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Article

Feasibility and benefit-cost of a digital portal for the agricultural sector

Factibilidad y beneficio-costo de un portal digital para el sector agropecuario

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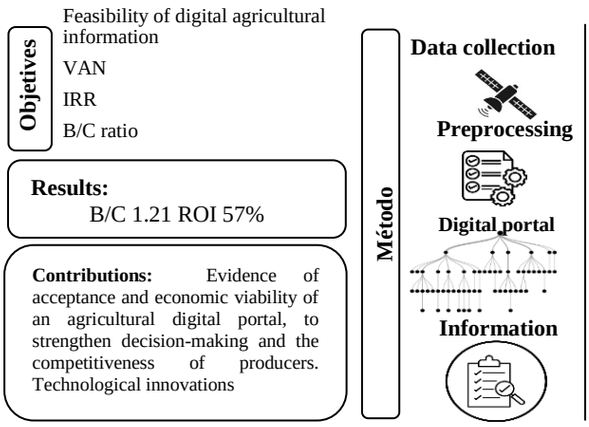
Abstract

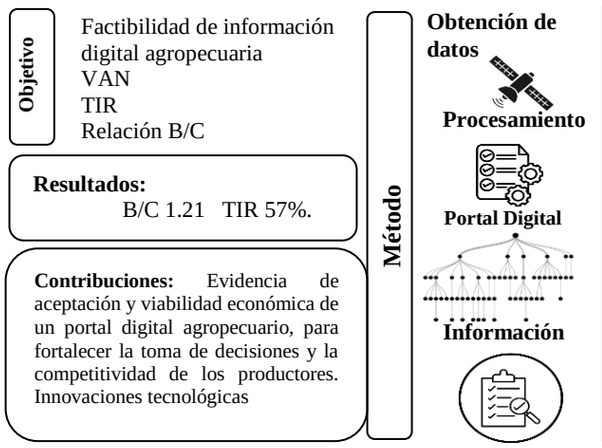
Access to updated information is essential for agricultural producers, as it improves productivity, profitability, competitiveness, and the technical planning of their daily activities. Currently, some producers obtain information through digital tools such as websites, social media, mobile applications, and instant messaging services. The objective of this study was to analyze the feasibility of establishing a digital portal for the agricultural sector in the South-Central region of Chihuahua and to evaluate its benefit–cost ratio. A structured survey was applied to producers, students, researchers, and other sector actors. The research followed a quantitative, applied, and correlational approach. Data analysis was conducted using SPSS through Cronbach's alpha for reliability and chi-square tests for variable association, while Excel was used for the benefit–cost calculation. Results showed high acceptance of the proposed digital portal, with 88.35% of respondents expressing interest in receiving agricultural information, and a benefit–cost ratio of 1.21. The study concludes that this initiative provides a solid foundation for developing a reliable and practical digital platform to strengthen strategic decision-making and enhance producers' competitiveness.



Digital technologies, Information, Primary sector, Decision-making

Resumen

La disponibilidad de información actualizada es esencial para los productores agropecuarios, pues mejora la productividad, rentabilidad, competitividad y planeación técnica de sus actividades. Actualmente, algunos productores acceden a información mediante portales web, redes sociales, aplicaciones móviles y mensajería instantánea. El objetivo de este estudio fue analizar la factibilidad de establecer un portal digital para el sector agropecuario en la región Centro-Sur de Chihuahua y evaluar su beneficio-costo. Se aplicó una encuesta estructurada a productores, estudiantes, investigadores y otros actores del sector. La investigación tuvo un enfoque cuantitativo, aplicado y correlacional. El análisis se realizó en SPSS mediante alfa de Cronbach y pruebas chi-cuadrada, y en Excel para el beneficio-costo. Los resultados mostraron alta aceptación del portal digital: el 88.35% manifestó interés en recibir información agropecuaria, y se obtuvo un índice beneficio-costo de 1.21. Se concluye que el estudio proporciona bases sólidas para una plataforma digital confiable y útil que fortalezca la toma de decisiones y la competitividad de los productores.



