Designing Diagnosis Instruments to Determine e-Commerce Readiness for Micro and Small Enterprises in Rural Areas

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Abstract

Before implementing electronic commerce, micro-businesses must conduct a diagnostic study to determine its feasibility. They must decide whether they have the technological resources required and determine if potential customers are also ready and willing to use this new distribution channel. To ease this diagnosis, two instruments are designed and evaluated. One for diagnosing the electronic commerce readiness of micro and small companies and the other to assess the potential consumer's ecommerce readiness. An iterative process was used for the design and evaluation of these diagnostic instruments. Academic experts with extensive experience in instrument design conducted the first evaluation; the second iteration was evaluated in a pilot field study involving six businesses and ten consumers from rural regions. Finally, the last evaluation was carried out through a case study in the Río Cuarto de Alajuela canton, in which 29 companies and 261 consumers from a specific region participated. In this article, evaluations made to the instruments in each of the different iterations are presented, while in the original article, the emphasis was given to the results of the final case study. It is important to note that the recommendations and opportunities for improvement obtained from the respective evaluations were applied in each of the iterations. Robust and efficient diagnostic instruments are the main product of this study.

Keywords: E-commerce, E-readiness, Technology acceptance, Micro-businesses, Rural zones.

1 Introduction

The world has been affected by a significant economic crisis during 2020 and 2021. The Covid-19 pandemic has caused this crisis, and it is palpable in almost every country in the world. This pandemic is estimated to have drastically weakened the economies of the Latin American countries. Some organizations, such as the Economic Commission for Latin America and the Caribbean (CEPAL), state that in many countries of the region, the growth rates of gross domestic product (GDP) have decreased from 6% to 0.2% [1]. Likewise, for Costa Rica, it is assumed that the GDP will reduce by 3.6% according to the Central Bank; this country "... will experience the worst recession in 38 years, especially due to the drop in exports and household consumption" [2].

The outlook is not encouraging because many micro and small companies are suffering the effects of this crisis. In rural areas, they must fight even more to combat this decrease in economic activity that threatens to bankrupt multiple businesses. In order to do so, it is necessary to establish new measures and alternatives that help boost or reactivate economies for micro-enterprises. One of the possibilities for supporting small businesses is to rely on

technology. For example, it is estimated that digital technologies have reduced the impact of the pandemic in some professions [3].

Thanks to the implementation and support of technology in business, it is possible to develop new electronic commerce scenarios that will allow small businesses to leverage sales drops and increase income. Nowadays, a small business needs to implement electronic commerce [2].

In the 2000s, e-commerce was predicted to have a significant impact on the way companies do business [4]. Today there are multiple alternatives for trading platforms worldwide, and Costa Rica is no exception [5]. This has been intensified by the economic crisis caused by COVID-19. Micro or small businesses should seek to take advantage of the potential benefits of technologies, which through the implementation of an electronic commerce platform become the main means to advertise and market products and services [6].

However, sometimes the implementation of electronic commerce as a new means of commercialization is not only a commercial decision, since not all companies, nor all consumers in a region, are technologically prepared to adopt e-commerce. Therefore, before implementing this trade modality, companies should carry out a diagnostic study, both to find out if they have the technological and logistical resources internally, and to diagnose whether their potential clients also have such preparation.

From this perspective, this work seeks to diagnose the current technological needs and the technological readiness that micro and small businesses in rural areas have to adopt digital electronic commerce platforms. The study's objective was to design a measurement model that allows knowing the technological preparation and acceptance of micro and small companies and their consumers to adopt electronic commerce platforms in rural areas through the application of a case study in that specific region. The validation of the instrument was carried out in the canton of Río Cuarto, Alajuela, Costa Rica.

An important point to note is that this study does not consider factors associated with logistics and distribution, important factors for electronic commerce. During our research we found out that Costa Rican postal service offers Pymexpress which efficiently allows deliveries throughout the national territory, and thus, the distribution logistics was not deemed as problematic, and therefore, was not addressed in our technological readiness instrument.

Although the study was developed during the economic crisis and under the pressure of the pandemic caused by the COVID-19, the development of the instruments was not based on characteristics generated by the pandemic. Therefore, they are generalizable beyond the pandemic crisis.

Among the main contributions of this study, it is highlighted that an instrument is made available to society with which an efficient diagnosis can be made. Its use allows knowing if the micro-enterprises and their potential consumers of a certain rural region are in the technological capacity to implement electronic commerce.

This article is an extended version of the article "Diagnosis for the adoption of electronic commerce platforms in micro and small businesses in rural areas: a case study of the Río Cuarto region, Alajuela" accepted at CLEI 2021 [7]. The objective of the original article was to disseminate the results of the case study at a specific Costa Rican rural area region. In this extended version, emphasis is given to the process of designing the instrument and the instrument itself.

It is important to highlight that the methodology used for the design and evaluation of the instrument allows the study to be innovative and useful for other people interested in conducting similar research, since an iterative design process was used. It consisted of three different evaluation stages; the first iteration with an expert evaluation, the second iteration with an evaluation through a field pilot and, finally, the third iteration, with a case study. This last stage takes place in the Río Cuarto de Alajuela canton, a rural area with little commercial development. It is important to point out that in each of the iterations, the recommendations and opportunities for improvement obtained from the respective evaluations were included in the developed instruments, which allowed obtaining robust and efficient diagnostic instruments at the end of the study.

The rest of the paper is structured as follows: Section 2 of this document describes the antecedents, where the essential concepts that other authors have dealt with in previous investigations will be evidenced. Followed by this, you will be able to observe the methodological process that was followed in this research. Section 4 shows the evaluation of the instruments developed as part of the research, after which the results obtained in the application of the case study are described in section 5. Finally, section 6 presents the conclusions of the study.

2 Background

We conducted a literature review to identify similar worlds and to determine if an instrument to measure technological readiness and technology needs for the adoption of electronic commerce platforms in micro-

enterprises had been proposed. It was determined that currently there is no literature that reports and analyzes cases of development of electronic commerce platforms for micro businesses in rural areas. However, some articles were found that describe the technological preparation that a micro and small business must have for a correct adoption of electronic commerce [5][8]. The search was conducted during the months of May and June 2020 and 49 results of interest were obtained, of which only 13 were included as part of this study.
The review was conducted in ACM, Springer, IEEE and Scopus and the research query used were:

- (("ecommerce" OR "emarket" OR "virtual markets" OR "social commerce") AND ("small business")).
- e-readiness AND ecommerce AND small AND medium enterprises.

The identified research papers focused on the factors that influence the success of an electronic commerce platform, as well as a description of the benefits of implementing this type of platform. In addition, documents were found that reveal the ways and importance of evaluating the trustworthiness of online commerce sites and other more general topics.
It is important to highlight that what factors influence the success or not of an e-commerce platform stands out. It is known that many platforms dedicated to online marketing are solely focused on information, they tend to be static sites and lack interaction factors for online transactions [9].
Also, it is important to mention that a critical factor for the success of an electronic commerce platform is trust. This factor becomes essential in the interaction between people. Confidence has a significant effect on consumers' purchasing intentions [10].
The identified papers allowed us to obtain knowledge for the design of the instrument that will be used in this research for the diagnosis of the technological preparation of micro-enterprises and consumers in rural areas.
For the second part of the literature review, we consulted on the preparation and technological needs that micro businesses for an adequate adoption of electronic commerce. The goal was to determine aspects related to the obstacles that micro and small companies face when implementing an electronic commerce platform.
We determined that technological preparation or e-readiness, is a critical aspect when implementing an electronic commerce platform. Many micro companies must adapt their businesses and use new technological tools for their commercial success. Technology is critical for micro businesses as it will help create value and positively impact business performance.
Technological readiness is defined as the degree of readiness of companies to access network infrastructures and technologies in each region. This concept is related to the degree to which a society is prepared to participate in digital business [11]. According to the studies consulted, to know and talk about the adoption of electronic commerce, it is essential to carefully address the aspect of technological preparation of micro and small companies and potential customers [12].
The success of an electronic commerce platform will depend not only on the effort of each business but also on the disposition of its clients, suppliers, and commercial partners, as well as their implementations of technological and logistical requirements to carry out electronic transactions. The following categories are highlighted that are measured for e-commerce readiness [8].

- Infrastructure and basic technologies
- Access to network services
- Internet use (uses in businesses, government, homes)
- Promotion and facilitation of the industry
- Skilled workforce
- Positioning for the digital economy (taxes and fees, industry self-regulation, government regulation, consumer confidence)

Even though e-commerce has been around for several years, many micro-businesses have not dared to implement these marketing tools and are wasting the potential benefits that they could obtain in the context of the pandemic and for the future. Some authors suggest that micro-businesses that support their businesses in technology could increase their economic productivity and have carried out studies to validate this causal relationship, finding a small causal relationship between both factors [13].

Finally, it is highlighted that this research aims to provide the knowledge base so that micro enterprises can diagnose and learn about their technological and business preparation.

3 Research Methodology

To meet the objectives established in this research, the design science methodology [14] was used, which is the theoretical basis for creating and evaluating the diagnostic instrument of technological preparation for the adoption of trading platforms. electronic in rural areas. Figure 1 shows the methodological process that this study followed.
It is highlighted that the methodology of design science raises three cycles: the relevance cycle, the design cycle and the rigor cycle [14]. For this study, the relevance cycle consists of a study of the characteristics and needs of the companies and potential clients of these companies in the region. The idea of this cycle is to characterize the environment in which the study will be carried out. Thanks to this stage, it was possible to obtain, through the support of the local government, a business registry made up of 80 micro-enterprises, which will be taken into account in the case study. The rigor cycle consists of the knowledge base for research, in which a search and review of information related to similar solutions is carried out, to adapt to the study context, which was carried out with the reviews previously described literature. Finally, in the design cycle, the artifact is built, and the knowledge obtained in the phases mentioned above is used to build the artifact, which will be a diagnostic instrument, designed iteratively [14].
The implementation of the case study, the application of the instruments and the collection of information allowed obtaining a series of data which will be transcribed and systematized in the next section. The objective was not only to know the situation of the specific region but also to determine the applicability level of the instrument used to make the diagnosis of the technological preparation of the micro enterprises in the region.

