelated. Complex systems: systems composed of a series of interrelated elements whose behavior and properties are not obvious to the naked eye. Complex systems are the result of an intricate network of simple operations. [5]
- Complexity of software development
    - La complejidad es inherente al software y se deriva de cuatro elementos Booch, cited by (Manuel & Lovelle, n.d.)
    - The complexity of the problem domain
    - The difficulty of managing the development process
    - The detail that can be achieved through the software
    - The problem of characterizing the behavior of discrete systems

Operational definition

It is necessary to compare the level of software complexity between two development and implementation styles. For this purpose, a dependent variable and an independent variable are defined. In other words, the dependent variable will obtain different values depending on the independent variable.

Dependent variable: "Degree of complexity of solution development / implementation."

Independent variable: "Development approach or style (Custom or Packaged)

The dependent variable is still a complex variable, which makes it difficult to measure. It should be broken down into more elementary parts, which are unambiguously measurable, and which in turn lead to indicators that can be used to analyze results.

Taking Hypothesis 2 as a basis, the following variables are identified for analysis.

Description of Hypothesis 2: Lack of or little knowledge of technology and e-commerce prevents the adoption of both concepts.

The latter must be expressed in a measurable way. This leads us to express it: The greater the knowledge of technology and e-commerce, the greater the willingness to adopt both concepts.

Variable 2: "Willingness to adopt digital technology."

- Dependent variable: "Willingness to adopt digital technology."
- Independent variable: "Level of digital technology literacy"

In the case of Variable 2, it is necessary to define several variables involved in the measurement, since the results may vary according to different cases.

Intervening variables:

- Sector of economic activity (commerce, industry, services)

[5] *Definition retrieved from www.significados.com retrieved April 3, 2022*

- Age of executives
- Age of the company
- Schooling of managers
- Others
- Business style (traditional or avant-garde)

Variable 3: "Reason for non-adoption of digital technologies."

Trying to measure the reason for non-adoption of digital technologies can be very complex. Although the first response might suggest that it is related to cost, there may be other reasons. For this reason, a short questionnaire is used, but it is complemented by interviews with open-ended questions that can provide more information.

Measuring instruments and techniques

The instruments used for the fieldwork were a questionnaire, interviews and documentary analysis.

A simple questionnaire was used for field work. It was validated by a selected group of the target sector, prior to being used in the entire sample of the population. The answers to this questionnaire are used to collect quantifiable data before making the diagnosis necessary to confirm the hypotheses.

In addition, interviews were conducted, after passing through a first filter of the questionnaire. The interviews were open-ended questions, through which it was possible to go deeper into the answers, and were carried out with the collaboration of volunteers.

Procedures and literature review

In order to achieve the objective of this study, the starting point was the identification and justification of a need. Background research work was carried out and the hypotheses and measurement method were identified. Subsequently, field work was carried out, after designing a simple survey aimed at a sample of the specific population. With the collaboration of experts, both in the scientific field and in the population sector, the questionnaires and questions were validated before being sent to the sample group. This work has made it possible to prepare a diagnosis of the real situation in the sector. With these data, and the data from the references of previously published studies, statistical analyses were performed, the results of which were used as the basis for the conceptual elaboration of the proposed model. In addition, the corresponding operational and financial feasibility study was prepared in order to prepare the final complete proposal, together with the conclusions.

Statistical analysis

In order to carry out the statistical analysis using the variables already identified, it was necessary to decompose them from complex variables into simpler variables and indicators. Similarly, the qualitative values also needed to be coded into numerical values in order to perform the analysis using statistical tools.

It is necessary to compare the complexity of software development in its two modalities analyzed in this study to support the suggested hypotheses.

Decomposition of variables

- Variable 1: "Complexity of Software Development and Implementation."

  Complexity of the problem domain (Ordinal qualitative variable).

  This variable refers to the difficulty in specifying requirements.

  Values:

  - High
  - Medium
  - Under

  Difficulty in managing the development process (Qualitative ordinal variable)

  Values:

  - High

- Medium
- Under

The detail that can be achieved through the software. It is broken down into two variables: (Both ordinal qualitative variables). The higher the level of standardization, the better the quality of the software, or the lower the complexity)

Use of standards

- Adequate 1
- Little 2

Whether or not to develop everything from scratch (re-use of code, "harness" functions, functions, objects, tools, GUIs, algorithms) (As it is being measured in degree of complexity, the highest value is assigned to the greatest detail. In other words, the greater the detail, the greater the complexity.)