Tecnologías digitales, Información, Sector primario, Toma de decisiones

Area: Advocacy and attention to national problems

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Introduction

In the digital age, information is power. In the agricultural sector, access to accurate and timely technical and financial information is essential for making informed decisions and increasing productivity. This becomes an indispensable tool for producers, technicians, and entrepreneurs in the sector, offering centralised access to key resources and data to drive growth and competitiveness. On the one hand, digital technology promotes production, but on the other, it puts at risk the participation of producers, workers, and labourers who do not know how to take advantage of it (Opennhaimer, 2021). Agricultural producers can currently receive this information through digital tools such as platforms, web portals, social networks, instant messaging, and mobile applications; however, there is a gap between a large number of producers in terms of their ability to use these technologies, which limits their use.

Furthermore, there is no centralised source of information on the topics of greatest interest. This reality prevents awareness of opportunities that contribute to the advancement and development of the sector.

Marinchenko (2020) mentioned that McKinsey Global Institute (MGI) specialists pointed out that up to 50% of global labour operations could be automated in the next 20 years. This technological movement is comparable to the industrial revolution that took place in the 18th and 19th centuries. Just as years ago, the availability of roads, water supply, electricity, and infrastructure construction was crucial for manufacturers and producers, today access to fast communications is essential for automating data collection, analysing large amounts of information, and making quick decisions (Serbulova et al., 2019).

It is clear that digital technology and the necessary devices depend on the availability of basic infrastructure for their functioning and operation, such as electricity, the internet, computers, and mobile phones. This infrastructure makes it possible to take advantage of innovations and useful and necessary data to drive the development of productive activities. For example, the United States Department of Agriculture (USDA) is offering loans to invest in digital technologies useful for the agricultural sector (MarketsandMarkets, 2024).

In the particular case of Mexico, in 2019, the National Agricultural Survey highlighted the registration of 4.5 million rural production units, of which 37.7% used some type of technology. However, only 5.5% of producers used computers and 7.8% used the internet. On the other hand, mobile phone use has increased steadily and dynamically among both rural and urban populations, regardless of their economic activity, including agricultural producers (ENA, 2019).

The objective of this study was to analyse the technical, economic and market feasibility of implementing a digital agricultural information portal in the south-central region of Chihuahua using a quantitative approach and a cost-benefit analysis. A structured survey with key questions was administered to producers, students, researchers and other actors linked to the sector. It is hoped that these results will support the creation of the digital portal to encourage agricultural producers in the region to make better decisions and thus strengthen their agricultural activities.

From an economic and market perspective, the research will provide valuable information on the potential for adoption of the digital portal, identifying barriers and opportunities that may influence its long-term sustainability. This will not only benefit agricultural producers by facilitating their access to key information, but will also provide tools to government, academic and business institutions interested in promoting the digitisation of the agricultural sector. This research contributes to the development of information-based strategies to improve the dissemination of agricultural information in the Central-South region, promoting the modernisation of the sector and facilitating informed decision-making. The results may also serve as a basis for technological projects aimed at the digitisation of the agricultural sector in the Central-South region of the state of Chihuahua.

Materials and methods

The study was carried out in the Central-South region of the state of Chihuahua, located in the heart of the state, and represents an area of great social and economic importance due to its agricultural, dairy and agro-industrial production, which includes the municipalities of Delicias, Rosales, Saucillo, Meoqui and Julimes.

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The research was conducted from October 2023 to March 2025 and involved agricultural and livestock producers, stakeholders in the sector, students and professors from the Faculty of Agricultural and Forestry Sciences of the Autonomous University of Chihuahua.

A total of 166 questionnaires were administered, exceeding the calculated minimum sample size (n=162), which strengthened the representativeness of the study. Table 1 shows the sample determination. Prior to the application of the surveys, a pilot study was conducted consisting of 15 electronic questionnaires in Google Forms, from which the following data were obtained, applying the following formula suggested by Rubio-Arias et al., (2024).

$$n = \sigma^2(Z^2)/D^2 \quad [1]$$

Market research (survey) was used as the technique for obtaining information. The questionnaire was designed in accordance with the objective set and was structured in three sections. The first identified the main types of information demanded by producers in the region's agricultural sector and its relevance for decision-making in the sector. The second section assessed producers' willingness to use a digital agricultural information portal and identified factors such as level of access to technology and frequency of use of digital tools. The third section considered the design of the portal, i.e., how producers prefer to receive information.

The SPSS (IBM) statistical package was used to analyse these results, performing a reliability analysis using Cronbach's alpha and variable association with the chi-square test.

Economic and financial análisis

Microsoft Excel was used to calculate the total cost of implementing the digital agricultural platform (CTC), taking into account the fixed costs (CF) and variable costs (CV) that will be incurred. Figure 1 shows this relationship. The initial investment and the expenses involved in the design and operation of the portal were analysed.

