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Identification of indicators to measure the polarization of scientific personnel in public universities in Bolivia

Identificación de indicadores para medir la polarización del personal científico en universidades públicas de Bolivia

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ABSTRACT

This study presents a proposal for indicators to assess the level of polarization among scientific staff at Bolivian public universities, identifying polarization as a significant obstacle to collaboration and knowledge generation. Supported by theories of knowledge management and organizational development, it emphasizes the importance of a favorable environment for innovation and cooperation. The research is based on the development of specific indicators in various dimensions, such as political ideology, interpersonal conflicts, and collaboration within research teams. The methodology includes the development of a survey to collect data and measure these factors. The study concludes that polarization negatively affects collaboration and innovation, suggesting strategies to mitigate these effects and promote a more collaborative and productive work environment.

Keywords:
"Knowledge Management"; "Polarization"; "Higher Education"; "Bolivia"; "Innovation"

RESUMEN

El estudio presenta una propuesta de indicadores para evaluar el nivel de polarización del personal científico en las universidades públicas de Bolivia, identificando la polarización como un obstáculo significativo para la colaboración y la generación de conocimiento. Fundamentado en teorías de gestión del conocimiento y desarrollo organizacional, se subraya la importancia de un ambiente favorable para la innovación y la cooperación. La investigación se basa en la formulación de indicadores específicos en diversas dimensiones como la ideología política, los conflictos interpersonales, y la colaboración en equipos de investigación. La metodología incluye la creación de una encuesta para recopilar datos y medir estos factores. El estudio concluye que la polarización afecta negativamente la colaboración y la innovación, proponiendo estrategias para mitigar estos efectos y promover un ambiente de trabajo más colaborativo y productivo.

Palabras clave:
"Gestión del conocimiento"; "Polarización"; "Educación superior"; "Bolivia"; "Innovación"

INTRODUCTION

Knowledge is vital to the existence of humanity, people, and organizations. Therefore, innovative organizations utilize knowledge management to generate knowledge. Universities, recognized as essential elements in the advancement of knowledge, must implement knowledge management systems to promote an innovation system that, in turn, contributes to the society´s well-being. According to Etzkowitz and Leydesdorff (2000), the university is one of the three fundamental actors in the triple helix model, along with industry and government, which interact to foster innovation and economic development. Knowledge management in universities involves not only the creation and dissemination of new knowledge, but also the practical application of this knowledge in industrial and governmental contexts.

Nonaka and Takeuchi (1995) emphasize the importance of converting tacit knowledge into explicit knowledge and sharing it efficiently, which is crucial for a strong innovation system. This collaboration between academia, industry, and government enables the creation of dynamic learning and development of networks that can address complex problems and generate innovative solutions (Carayannis & Campbell, 2009). Furthermore, the implementation of knowledge management systems in universities should include mechanisms for technology transfer and research commercialization, which can increase industry competitiveness and improve the population´s quality of life. According to Carayannis and Campbell (2012), this holistic and collaborative approach is essential for creating a sustainable innovation ecosystem that benefits society as a whole. Furthermore, these systems require a favorable environment for their successful development. Knowledge management is a complex process that requires an appropriate context to flourish.

Based on Davenport and Prusak (1998), an enabling environment for knowledge management includes an organizational culture that values and promotes knowledge sharing, as well as the existence of technological infrastructures that facilitate the collection, storage, and dissemination of information. However, having the best technology is not enough if individuals within the organization prioritize their personal interests over organizational goals. Nonaka and Takeuchi (1995) emphasize that knowledge is created and shared through social interactions, which underscores the need for a culture of trust and collaboration. When employees feel that their contributions are valued and that their personal development is aligned with the organization's goals, they are more willing to share their knowledge (Kreiner & Schultz , 1993).

An enabling environment must also consider the human dimension of knowledge. Intrinsic motivation and appropriate incentives are essential for employees to contribute to the knowledge management system. For Osterloh and Frey (2000), people are more motivated to share knowledge when they see a convergence between their personal goals and those of the organization. Therefore, it is essential for organizations to develop policies and strategies that align these interests. Furthermore, an enabling environment requires clear policies and strategies that support knowledge management. According to Alavi and Leidner (2001), organizations must establish specific knowledge-related objectives and goals, as well as metrics to evaluate their progress. The implementation of incentives for knowledge creation and sharing is also crucial for the success of these systems. Considering this, the present research focuses on the development of indicators to measure the levels of polarization among research staff at public universities in Bolivia.