- High degree of detail development 3
- Medium level of detail development 2
- Adequate level of detail development 1

The problem of characterizing the behavior of discrete systems. It is decomposed into four variables (all ordinal qualitative)

- Software quality
- Data integrity
- Integration
- Security

Values:

- High Complexity 3
- Complexity Low 1

- Variable 2: "Willingness to adopt digital technology" (Qualitative ordinal variable)

Values: High, Medium, Low (3,2,1)

- Variable 3: "Reason for not adopting digital technologies" (Nominal qualitative variable)

Values: Cost, don't need it, Complex, lack of personnel, not the time.

Tables 6, 7, 8 and 9 summarize the operationalization and decomposition of the variables needed to test the hypotheses in the field, and identify the possible values and ranges for each one.

Table 6

Decomposition of variables Hypothesis 1

	Hypothesis 1				
Expressed in prose	"The complexity inherent in the development and implementation of IT solutions and/or applications hinders the adoption of digital technology."				
Variable 1	"Complexity of software development"				
Expressed in measurable form:	The complexity of software development can be broken down into four dimensions				
			Values		Type
Dimension 1	1)Complexity of the problem domain	High	Medium	Under	Qualitative Ordinal
Dimension 2	2) Difficulty in managing the process				
Dimension 3	3rd) Standardization level				
	3b) Develop everything from scratch				
Dimension 4	4th) Software Quality				
	4b) Data integrity				
	4c) Integration				
	4d) Safety				

Note: operationalization of the variable that measures the level of complexity of the development and implementation of IT solutions.

Table 7

Variables of the proposed assumption

	Assumption - Proposal		
	"Packaged solutions are less complex than custom solutions."		
		Values	
Dependent variable	Degree of complexity	High	Under
Independent variable	Development style	Packaging	Tailor-made

Note: Variables required to measure the assumption supporting the proposal to favor the use of packaged software over custom-developed software. Own elaboration.

Table 8

Decomposition of variables - Hypothesis 2

	Hypothesis 2				
Expressed in prose	"Lack of or little knowledge of technology and e-commerce prevents adoption of both concepts."				
Expressed in measurable form	"The greater the knowledge of technology and e-commerce, the greater the readiness for both concepts."				
		Values			
Dependent variable	Willingness to adopt digital technology	1	2	3	4
Independent variable	Level of knowledge of digital technology	1	2	3	4
	Intervening variables				
		Values			
Variable 1	Sector of economic activity	Trade	Agro	Industry	Services
Variable 2	Age	Numerical value			
Variable 3	Age of the company	Numerical value			
Variable 4	Grade of schooling	University	Technician	Secondary	None
Variable 5	Style or "cut of the company"	Traditional		Vanguard	

Note: Variables that measure the relationship between the level of knowledge of digital technologies and the willingness to use them. Own elaboration.

Table 9

Decomposition of variables Causes of non-adoption of the Technology

Variable	*Reason for non-adoption of technology*			
Why you need to measure	To understand the real reasons to support the proposed model			
Values	Cost	Very complex	Lack of qualified personnel	Lack of interest
Long answer question	The answer is requested in more detail: 1) Previous experiences (bad) 2) Abandonment 3) External and/or internal factors, not included in the survey			

Statistical analyses used

To demonstrate the comparison of the level of complexity of software development, it is necessary to compare the two development models: custom and packaged software, i.e. two groups. Descriptive and inferential statistics were used for this analysis. All the simple variables that compose the variable "software development complexity" are ordinal qualitative variables, since three levels of complexity were defined, in order to be able to compare in an unequivocal way. The tests indicated are nonparametric, since they are ordinal qualitative

variables. The test indicated for this case is the Mann-Whitney U test, by means of which relative comparisons can be established between two independent sample groups. In the case of the variable to be measured, it allows comparing whether one group is higher or lower than the other.

Descriptive statistical analysis is used to demonstrate the relationship between the level of knowledge of digital technology and willingness to use it. In this case, relative frequencies are described that demonstrate the hypothesis: the greater the knowledge of digital technology, the greater the willingness to use it. For this variable, a correlation analysis should be performed between the level of knowledge and willingness. Spearman's correlation test allows us to measure whether one variable increases when the other increases, for ordinal values.

