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Presentation of Content

In the first article we present, *New value determinants to expand the scope of traditional patent valuation methodologies*, by ALONSO-CALPEÑO, Mariela Juana, PÉREZ-JIMÉNEZ, Carlos and CELIS-FLORES, Miguel Ángel, with ascription in the Instituto Tecnológico Superior de Atlixco and the Universidad Popular Autónoma del Estado de Puebla, as next article we present, *Variables determining the growth of micro and small businesses*, by LANDAZURI-AGUILERA, Yara, with ascription in the Instituto Tecnológico de Sonora, as next article we present, *Impact factors in sustainable economic development*, by ACOSTA-MELLADO, Erika Ivett, LANZADURI-AGUILERA, Yara and MURILLO-FÉLIX, Cecilia Aurora, with ascription in the Instituto Tecnológico de Sonora, as next article we present, *Challenges of the environmental management of Mining in Mexico*, by RIVERA-ACOSTA, Patricia & MARTINEZ-TORRES, Rosa Elia, with ascription in the Instituto Tecnológico de San Luis Potosí.

Content

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New value determinants to expand the scope of traditional patent valuation methodologies

Nuevos determinantes de valor para ampliar el alcance de las metodologías tradicionales de valuación de patentes

ALONSO-CALPEÑO, Mariela Juana†*, PÉREZ-JIMÉNEZ, Carlos and CELIS-FLORES, Miguel Ángel

Instituto Tecnológico Superior de Atlixco
Universidad Popular Autónoma del Estado de Puebla

ID 1st Author: *Mariela Juana, Alonso-Calpeño* / **ORC ID:** 0000-0001-7276-1923.

ID 1st Coauthor: *Carlos, Pérez-Jiménez* / **ORC ID**: 0000-0002-8584-9569, **CVU CONACYT ID**: 87058

ID 2nd coauthor: *Miguel Ángel, Celis-Flores* / **ORC ID:** 0000-0002-2209-7849, **CVU CONACYT ID:** 26288

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Abstract

The aim of this investigation is to identify determinants of value considered in the proposals which have emerged during 2013-2018 regarding patents valuation, and to stablish if these elements appeared as proposals to eliminate the limitations that the classic valuation methods could present. The methodology used includes a review in the Web of Science and EBSCOhost databases using keywords; first, to identify whether there were authors who mentioned limitations in classical quantitative valuation methods, such as cost, market and income; later, to recognize if they addressed any of these limitations through new indicators. The results show that the new approaches do possitively address the limitations detected in the so-called classic valuation methodologies; we found 42 indicators for valuing intellectual property, 11 of which are the most mentioned in new proposals. These results contribute to the patent valuation process, by expanding the range of indicators used to determine their value.

Valuation methods, Valuation of patents, Valuation indicators

Abstract

El objetivo de esta investigación es identificar los determinantes de valor que se consideran en las propuestas que han surgido durante el periodo 2013 a 2018 respecto a la valuación de patentes, y establecer si estos surgieron como propuestas para eliminar las limitantes que pudieran presentar los métodos clásicos de valuación. La metodología utilizada, incluye una revisión en las bases de datos de Web of Science y EBSCOhost utilizando palabras clave; primero, para identificar si había autores que mencionaban deficiencias en los métodos de valuación cuantitativos clásicos, como los de costo, mercado e ingreso; después, para reconocer si abordaban alguna de esas limitantes a través de nuevos indicadores o elementos. Los resultados muestran que los nuevos planteamientos sí abordan las limitantes detectadas en las denominadas metodologías clásicas de valuación, se encontró un total de 42 indicadores para valuar propiedad intelectual, de los cuales 11 son los que más se mencionan en las nuevas propuestas. Estos resultados contribuyen al proceso de valuación de patentes, al ampliar el abanico de indicadores utilizados para determinar su valor.

Métodos de valuación, Valuación de patentes, Indicadores para valuación

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*Correspondence to Author (email: mariela.alonso@itsatlixco.edu.mx)
†Researcher contributing first author.

Introduction

With the emergence of the knowledge-based economy, the main value-generating activities in organizations are in the field of intangible assets (Pärs and Sander, 2015). An intangible asset is an asset without physical substance which is expected to offer economic benefits in the future (Lagrost, Martin, and Dubois, 2010; Pareja Vasseur and Cadavid Pérez, 2016; Pärs and Sander, 2015). These economic benefits may be present in income on the sale of products or services, cost savings or increased productivity (Astudillo M., Marcela; Mancilla R., 2014).

