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Museum perspective: identification of trends in the evolution of Pachuca's museums in 2040

Prospectiva museística: identificación de las tendencias en la evolución de los museos pachuqueños en el año 2040

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Abstract:

Museums, beyond their roles as conservators and disseminators of a community's tangible and intangible heritage, play a crucial role in raising public awareness about societal development, cultural exchange, mutual understanding, cooperation, and peace among peoples (Gobierno de México, 2018). This research aims to describe the potential future of museums in the city of Pachuca de Soto, Hidalgo, for the year 2040, employing the strategic foresight technique to generate four possible scenarios to guide decision-making: inertial, incremental development, recoil, and structural change. The sample included seven museums in Pachuca de Soto, where nine semi-structured interviews were conducted. The analysis was performed using ATLAS.ti version 24 software. The interview results provided the foundation for developing the four proposed scenarios, which can serve as a guide for decision-making for Pachuca's museums. This type of research is the first to be carried out at the municipal level. 1

Keywords:

Museums, strategic foresight, semi-structured interview.

Resumen:

Los museos, más allá de su papel como conservadores y difusores del patrimonio tangible e intangible de una comunidad, desempeñan un papel crucial en la sensibilización pública sobre el desarrollo social, el intercambio cultural, el entendimiento mutuo, la cooperación y la paz entre los pueblos (Gobierno de México, 2018). Esta investigación tiene como objetivo describir el futuro potencial de los museos de la ciudad de Pachuca de Soto, Hidalgo, para el año 2040, empleando la técnica de prospectiva estratégica para generar cuatro posibles escenarios que orienten la toma de decisiones: inercial, desarrollo incremental, retroceso y cambio estructural. La muestra incluyó siete museos de Pachuca de Soto, en los que se realizaron nueve entrevistas semiestructuradas. El análisis se realizó utilizando el software ATLAS.ti versión 24. Los resultados de las entrevistas proporcionaron la base para desarrollar los cuatro escenarios propuestos, los cuales pueden servir como guía para la toma de decisiones para los museos pachuqueños. Este tipo de investigación es la primera en realizarse en el ámbito municipal. 1

Palabras Clave:

Museos, prospectiva estratégica, entrevista semiestructurada.

Introduction

According to United Nations Educational, Scientific and Cultural Organization (UNESCO), the number of museums worldwide has increased from 22,000 in 1975 to 104,000 in 2023. Museums play "a preponderant role in the development of the local and regional creative economy. They are increasingly present in society, are interested in its problems, and offer spaces for debate and exchange, encouraging citizen participation". 2, 3

A study by Ernst & Young (2015) found that cultural and creative industries in Latin America represent 6% of the world market and provide 1.9 million associated jobs. In

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Mexico, according to data from the National Institute of Statistics, Geography, and Informatics, the cultural and creative industries generated 3.1% of the Gross Domestic Product in 2022, contributing to 1.36 million jobs. 4, 5

In 2023, museums in Mexico received 48.4 million visitors, an increase of 10.8 million from 2022, with Mexico City, Nuevo León, and the State of Mexico accounting for 61.9% of the total. 6

In Hidalgo, museums reported 510,058 visitors across 38 registered museums with the Ministry of Culture. Despite being among the top 15 states with the highest number of museums, Hidalgo has one of the lowest visitor influxes nationwide. These factors underscore the need for exploratory research to describe the potential future of museums in the city of Pachuca for the year 2040, using the strategic foresight technique to generate four possible scenarios to guide decision-making. 7, 8

Theoretical Framework

The theoretical framework of this article encompasses strategic foresight and key elements related to museums, detailed below.

Strategic Foresight

Organizations today operate in highly competitive environments, often prioritizing operational effectiveness over strategic planning. Porter (2011) argues that executives frequently conflate strategy with operational effectiveness, which he defines as practices that optimize resource usage, such as reducing product defects or accelerating product development. 9

Porter (2011) notes that while operational effectiveness advances companies toward the productivity frontier—the aggregate of best practices at a given time—it is insufficient for sustained competitive advantage for two reasons. First, profitability eventually plateaus. Second, competitive convergence occurs, leading to industry homogenization. 9

Strategic planning methodologies include future studies, which can be deterministic or voluntaristic. The former, which emerged in the US in the late 1940s, relies on forecasting and foresight, focusing on trend behaviors. The latter, strategic foresight, aims to shape the future by managing relationships among system actors, objectives, and factors, resulting in multiple possible futures. 10

One technique used by the voluntarist approach is strategic prospective. According to Astigarraga (2016), this is a systematic, participatory process of constructing a long-term vision to inform current decision-making and mobilize joint actions. Not only about predicting the future but also about constructing it, linking foresight with strategy and strategic planning. 11

The Organization for Economic Cooperation and Development defines strategic foresight as a structured approach to using future-oriented ideas to anticipate opportunities and challenges and prepare for change. It involves methodologies such as horizon scanning, megatrend analysis, and scenario development to explore future possibilities. 12

Although the study of the future dates back to ancient times, strategic foresight as a discipline originated in France, with Gaston Berger considered the father of this field. There are now several models and techniques related to strategic foresight. 2

Marsh et al. (2002) highlight that strategic foresight is a convergence of several multidisciplinary fields such as future studies, new strategic planning, organizational development, and scientific and technological foresight (Figure 1). 13

Figure 1. Strategic foresight

Mojica (2006) outlines that every prospective analysis consists of four fundamental stages: identification of the main variables and actors, as well as the design of strategies based on the choice of one of the previously constructed scenarios. One way to facilitate the identification of each stage is by asking questions, as can be seen in Figure 2. 14

Variables	What are the key aspects of the topic we are studying?	Where are we?
Actors	What is the behavior of the social actors?	How are the social actors operating?
Scenarios	What might happen in the future?	Where are we headed? Where else can we go? What is our best option?
Strategies	What should we do from the beginning to build our future?	What objectives and goals should we achieve and through what actions?