Results

Using commercial references, a comparative table was drawn up to demonstrate the hypothesis. The results are shown in Table 10.

Table 10

Custom and Packaged Solutions Complexity Comparison Chart

Criteria	*Package*	*Tailor-made*
Complexity in the specification of requirements	Low Complexity	High Complexity
Difficulty in managing the development process	Difficulty Low	High Difficulty
Standardization level	High Level	Medium or Low Level
Detail that can be achieved in software development	High Level	Medium or Low Level
Software Quality	High Quality	High, Medium or Low Quality
Data integrity	High Level	High, Medium or Low Level
Integration	High Level	Medium or Low Level
Security	High Level	Medium or Low Level

Note. Comparative table of complexity level results according to aspects between customized solutions and packaged solutions. Own elaboration.

To confirm or rule out the second hypothesis, studies conducted and published by recognized institutions, following measurement standards, were used.

In the Diagnosis of Socioeconomic Impact conducted by UNPYME and AMPYME[6], in 2021, the effects of the COVID-19 pandemic on MSMEs in the Republic of Panama were measured.(UNPYME & AMPYME, 2022)

Two measurements were made in this study. A first measurement was made from December 1 to 15, 2020, and a second measurement was made from January 1 to 16, 2021, in order to verify the evolution of the indicators.

[6] Micro, Small and Medium-Sized Enterprise Authority

Demographic characteristics of the sample

The study used data from 28 unions affiliated to UNPYME. The sample was taken from formally constituted companies, with taxpayer identification and tax returns. The survey was administered digitally.

The total population was 6274 companies in both measurements. In the second measurement, of interest for this research, 1858 surveys were received, representing 29.60 of the population, with a consistency reliability of 0.91.

As results of the study, it was found that the educational level of the small business owner is composed of 15% not studied, 24% primary school level, 23% middle school level, 29% high school level, and 9% with a higher education level.

On the other hand, only 36% of small businesses know about Ecommerce, 6% make sales over the Internet, 32% are interested in learning about the Internet, and 72% want to make sales over the Internet.

In addition, 89% of the small companies are family-owned.

Relationship to the Hypotheses and Objectives of the Study

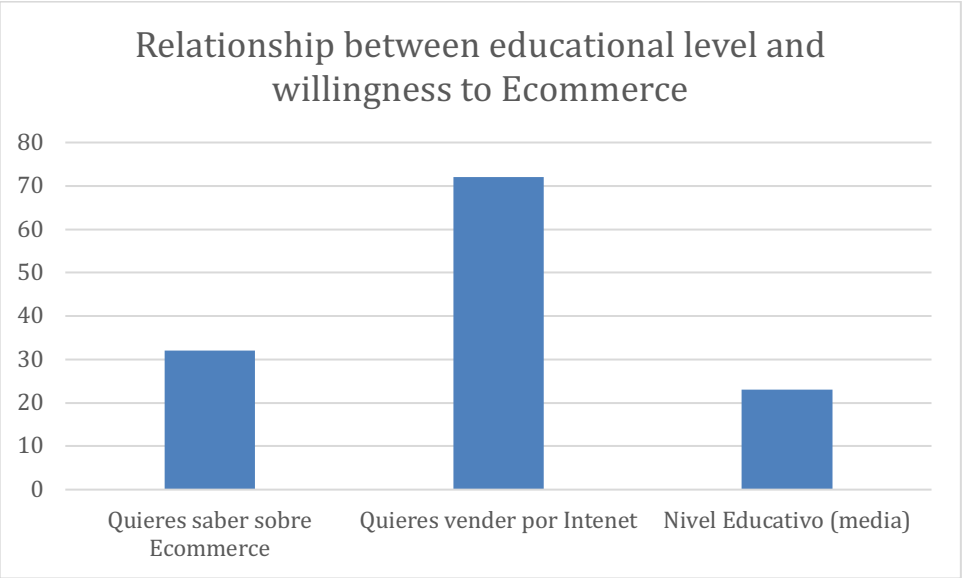
The data from the aforementioned study that were useful for this research are those related to the hypotheses and measurement objectives of interest to us. Small business owners' educational level, current Ecommerce adoption, and interest in Ecommerce were used. Similarly, data related to the current use of digital tools and how they relate to interest in E-commerce, or selling over the Internet, was used.