For this purpose, the theoretical framework of this research work is solidly based on several investigations by authors such as: Nonaka and Takeuchi with their spiral model of knowledge management in 1995, Peter F. Drucker with his contribution in his book "Knowledge Management", Michael Polanyi - Personal Knowledge , Peter M. Senge - The Fifth Discipline, Henry Mintzberg - Designing Effective Organizations , Adam Smith - The Wealth of Nations, Davenport, Thomas H. Prusak , Laurence - Knowledge in Action: How Organizations Manage What They Know, Joseph Alois Schumpeter – Business Cycles, Edgar Morin , and several others on knowledge management. A

document review was conducted to gather information. The conclusions reached are important because levels of polarization significantly affect knowledge generation. Ultimately, this research delves into a study conducted in a master's program at the Center for Higher University Studies, which identified several elements that must necessarily be interrelated in the complex process of knowledge management. Thus, this work focuses on the third element: the enabling environment.

Within the knowledge management system, it is necessary to have an enabling environment. "Companies must provide an organizational context that allows employees to share and create knowledge. This includes not only the physical infrastructure, but also a culture that fosters open communication and mutual trust." (Nonaka & Takeuchi, 1995, p. 72). Although this statement is within the business world, in their book, Nonaka and Takeuchi present the SECI (Socialization, Externalization, Combination, and Internalization) model as a framework for understanding how knowledge is created and managed within organizations. They emphasize that an enabling organizational environment is essential for employees to feel comfortable sharing their knowledge and experiences, which is a key component for innovation and continuous improvement.

They also emphasize, "The creation and sharing of knowledge do not occur in a vacuum; they require an organizational environment that supports and encourages these activities. An enabling environment is essential for individuals to feel comfortable sharing their knowledge and experiences." (Davenport & Prusak , 1998, p. 34). Deem and Brehony argue that public universities, when adopting knowledge management practices, must create environments that promote collaboration and the exchange of ideas between academics, students, and administrative staff. They point out that: "In the university environment, especially in public institutions, it is vital to create an environment that facilitates interdisciplinary collaboration and the exchange of knowledge. This not only improves the quality of education and research, but also strengthens the institution's capacity to respond to social and economic challenges." (Deem & Brehony, 2005, p. 109) Thus, much research has underlined the need for a favorable environment for the generation of knowledge, an environment in terms of favorable levels of interaction and interrelationships between people in an organization. In the case of universities, they emphasize the need to form interdisciplinary and multidisciplinary groups, in order to have a clearer vision of the complexity that surrounds them.

On the other hand, Henry Mintzberg, in "The Structuring of Organizations" (1979) describes adhocracy as a flexible, decentralized organizational structure, well-suited to innovative and dynamic environments. However, this flexibility can also allow personal or group interests to dominate if not properly managed.

Joseph Schumpeter, in "The Theory of Economic Development" (1911), introduces the concept of creative destruction, where entrepreneurs (in this case, scientists) act as agents of change and progress.

However, when these agents are influenced by political interests:

1. Particular Interests over Collectives: Scientists may focus on projects that promote their own political ideals, rather than those that benefit the organization as a whole.

2. Tensions and Conflicts: Polarization can increase internal tensions and conflicts, hindering the collaboration and organizational cohesion necessary for the advancement of knowledge and innovation.

Ultimately, the polarization of scientific staff by political affinity can lead to personal interests prevailing over organizational interests, as suggested by the theories of Mintzberg and Schumpeter. The adhocracy structure described by Mintzberg can facilitate goal fragmentation in the absence of adequate management, while Schumpeter's entrepreneurial focus can be inclined toward particular rather than collective interests.