Table 1. Stages of strategic foresight

This author proposes a basic model with the fundamental stages of strategic foresight, which can be observed in Figure 2. This model, in addition to linking the elements mentioned above, indicates the process to follow both for obtaining and processing the information collected.

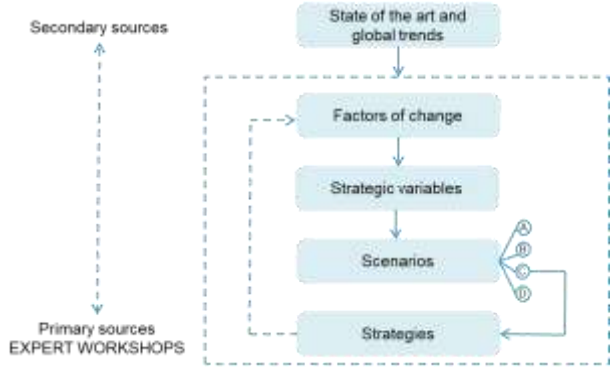


Figure 2. Key stages of strategic foresight

As can be seen in Figure 2, the use of primary and secondary sources allows us to establish the state of the art and global trends from which it is possible to identify strategic variables through the factors of change, this being the input to build various scenarios, with strategies being designed based on the choice of one of these scenarios.

Hernández et al. (2019) conceive strategic foresight as a tool used within the planning process to guide present actions in constructing a probable future for the organization, providing crucial elements for decision-making. They emphasize an active and creative attitude towards the future, with scenarios being a key element of the process. 15

Chermack (2013) describes scenarios as narratives of possible future environments. They involve various dynamics challenging decision-makers and provide different contexts to consider risks, benefits, and strategic options. Scenario planning, according to Chermack, is a process of developing and using a set of scenarios to explore and test decision options, integrated with strategy. 16

Regarding the process of developing scenarios, authors differ in their approaches. Schoemaker (1995), proposes ten steps: defining the scope, identifying major stakeholders, identifying basic trends, identifying key uncertainties, constructing initial scenario themes, checking for consistency and plausibility, developing learning scenarios, identifying research needs, developing quantitative models, and evolving toward decision scenarios; while Chermack (2013), suggests defining a question, problem, or decision; developing an estimated scope and timeframe; building the scenario team; conducting external analysis; conducting interviews; brainstorming major forces; ranking forces by impact and uncertainty; building scenario logics; and testing the business model. 16, 17

Museums

The conceptualization of museums varies depending on the author. The Royal Academy of the Spanish Language defines a museum as a non-profit institution dedicated to the acquisition, conservation, study, and exhibition of culturally significant objects. Additionally, it is considered a building or place intended for the study of sciences, literature, and the liberal arts. 18

Hernández (1992) describes a museum as comprising collections (contents), buildings (context), and both internal (specialists, administrators, technicians) and external (public) personnel. Schärer (2007) views museums as places that safeguard and study objects and their values, interpreting absent facts. Desvallées and Mairesse (2010) note that "museum" can refer to both the institution and the physical establishment for selecting, studying, and presenting material and immaterial testimonies of individuals and their environment. 19, 20, 21

Poveda (2018) and Fernández (1995) explore the etymology of the term, tracing its origin from Latin, musēum and Greek ***μουσείον***. They point out that initially the word museum was used with two different nuances, on the one hand, the term museum comes from the Greek museion, which means "place dedicated to the Muses" (locus musis sacer) referring to the nine muses, daughters of Zeus. who were the protective goddesses of poetry, history, arts and sciences and had the task of teaching humans, becoming the source and origin of the museum, thus, the museion becomes a monument, as a support and instrument of memory; secondly, the museum referred to the museion and library of Alexandria, where scholars met in classical times to discuss and learn all the science. 22, 23

Despite varying definitions, the International Council of Museums (ICOM) aims to establish a universal concept. ICOM defines a museum as a non-profit, permanent institution serving society by researching, collecting, conserving, interpreting, and exhibiting material and intangible heritage. Museums promote diversity and sustainability, operate ethically, and offer educational and reflective experiences. 24

Museum classification also varies. Poveda (2018), citing Schouten, divides museums into traditional and contemporary categories. Witker (2001) classifies them by themes and collections, resource origins, audience, influence area, and exhibition type. León (2010) identifies types such as art, history, science, technology, and ethnology museums. The Spanish National Institute of Statistics and UNESCO classify museums into fine arts, decorative arts, contemporary art, science and technology, history, site, archaeological, ethnography and anthropology, natural sciences, specialized, general, and house museums. 3, 22, 25, 26, 27

UNESCO and ICOM taxonomies underpin León and Witker's classifications. ICOM's official website offers documents and courses on museum ethics, key concepts, and methodologies, drawing on global expertise.

Effective scenarios are characterized by logical, open, informal, inclusive, holistic, and constructive processes. 28

Literature review

Strategic foresight has been applied across various fields of study; however, its application to cultural industries remains limited. The literature review revealed articles focusing on the application of diverse economic-administrative techniques and methods, including marketing. Key studies are summarized below.