Within the concept of intangible assets, intellectual property (IP) is a priority, with commercial profit and competitive advantage. The IP has 2 classifications: copyright and industrial property, the latter includes patents, trademarks, industrial designs, utility models and geographical indications (Pareja Vasseur and Cadavid Pérez, 2016).

Patents are exclusive rights granted to an invention, which can be products or processes that provide new ways of doing something or offer a new technical solution to a problem. Patents apply to inventions and deal with how things are made, what they are made of, what they do and how they do it (Saaranto, 2016). The relevance of patents in organizations is that they are indicators of productivity and creativity. Therefore, they are considered a source of added value (Pareja Vasseur and Cadavid Pérez, 2016), since they are used as a substitute for the invention in which their value is recognized (Smith and Cordina, 2015).

Thus, it is important that its economic value be determined (Grimaldi, Cricelli, and Rogo, 2017). The concept of the value of patents refers to the ability to support the process of value creation of the company and its strategic business objectives (Grimaldi et al., 2017), so they are considered elements that must be managed with precision and included in the general corporate and commercial strategy (Soranzo, Nosella, and Filippini, 2017). The importance of patent valuation has grown rapidly, since technological transactions are increasing with the objective of transferring and commercializing the Research and Development (R&D) results generated both in the productive sector and in the academic sector (Kim, Kim, and Kim, 2015).

Through the transfer, IP rights are formally transmitted to third parties, and therefore, valuation is preponderant (Pérez-hernández and Calderón-martínez, 2014), since by assigning an economic and market value, the economic benefit to be obtained can be calculated through the various legal figures through which it can be transferred (Kjellberg & Mallard, 2013).

The existing literature is relatively rich in different valuation methods and in discussion that relates to various components of its value. Quantitative and qualitative approaches are mentioned (Saaranto, 2016; Soranzo et al., 2017). Within the quantitative three basic approaches are: cost based, market based, and income based (Lagrost et al., 2010; Wirtz, 2012). Also, methods have been developed from them (Allenby, Brazell, Howell, and Rossi, 2014; Collan, Fedrizzi, and Luukka, 2013; Collan and Heikkilä, 2011; Jun, Park, and Jang, 2015; Kim et al., 2015; Kopczewska and Kopyt, 2014; Thoma, 2013).

But there is no unified and/or shared approach to IP valuation (Odasso, Prati, & Scellato, 2014; Saaranto, 2016). There are only methods and approaches that are more or less suitable for certain types of IP (Lagrost et al., 2010; Saaranto, 2016). As a result, we present the following questions: why, if the range of patent valuation methodologies is so wide, are new approaches emerging to carry out this process? Are there limitations to the application of the classical valuation methods that drive this emergence? What are these limitations? Are the new approaches based on classical methods and only rethink using new elements or indicators to set the value of a patent? What are these elements and indicators on which the determination of the value of a patent is based?

Based on these questions, this paper aims to identify the determinants of value which are considered in the proposals arisen during the period 2013 to 2018 regarding patent valuation and establish whether these emerged as proposals to eliminate the limitations that classic valuation methods could present.

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For this, a review of the literature was carried out in the Web of Science and EBSCOhost databases using keywords; first, to identify whether there were authors who mentioned deficiencies in classical quantitative valuation methods, such as those of cost, market and income; then, to recognize if they addressed any of these deficiencies through new indicators or elements.

The content of the document is divided into four sections: the first deals with the context of the valuation and the approaches associated with it. The following addresses the research methodology used. In the third, the analysis of the results obtained, and finally the conclusions derived from this investigation.

Patent valuation: Importance and implications

Knowing how much an asset is worth and what determines that value is a prerequisite for making intelligent decisions regarding economic or strategic transactions (Mazzariol and Thomas, 2016). This implies performing a functional analysis that should identify all the factors that contribute to value creation (Casarrubio, 2017). The valuation of patents is important in two ways: one prior to obtaining the patent (Soranzo et al., 2017), since it is desirable to understand the commercial value of the technology and the dynamics of the prospective market before drafting the claims of the patent, because its value depends on the scope of its claims, (Weckowska, 2015); and another, regarding its commercialization (Soranzo et al., 2017), that is, if it is feasible to be commercialized and if it has interest for the market (Allenby et al., 2014).