The above-mentioned leads to the expression that in recent years increasing polarization has been observed in various social and political contexts; it has had significant repercussions on academic

institutions, including public universities in Bolivia. High levels of polarization can affect collaboration, communication, and the work environment within research centers. Peter Senge, in his work "The Fifth Discipline" (1990), argues that organizations must foster an environment conducive to learning and knowledge generation. Similarly, Davenport and Prusak (1998) in "Knowledge in Action" highlight the importance of creating an organizational environment that facilitates the creation, exchange, and management of knowledge. Furthermore, Ikujiro Nonaka and Hirotaka Takeuchi (1995), in his work "The knowledge-creating organization", emphasizes the need for an organizational environment that supports the creation of knowledge through processes such as socialization, externalization, combination and internalization.

The specific problem addressed in this study is the identification of indicators to measure the level of polarization among researchers in research centers at public universities in Bolivia. This polarization manifests itself in various dimensions, including political ideology, interpersonal conflicts and tensions, collaboration and teamwork, social media behavior, and attitudes and perceptions toward diverse opinions. Measuring these indicators is crucial to understanding the impact of polarization in the academic environment and developing strategies that promote a more collaborative and productive environment.

Polarization can have deep implications for the dynamics of work in research centers, affecting both collaboration and innovation. In an environment where collaboration is essential for the advancement of knowledge, polarization can create barriers that hinder cooperation between researchers, limiting the exchange of ideas and the synergy necessary for the development of innovative projects. Innovation, which often arises from the integration of diverse perspectives, can be compromised in a polarized environment where ideological differences generate tensions and divisions.

Assessing the level of polarization among researchers is important to understanding how ideological and political divisions can influence the productivity and quality of academic research. If researchers are divided along ideological lines, the effectiveness of their collaborations is likely to be reduced, and the generation of new and valuable knowledge will be hampered.

A high level of polarization can negatively affect the work environment, creating an environment less conducive to constructive debate and collaborative problem-solving. Understanding the impact of polarization allows for the design of strategies to foster a more collaborative and productive environment, mitigating its negative effects and promoting a culture of respect and cooperation among researchers. Davenport and Prusak (1998) underscore the importance of a collaborative environment for effective knowledge management and innovation, highlighting that cooperation and mutual respect are fundamental to the success of organizations. Similarly, Nonaka and Takeuchi (1995) emphasize that an environment of respect and collaboration is essential for knowledge creation and innovation. Furthermore, Senge (1990) emphasizes that organizations must become "learning organizations," where systems thinking and collaboration are key to success and innovation.

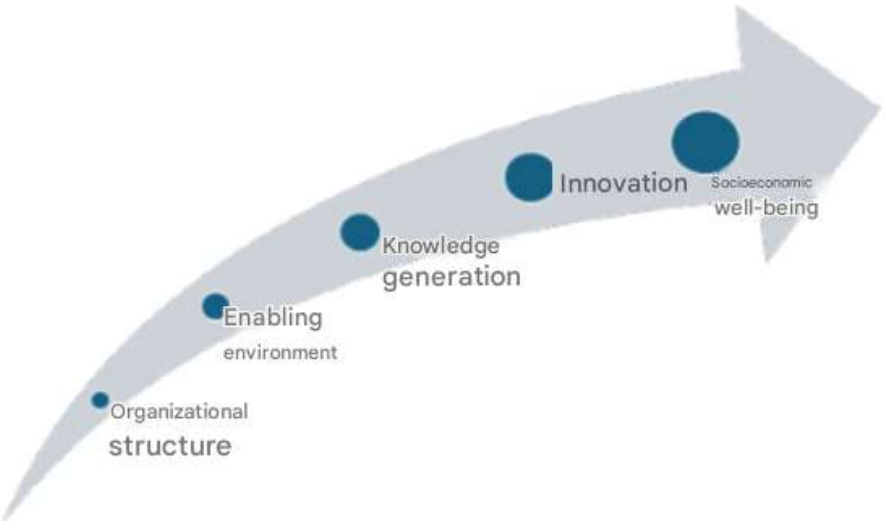
Henry Etzkowitz and Loet Leydesdorff have also made significant contributions to understanding the dynamics of knowledge production and innovation in research settings. Etzkowitz's work on the "Triple Helix" model (Etzkowitz , 2008) underlines the importance of interactions between universities, industry, and government in fostering innovation. According to Etzkowitz, a collaborative environment where different sectors work together is decisive for generating new knowledge and promoting innovation. The model emphasizes the need for flexible and open communication channels between these sectors, highlighting that polarization within any one of these sectors can disrupt the overall innovation ecosystem.