For museums, only the research by Pauget et al. (2021) was found, who applied the Delphi technique to 99 experts in the field to construct three possible scenarios. 29

Coblence and Sabatier (2014) analyzed the business model of one of the world's most significant museums, the Louvre. Their longitudinal study demonstrates the transition from a growth-oriented business model to a global and innovative one, emphasizing the organization's efforts to create symbolic value from its unique art collections through innovative exhibitions and displays. 30

Woodward (2012) explored the changing expectations faced by the museum sector over the last century to generate revenue and meet contemporary service demands. A self-completion questionnaire was sent to 150 museums across Yorkshire, achieving a response rate of 33% (49 responses), followed by interviews with 15 directors from museums of various sizes, both public and private. The study reveals the transformation of museums, which have shifted from a focus on curatorship to offering a wide range of services, largely generating their income independently of government support. The main revenue-generating activities (ticket sales, catering sales, and sales of other goods) and barriers to income generation (insufficient internal resources, external market factors, and cultural resistance to income generation) were identified. 31

Evans et al. (2010) conducted a case study using semi-structured interviews, institutional document analysis, and observational research, developing a model of key drivers, impediments, and manifestations of brand orientation in museums across the United Kingdom, United States of America, and Australia. The study identified both philosophical and behavioral aspects of brand orientation, presenting six attributes that include brand orientation as an organizational culture and decision-making compass, and four brand behaviors (distinctiveness, functionality, augmentation, and symbolism). The conceptual model highlights critical antecedents to brand orientation in a museum context. 32

Hume and Mills (2011) utilized a case study combining content analysis of websites and annual reports to profile the online behavior and practices of the museum sector. Data from 12 national and international museums provided an overview of current operations, concluding that the pressure to attract visitors necessitates the use of marketing practices to position museums and create experiences that encourage repeat visits for long-term growth and revenue renewal. New technologies are highlighted as a method to enhance visitor experiences. 33, 34, 35

Gilmore and Rentschler (2002) presented a conceptual framework for museum management, considering the context of museum services and delivery. Their study of two museums, one in Ireland and the other in Australia, focused on the management styles of museum directors and illustrated the shift from traditional custodial conservation to contemporary education and public entertainment. They proposed a service marketing model for museum management, addressing internal performance (staff knowledge and ability to deliver service, feedback and communication between managers, staff, volunteers, visitors, internal communication and interdepartmental co-operation), and external performance (education, accessibility and communications). 36

Camarero and Garrido (2009) from the University of Valladolid conducted an empirical analysis of 182 Spanish museums. Their study aimed to examine the implications of three strategic orientations—customer orientation, sales orientation, and custodial orientation—on improving

social performance (education and conservation) and economic performance (income or number of visitors). The results indicated that social performance is strongly associated with custodial and customer orientations, whereas economic performance is primarily influenced by a sales orientation. 37

Proteau (2018) addresses the challenges that museums face in terms of financing. The study analyzes both successful and failed alliances, concluding that corporate sponsorships of museums are feasible and mutually beneficial. 38

In Mexico, research explored the government's role as a key player in the consolidation of the Ecomuseum project in Tepic, Nayarit. Using a qualitative methodology with observation and interview techniques, and strategic foresight software, the study mapped the project stakeholders. The researchers concluded that, despite the government's central role, strategies to enhance social cohesion, community identity, territorial appropriation, and cultural promotion are necessary. They proposed two ways to enhance possibilities and two ways to overcome the obstacles identified in the study. 39

Methodology

The study design is exploratory and qualitative, encompassing descriptive and interpretive research, as “description itself has a necessary role in qualitative research; although this role is necessary, it is not sufficient, as interpretation is also needed”. 40

Data collection was conducted through interviews, defined as “a conversation with a specific purpose beyond the simple act of talking.” For this research, semi-structured interviews were utilized, valued for being “flexible, dynamic, and non-directive”. 41

The interview questions were derived from the article "The Future of French Museums in 2030". This survey, validated by experts in the field, is included in the annex of the article and comprises eight categories (definition, demography and change, tourism, economy and finance, technology, governance, strategy and management, laws and regulations) and a total of forty-nine questions. For this study, five of the eight categories were employed, alongside fourteen of the forty-nine questions. 29

The selection criteria for both, categories and items, included the translation and adaptation of the questions to the Spanish language, as well as to the Mexican context, the time required for the application of the survey and the variables considered for the generation of scenarios. Additional data collected in the interviews included sociodemographic variables such as full name, age, gender, degree of education, and the interviewees' roles within their organizations.

To determine the sample, two databases were consulted: the National Statistical Directory of Economic Units (DENUE) of the National Institute of Statistics and Geography (INEGI) and the Mexican Cultural Information System (SIC). From these databases, the number of existing museums per municipality in the state of Hidalgo was obtained, as can be seen in Table 2. 42, 43

No.	Municipality	Museums SIC	%	Museums DENUE	%
1	Acaxochitlán	1	1.8	1	2.4
2	Actopan	1	1.8	3	7.1
3	Ajacuba	1	1.8	-	-
4	Apan	1	1.8	-	-
5	Atotonilco de Tula	1	1.8	1	2.4
6	Atotonilco El Grande	1	1.8	-	-
7	Chapantongo	-	-	1	2.4
8	Chilcuautla	1	1.8	-	-
9	Emiliano Zapata	1	1.8	-	-
10	Epazoyucan	1	1.8	-	-
11	Francisco I. Madero	1	1.8	1	2.4
12	Huehuetla	-	-	1	2.4
13	Huejutla de Reyes	-	-	1	2.4
14	Huichapan	1	1.8	1	2.4
15	Ixmiquilpan	1	1.8	-	-
16	Metepec	1	1.8	-	-
17	Mineral del Chico	-	-	1	2.4
18	Mineral del Monte	5	8.9	6	14
19	Nopala de Villagrán	1	1.8	1	2.4
20	Pachuca de Soto	10	18	9	21
21	Santiago de Anaya	1	1.8	-	-
22	Santiago Tulantepec	1	1.8	1	2.4
23	Tasquillo	1	1.8	-	-
24	Tecozautla	2	3.6	-	-
25	Tepeapulco	3	5.4	1	2.4
26	Tepeji del Río	2	3.6	-	-
27	Tizayuca	1	1.8	-	-
28	Tlahuelilpan	1	1.8	-	-
29	Tolcayuca	1	1.8	-	-
30	Tula de Allende	2	3.6	1	2.4
31	Tulancingo de Bravo	5	8.9	6	14
32	Villa de Tezontepec	1	1.8	-	-
33	Yahualica	1	1.8	1	2.4
34	Zacualtipán de Ángeles	2	3.6	2	4.8
35	Zempoala	2	3.6	3	7.1
36	Zimapán	1	1.8	-	-
TOTAL		**56**	**100**	**42**	**100**

Table 2. Number of museums by municipality in the state of Hidalgo

As illustrated in Table 2, there is a significant discrepancy in the number of museums reported by each source. To identify the municipalities with the highest number of museums, a data standardization process was undertaken, prioritizing the highest reported numbers, resulting in Table 3.