For the valuation of patents it is necessary to consider, among others, aspects such as the purpose of the valuation, the moment, the competition, the method to be used (Sung, Jun, Kim, and Park, 2017), factors and risks that affect the value of the patent from the economic, legal and technical context (Svačina, 2015). Also, that the price of the license is treated as the value of a patent and, at the same time, as a reward for the depreciation of this asset (Kopczewska & Kopyt, 2014); this makes it a process in which the identification of its drivers continue to represent key challenges (Kim et al., 2015; Lee et al., 2016; Odasso et al., 2014; Svačina, 2015).

Valuation Approaches

From the theoretical point of view, the most precise methods to value intangible assets, such as patents, can be divided into two: qualitative and quantitative.

Qualitative methods can be used to assist in the decision-making process regarding the company's IP strategy, or to understand the position of the IP asset portfolio in line with the competitive landscape (Lagrost et al., 2010). They are achieved using assessments based on ratings or value indicators. On the other hand, quantitative methods can be used to give monetary value to assets. As monetary evaluation is often the objective, quantitative methods are more widespread (Pärs and Sander, 2015).

Quantitative Valuation Methods

Three classical methods of quantitative valuation are predominantly used: the cost-based, market-based and income-based methods (Wirtz, 2012), although the option-based approach is also used to a lesser extent (Pärs and Sander , 2015). The cost method is based on the principle that there is a link between the costs incurred during the development of an intellectual property asset and the final value of this asset, as well as the economic principles of replacement and price equilibrium.

They include two techniques: history-based and future-based (Lagrost et al., 2010; Pärs and Sander, 2015; Saaranto, 2016; Wirtz, 2012). Among the most used types of costs are those of reproduction cost, replacement or replacement method, prevention costs and trends in historical costs. The method can be applied to value the intangible asset when it is at an initial level of development and therefore its market is not very clear; the level of uncertainty is high and knowledge of future business is very limited (González, 2011). In the case of the market-based approach, the value of intangibles is evaluated based on transactions with similar assets. This method can only be used if there are enough transactions with the similar asset in the recent past between unrelated parties, and the price information of these exchanges is available to the public. However, these conditions are generally not met (Pärs and Sander, 2015).

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The income-based method attempts to calculate the present value of the flow of projected future revenues that arise from the object of IP during its expected economic life (Lagrost et al., 2010). It is suitable for investors, since they prefer to know how much intellectual property will generate in the future, how large is the risk involved in the investment and how soon the cash flows will pay for the investment (Saaranto, 2016).

Qualitative valuation methods

Qualitative valuation can be used to highlight the strategic relevance of a patent based on several considerations, such as information on the current and potential business environment, the legal strength of a patent, the relative importance in its technological field and, finally, the effectiveness of its exploitation strategy (Soranzo et al., 2017). The qualitative approach evaluates intellectual property assets using indicators that are important in the strategy or management of the company (Saaranto, 2016). One of the main criticisms often made regarding the qualitative method is its subjectivity (Lagrost et al., 2010).

It should be noted that even when a quantitative assessment is performed, the results of the qualitative assessment of a technology are referenced anyway. For example, when it comes to fundamental technology and improvement technology, differences should always be observed in the results of their quantitative assessment (Ishii, 2016).

Methodology

Because this research seeks to contribute to the patent valuation process, by broadening the range of indicators used to determine its value, we should first determine if restrictions were identified in the literature that limited the application of cost-based methods, markets, and income; and second, if they make a proposal to address them, and identify new determinants they propose to achieve it.

For this purpose, the literature review focused on the Web of Science and EBSCOhost databases, in order to retrieve scientific articles with diverse approaches and contexts, using keywords (Table 1).

To identify whether the literature mentioned limitations on the scope of application of classical quantitative valuation methods, scientific articles were considered as of 2010. To recognize whether they addressed any of these limitations through a proposal, and by what new determinants posed to do so, publications were analyzed in the period between 2013 and 2018.

Database	Subject	Key words
Web of Science & EBSCOhost	Valuation methods	Valuation methods; Valuation methods AND patents Valuation methods AND portfolio patent; valuation methods AND technology
	Intangible assets	Intangible assets AND valuation; Intangible assets AND patent; valuation AND methods AND intangible assets
	Patents	Patents AND valuation; Patents AND portfolio AND (valuation OR value); methods AND (valuation OR value) AND patents

Table 1 Search strategy

For the discrimination of publications, the abstracts, the mentioned problem and the objective were analyzed. A second filter consisted in recognizing if they identified limitations on the scope of the classical methods, if they proposed something to solve it, and subsequently, what method they implemented to solve it.