Leydesdorff's research on "Mode 2" knowledge production (Gibbons, Limoges, Nowotny, Schwartzman, Scott, & Trow, 1994), which he co-authored, describes a shift towards a more socially distributed, application-oriented, and transdisciplinary mode of knowledge production. This mode of knowledge production relies heavily

on the integration of diverse perspectives and the ability to work across disciplinary and institutional boundaries. Leydesdorff (2001) argues that polarization can hinder this integrative process, as it can lead to fragmentation and compartmentalized thinking, which is detrimental to innovation. Ultimately, assessing the level of polarization among scientific staff is critical to understanding how ideological divisions can influence the productivity and quality of scientific research.

From the works of Davenport and Prusak, Nonaka and Takeuchi, Senge, Etzkowitz, and Leydesdorff, it is clear that fostering a collaborative and respectful environment is essential for effective knowledge and innovation management. By addressing polarization, research institutions can create a more conducive environment for collaboration, ultimately improving their ability to conduct high-quality, innovative research.

Figure 1. Importance of a favorable environment in the generation of knowledge in organizations



Note: This figure reflects the need for an enabling environment for knowledge generation.

Theoretical references

The theoretical basis of this research focuses on the variable Polarization Level, which is directly related to the favorable environment necessary for knowledge generation.

Knowledge generation is the goal of knowledge management, which in turn configures a knowledge management system for innovation.

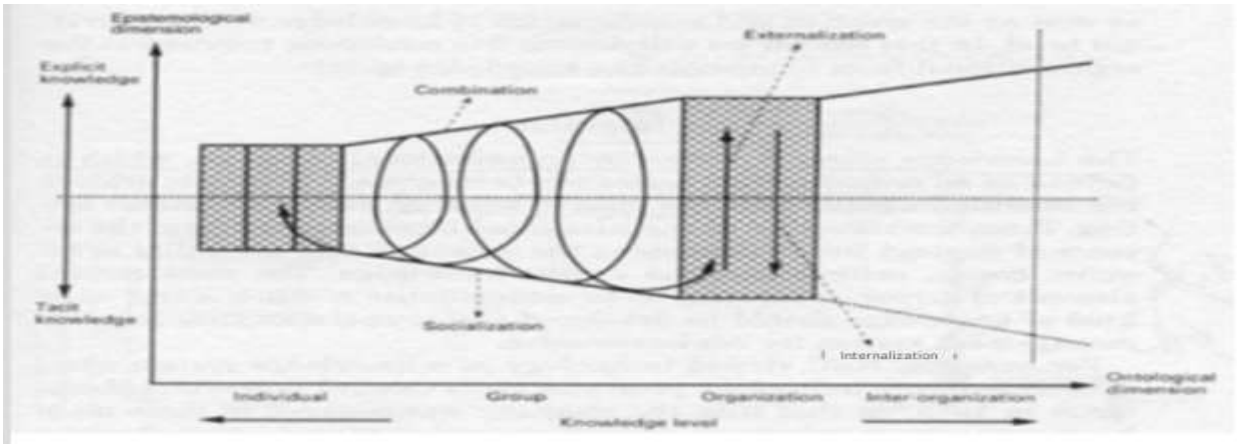
Knowledge management

It is a complex, multidisciplinary, and infinite activity. Knowledge management is a hybrid discipline that includes and integrates elements from areas of study (research and techniques related to organizational development and culture, change management, communication strategies, and human resources), information science, library science, information technology, and learning. Their joint application results in benefits such as improved performance and competitiveness, as well as the promotion of innovation and integration within the organization (ECLAC, 2024).

For Rodríguez, knowledge management consists of a set of systematic processes (identification and acquisition of intellectual capital; processing, development, and sharing of knowledge; and its utilization) aimed at organizational and/or personal development and, consequently, the generation of a competitive advantage for the organization and/or the individual (Rodríguez, 2006).

Generation of organizational knowledge, these are (Nonaka & Takeuchi, 1995). This generation of organizational knowledge was defined as "... the capacity of a company as a whole to create new knowledge, as well as disseminate it throughout the organization and establish it in products, services and systems" (p. 3).