No.	Municipio	Museums SIC-DENUE	%
1	Pachuca de Soto	10	15
2	Mineral del Monte	6	9.2
3	Tulancingo de Bravo	6	9.2
4	Actopan	3	4.6
5	Tepeapulco	3	4.6
6	Zempoala	3	4.6
7	Tecozautla	2	3.1
8	Tepeji del Río	2	3.1
9	Tula de Allende	2	3.1
10	Zacualtipán de Ángeles	2	3.1
TOTAL		**39**	**60**

Table 3. Hidalgo municipalities that concentrate the largest number of museums in the state

The research population focused on the area with the highest concentration of museums, specifically the city of Pachuca de Soto, which hosts 15% of such institutions. Letters requesting support for conducting interviews were sent to 10 museums, resulting in positive responses from the institutions listed in Table 4. Data collection took place in November and December of the year 2023. 44, 45, 46, 47, 48, 49, 50

No.	Museums	Type	Id	Date's application
1	Museo de Miniaturas	Private	MM	08-nov-23
2	Museo de la Fotografía	Public	MF	09-nov-23
3	Museo Regional del Ajolote	Private	MA	15-nov-23
4	Museo de Mineralogía de la UAEH	Public	MU	21-nov-23
5	Museo Virtual de Pachuca (MUVIPA)	Public	MP	22-nov-23
6	Museo El Rehilete	Public	MR	24-nov-23
7	Archivo Histórico y Museo de Minería (AHMMAC)	Private	MH	07-dic-23

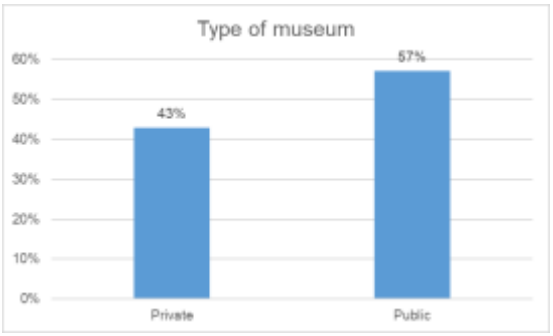
Table 4. Sample selected for the research

During the review of museums listed in the two consulted databases, discrepancies were identified in the names and addresses of the institutions, as detailed in Table 5. To resolve these discrepancies, initial contact was made by telephone. Subsequently, visits were conducted to the properties listed in each database to determine the sample to which the aforementioned letters were sent. It is noteworthy that two interviews were conducted at the MUVIPA and AHMMAC museums instead of one, resulting in a total of 9 interviews.

No.	Museums SIC	Museums DENUE
1	Museo Interactivo para la Niñez y Juventud Hidalguense El Rehilete	Museo Interactivo para la Niñez y Juventud Hidalguense El Rehilete
2	Museo de Miniaturas	Museo de Miniaturas
3	Museo de la Fotografía	Museo de la Fotografía
4	Museo de Minería	Archivo Histórico y Museo de Minería
5	Museo Centro Interactivo Mundo Futbol	Centro Interactivo Mundo Tuzo
6	Museo Salón de la Fama	Galería Leo Acosta
7	Sala de Exposiciones del Centro INAH Hidalgo	Galería El Cuartel del Arte
8	Museo de Mineralogía de la UAEH	Foro Cultural Efrén Rebolledo
9	Sala San Francisco Arte e Historia	Galería del Arte del Centro Cultural El Reloj
10	Museo Regional del Ajolote (Ajolotario Miquiztli Xolotl)	-

Table 5. Sample selected for the research

The sample comprised 3 private museums and 4 public museums, representing 43% and 57%, respectively, as can be seen at Graph 1.



Graph 1. Type of museum

Four men and five women were interviewed, all of whom held at least a bachelor's degree, with some having attained a master's degree. Among the interviewees, five held strategic positions within the museums, while the remaining individuals were engaged in tactical-operational roles.

Results

The transcriptions of the nine interviews conducted in the seven museums were processed using Atlas.ti software, version 24. According to the Atlas.ti manual, there are two principal modes of working: the data level and the conceptual level. For this research, the data level was utilized. The coding of the information was carried out using Artificial Intelligence Coding (AIC) and Intentional Artificial Intelligence Coding (IAIC). AIC supports the researcher by conducting fully automated inductive coding, thereby saving valuable time by processing data and performing the initial coding. IAIC, on the other hand, allows researchers to have more control over the coding

process, determining the coding based on a series of questions established by the researcher. 51

Intentional Artificial Intelligence Coding (IAIC)

For intentional coding with Artificial Intelligence (IAIC), the input provided to the application consisted of the five dimensions of the survey used in the semi-structured interviews, summarized into ten questions, as shown in Table 6.