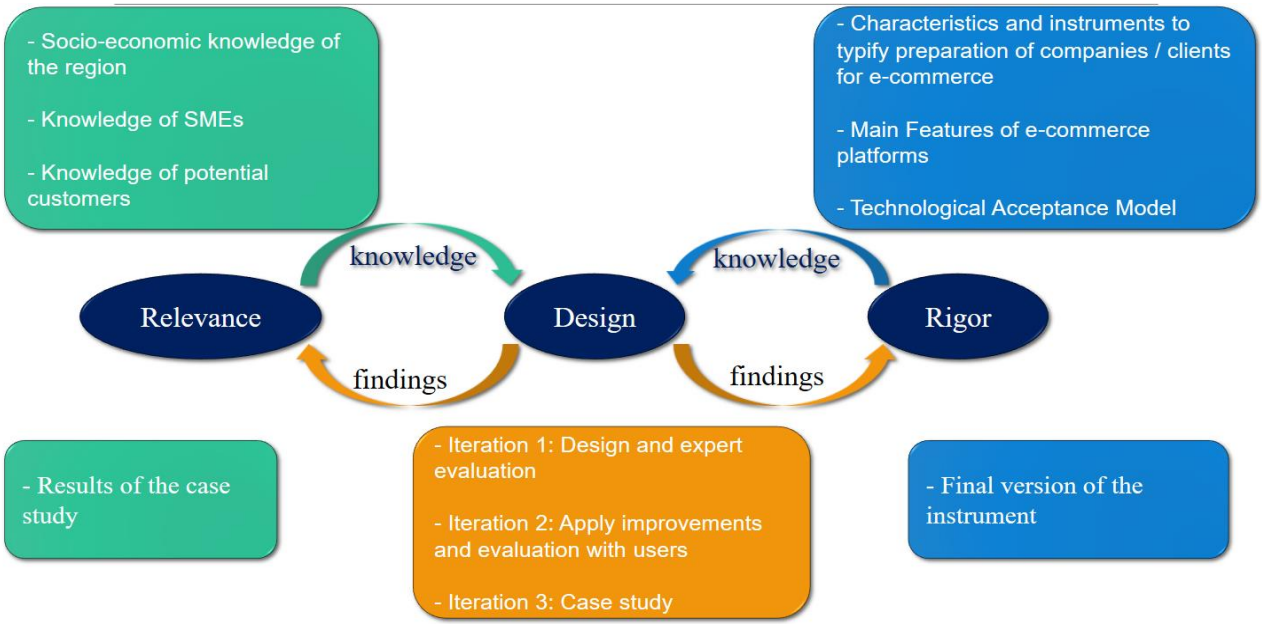

Figure 1: Research Methodology - Design Sciences

3.1 Instrument construction process

3.1.1 Diagnosis of preparation and technological acceptance

For the diagnosis of the technological preparation and acceptance of companies and their clients, there are multiple instruments, customized in many cases at the researcher's convenience. In the results of the literature review carried out, a series of relevant constructs were obtained that served as the basis for the design of the first version of the instruments, both to measure the technological readiness of companies, as well as potential clients. Table 1 shows the constructs and applicability for each category of the study.

Table 1: Constructs for e-readiness assessment instruments, taken from [15] [16] [17] [18] [19]

Construct	Companies	Clients
Availability and access to technological devices	√	√
Internet connectivity and speed	√	√
Internet uses	√	√
Email availability and use	√	√
Website availability	√	√
Availability of social networks	√	
Digitization of internal processes	√	
E-commerce experience	√	√
Number of company employees	√	
Products and services marketed	√	
Personal and demographic data		√

The constructs described allow an adequate diagnosis of the degree of technological preparation. However, as observed in the results of the literature review, it is also advisable to know the degree of technological acceptance of electronic commerce that the customers will have, as well as the owners or employees of the micro and small businesses that will implement the technological tools in their sales or purchase process.

The constructs in Table 1 can be combined with some existing standardized instruments such as the TAM model [12]. This model tries to explain the relationship between the use of technology and the perception of its utility [20]. It should be noted that a series of variants and adaptations have emerged from the TAM model. One of these alternatives consists of making some variations and adding complementary constructs to those established in the original model according to the researcher's need. This model is known as extended TAM, which includes constructs that are complementary to those established in the original model [21].

The extended TAM model contemplates the insertion and combination of external variables combined with new constructs from other models [21]. These external variables help to identify which factors directly influence the constructs established in the model, such as utility and ease of use perceived by users [12]. Figure 2 shows an adaptation of the extended TAM model on which this research will be based.

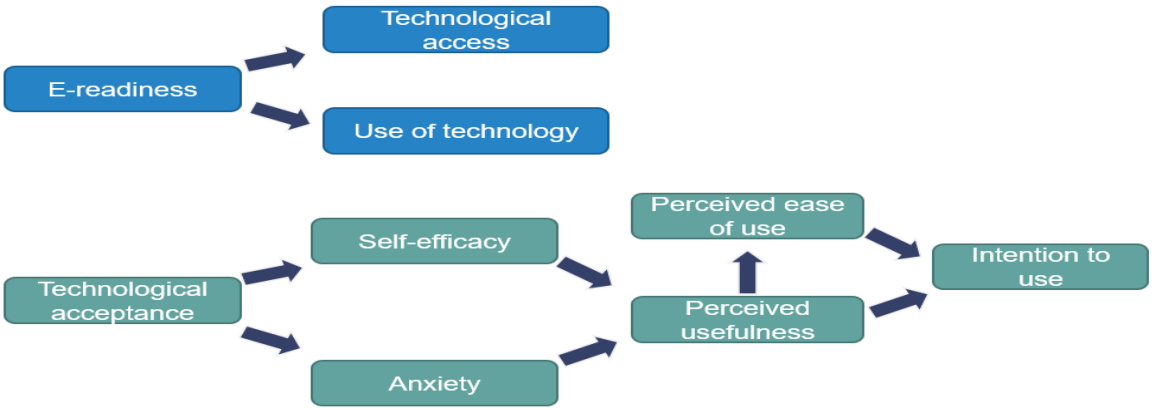

Figure 2: Adaptation of the extended TAM model [21] [22]

3.1.2 Iterative design of instruments for the diagnosis of technological preparation and acceptance

The iterative construction of the instruments to carry out the diagnosis of the preparation and technological acceptance will be based on the design cycle that is explained in the methodology and that can be visualized in Figure 1.

For the iterative process, the knowledge base generated in the rigor cycle is used. In this specific case, the constructs defined in the previous section as a theoretical basis, as well as the extended TAM proposal described in

figure 2 were included, producing the first version of the diagnostic instruments for technological preparation and acceptance. With support and expert review the research instruments were built.
The instruments, both for companies and clients, are made up of four study dimensions, described below:

- Demographic factors: general information on demographic data of the clients and general information about the companies are obtained.
- Access to technological resources: the user is asked to indicate which technological resources they have access to.
- Use of technology resources and services: the participant is asked to describe the uses he/she makes of technology resources.
- Perception of technological acceptance: the participant is asked to evaluate the statements described by the TAM model according to the possible implementation of an electronic commerce platform.

Additionally, the instrument begins with a presentation and justification of the study, as well as the general instructions to complete the instrument.

4 Instrument Evaluation

This section describes the results obtained in the evaluation of the instruments, both in the diagnosis of the companies, as well as that of the potential clients.

4.1 Evaluation of the instruments by experts

The details of the evaluation carried out by the four experts for both versions of the diagnostic instruments are shown below. The modifications requested in this iteration were incorporated into the instrument, to later be evaluated by potential users.

4.1.1 Evaluation of diagnostic instrument for companies

Table 2 shows the improvement criteria indicated by the experts for the diagnostic instrument for companies.

Table 2: Expert evaluation of the diagnostic instrument for companies

Evaluator 1
Improve the description of the general instructions
Add new categories in the product area: Pharmacy, Gifts, Beauty Products, Appliances
Modify age range
Add examples in the question of social networks (Facebook, Instagram)
Modify evaluation of the Likert scale for a simpler evaluation with 5 options (-2 to 2) and names of the categories (Strongly disagree to Strongly agree)
Change the word seller for "entrepreneur" and "sales performance"
Improve the description of the general instructions
Add new categories in the product area: Pharmacy, Gifts, Beauty Products, Appliances
Evaluator 2
Place at the top “Graduate Program in Computer Sciences”
Inform the participant of the approximate time to complete the form
Balance age range
Specify type of computer, desktop or laptop
In part IV delete the word "I feel that"

Evaluator 3
It is important to check if the company has staff or IT support
Evaluator 4
In the question of the products that are marketed, it is recommended to eliminate the option of "gifts" In the question about whether you have carried out electronic commerce, it is advisable to leave more space for the participant. For part IV on the perception of technological acceptance, it is recommended to add the column "I don't know"

4.1.2 Diagnostic instrument evaluation for clients

Table 3 shows the improvement criteria indicated by the experts for the diagnostic instrument for clients.

Table 3: Expert evaluation of the diagnostic instrument for clients

Evaluator 1
Modify age range
Modify the way of asking about the profession
Place the same product categories of the instrument to companies
Add claim about e-commerce usage
Modify evaluation of the Likert scale for a simpler evaluation with 5 options (-2 to 2)
Evaluator 2
Place at the top "Graduate Program in Computer Science"
Inform the participant of the approximate time to complete the form
Balance age range
Assess the option of not asking the salary range
Specify type of computer, desktop or laptop
In part IV delete the word "I feel that"
Evaluador 3
No changes proposed
Evaluador 4
In the question of the products that are bought, it is recommended to eliminate the option of "gifts" For part IV on the perception of technological acceptance, it is recommended to add the column "I don't know" It is indicated that there is a lot of similarity between the following statements: "Using the e-commerce platform can improve my performance as a customer" AND "Using the e-commerce platform can make my performance as a customer more effective"

After incorporating the opportunities for improvement provided, the second iteration begins with the aim of evaluating both instruments again. This time with potential users.

4.2 Evaluation of the instruments by potential users

As indicated in the methodology, for the second iteration, 16 people were invited to participate, including six small and medium-sized entrepreneurs who evaluated the company instrument, and ten potential customers (users) who

participated in the evaluation of the customer instrument. All these participants are residents of nearby rural regions, such as San Carlos and Pococí, in Costa Rica.
The evaluations of the instruments were carried out from using a different strategy. The standardized UEQ-S questionnaire was used, which attempts to measure its pragmatic quality and its hedonic quality. The UEQ-S questionnaire includes eight pairs of concepts. The participant is asked to select from seven paired-concepts with which concept, he identifies the most. In this scale there are three positive values, three negative values and one neutral. Likewise, the participants were asked a series of additional questions.
The details of the evaluation carried out by the participants for both versions of the diagnostic instruments are shown below.