Figure 2. *Importance of a favorable environment in the generation of knowledge in organizations*



Note. *Taken from Nonaka & Takeuchi "The Knowledge creating company", 1995.*

Definition of the Variable: Level of Polarization of Researchers

Concept of Polarization

Polarization refers to the growing division and extermination of the opinions, beliefs, or attitudes of individuals or groups within a society. In a political context, polarization implies that people's opinions are concentrated at the extremes of the ideological spectrum, reducing the space for moderate positions and compromise.

Polarization is a widely studied concept in the social, administrative, and political sciences. Below is a definition based on recognized scientific research.

Table 1. Definitions of polarization

Definition	Author	Work	Year
The increasing ideological distance between political parties and their followers, resulting in greater homogeneity within parties and greater heterogeneity between them.	James E. Campbell	"Polarized: Making Sense of a Divided America"	2016
When people find themselves in discussion groups composed of like-minded individuals, they tend to adopt more extreme positions in the direction of their initial inclinations, leading to greater polarization.	Cass R. Sunstein	"Going to Extremes: How Minds Unite and Divide"	2009
Polarization within organizations can lead to segmentation in communication and the development of 'information bubbles' where only existing beliefs are shared and reinforced, making effective knowledge creation and management difficult.	Doris A. Graber	"Processing Politics: Learning from Television in the Internet Age"	2001
Polarization can hinder knowledge management by creating information silos within organizations. These silos limit the flow of knowledge and hinder interdisciplinary collaboration, crucial for innovation and informed decision-making.	Michael E. D. Koenig and T. Kanti Srikantaiah (editors)	"Knowledge Management Lessons Learned: What Works and What Doesn't"	2004

Source: Prepared by the authors

In academic research centers, polarization can manifest itself in several ways:

Table 2. *Polarization in the Academic Field*

Type of Polarization	Definition	Author	Work	Year
Ideological Polarization	Marked differences in the political and social beliefs of researchers.	John H. Evans	"Morals Not Knowledge: Recasting the Contemporary U.S. Conflict Between Religion and Science"	2018
Polarization of Opinions	Significant divergences in opinions about academic policies, university administration, and research approaches.	Neil Gross and Solon Simmons (editors)	"Professors and Their Politics"	2014
Polarization in Collaboration	Decrease in interdisciplinary collaboration and joint projects due to ideological differences.	Cass R. Sunstein	"Going to Extremes: How Like Minds Unite and Divide"	2009

Source: Prepared by the authors

1. Ideological Polarization: Marked differences in the political and social beliefs of researchers.

2. Polarization of Opinions: Significant divergences in opinions on academic policies, university administration, and research approaches.

3. Polarization in Collaboration: Decrease in interdisciplinary collaboration and joint projects due to ideological differences.

Level of Polarization

The level of research polarization can be defined as the degree to which researchers at research centers display attitudes, behaviors, and perceptions that reflect ideological and opinion divisions. This level is assessed based on several dimensions, such as political ideology, interpersonal conflicts and tensions, collaboration and teamwork, social media behavior, and attitudes and perceptions toward diverse opinions.

It would be very interesting for the university to address current issues such as pollution and violence from different areas of knowledge, which would allow research to be committed to solving these problems.

Dimensions of the Variable

1. Political Ideology:

- Degree of identification with specific political ideologies.
- Participation in political activities.
- Opinion on relevant political issues.

2. Conflicts and Tensions:

- Frequency of interpersonal conflicts due to political differences.
- Perception of tensions in the workplace related to politics.

3. Collaboration and Teamwork:

- Level of collaboration with colleagues of different political ideologies.
- Projects carried out in collaboration with researchers of different ideologies.

4. Behavior on Social Networks:

- Frequency of expression of political opinions on social networks.
- Reaction to colleagues' political opinions on social media.

5. Attitudes and Perceptions:

- Perception of ideological diversity within the research center.
- Attitude towards diversity of opinions in the workplace.

METHOD

This study adopts a document review methodology to propose indicators that assess the polarization of scientific personnel at public universities in Bolivia. The document review allows for the collection and analysis of relevant information from secondary sources, including academic documents, institutional reports, and specialized literature on knowledge management and organizational dynamics.