Results

In the initial search, 86 articles were retrieved. In the first phase of the analysis that consisted of recognizing the limits of scope in the classical quantitative methods of valuation, of those 86, 23 were used. For the second phase of the study, which consisted of reviewing the proposals of new methods to value patents and establish whether they focused on resolving any of the limitations previously identified, and how they proposed to achieve it, 13 articles were obtained.

Analysis of results

In the first phase of the analysis, we obtained the results shown in Table 2.

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Methods with quantitative approach			
	Cost-based	**Market-based**	**Income-based**
Value determinants	-Play Costs - Replacement costs -Physical appreciation -Functional obsolescence	-Offer and demand of the active market -Similar and comparable transactions -A multiplier to transfer important prices	-Future cash flow. -Duration of cash flow -Appropriate discount rate, which considers the risk involved with the cash flow
Reach limitations	-It may be difficult to estimate indirect costs -It is complicated if the expenses do not appear separately in the financial statements -It is not related to any market value -Does not evaluate future benefits arising from the asset (does not confirm that it will acquire value).	-It cannot be applied in cases of unique assets. -There is limited information about transactions and trade secrets. -It is a challenge to find similar IP assets. -To ensure that market transactions are comparable, sufficient information is needed on the prices, scope and terms and conditions related to the exchange or sale of the IP asset.	-It may be difficult to project a reasonable future cash flow. -It is difficult to predict the probability of success or evaluate the risk, since there is no standard value for these technologies. -It is not easy to guarantee the objectivity of the valuation results.

Table 2 Determinants of value and limitations of the classical methods of patent valuation that use the quantitative approach
Source: Prepared by the authors from (Drivas & Panagopoulos, 2016; Grimaldi et al., 2017; Hernández-García, Güemes-Castorena, & Ponce-Jaramillo, 2018; Ishii, 2016; Kim et al., 2015; Kopczewska & Kopyt, 2014; Lagrost et al., 2010; Lawryshyn, Collan, Luukka, & Fedrizzi, 2017; Pärs & Sander, 2015; Saaranto, 2016; Wirtz, 2012)

The results of this analysis agree with what authors such as Kjellberg & Mallard, (2013) mention about the need for more multidimensional, dynamic and understandable methods and metrics to capture their characteristics.

Based on this information, a classification was implemented of the limitations addressed by the different authors, with respect to the three classical valuation methods mentioned above in Table 1. The information is shown in Table 3.

Aspects not included in the scope of the cost-based method		
Authors	It is not related to any market value	It does not evaluate future benefits arising from the asset (it does not confirm that it will acquire value).
(Angelis, Ford, & Dillard, 2014)	X	
(Chang & Fan, 2017)		X

Table 3 Authors who have addressed some of the aspects not considered in the cost-based valuation methods

Table 4 shows the limitations indicated in the quantitative method based on the market, which are being addressed in new proposals for valuation methods.

Finally, Table 5 shows those that refer to quantitative methods based on income. In them, it can be noted that although not all the limitations of each quantitative method have been covered, they have begun to be resolved in order to broaden their scope.

Likewise, it can be observed that Angelis et al., (2014) has addressed limitations indicated in the three classic methods (cost-based, market-based and income-based). Also, 7 of the 12 authors have focused on the gaps left by income-based methods, with greater emphasis on projecting a reasonable future cash flow. It is also observed that the least tackled method is cost-based.

Aspects not included in the scope of the market-based method				
Authors	It cannot be applied in cases of single assets	There is limited information about transactions and trade secrets	It is a challenge to find similar IP assets	To ensure that market transactions are comparable, sufficient information is needed on the prices, scope and terms and conditions related to the exchange or sale of the IP asset.
(Angelis et al., 2014)	X			
(Kopczewska & Kopyt, 2014)			X	
(Svačina, 2015)				X
(Sung, Jun, Kim, & Park, 2017)		X	X	X

Table 4 Authors who have addressed some of the aspects not considered in market-based valuation methods

Subsequently, we prepared a classification of the value determinants that the authors add to their proposals to determine the economic value of the patents. 42 value determinants were identified and also a convergence of the different authors towards 12 main ones. These are shown in Table 6.