4.2.1 Evaluation of diagnostic instrument for companies

Table 4 shows the pairs of concepts that were evaluated in the UEQ-S section for both pragmatic and hedonic quality, as well as the averages obtained for the diagnostic instrument of the companies.

Table 4: Companies instrument evaluation data

Scale	Negative concept	Positive concept	Average	Variance	Standard deviation
Pragmatic quality	obstructive	supportive	1,8	1,0	1,0
	complicated	easy	2,8	0,2	0,4
	inefficient	efficient	1,5	3,5	1,9
	confusing	clear	2,0	4,0	2,0
Hedonic quality	boring	exciting	-0,3	1,9	1,4
	not interesting	interesting	0,5	2,7	1,6
	conventional	inventive	0,5	1,1	1,0
	usual	leading edge	0,5	0,3	0,5

Likewise, in Figure 3 it is possible to better observe the averages obtained from the analysis of the UEQ-S questionnaire. UEQ theory indicates that scale values greater than 0.8 represent a positive evaluation and values less than -0.8 represent a negative evaluation [24]. For this specific case, and as seen in Table 4 and Figure 3, positive values were obtained from the evaluation of this instrument.

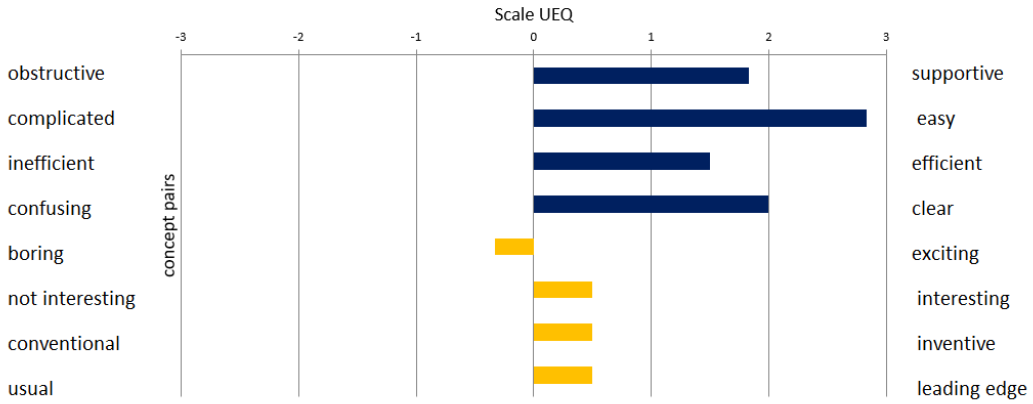

Figure 3: Evaluation averages UEQ-S – companies instrument

The UEQ-S tool allows a comparison to be made with established benchmarks from previous studies. This comparison validates the responses obtained against the instrument's benchmarks. From the above, figure 4 is obtained. It highlights that the pragmatic quality variable is classified as excellent, while the hedonic quality

variable is classified as poor. This poor evaluation is to some extent to be expected, since UEQ is designed to measure satisfaction in the context where an individual experiments with a new technology, and not with a traditional measurement instrument such as a questionnaire.

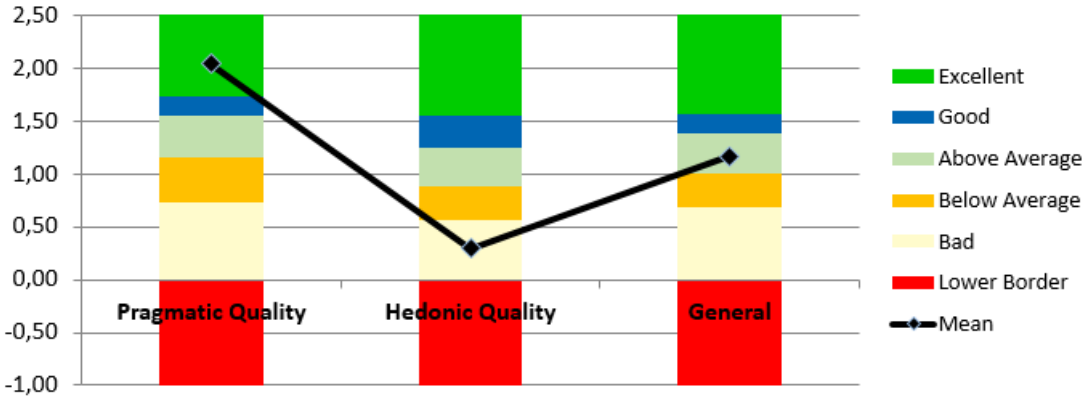

Figure 4: Benchmarks UEQ-S - companies instrument

On the other hand, Table 5 shows the improvement criteria that were indicated by the micro-companies participating in the diagnostic instrument. It is possible to appreciate that, among the main opportunities for improvement proposed by entrepreneurs, it is highlighted that the instrument should be shortened. They expressed that it is extensive and that it has some statements that sound similar. This factor causes a low rating in the evaluation of "boring / exciting" as shown in figure 3. Despite this, and as seen in the figure, it is relevant to point out that the participants mostly agree that the instrument is clear, efficient, and easy.
Given the suggestions of the participants, experts where asked about the possibility of cutting down some of the statements that make up section IV of the instrument. The review of the instrument was carried out in conjunction with the experts and from the above, the decision was made to shorten the instrument and eliminate the statements that are similar.

Table 5: User evaluation of the diagnostic instrument for companies

What do you like least about the diagnostic instrument of the technological preparation and acceptance of companies?
The questions are a bit repetitive
It's a bit long
What improvements would you make to the diagnostic instrument for the technological readiness and acceptance of companies?
Maybe merge some questions to shorten the questionnaire
Simpler questions
Make it shorter
What questions would you add to the diagnostic instrument of the technological preparation and acceptance of companies?
If the company has not implemented this modality, ask why it has not done so so far, so that they could know what the impediments are more clearly
What questions would you eliminate from the diagnostic instrument of the technological preparation and acceptance of companies?
Maybe mix some of them and thus shorten it

4.2.2 Evaluation of diagnostic instrument for clients

Table 6 shows the pairs that were evaluated for both pragmatic and hedonic quality, as well as the averages obtained for the diagnostic instrument.

Table 6: Client instrument evaluation results

Scale	Negative concept	Positive concept	Average	Variance	Standard deviation
Pragmatic quality	obstructive	supportive	2,2	0,8	0,9
	complicated	easy	2,7	0,2	0,5
	inefficient	efficient	2,5	0,5	0,7
	confusing	clear	2,6	0,5	0,7
Hedonic quality	boring	exciting	1,4	0,9	1,0
	not interesting	interesting	1,6	1,2	1,1
	conventional	inventive	1,3	1,8	1,3
	usual	leading edge	1,5	1,8	1,4

Likewise, in Figure 5 the averages obtained from the analysis of the UEQ-S questionnaire can be observed in a better way.

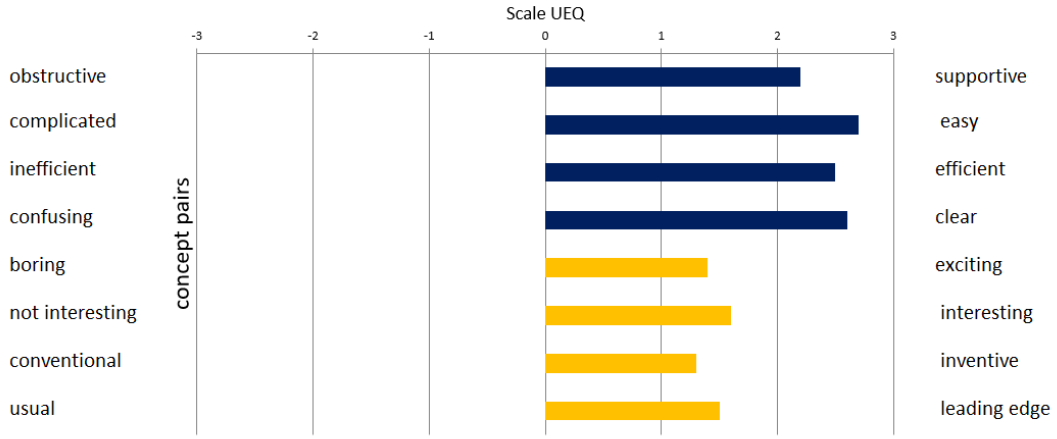

Figure 5: Evaluation averages UEQ-S - clients instrument

As seen in Table 6 and Figure 5, positive values were obtained in the evaluation of this instrument for customers. Likewise, it should be noted that the comparison with reference points established by UEQ, shown in figure 6, the pragmatic quality variable is classified as excellent, while the hedonic quality variable is classified as good. In addition, it is noted that in general the instrument obtains an excellent rating.

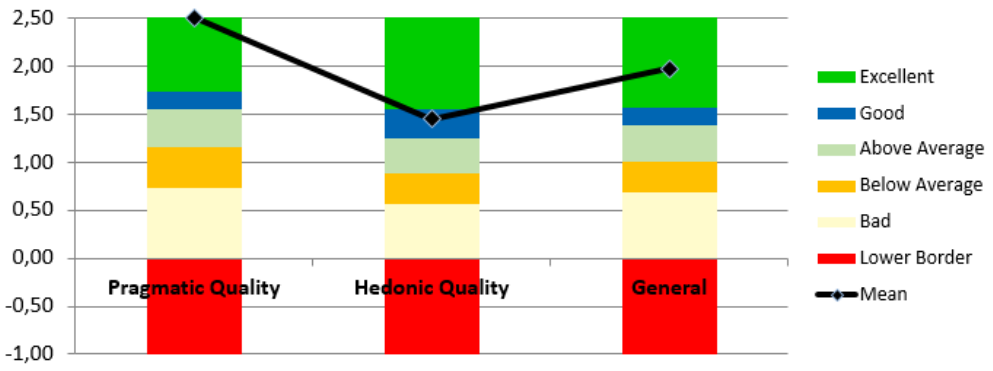

Figure 6: Benchmarks UEQ-S - clients instrument

On the other hand, the users participating in the evaluation have provided a series of recommendations and observations that are described in Table 7. Among the main opportunities for improvement proposed by the participants, it stands out that they feel that the instrument is extensive and that it has questions that seem to be repeated. Despite this, and as can be seen in Figure 5, the participants mostly agree that the instrument is clear, efficient, and easy to answer.