Box 1

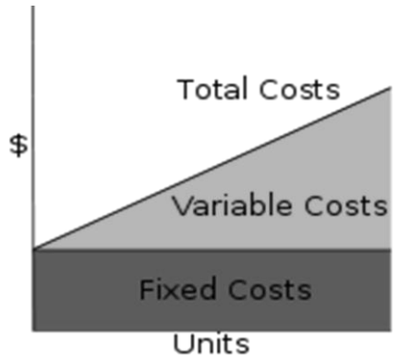

Figure 1
Graph showing the concept of total cost
Source: From Pacheco et al, 2024

For the development and implementation of the portal, investments were considered in computer equipment and servers, software and web development, domain and hosting, furniture, and multimedia and office equipment. In the specific case of expenses for the platform's operational activities, water, electricity, telephone, internet, and salary payments were also considered. With the aim of providing clear and timely information to producers in the agricultural sector.

Box 2

Table 1
Determining the sample size

Level of Education	Number
N Valid	27
Lost	0
Media	34.81
Variance	510.54
D (5%) average	1.74
D (10%) average	3.48
D1^2	3.02
D2^2	12.11
n =	647.43
n=	161.85

Source: Own Elaboration

The investment and expenditure information is used to perform a profitability analysis, considering the financial variables of Net Present Value (NPV), Internal Rate of Return (IRR) and Benefit-Cost Ratio (B/C). The NPV calculation analyses a project's investment based on future income and expenditure (Montes et al, 2023v). As a result, it is possible to know how much would be gained or lost by making a given investment.

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IRR is an indicator of the profitability of projects or investments; thus, the higher the IRR, the greater the profitability (Magni, 2011), thereby supporting good decision-making regarding the investment to be made. With regard to the B/C ratio, this parameter represents the relationship between costs and benefits over a given period. The simplest formula is used to calculate it (Ortega *et al*, 2023).

$$\text{Benefit Cost} = \left(\frac{\text{Net profit}}{\text{Net cost}}\right) \times 100$$

Results and discusión

The results show that most participants expressed a high willingness to receive digital information (88.35%) (Figure 2). This result represents an opportunity to implement technological tools as a means of dissemination. This shows that the adoption of digital technology is not immediate, even when a great deal of effort is invested in encouraging this process. (Dimara y Skuras, 2003).

Box 3

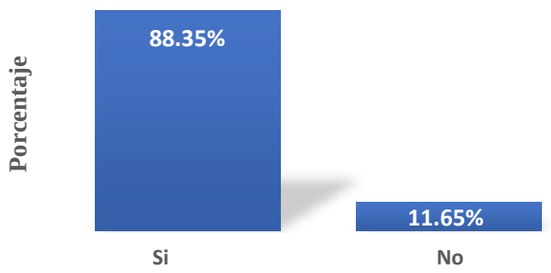

Figure 2

Source: Own Elaboration

People interested in receiving information about the agricultural sector

The information obtained confirms that agricultural producers and other actors in the sector are concerned with input prices (98.54%), government policies and support programmes (65.53%), and, thirdly, financing opportunities (45.63%). This result shows the importance of having reliable and up-to-date information for economic decision-making, which is a key need in this sector. Regarding the ideal frequency for updates, 46.12% prefer to receive information weekly, 30.10% monthly, 16.02% consider biweekly to be adequate, and 7.77% daily.

With regard to the technological devices used, the most common was the mobile phone, with 94.66% of respondents, the laptop or portable computer with 46.60%, and 29.13% other desktop devices. The most accepted formats for receiving information were material with images (40.78%) and videos (29.61%), indicating that producers seek clear, concise, visual content that is easy to understand.

For the economic-financial analysis, cash flow was used to show the initial investment, income, costs, and the discount rate projected over five years (Table 2). A positive NPV of 317,438.00 was obtained, an IRR (57.87%) higher than the evaluation rate, and a benefit-cost ratio of 1.21, which means that each peso invested recovers a surplus of 0.21 pesos (Table 3).