Using the data from the UNPYME study, the average educational level of small business owners is pre-middle school education.

Figure 5 shows the relationship between the educational level of the business owner and his or her interest in ecommerce, and Figure 6 shows the relationship between the use of digital tools and interest in selling online. Figure 7 also shows the relationship between the owner's or manager's knowledge of Ecommerce and their interest in learning about it.

Figure 5

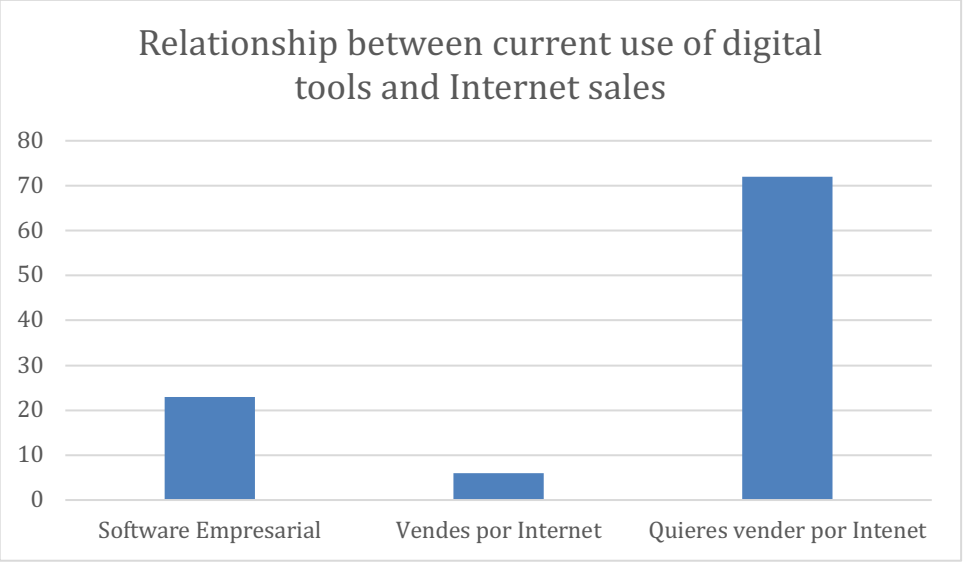
Relationship between educational level and willingness to Ecommerce



Note: Graph showing the relationship between the educational level of the company's management and their interest in Ecommerce. Own elaboration with data from (UNPYME & AMPYME, 2022)

Figure 6

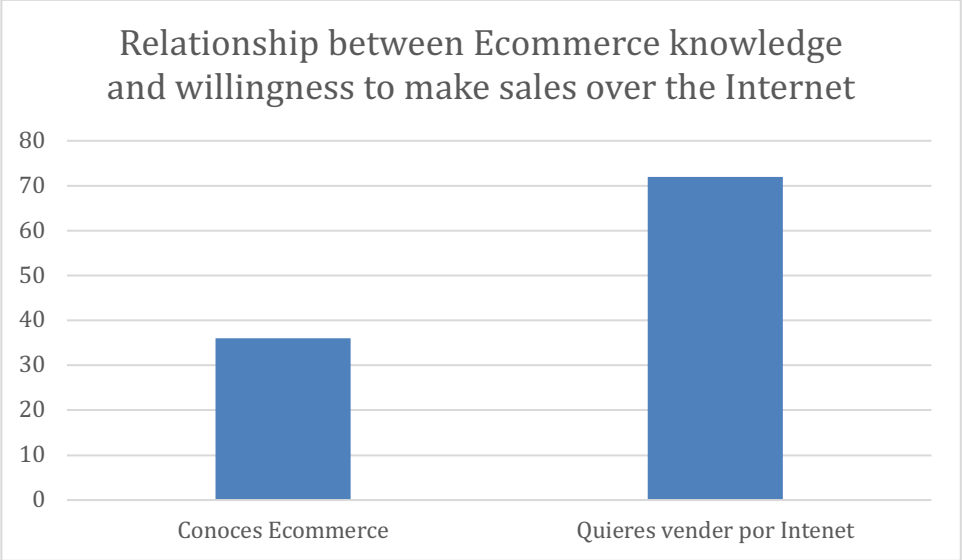
Relationship between use of digital tools and internet sales