Likewise, given the suggestions of the participants, a new consultation with experts was carried out. They were asked about the possibility of cutting some of the statements that make up section IV of the instrument. The review of the instrument was carried out in conjunction with the experts, and the decision was made to shorten the instrument and eliminate the statements that were seemed similar. The changes proposed by the participants are applied to the new version of the instrument, which was used in the case study.

Table 7: User evaluation of the diagnostic instrument for clients

What do you like least about the diagnostic instrument of the technological preparation and acceptance of clients?
It is very long
It's a bit long
Very long
Extensive
What improvements would you make to the diagnostic instrument for the technological readiness and acceptance of clients?
More creativity
Not so technical
Some questions seemed repeated to me
Remove similar questions and make it shorter
Shorten the survey
What questions would you add to the diagnostic instrument of the technological preparation and acceptance of clients?
Previous experience, and thus see if you have grounds to respond
What questions would you eliminate from the diagnostic instrument of the technological preparation and acceptance of clients?
I would only remove very technical words
The questions that seem repeated
The repeated questions
There are some that look alike

5 Case Study - Use of Instruments

This section presents the results of applying the instruments created to the Río Cuarto de Alajuela region. The intention is to measure the degree of technological preparation of the region, but at the same time, it is also to evaluate the instruments developed.
The micro-enterprises participating in this research were obtained based on the business register provided by the Municipality of Río Cuarto, which included almost 80 micro-enterprises. For the case study, it was intended to cover at least 30% of these companies. To invite businesses to participate, a telephone call or a visit to the business premises was made. Fortunately, 29 micro-enterprises participated in the evaluation of the instrument. On the other hand, possible customers where contacted in person in their regular settings (homes or commercial streets). We obtained the support of 261 people who participated in the evaluation of the instrument.

5.1 Results of the diagnostic instrument for companies

5.1.1 Demograpghic data for companies

All the participating companies have between one to five employees. These companies belong to different economic sectors. Companies that sell handicraft items, as well as products such as clothing and shoes, stand out with a greater participation. The variety of products represented in the sample is due to the effort made to obtain the opinion of various sectors. On the other hand, it was found that most of these participating companies have clients of all ages. Of the 29 businesses surveyed, 90% indicate they have customers of all ages and only 10% indicate an age segment between 21 and 35 years old.

5.1.2 Access to technological resources -- companies

Of the 29 companies consulted, 90% say that they do not have any IT support in their businesses. Likewise, as shown in figure 7, 18 companies indicate that they have one computer equipment, mostly a desktop computer that represents 37% of the devices, and only 16 of these micro businesses indicate that they have access to a smart telephone. It is important to note that none of the participating companies reported having access to other resources such as tablets, scanners, servers or network equipment and information backup equipment.

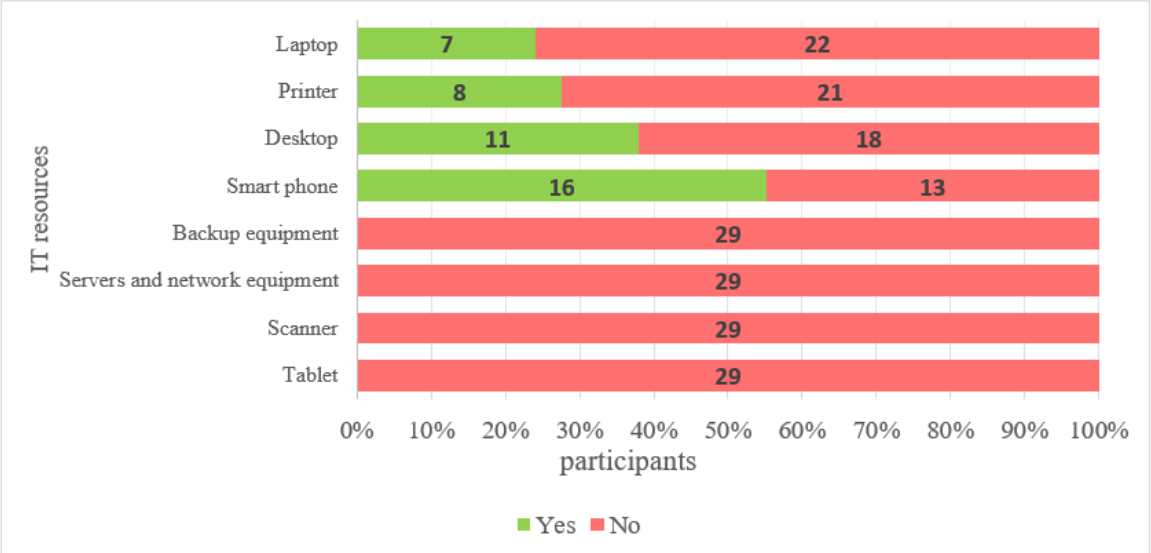

Figure 7: Access to technological resources - companies

97% of those surveyed mentioned having an internet connection. Figure 8 shows that 55% mention having a connection between 2 to 6 Mbps, and another 24% with speeds greater than 6 and less than 10 Mbps. No participant has a connection equal to or greater than 50 Mbps. On the other hand, half of the businesses describe the Internet service as "good", while the rest indicate it as "fair" or "bad".

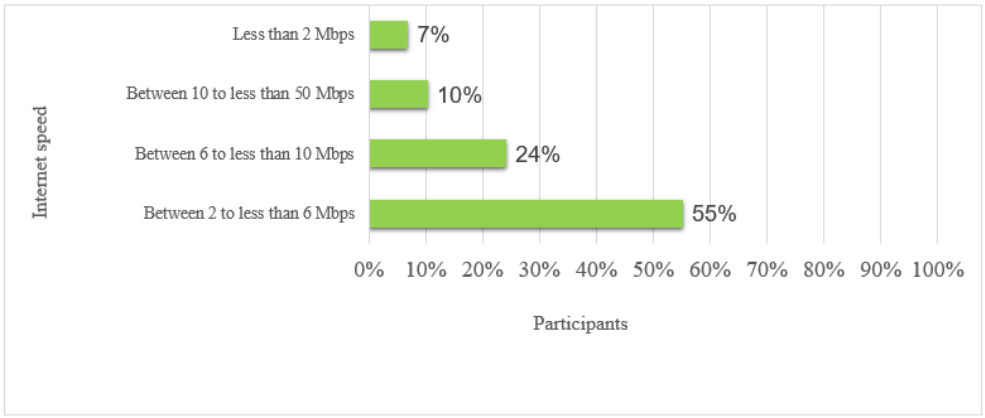

Figure 8: Internet velocities - companies

5.1.3 Use of technological resources -- companies

Figure 9 shows the uses of technological resources and services by the companies consulted. More than 18 of the participating companies use email and a social network such as Facebook or WhatsApp. Likewise, an aspect to note is that three of the businesses consulted indicate that they have an already established online store and only one account with an e-commerce website.

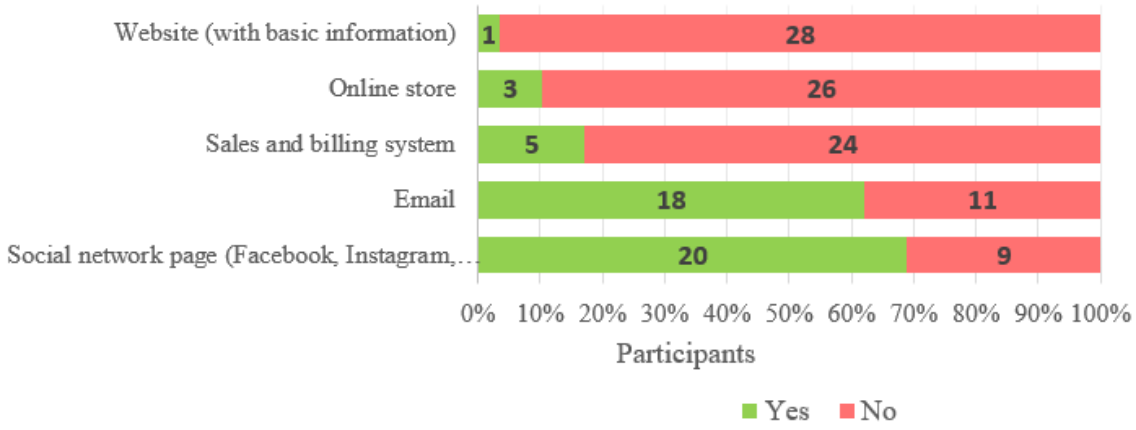

Figure 9: Use of tecnological resources - companies

Additionally, it was found that 76% of companies have never made sales through electronic commerce, and 32% would not be willing to implement it in the near future.

5.1.4 Technological acceptance - companies

Technological acceptance is measured with phrases that must be reflected on a five-point likert scale, in which there are two negative values (strongly disagree, disagree- in shades of red), one neutral (neutral- white) and two positive values (agree and strongly agree- in shades of green).

5.1.4.1 Perceived ease of use

Figure 10 shows the results obtained in perceived ease of use. 69% of the participating companies positively evaluate the ease of learning to use an electronic commerce tool and only three (2 + 1) of the 29 declare negative values. On the contrary, regarding the perception of becoming an expert in the use of the platform, negative and positive evaluations are even. In the same way, in this figure it is clearly seen that a large majority, 79% of the

companies consulted, consider that the perception described is limited by the lack of experience in the use of said technological platforms.