Category	Items
C1: Definition	What is your opinion on the main role of museums in the year 2040?
C2: Demography and Change	Will the aging of the general population significantly affect the museum's missions in the year 2040?
	Will the educational level of the general population significantly affect the museum's missions in the year 2040?
	Will greater diversity of the general population significantly impact the museum's missions in the year 2040?
C3: Economy and Finance	Will collaboration with companies and growth of commercial spaces significantly affect the museum's missions in the year 2040?
	Will reduced government funding and increasing admission feessignificantly impact the museum's missions in 2040?
C4: Technology	Will the digitization of collections and the development of new applications significantly affect the museum's missions in the year 2040?
C5: Strategy and Management	Will the dimensions of edutainment and social significantly affect the museum's missions in the year 2040?
	Will the retirement of museum staff significantly impact the museum's missions in the year 2040?
	Will the emergence of new professions significantly affect the museum's missions in the year 2040?

Table 6. Input IAIC

A total of 9 documents were analyzed, resulting in 137 citations and 182 codes grouped into 5 dimensions, as depicted in Figure 3.

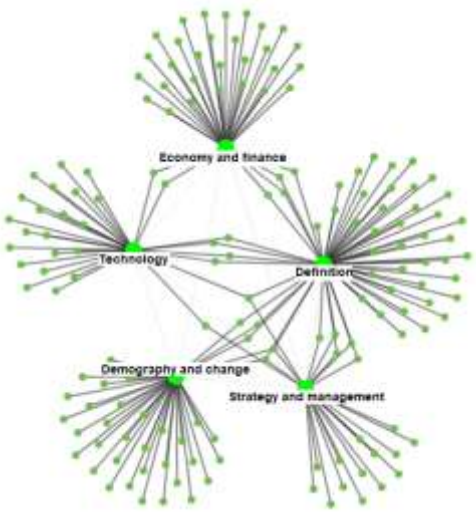


Figure 3. Output with IAIC

Quoting the Atlas.ti manual, the code-document table is the cross-tabulation of codes or groups of codes by documents or groups of documents. This table shows the frequency with which a code (or codes from a code group) has been applied to a document or group of documents. Table 7 presents the results obtained for this research. 51

	MH-E1 31 cites	MH-E2 12 cites	MA 18 cites	MF 14 cites	MU 16 cites	MM 13 cites	MR 12 cites	MP-E1 11 cites	MP-E2 10 cites	Totals
Definition	24	10	14	12	12	9	8	9	8	106
Demography and Change	9	3	4	4	5	3	2	2	1	33
Economy and Finance	9	4	3	3	4	3	3	4	2	35
Strategy and Management	3	-	2	2	1	3	-	2	-	13
Technology	7	3	4	2	1	3	3	2	2	27
Totals	52	20	27	23	23	21	16	19	13	214

Table 7. Document Code Analysis with IAIC

As shown in Table 7, the dimension with the most citations is the definition dimension (106 quotations), followed by the economy and finance dimension (35 quotations), and the demography and change dimension (33 quotations).

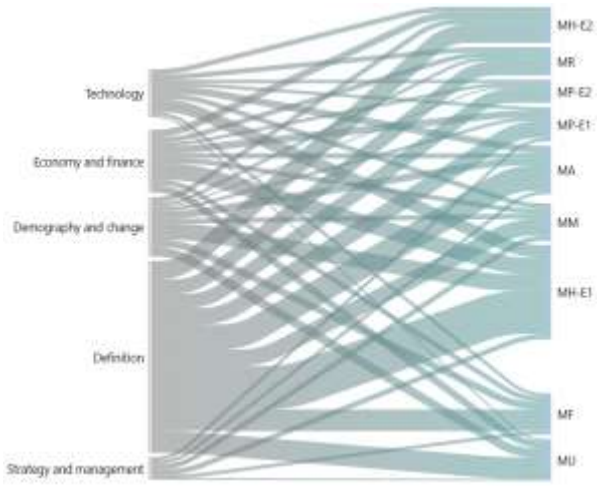
Some of the comments related to the definition of museum are the following:

> MH-E1: “ser centros de cultura que apoyan la educación”.
>
> MF: “es la expresión propia de la identidad de una comunidad”.
>
> MU: “es un generador de foros para expandir, y divulgar el conocimiento”.

Regarding the economic and financial dimension, the interviewees touched on topics related to business collaboration, economic recovery, and growth. Some of the answers were as follows:

> MP-E1: “Se puede colaborar con empresas tanto locales como pues nacionales e internacionales...crear estas alianzas da esa oportunidad de mejorar”.
>
> MR: “es obvio que las empresas van a buscar ser más visibles en algo que sea similar a su objetivo”.

Sankey's Graph 2 visualizes the distribution of quotes provided by each interviewee.



Graph 2. Sankey´s graph dimensions-interviewees with IAIC

It is noteworthy that the strategy and management dimension was not considered by a third of the interviewees, including the second interviewee from MUVIPA (MP), AHMMAC (MH), and the Museo El Rehilete (MR).

Another analysis conducted was co-occurrence, which, according to the Atlas.ti manual, provides a quick overview of where interesting overlaps in the coded data might exist, as shown in Table 8.

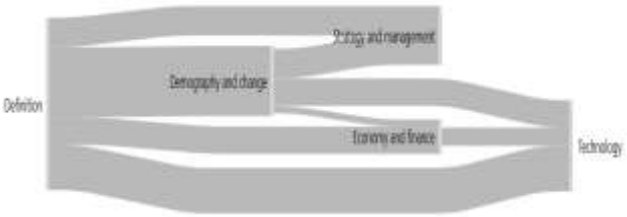
	Definition	Demography and Change	Economy and Finance	Strategy and Management	Technology
Definition		31	12	13	20
Demography and Change	31		3	13	12
Economy and Finance	12	3			8
Strategy and Management	13	13			
Technology	20	12	8		

Table 8. Co-occurrence Analysis with IAIC

The importance of implementing technological aspects is present in museums, as we can see in the following comment:

> MH-E2: “las plataformas digitales tenemos ya que incluirlas en en los aprendizajes...si no hacemos un un cambio hacia la transformación digital en los museos va a ser muy complejo que que nos volteen a ver”.