Aspects not included in the scope of the income-based method			
Authors	It can be difficult to project a reasonable future cash flow	It is difficult to predict the probability of success or assess the risk, since there is no standard value for these technologies	It is not easy to guarantee the objectivity of the valuation results.
(Angelis et al., 2014)		X	
(Jun, Park, & Jang, 2015)	X		X
(Kim, Kim, & Kim, 2015)		X	
(Russell, 2016)		X	
(Grimaldi, Cricelli, & Rogo, 2017)	X		
(Lawryshyn, Collan, Luukka, & Fedrizzi, 2017)	X		
(Hernández-García, Güemes-Castorena, & Ponce-Jaramillo, 2018)	X		

Table 5 Authors who have addressed some of the aspects not considered in income-based valuation methods

	Indicator	Total
1	Expiry time	6
2	Citations	5
3	International Patent Classification Code / IPC)	5
4	Claims	5
5	R&D cost	5
6	Territory (market size)	4
7	Compound annual growth rate of the market	3
8	Technological area	2
9	Patent number in the portfolio	2
10	Portfolio Size	2
11	Technology cycle time	2
12	Marketing time	2

Table 6 Convergence of authors towards the mention of value determinants
Source: Prepared by the authors from (Angelis, Ford, & Dillard, 2014, Kopczewska & Kopyt, 2014, Odasso et al., 2014, Jun et al., 2015, Kim et al., 2015, Svačina, 2015, Thoma, 2015, Yoo, Kim, & Jeong, 2015, Lee et al., 2016, Russell, 2016, Chang & Fan, 2017, Grimaldi et al., 2017, Sung et al., 2017).

As it can be seen, of 12 authors, 6 position as the most important determinant the expiry time, since they represent 46% of the mentions. It can also be observed that these indicators are related to qualitative methods, specifically in the approach of value indicators, such as number of references to previous patents generated during the search process, number of citations, number and quality of claims, the size of the family of patents (Lagrost, Martin, & Dubois, 2010), applicants, inventors, international patent classification code (IPC), geographical extension of the patent, and abstracts of inventions (Grimaldi et al., 2017), among others.

All this allows us to infer that the methods that are being generated include a mixed approach. And, although according to Ishii (2016), by linking the results of the qualitative assessment with those of the quantitative assessment a new challenge difficult to address regarding how qualitative properties can be quantified will arise, these proposals are solving it from that perspective.

Conclusions

According to the objective set out in this investigation, which was to identify the value determinants considered in the proposals during the period 2013 to 2018 regarding the valuation of patents, it has been shown that 12 indicators were considered -expiry time , citations, IPC, claims, R&D costs, market size, compound annual growth rate of market, technological area, patent number in the portfolio, portfolio size, technological cycle time, and marketing time- to determine the patent value, and that this provides flexibility to that process.

It can be asserted that the proposed methods have emerged as a response to eliminate the limitations that the classical valuation methods might present. Likewise, it is evident that they continue to develop in order to resolve the absence of a shared approach to determine their economic value.

Thus, it can be deduced that there has been a breakthrough in the subject, but also that the orientation of value determination is migrating towards a mixed approach.

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It is inferred that the research work on the subject will continue to be approached from different perspectives and contexts, in order to find the economic value of the patents and obtain the maximum benefit when going to market. This review has not been exhaustive, since only articles available in the aforementioned data sources were consulted, and we only contemplated a period of five years.

References

Allenby, G. M., Brazell, J., Howell, J. R., & Rossi, P. E. (2014). Valuation of Patented Product Features. *The Journal of Law and Economics*, *57*(3), 629–663. https://doi.org/10.1086/677071

Angelis, D. I., Ford, D. N., & Dillard, J. T. (2014). Valuation of Real Options as Competitive Prototyping in System Development. *Defense AR Journal*, *21*(3), 668–692. Retrieved from https://calhoun.nps.edu/bitstream/handle/10945/45407/ARJ-70_Angelis.pdf?sequence=1

Astudillo M., Marcela ; Mancilla R., M. E. (2014). La valuación de los bienes intangibles en México. *Actualidad Contable FACES Año 17*, *9*(33), 45–60. Retrieved from http://www.redalyc.org:9081/articulo.oa?id=25731098002

Casarrubio, B. P. (2017). *Tratamiento de los activos intangibles*. Retrieved from https://repositori.upf.edu/bitstream/handle/10230/33175/BorjaPascualTFG.pdf?sequence=1&isAllowed=y

Chang, S.-H., & Fan, C.-Y. (2017). A new model for measuring the impact of patent value growth trajectory. *International Journal of Technology, Policy and Management*, *17*(1), 40–57. https://doi.org/10.1504/IJTPM.2017.083742

Collan, M., Fedrizzi, M., & Luukka, P. (2013). Expert Systems with Applications A multi-expert system for ranking patents : An approach based on fuzzy pay-off distributions and a TOPSIS – AHP framework, *40*, 4749–4751.