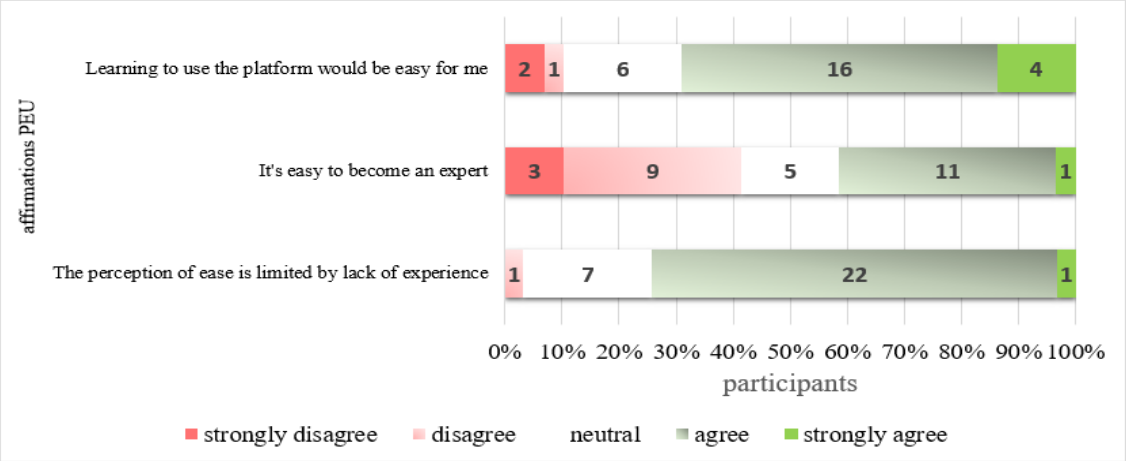

Figure 10: Perceived ease of use - companies

5.1.4.2 Perceived usefulness

The results of the perception of utility for electronic commerce platforms are described in figure 5. This figure highlights that only five (3 + 2) of the surveyed companies regard negatively the potential improvement in sales performance with the use of the e-commerce platform. On the contrary, 23 companies (16 + 7) perceive that if these technological tools were used, they expect that there would be an improvement in sales performance.

In the same way, 22 companies (14 + 8) recognize that the use of an electronic commerce platform would facilitate the tasks they carry out in their businesses, and only four of the businesses consulted consider the opposite.

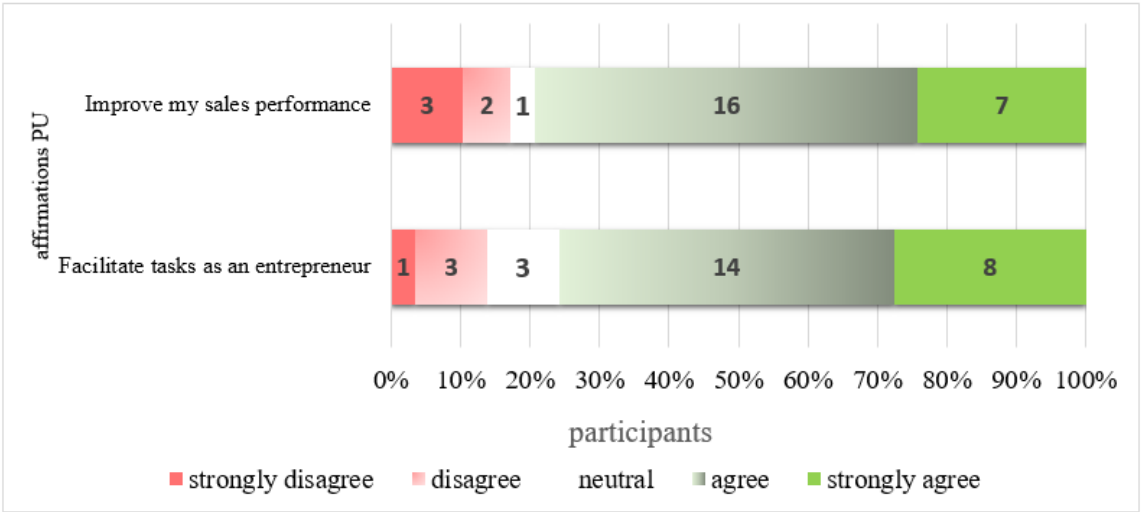

Figure 11: Perceived usefulness - companies

5.1.4.3 Behavioral intention to use

Participating companies were asked about some statements related to the intention to use e-commerce platforms in the near future. Figure 12 shows the evaluations obtained. Given the statement "I consider it a good idea to use the

electronic commerce platform for my sales" only five (2 + 3), of the companies consulted, made a negative assessment, three were neutral and 21 (15 + 6) of them value this statement positively.
On the other hand, when faced with the statement about using the tool in the near future, 18 of the companies (17 + 1) mentioned being in agreement, four companies (1 + 3) gave a negative opinion about the perception that it would be pleasant to use an e-commerce platform, while 15 of the businesses (12 + 3) present positive values in this statement. Finally, it is noted that very few companies consider that it would be absurd to use e-commerce tools (with only 3 agree and 2 strongly agree).

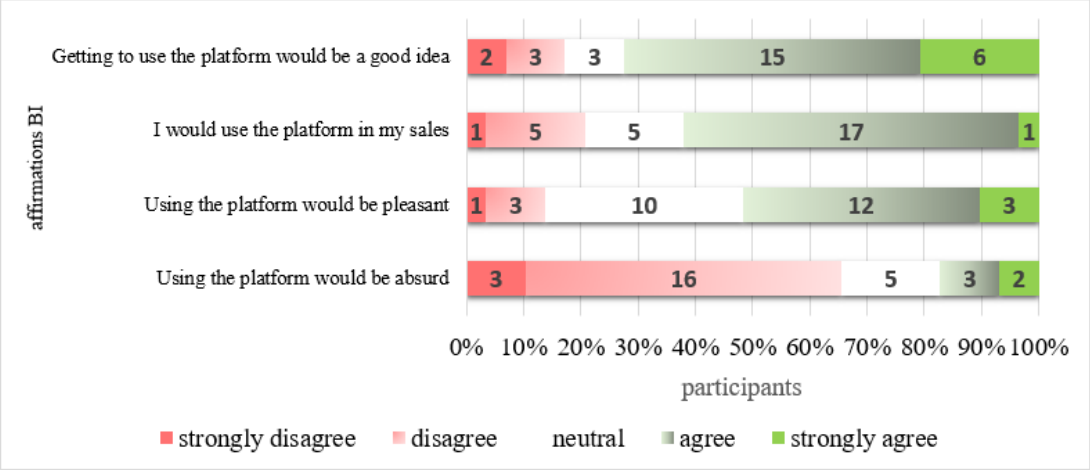

Figure 12: Behavioral intention to use - companies

5.1.4.4 Self-efficacy

Figure 13 describes the evaluations of the participating companies on the claims related to self-efficacy. It is observed that almost all companies consider that they could use the electronic commerce platform, even if they have not used it before; 26 companies (24 + 2) registered positive evaluations, two companies expressed neutral scores and no company stated negative values. Likewise, 20 of the companies considered that they can use these e-commerce tools, even if there is no person to guide them through the process.

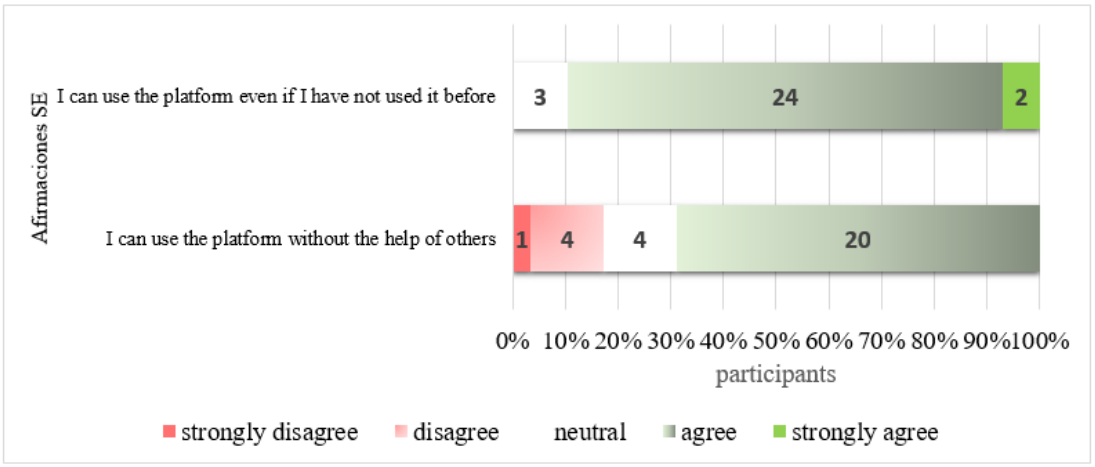

Figure 13: Self-efficacy - companies

5.1.4.5 Anxiety

The results on the perception of anxiety can be seen in figure 14. Regarding the statement "I doubt about using the electronic commerce platform for fear of making mistakes that I cannot correct", 13 (10 + 3) positive evaluations, 7 neutral and 9 negative scores (1 + 8).
On the other hand, regarding the statement "I feel that the use of the electronic commerce platform will generate stress for me", it is observed that 12 negative values are obtained (2 + 10), 8 neutral and 9 positively qualify this statement (6 + 3).

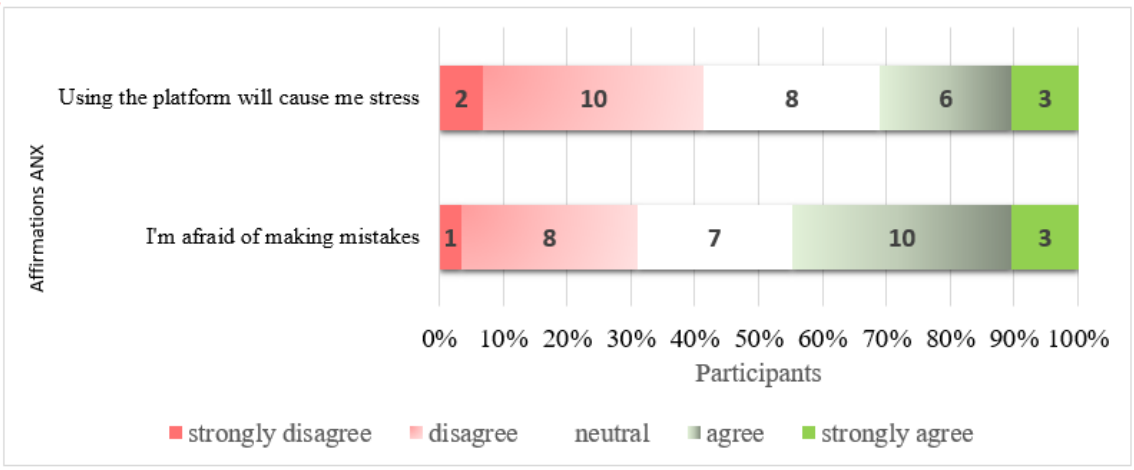

Figure 14: Anxiety - companies

Despite the positive and even optimistic results of the surveyed entrepreneurs, it is important to note that 62% of the companies surveyed stated that they were not prepared to implement an electronic commerce platform, and only 38% considered that they were technologically ready to implement these tools.
Next, we describe the vision of the potential clients.