The three codes with the highest co-occurrence are definition followed by demographics and change, and technology in third place. The relationships between these co-occurrences are depicted in Table 8 and Sankey's Graph 3.



Graph 3. Sankey´s graph co-occurrence codes with IAIC

The Sankey graph illustrates the strong connections between the definition code and other codes, primarily with the demographics and change code. Conversely, the strategy and management code show a total lack of relationship with the economy and finance codes, as well as technology.

Regarding the strategic and management aspect, we see that only some museums consider it, as the following comment shows:

> MA: “son pocas personas las que se dedican...al manejo administrativo”.

Finally, Figure 4 presents the word cloud created, considering nouns, verbs, adjectives, and adverbs. As shown, the noun “museum” (museo) is the most frequent word, with the verbs “have” (tener), “being” (ser), “believe” (creer), and “say” (decir) also frequently appearing. The adverb “then” (entonces) is the third most common word, and the adjective “good” (bueno) ranks tenth.

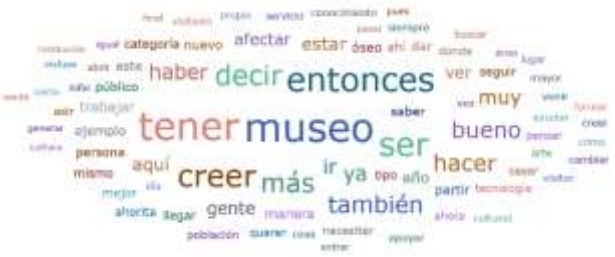


Figure 4. Word cloud with IAIC

Artificial Intelligence Coding (AIC)

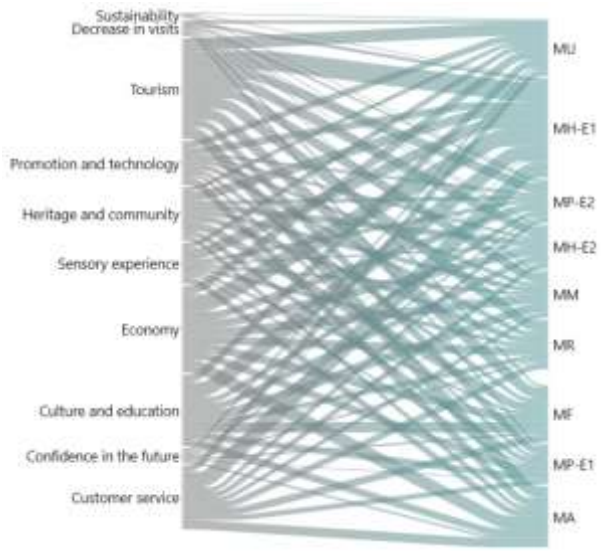
Coding with AIC yielded a total of 159 quotes, which were assigned to 218 codes in 133 categories. Due to the volume generated by the application, we reduced the number of codes to the top 10 with the highest number of citations. The first analysis performed was the code-document analysis, the results of which are shown in Table 9.

	MH-E1 35 cites	MH-E2 14 cites	MA 18 cites	MF 16 cites	MU 19 cites	MM 15 cites	MR 14 cites	MP-E1 14 cites	MP-E2 12 cites	Totals
Customer service	15	5	9	7	6	4	6	5	4	61
Confidence in the future	1	1	2	2	2	1	2	1	2	14
Culture and education	14	6	7	10	7	8	5	6	5	68
Decrease in visits	3	1	-	2	3	1	1	2	2	15
Economy	16	8	12	8	8	9	8	7	7	83
Sensory experience	10	2	6	3	5	3	4	2	4	39
Heritage and community	9	6	4	8	4	5	6	5	4	51
Promotion and technology	7	3	7	4	6	4	5	3	3	42
Sustainability	1	1	-	-	1	1	-	-	1	5
Tourism	19	9	11	10	12	9	10	7	9	96
Totals	95	42	58	54	54	45	47	38	41	474

Table 9. Document Code Analysis with AIC

Table 9 shows that the highest number of citations came from interviewee number 1 of AHMMAC (95 quotations), followed by the Museo Regional del Ajolote (58 quotations), and Museo de Fotografia y Museo de Mineralogia de la UAEH (54 quotations each). Most quotations from AHMMAC and Museo Regional del Ajolote are distributed across the dimensions of tourism, economy, and customer service.

Sankey's Graph 4 visualizes the distribution of quotes provided by each interviewee.



Graph 4. Sankey´s graph dimensions-interviewees with AIC

Tourism (96 quotations), economy (83 quotations), and culture and education (68 quotations) are the aspects most mentioned by interviewees from the seven museums, with sustainability (5 quotations) mentioned the least.

Some of the comments related to tourism refer to the cultural, sustainable, responsible, community or even local aspect, as it can be seen in the quotations transcribed below:

> MP-E2: “nos gusta enfocarnos en los niños... en despertar el interés de las artes a los niños, entonces esperamos que esos niños crezcan y también se interesen en el arte y en los museos”.
>
> MM: “los niños de ahorita cuando crezcan pues van a querer ver en un museo cosas que tal vez vieron de niños”.
>
> MH-E2: “el viajero está cambiando, como que su pensamiento, su forma de actuar, entonces está buscando experiencias profundas y los museos fungen en espacios donde se pueda comunicar diferentes conocimientos y creo que son espacios donde se puede tener…ese objetivo o armar ese objetivo de reconocer el espacio, el territorio, la forma de vida, todo eso”.

Another analysis performed was co-occurrence, with results shown in Table 10. Although there is a change in the co-occurrence of codes, this does not affect the dimensions of tourism, economy, and culture and education. The table demonstrates strong co-occurrence between tourism and economy, as well as tourism and culture and education. The third-highest co-occurrence was between customer service and sensory experience.