Research Type: The research is framed within an exploratory approach, seeking to identify and

structure indicators that can measure polarization in the Bolivian academic field.

Methodological Design: A systematic documentary review design is used to select and critically analyze the existing literature on polarization in university contexts.

Population and Sample: The target population includes researchers and academic staff from public universities in Bolivia. The sample includes relevant documents that address issues of polarization, knowledge management, and organizational dynamics within the Bolivian university environment.

Techniques and Instruments: Content analysis techniques are used to categorize and evaluate the collected information. Primary data collection instruments are not used, given the documentary review approach.

Methodological Justification: The documentary review was selected for its ability to comprehensively explore the current state of knowledge on polarization in Bolivian public universities, providing a solid theoretical basis for the development of indicators.

This methodology provides a rigorous framework for structuring the proposed indicators and contributes to understanding the effects of polarization in the academic environment, thus laying the groundwork for future research and university management strategies.

RESULTS

The results of this research reveal indicators proposed for assessing the polarization of scientific personnel at public universities in Bolivia. Based on the systematic document review, several key factors contributing to polarization in the academic environment were identified:

Polarization Dimensions: Indicators were structured in various dimensions, including political ideology, interpersonal conflicts, and collaboration in research teams.

Impact on Collaboration and Innovation: It was evident that polarization can act as a barrier to interdisciplinary collaboration and innovation generation, negatively affecting academic dynamics.

Need for an Enabling Environment: The importance of creating an organizational environment that fosters cooperation and respects diversity of opinions, thus mitigating the adverse effects of polarization, was highlighted.

Strategic Recommendations: Strategies for university management were formulated, such as promoting open communication, establishing policies for interdisciplinary collaboration, and creating spaces for constructive debate.

These results provide a solid foundation for future research and the implementation of policies that promote a more collaborative and productive academic environment in Bolivia's public universities.

DISCUSSION

This research on the polarization of scientific personnel at Bolivian public universities offers significant insights that warrant in-depth discussion. The key points derived from the results and their relevance within the theoretical and practical context are discussed below:

1. Dimensions of Polarization and Collaboration: The proposed indicators highlight the complexity of ideological and political polarization in the academic environment. These factors not only affect collaboration among researchers but also influence universities' ability to foster a collaborative and productive environment.

2. Implications for University Management: Recommended strategies, such as promoting open communication and creating spaces for constructive debate, are essential to mitigating the negative effects of polarization. These actions can not only improve organizational dynamics but also strengthen institutions' capacity to generate innovative and multidisciplinary knowledge.

3. Connections to Existing Literature: The discussion is enriched by connecting the findings with theories of knowledge management and organizational development. The importance of a robust theoretical framework is highlighted to better understand how polarization impacts university dynamics and how effective interventions can be designed.

4. Limitations and Areas for Future Research: It is crucial to acknowledge the study's

limitations, such as its reliance on desk reviews and the potential lack of direct empirical data. We suggest further exploring how polarization affects different areas of knowledge and evaluating the effectiveness of the proposed indicators in diverse contexts.

In summary, this discussion broadens the understanding of the results by placing them within a strong theoretical framework and highlighting their importance for university management and the promotion of a collaborative and innovative academic environment in Bolivia.

CONCLUSIONS

Assessing the level of polarization among researchers at Bolivian public universities is essential to understanding its effects on the productivity and quality of academic research. High ideological and political polarization can seriously hamper collaboration, innovation, and the work environment. This underscores the urgent need to promote a university environment that fosters cooperation and respects diverse opinions.

Polarization can also limit the interdisciplinary collaboration central to addressing complex problems, negatively impacting the ability to develop innovative and multifaceted projects. It is imperative that universities implement policies that foster open communication, mutual trust, and interdisciplinary collaboration to counteract these adverse effects.

This research provides a solid foundation for future studies that could apply and evaluate the proposed indicators in different contexts. It is recommended to further explore how polarization affects various areas of knowledge and design more effective interventions for knowledge management in university settings.

These conclusions not only summarize the key findings but also highlight the importance of addressing polarization as a significant challenge for improving research and academic dynamics at Bolivian public universities.

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