5.2 Results of the diagnostic instrument for clients

5.2.1 Demographic data for clients

Figure 15 shows the age distribution of participants, which is very similar to the region´s population distribution.

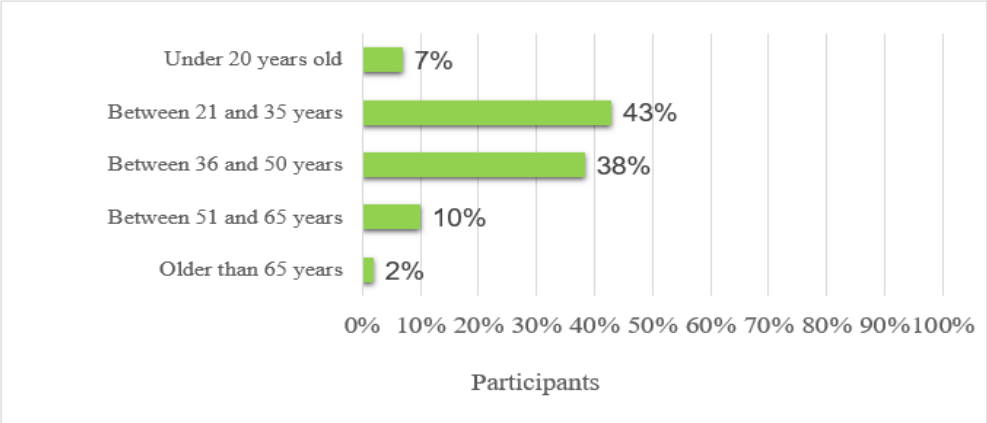

Figure 15: Participant age distribution – clients

Additionally, the schooling of the participants was considered, the results can be seen in figure 16. This distribution is representative for a rural Costa Rican area.

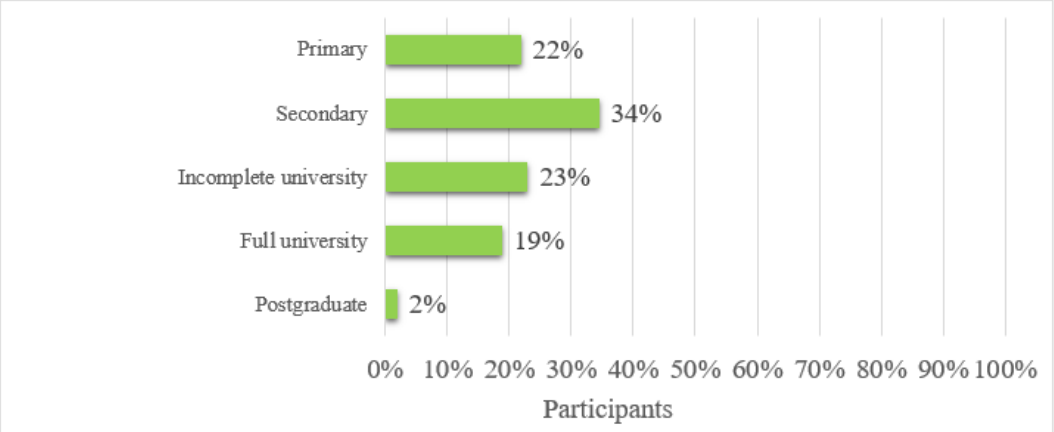

Figure 16: Education level of participants

Another important aspect to note is that 66% of the participants mention that they currently work and the remaining percentage state that they do not have a job at the moment. This factor can be influenced by the unemployment levels that the country has as a result of the COVID-19 pandemic, which for the month of October, 2020, was established at more than 23% of the population [25].

5.2.2 Access to technological resources - clients

In this variable, it is highlighted that all the participants mentioned having a smart phone. Likewise, as can be seen in figure 17, the next important computing resource for the respondents is the laptop, to which 170 of the 261 participants say they have access.

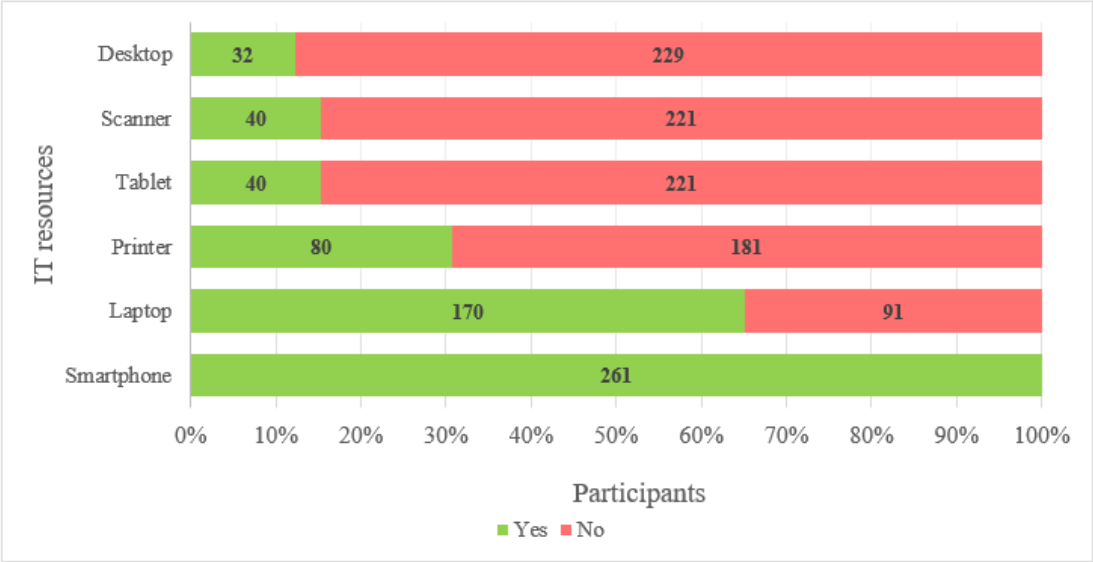

Figure 17: Access to technological resources- clients

93% of the people surveyed mentioned having an internet connection. Linked to the above, figure 18 shows the speeds of internet connections, it can be seen that 42% of those surveyed mention having a connection between 2 to 6 Mbps and while 31% have connections of 2 or less Mbps. At this point, it stands out that only four participants have a connection equal to or greater than 50 Mbps. Likewise, it is relevant to note that 47% of people state that their connection is "regular", followed 24% who classify it as a "good" connection.

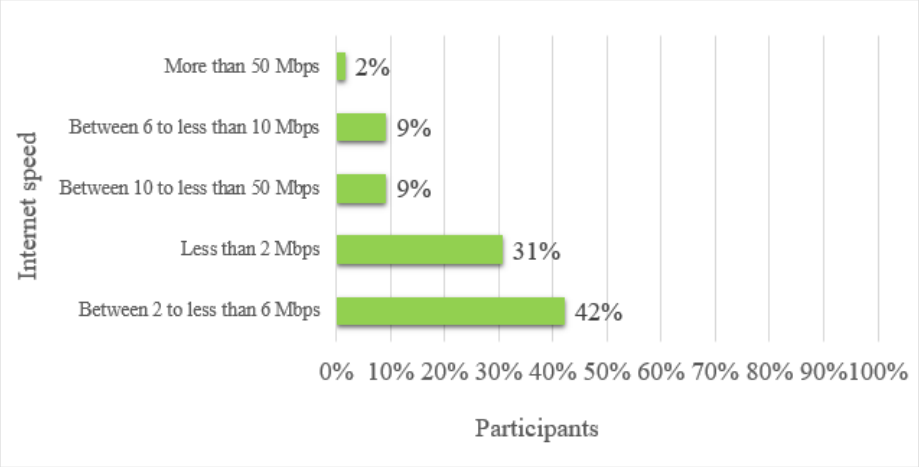

Figure 18: Internet velocities – clients

5.2.3 Use of technological resources - clients

Figure 13 shows that 204 people (90 + 114) state that they use email regularly, which means 78% of the total number of people consulted. Likewise, 93% of the participants mention that they regularly use a social network such as Facebook or WhatsApp. On the other hand, regarding the statement about visiting e-commerce pages regularly, only 41% do so, and 33% do not (they classify it as disagreeing or strongly disagreeing).

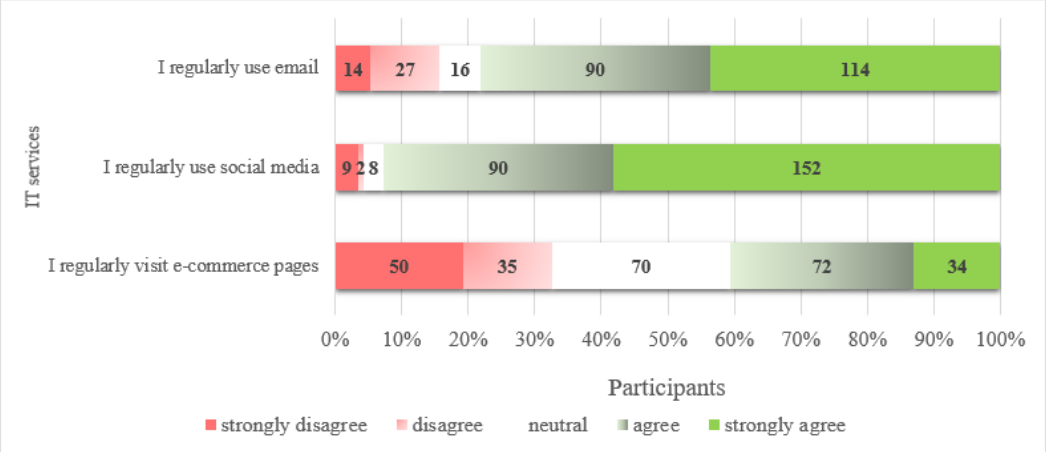

Figure 19: Use of technological resources - clients

Additionally, it was found that 56% of people indicate having made purchases through electronic commerce, and that 44% have never done so. However, of these participants, 66% would be willing to make an online purchase in the near future.

5.2.4 Technological acceptance - clients

Results obtained for each of the perception variables of the technology acceptance model are detailed below.

5.2.4.1 Perceived ease of use

Figure 20 shows the results obtained in the perceived ease of use, it is possible to highlight that 196 participants (130 + 66), positively evaluate the ease of learning to use the tool and only 27 users (1 + 26), declare disagree. On

the other hand, regarding the perception of becoming an expert in the use of the tool, 49% declare a positive score, while 28% do not agree.
In the same way, in this figure it is observed that more than half of the participants consider that the perception expressed is limited by the lack of experience in the use of said technological platforms.