Box 4

Table 2

Cash flow

Year	Total costs ($)	Total revenue ($)	Update factor (%)	Updated costs ($)	Updated income ($)	Discounted net cash flow ($)
0	195,000	0	1.000	195,000	0.00	-195,000
1	319,980	435,000	0.909	290,890	395,454	104,563
2	335,979	456,750	0.826	277,668	377,479	99,810
3	352,778	479,588	0.751	265,047	360,321	95,273
4	370,417	503,567	0.683	252,999	343,942	90,943
5	388,938	585,174	0.621	241,499	363,346	121,847
Total	**1,574,154**	**2,460,078**		**1,523,106**	**1,840,544**	**317,438**

Source: Own Elaboration

Box 2

Table 3

Calculation of financial indicators using a discount rate of 10%

VAN	$ 317,438
TIR	57.87%%
B/C	1.21

Source: Own Elaboration

Conclusions

It is concluded that there is a marked willingness on the part of producers, students, researchers and other actors in the agricultural sector to access information through digital media. This acceptance provides evidence of the need to establish a formal mechanism for the development of a digital portal, which would function as a strategic tool to improve access to up-to-date information, strengthen decision-making and contribute to the competitiveness of the sector.

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Likewise, it is confirmed that the creation of a digital agricultural portal is not only relevant and timely, but also financially viable. The economic analysis carried out with a discount rate of 10% yielded a Net Present Value (NPV) of $317,438, an Internal Rate of Return (IRR) of 57.87% and a Benefit-Cost (B/C) ratio of 1.21, values that indicate favourable profitability and justify the implementation of the project.

Taken together, these results support the conclusion that the design and launch of a digital portal will contribute significantly to improving the availability of reliable and timely information, thereby boosting productive efficiency, strategic planning, and sustainability in the region's agricultural sector.

Recommendations

It is recommended to move forward with the design and implementation of a digital agricultural portal, as the results obtained show high acceptance by stakeholders in the sector and a clear need for reliable, up-to-date and accessible information. This tool has the potential to strengthen decision-making, improve the competitiveness of producers and facilitate the dissemination of technical content in a timely manner.

Given that the financial analysis revealed favourable economic viability, it is suggested that this be used to justify the allocation of resources and ensure the continuity of the project. These indicators support the view that the investment is profitable and that the portal can be sustained in the medium term, especially if it is complemented by strategies for continuous updating and user training.

It is also recommended that the portal's design respond directly to the real needs of producers and other participants in the sector, incorporating relevant content, intuitive technological tools, and feedback mechanisms. This will ensure that the platform is consolidated as a useful, efficient, and widely used resource. It is also suggested that partnerships be established with academic institutions, government agencies, and sector organisations to ensure that information is constantly updated, to strengthen its reach, and to maximise the expected benefits of the project.

Declarations

Conflict of interest

The authors declare that they have no conflict of interest. They have no known competing financial interests or personal relationships that could have appeared to influence the article reported in this article.

Contribution of the authors

Zamora-Domínguez, María Elena: Contributed the project idea and research development.

Ortega-Montes, Fabiola Iveth: Contributed to research direction, data analysis, and editing.

Macías-López, María Guadalupe: I contributed to the research method.

Rubio-Áreas, Héctor Osbaldo: I contributed to data analysis, review, and editing.

Availability of data and materials

The data sets used or analysed during the current study are available from the corresponding author upon reasonable request.

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Abbreviations

TICs	Digital systems that manage emerging technologies
B/C	Cost-Benefit Ratio
CF	Fixed Costs
CTC	Total Cultivation Cost
CV	Variable Costs
TIR	Internal Rate of Return
VAN	Net Present Value

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Information: A set of data with meaning, i.e., that reduces uncertainty or increases knowledge about something. In truth, information is a message with meaning in a given context, available for immediate use and providing guidance for actions by reducing the margin of uncertainty regarding our decisions (Chiavenato, 2006)

Communication: The exchange of information between people. It means making a message or information common. It is one of the fundamental processes of human experience and social organisation. (Chiavenato, 2006).

Dissemination: The action and effect of disseminating (propagating, divulging or spreading). The term, which comes from the Latin diffusio, refers to the widespread communication of a message. (Pérez Porto, 2021)

Specialised Portals: Also known as vertical portals, vortals (from Vertical Portal) or VEPs ('Vertical Enterprise Portal'), they tend to focus exhaustively on one aspect within a geographical or thematic area (finance, current affairs, health, etc.), or adapt their content to the needs of the customer (both information and services). (Baró, et al., 2001).

Market segmentation as 'the way a company decides to group customers, based on important differences in their needs or preferences, with the aim of achieving a competitive advantage' (Thompson, 2005).

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