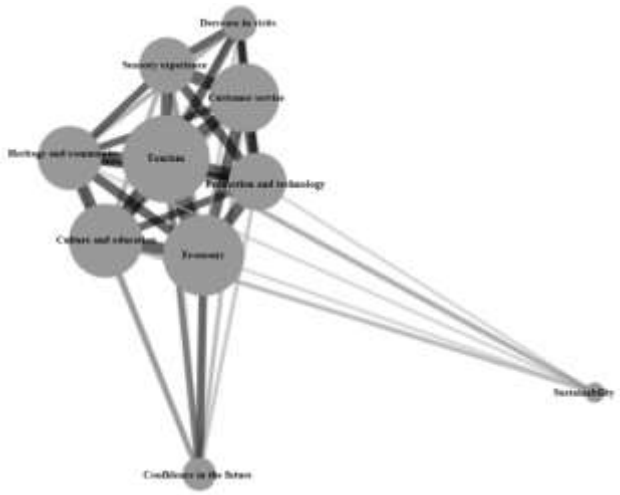
	Customer service	Culture and education	Economy	Sensory experience	Heritage and community	Promotion and technology	Tourism
Customer service		6	25	34	11	25	26
Culture and education	6		31	5	31	12	47
Economy	25	31		7	18	27	64
Sensory experience	34	5	7		12	18	25
Heritage and community	11	31	18	12		11	30
Promotion and technology	25	12	27	18	11		32
Tourism	26	47	64	25	30	32	

Table 10. Co-occurrence Analysis with AIC

Some of the comments related to economy and tourism are as follows:

> MU: “sería injusto hablar de pagos de entradas más altas...porque sobre todo es una presión económica, sería simbólico, lo suficiente”.
>
> MR: “los museos tienen que enfocarse en ser atractivos…y ser accesibles…particularmente en este museo…los papás prefieren traer al niño al museo que llevarse al niño al centro comercial”.

Graph 5 illustrates the weight and strength of the relationships between codes, reinforcing the observations in Table 10. The sustainability and confidence in the future codes have the least weight and strength, while the tourism code, positioned at the center of the sensory experience, customer service, promotion and technology, economy, culture and education, and heritage and community codes, exhibits the greatest weight and strength.



Graph 5. Co-occurrence codes graph with AIC

It should be noted that the word-cloud remains unchanged, as it is generated based on the frequency of nouns, verbs, adjectives, adverbs, etc. Since the same interview transcripts were analyzed by intentional AI, the result is identical. Similarly, the concept word-cloud is consistent, as shown in Figure 5. The word “museum” (museo) with 303 citations is in first place, followed by

"people" (gente) with 87 citations and "year" (año) with 67 citations.

Figure 5. Concept word cloud with AI Coding

Scenarios

Masini and Medina (2000) state that "there is no single way to plan scenarios," making their construction a significant challenge. For this research, the key variables identified in the results were considered, utilizing both intentional and unintentional AI, the challenges suggested by Pauget et al. (2021), and the eight metafunctions proposed by Dubuc (2011), as shown in Figure 6. Additionally, trends identified by the American Association of Museums (2012) were integrated. 29, 52, 53, 54

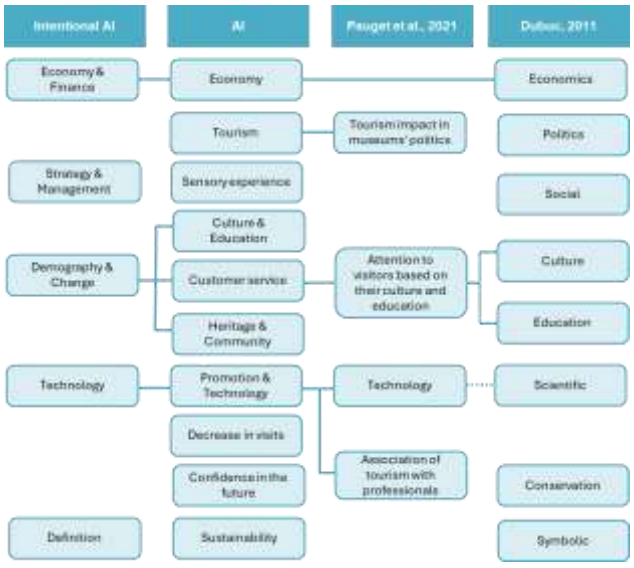


Figure 6. Variables used in scenario design

The four scenarios were constructed based on the prospective assessment scale proposed by Espinal et al. (2020) and Masini et al. (2000), as illustrated in Table 11. 52, 55

Future scenario	Description
Inertial	Continuation of existing trends
Incremental development	Improving the current situation
Recoil	Deterioration of the current situation
Structural change	Maximum degree of transformation

Table 11. Prospective assessment scale

The inertial scenario depicts what will occur if key factors continue their current trajectories. The incremental development scenario suggests reasonable adjustments that may occur in the short or medium term, based on existing competitive conditions. The structural change scenario involves a profound and structured transformation, driven by processes that break existing trends. Finally, the regression scenario considers the deterioration of the current situation due to destabilizing, unexpected, or uncontrolled factors. 55

Inertial scenario

The mission of the museum remains the conservation and dissemination of societies' intangible and tangible heritage, with no significant changes to its institutional definition. Few museums are concerned about the future, trusting that current conditions will persist indefinitely, leading to a low interest in generating change.

In this scenario, public museums continue to rely on government budgets, while private museums generate income through traditional means (donations, visits, souvenirs, etc.). Strategically and managerially, museums continue to operate without significant emphasis on these aspects, focusing on operational efficiency and neglecting strategic initiatives. Museums remain political instruments that generate identity and shape citizens according to certain values and ideologies.