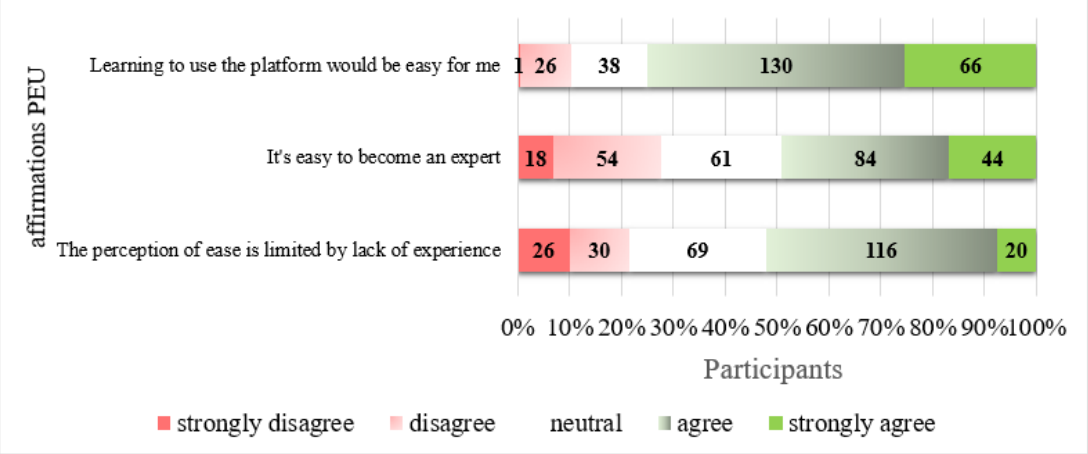

Figure 20: Perceived ease of use – clients

5.2.4.2 Perceived usefulness

The results of the perception of utility in terms of electronic commerce platforms are described in figure 15. This figure highlights that only 10 people (6 + 4) do not consider that the use of the electronic commerce platform would improve their performance as a customer. Likewise, 220 participants (148 + 72) perceive that if these technological tools were used, there would be an improvement in the performance of their purchases.
In the same way, 228 respondents (142 + 86), 87% of users, recognize that the use of an electronic commerce platform would facilitate the tasks they carry out in their purchases and only eight of the users consulted consider the opposite.

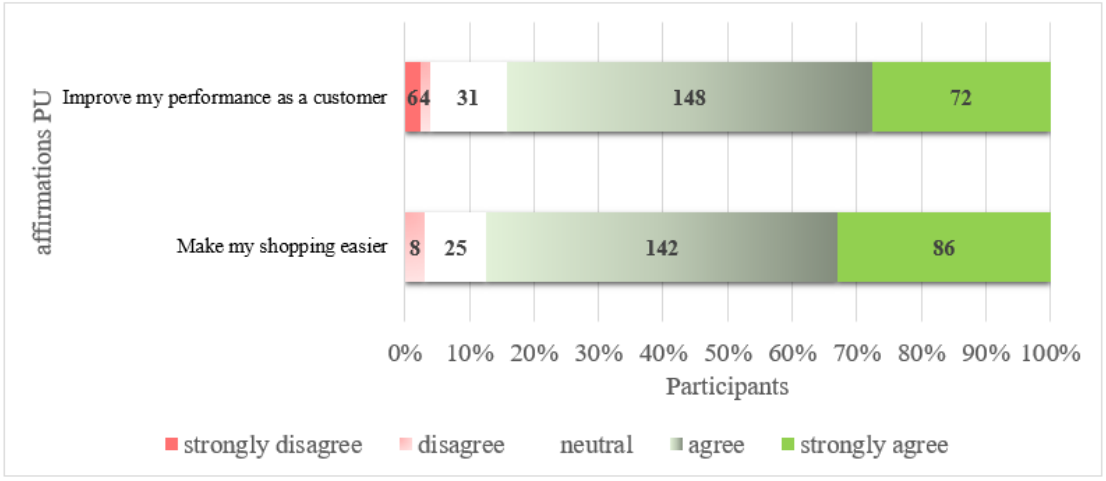

Figure 21: Perceived usefulness - clients

5.2.4.3 Behavioral intention to use

Participating users were asked about some statements related to the intention to use e-commerce platforms in the near future. Figure 22 shows the valuations obtained. Given the statement "I consider it a good idea to use the

electronic commerce platform for my purchases", only 18 of the people consulted (6 + 12), expressed their disagreement with the statement.
On the other hand, when faced with the statement about using the tool in the near future, 154 users surveyed (106 + 48) mentioned agreeing, but on the contrary, 30 people (6 + 24) indicated that they did not agree. In the same way, only 14 participants (6 + 8) gave a negative opinion about the perception that it would be pleasant to use an electronic commerce platform in their purchases, while 170 people (132 + 38) presented positive values in this statement.
Finally, it is highlighted that very few participants, only 3% of the people consulted, consider that it would be absurd to use electronic commerce tools in their purchases

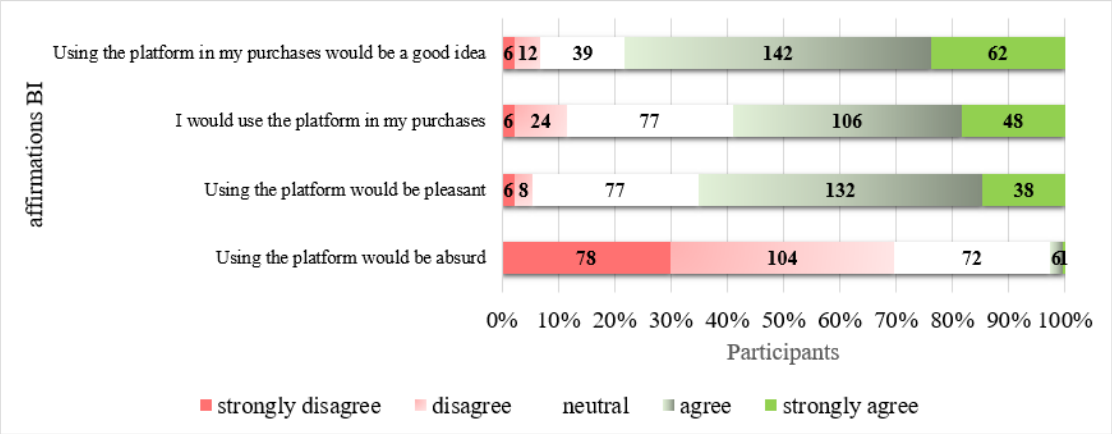

Figure 22: Behavioral intention to use - clients

5.2.4.4 Self-efficacy

Figure 23 describes the participants' evaluations of the statements related to self-efficacy. In the first instance, it is observed that a great majority, 186 people (132 + 54), consider that they could use the electronic commerce platform, although they have not used it before, and only 38 people (12 + 26), believed otherwise. Likewise, 164 of the users consulted (114 + 50), consider that they can use these tools, although there is no person to guide them, and 50 people (24 + 26), believed the opposite.

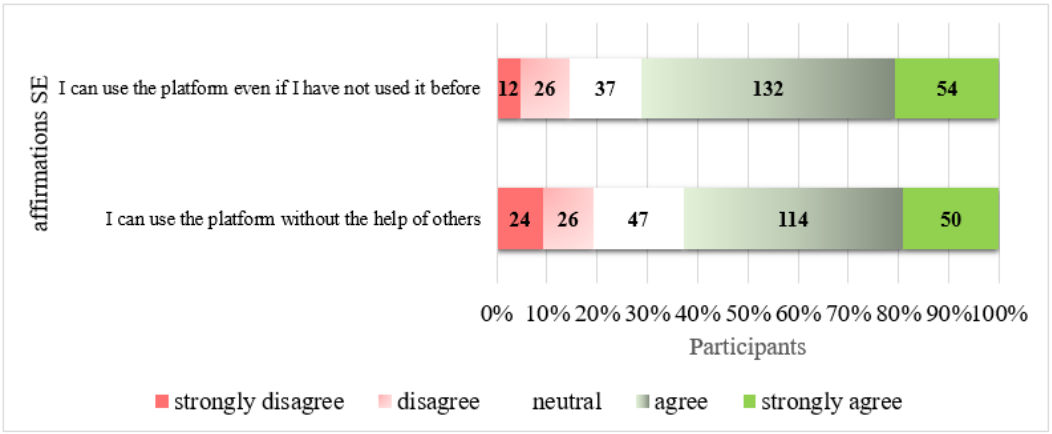

Figure 23: Self-efficacy - clients

5.2.4.5 Anxiety

The results on the perception of anxiety can be seen in figure 24. Regarding the statement “I doubt about using the electronic commerce platform for fear of making mistakes that I cannot correct” (bottom line), 108 positive

evaluations were recorded (76+ 32), 59 neutral and 94 negative scores (44 + 50). On the other hand, the statement "I feel that the use of the electronic commerce platform will generate stress for me" (top line) obtains 120 negative values (50 + 70), 73 neutral, while 68 positively qualify this statement (60 + 8).

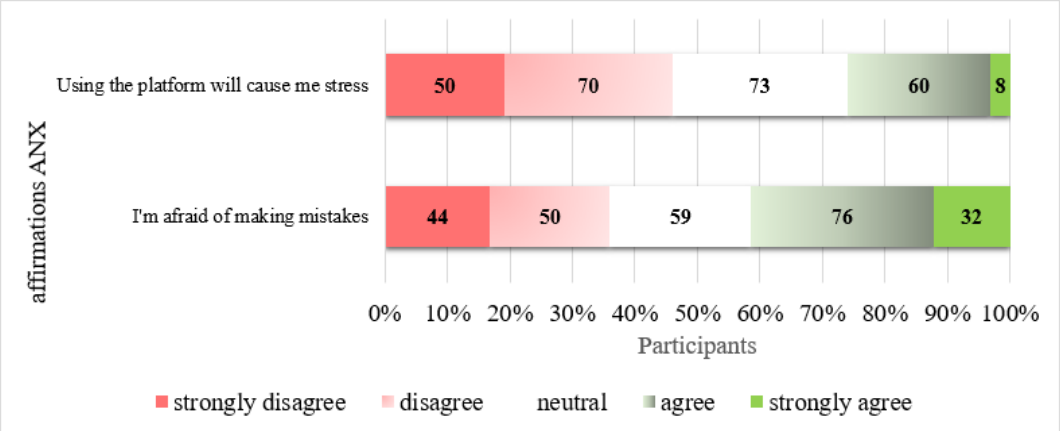

Figure 24: Anxiety - clients

The results on the perception of anxiety can be seen in figure 24. Regarding the statement “I doubt about using the electronic commerce platform for fear of making mistakes that I cannot correct” (bottom line), 108 positive evaluations were recorded (76+ 32), 59 neutral and 94 negative scores (44 + 50).
On the other hand, the statement "I feel that the use of the electronic commerce platform will generate stress for me" (top line) obtains 120 negative values (50 + 70), 73 neutral, while 68 positively qualify this statement (60 + 8).