Note. Relationship between reported use of digital tools, current online sales, and interest in selling online. Own elaboration with data from (UNPYME & AMPYME, 2022)

Figure 7

Relationship between Ecommerce knowledge and interest in Ecommerce



Note: Relationship between the level of knowledge of e-commerce and the willingness to use it on the part of the company's managers in the sector. Own elaboration with data from (UNPYME & AMPYME, 2022)

From these results, it can be seen that, regardless of the educational level of the owner or executive, there is a high percentage of interest in learning about Ecommerce. Similar results are observed in relation to Ecommerce knowledge. Despite the relatively low percentage of knowledge, this does not affect the fact that the level of interest in Ecommerce remains high. Table 11 shows a summary of the results and their relationship with the hypotheses proposed.

Table 11

Hypothesis, Objective, Result and Conclusion of the Objective

Hypothesis	*Associated target for response*	*Method of obtaining response*	*Result*	*Conclusion of Objective*
H1	SO3, SO4	Surveys, interviews and documentary analysis	The hypothesis is tested	The benefit of the use of packaged software is proven
H2	SO1, SO2, SO5		The hypothesis is discarded	Lack of knowledge is ruled out as a barrier to ecommerce adoption
H3	SO1, SO2, SO5		The hypothesis is discarded	It is ruled out that there is little interest
H4	SO3, SO4		The hypothesis is confirmed	Cost is confirmed to influence technology adoption

Note: Table synthesizing the relationship of the Hypothesis, the results and the related conclusion.

Discussion and conclusions

The purpose of this research was to identify the causes of the low adoption of digital technology and e-commerce in small businesses in Panama, in order to design and propose a solution model for the sector's problems.

The main findings of this study are discussed below.

- The results obtained in the study group show that, although there is a need and desire to automate and carry out e-commerce, the level of knowledge required to do so is not

reflected. In other words, you want to achieve the objective, but you do not know how to get there.

- Initially, one of the hypotheses raised was that there was no interest in achieving the objective, due to a lack of knowledge of the subject. However, this hypothesis was discarded with the results obtained, which demonstrate that, in spite of not having the necessary knowledge, the objective is desired.
- No previous studies are available where this type of relationship is made. There are descriptive studies that indicate these results separately, but without correlating them.
- It is proven, through simple statistical analysis, that the best way to achieve the proposed objectives is through the implementation of packaged software, particularly SaaS, as it provides the necessary capabilities and meets the requirements of the sector.
- A review of successful cases shows that it is necessary to adopt emerging technologies, as they offer a more sustainable solution over time.
- The results also show the great need to acquire digital skills knowledge, at different levels within the organizational structure. Generally, small companies are mainly family-owned, and the owner is also the most senior executive and decision-maker.

It is important to mention that this study was considerably limited in the field work, and the consultation of figures or results of previous studies. Studies on the subject are scarce. Official census and data institutions were consulted, but no results were obtained. This made it necessary to resort to studies by independent entities, such as the CNC, or trade groups such as UNPYME. On AMPYME's website, where a technology adoption survey is published, the results of the survey have not been published, and it is not known how many companies have answered the survey.

Although the contributions in this study are not sufficient, they do give an important idea about the problem raised, particularly with regard to the links or correlations between the known information. On the other hand, it certainly provides a tangible and workable solution; one that, while not perfect or exhaustive, goes a step beyond any previous attempt. In this sense, this study should be taken as a starting point to develop detailed action plans that will lead to the achievement of the objectives.

Possibly the hypothesis was discarded (if you want to automate, despite not having the knowledge), driven by the events that occurred due to the pandemic. During the pandemic, the immense need to automate and carry e-commerce became evident, possibly leading many who were previously uninterested to want to get it.

One of the shortcomings or gaps in the attempts to support the sector is the fact that no concrete proposals have been made that can be implemented. Nor has there been a study with indicators to measure progress on the subject, once the results of surveys have been published, or to make recommendations. There is no measurement of how many companies have improved their performance indicators, or if bankruptcies have been avoided, or any other favorable result, for example.

One of the most important conclusions of the study is the confirmation of the great need for digital education among members, managers or owners of companies in the sector. This is something that can never be valued enough.

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Date received: 23/10/2022
Revision date: 08/04/2023
Date of acceptance: 10/04/2023