Technological acquisition is minimal due to economic limitations and a lack of interest in integration. Monetary restrictions also limit promotional activities, which rely primarily on word of mouth and, in the best cases, electronic means such as websites or social networks.

Demographic aspects are not considered when stratifying services, treating all visitors equally, except for some vulnerable populations. The sensory experience remains traditional and limited due to scarce or nonexistent technology use. Although the number of visits is constant, it is expected to decrease in the medium to long term.

Tourism, while necessary, does not involve project management or synergies with specialized organizations (e.g., travel agencies and higher education institutions) in the short to medium term. Museums limit themselves to

being transmitters rather than generators of culture, maintaining a static position. Similarly, their role in education is passive, missing opportunities to generate knowledge, including scientific knowledge, or address sustainability issues.

Incremental development scenario

While the mission of museums remains unchanged in the short term, it begins to transform in the medium to long term as they envision an uncertain future. Their concern for future sustainability leads museums to gradually adapt to these changes.

Public museums, anticipating future budget cuts, seek alternative income sources. Private museums explore new revenue streams, such as micro-donations, both physical and digital. There is a growing awareness of the need to professionalize strategic and management aspects to ensure continuity and expansion. While currently political instruments, museums are seen as potential generators of individual self-knowledge and diversity in the medium to long term.

As income increases, so does investment in technology, reflecting a genuine interest in integration. Enhanced technology enables intelligent advertising through various electronic media, including social networks and websites, with specialists enhancing promotion efforts. Museums extend their reach beyond physical walls through open-air exhibitions, mobile museums, and temporary stores. Street art relaxes cultural authority and revives localism. In-person and participatory experiences, small temporary excursions, and flexible innovations are designed and promoted through platforms and social networks, fostering cooperative marketing and IT efforts.

Demographic changes are increasingly important, enabling museums to better meet visitor needs. While initially traditional, sensory experiences become more diverse with technological integration, leading to a gradual increase in visitors over the medium and long term.

To attract more visitors and tourists, museums collaborate on projects with specialized organizations, such as travel agencies and higher education institutions. These exchanges transform museums into cultural managers, assuming an active role. Initially seeking to increase visits, museums eventually become co-participants in scientific research, exploring topics like sustainability.

Recoil scenario

The current disinterest in the future of museums has led to stagnant missions, exacerbating the disconnection between these institutions and the evolving social landscape. Consequently, some museums are compelled to reevaluate and redesign their missions in response to this widening gap.

Public museums, often funded by government budgets, are experiencing a decline in both staffing and financial support for maintenance. As conditions deteriorate, decentralization trends emerge, transferring responsibilities to state and municipal levels, which may result in a shift in direction or even the closure of these institutions. Private museums face similar challenges; decreasing visitor numbers and revenue force them to increase entrance fees, diversify activities, and, in some cases, sell collection items to ensure survival. However, these measures sometimes lead to a complete change in the museum's direction or permanent closure.

The persistent reduction in economic resources hinders investment in technology, marketing, and advertising. This financial strain also precludes collaboration and participation with interested organizations, stifling processes of knowledge generation, creativity, and innovation.

Despite significant demographic shifts, museums continue to offer traditional services, resulting in a steady decline in visitor engagement. Sensory experiences remain conventional, failing to attract and retain audiences.

Without active participation in collaborative projects, museums assume a progressively passive role in cultural management, rendering them increasingly obsolete and prone to eventual disappearance.

Structural change scenario

The mission of museums is constantly evolving. While preserving societal heritage, museums become spaces for coexistence, recreation, and play, allowing exploration of past, present, and future through technological advances. The future becomes more tangible.

In this scenario, museums undergo a profound change in fundraising strategies. Both public and private museums implement various financial strategies, including mobile donations, increased ticket prices, selling collection pieces, temporary retail stores, partnerships with for-profit organizations, and launching their own ventures. Strategic and management aspects are crucial, generating operational effectiveness and sustainable competitive advantages. Museums shift from being political instruments to venues for individual self-modeling, fostering enriching diversity.

Technology plays a fundamental role, with substantial investments enhancing promotion, communication, and experiences through virtual reality and QR codes. Social networks manage crowdsourcing projects.

Demographic considerations are integral, with museums updating service stratification to offer personalized experiences through technological applications, leading to an increase in visitors over the medium and long term.

Tourism is a major income source, with ongoing collaborative projects with specialized organizations. These synergies position museums as knowledge generators, addressing sustainability and playing an active educational role. Museums explore new participation methods, such as online access, physical incorporation into schools, teacher training, and commitment to the educational system, serving students comprehensively.

Conclusions

This exploratory research has provided insights into the current state of Pachuca's museums across various dimensions, including their vision for the future by 2040.

Most museums acknowledge the modifications they have undergone and anticipate the adjustments required in the medium and long term. Nearly all interviewees consider their institutions to remain vital spaces for the conservation and dissemination of both tangible and intangible heritage in an increasingly diverse society.

Public museums, unlike their private counterparts, exhibit less concern over economic and financial aspects due to their allocated budgets. Regarding cultural aspects, the interviewees recognize the significant role museums play. However, this awareness does not always extend to new methods of participation in the educational field.

Strategic and administrative aspects are largely unfamiliar to these institutions, possibly due to a lack of resources or interest. This represents a significant opportunity to establish strategies that could generate sustainable competitive advantages in the medium and long term, positioning museums favorably against other leisure options.

Based on the responses obtained, it appears that few museums are aware of new trends for generating greater economic resources and reaching new and diverse audiences. Additionally, technological integration is of minimal interest, despite its potential to substantially increase revenue through investment.

It is recommended that partnerships with universities and specialized tourism agents be pursued to develop projects that promote the services offered by Pachuca museums and generate cutting-edge scientific knowledge. Therefore, it is imperative to expand and deepen this study.

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