5.3 Opportunities for instrument improvement

After using the instruments in the case study, the improvement opportunities obtained for each of the evaluated instruments are presented.

5.3.1 Evaluation of diagnostic instrument for companies

Thanks to the participation of the companies in the case study, it was verified that the designed instrument was well accepted by the participants. However, it was found that there are opportunities for improvement that can be applied. In the first instance, in the first part, specifically in question 4, the entrepreneurs are consulted about the products they sell, and several answers were obtained in the "other" box. When reviewing in detail, products such as costume jewelry are observed, as well as poultry farms that were not considered, so it would be advisable to take these categories into account in future applications of this instrument.
On the other hand, when asked whether the business had IT support staff, the question seems to be very open or not entirely clear. Three micro-companies mention having this support; however, it is not that these businesses maintain a computer scientist collaborating with tasks in the business, but the owner himself or one of his collaborators has some knowledge about technology. It is advisable for future applications of the instrument to modify this question to obtain more specific data.
For the rest, the instrument seems to have fulfilled the objective of adequately diagnosing the technological needs and the perception of technological acceptance of micro and small companies in this region.

5.3.2 Evaluation of diagnostic instrument for clients

In the same way as for the companies´ instrument, the responses of potential clients in the study case were acceptable, and it was possible to verify that the designed instrument meets the objective for which it was designed. However, it was found that there are improvement opportunities that can be applied, which are detailed below.
The demographic variables seek to determine the level of education of the participants, however, in rural regions there is some amount of illiteracy, which was not expected. For this case study, one of the participants stated that he did not have any level of education, which was not contemplated on the instrument.

Likewise, the instrument corroborated the number of people who work and what their occupations were, however, there were many people who stated that they did not work. However, asking the cause of not been working was not contemplated, for example, if he was a student, a pensioner or if he was temporarily unemployed.
For the rest, the instrument seems to have fulfilled the objective of adequately diagnosing the technological needs and the perception of technological acceptance of the people of this region.

6 Conclusions

In this research, two instruments were designed for the diagnosis of the readiness for electronic commerce of a rural region: one for micro businesses and the other for potential clients. The design process was iterative. Each iteration included the evaluation of the instruments, and after validating the results, the improvements were applied to the instruments for the next iteration.
The design of the initial version of the instrument was based on the results obtained from a literature review. The first iteration of the evaluation was carried out by four academic experts, who provided contributions from their experience in the design and application of instruments in multiple previous research projects. It is highlighted that the opportunities for improvement presented by these experts helped to produce an understandable and solid instrument, with which it would be possible to carry out the diagnosis in the most appropriate way.
On the other hand, for the second evaluation, an initial field test was carried out, with 6 companies and 10 real consumers. These participants were in areas near the canton of Río Cuarto, such as Guápiles and San Carlos.
The results of this second iteration focused especially on the dimension and conformation of the instrument. Participants indicated that it was lengthy and that there seemed to be some similarities between some of the questions. The opportunities for improvement of this iteration were extremely important, since real data was obtained, and the participants responded to the instrument from their perspective of entrepreneurs and consumers. Proposed changes were evaluated again with the experts from the first evaluation, who stated that they agreed with the opinions obtained.
Finally, the instruments were used in a case study, which was developed in the canton of Río Cuarto de Alajuela. 29 companies and 261 consumers from the region participated. The case study fulfilled the objective of carrying out the diagnosis of the technological readiness for electronic commerce in the region. The results of the information collection using the instruments made it possible to detect a series of technological shortcomings of not only the companies of a region, but also of its potential consumers.
As a result of this process, robust instruments exist, capable of adequately diagnosing the preparation and technological acceptance of companies and potential consumers for electronic commerce. With the case study results, we found evidence that, despite the fact that the government, providers of electronic commerce platforms and the media constantly motivate entrepreneurs to implement technology platforms for their sales, it is clearly found that not all companies nor their consumers are technologically prepared for these implementations. So, it is advisable to apply a diagnosis such as the one designed in this investigation to determine the feasibility of adapting e-commerce at rural areas.

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References

[1] CEPAL, "*Dimensionar los efectos del COVID-19 para pensar en la reactivación*," 2020. [En línea]. Available: https://repositorio.cepal.org/handle/11362/45445.

[2] M. Flórez, "*Economía de Costa Rica decrecerá un 3,6% en el 2020 debido al COVID-19, según Banco Central*," 2020. [En línea]. Available: https://semanariouniversidad.com/ultima-hora/economia-de-costarica-.

[3] J. Chen, N. Windasari y R. Pai, "*Exploring E-readiness on E-commerce adoption of SMEs: Case study South-*

East Asia," IEEE International Conference on Industrial, pp. 1382-1386, 2013.

[4] Turban, E., Whiteside, J., King, D., & Outland, J. *Introduction to electronic commerce and social commerce*. Springer. 2017.

[5] J. Garza, "*Si tiene una pyme, aventúrese en el comercio electrónico*," 2020. [En línea]. Available: https://www.larepublica.net/noticia/si-tiene-una-pyme-aventurese-en-el-comercio-electronico.

[6] C. Giles, "Recomendaciones para las MIPyME ¿Qué hacer para sobrevivir a la pandemia del Covid-19?," 2020. [En línea]. Available: http://www.bibliodigitalibd.senado.gob.mx/bitstream/handle/123456789/4845/Nota86_RecomendacionesMipymePdf.pdf?sequence=8&isAllowed=y.

[7] M. Barquero and G. Marín. "*Diagnosis for the adoption of e-commerce platforms in micro and small enterprises in rural areas: case study of the region of Río Cuarto, Alajuela*". XLVII *Latin American Computer Conference (CLEI)*, 2021.

[8] E. Whiteside, D. King y J. Outland, "Introduction to electronic commerce and social commerce", Springer, 2017.

[9] P. Maoneke y N. Isabirye, "An e-Commerce model for hospitality SMMEs, A case of the Eastern Cape," Proceedings of the Southern African Institute for Computer Scientist, pp. 50-59, 2014.

[10] AlArfaj, A., Solaiman, E., & Marshall, L. "*Why would you buy from a stranger?" Understanding Saudi citizens' Motivations and Challenges in Social Commerce*. In IFIP Conference on Human-Computer Interaction (pp. 711-732). Springer, Cham. 2019.

[11] Durek, V., & Reoep, N. B. *Review on e-readiness assessment tools*. In Central European Conference on Information and Intelligent Systems (p. 161). Faculty of Organization and Informatics Varazdin. 2016.

[12] L. Varela, L. Tovar y J. Chaparro, "*Modelo de aceptación tecnológica (TAM): un estudio de la influencia de la cultura nacional y del perfil del usuario en el uso de las TIC*," Innovar: Revista de Ciencias Administrativas y Sociales, pp.187-203, 2010.

[13] C. Huaroto, "*El Uso de Internet y la Productividad de las Microempresas: Evidencias del Caso Peruano (2007–2010)*," ITDI, 8(4), pp. 129–144, 2012.

[14] Vaishnavi, V. K., & Kuechler, W. *Design science research methods and patterns: innovating information and communication technology*. Crc Press. 2015.

[15] MacKenzie, L. M. (2006). *Use of the internet as a business tool by small and medium -sized enterprises (SMES): A descriptive study of small minnesota-based manufacturers' internet usage (Order No. 3226194)*. Available from ProQuest Dissertations & Theses Global. (304909435).

[16] Kollmann*, T., Kuckertz, A., & Breugst, N. *Organizational readiness and the adoption of electronic business: The moderating role of national culture in 29 European countries*. ACM SIGMIS Database: the DATABASE for Advances in Information Systems, 40(4), 117-131. 2009.

[17] Walfall, C. S. *The Use and Adoption of Information Communication and Technologies (ICTs) by Jamaican Micro, Small and Medium Sized Enterprises (MSMEs)* (Doctoral dissertation, Howard University). 2014.

[18] Alexander, C. A. *A study of environmental, organizational and information technology issues in e-business adoption and assimilation in small firms*. Southern Illinois University at Carbondale. 2006.

[19] Uneanya, M. N. *Factors that Affect e-Commerce Adoption in Nigeria (Doctoral dissertation*, Capella University). 2019.

[20] Subawa, N. S., Widhiasthini, N. W., & Mimaki, C. A. (2020, February). *An Empirical Study of E-Marketplace Acceptance in MSMEs under the Constructs of Effort Expectancy, Social Influence and Facilitating Condition Factors*. In Proceedings of the 2020 The 6th International Conference on E-Business and Applications (pp. 116-120).

[21] J. Prieto, S. Migueláñez y F. García-Peñalvo, *"¿Utilizarán los futuros docentes las tecnologías móviles? Validación de una propuesta de modelo TAM extendido*," Revista de Educación a Distancia (RED), pp. 50, 2017.

[22] Sandí. J. C. Juegos serios para la indagación de competencias tecnológicas que puedan integrarse en la práctica pedagógica del profesorado. Una propuesta de aplicación en la Sede del Atlántico de la Universidad de Costa Rica (UCR). 2018.

[23] Chew, H. E., Levy, M., & Ilavarasan, V. The limited impact of ICTs on microenterprise growth: A study of businesses owned by women in urban India. Information Technologies & International Development, 7(4), pp-1. 2011.

[24] Schrepp, M., Hinderks, A., & Thomaschewski, J. Construction of a Benchmark for the User Experience Questionnaire (UEQ). IJIMAI, 4(4), 40-44. 2017.

[25] INEC, "Tasa de desempleo nacional fue de 23,2%," 2020. [En línea]. Available: https://www.inec.cr/noticia/tasa-de-desempleo-nacional-fue-de-232