Collan, M., & Heikkilä, M. (2011). Enhancing patent valuation with the pay-off method. *Journal of Intellectual Property Rights*, *16*(5), 377–384.

Drivas, K., & Panagopoulos, A. (2016). Using the patent term changes in assessing the evolution of patent valuation from filing to maturity. *European Journal of Innovation Management*, *19*(4), https://doi.org/10.1108/EJIM-04-2015-0027

González, P. (2011). Una Aproximación a Un Modelo De Decisión Para Valorar Activos Intangibles Basados En Tecnología: Caso Estudio Compañía De Software Colombia S.a. *Revista Universo Contábil*, *7*(1), 106–121. https://doi.org/10.4270/ruc.2011107

Grimaldi, M., Cricelli, L., & Rogo, F. (2017). *Valuating and analyzing the patent portfolio: the patent portfolio value index*. *European Journal of Innovation Management*. https://doi.org/10.1108/EJIM-02-2017-0009

Hernández-García, R. D., Güemes-Castorena, D., & Ponce-Jaramillo, I. E. (2018). A real option based model for the valuation of patent protected technological innovation projects. *World Patent Information*, *53*(March), 24–38. https://doi.org/10.1016/j.wpi.2018.05.002

Ishii, Y. (2016). *Valuation of intellectual property*. Tokyo. https://doi.org/10.1108/14691930510611094

Jun, S., Park, S., & Jang, D. (2015). A Technology Valuation Model Using Quantitative Patent Analysis: A Case Study of Technology Transfer in Big Data Marketing. *Emerging Markets Finance and Trade*, *51*(5), 963–974. https://doi.org/10.1080/1540496X.2015.1061387

Kim, J., Kim, J., & Kim, S.-K. (2015). A Patent Valuation Method Using Game Theoretic Real Option Approach. *Journal of the Korean Operations Research and Management Science Society*, *40*(2), 43–61.

Kjellberg, H., & Mallard, A. (2013). Valuation Studies? Our Collective Two Cents. *Valuation Studies*, *1*(1), 11–30. https://doi.org/10.3384/vs.2001-5992.131111

Kopczewska, K., & Kopyt, M. (2014). Non-linear corrections in market method of patent valuation. *Business and Economic Horizons*, *10*(3), 177–190. https://doi.org/10.15208/beh.2014.15

ISSN 2410-342X

Lagrost, C., Martin, D., & Dubois, C. (2010). Intellectual property valuation: how to approach the selection of an appropriate valuation method. *Journal of Intellectual Capital*, *11*(4), 481–503. https://doi.org/10.1108/EL-01-2014-0022

Lawryshyn, Y., Collan, M., Luukka, P., & Fedrizzi, M. (2017). New procedure for valuing patents under imprecise information with a consensual dynamics model and a real options framework. *Expert Systems with Applications*, *86*, 1339–1351. https://doi.org/10.1016/j.eswa.2017.05.056

Lee, J. H., Khee-su, B., Lee, J. W., In, Y., Kwon, T., & Lee, W. (2016). Valuation method by regression analysis on real royalty-related data by using multiple input descriptors in royalty negotiations in Life Science area-focused on anticancer therapies. *Journal of Open Innovation: Technology, Market, and Complexity*, 2–21. https://doi.org/10.1186/s40852-016-0047-7

Mazzariol, P., & Thomas, M. (2016). Theory and practice in M&A valuations. *Strategic Direction*, *32*(6), 8–11. https://doi.org/10.1108/SD-03-2016-0032

Odasso, C., Prati, V. G., & Scellato, G. (2014). Selling patents at auction : an empirical analysis of patent value. *Industrial and Corporate Change*, *24*(2), 417–438. https://doi.org/10.1093/icc/dtu015

Pareja Vasseur, J., & Cadavid Pérez, C. (2016). Valoración de patentes farmacéuticas a través de opciones reales: equivalentes de certeza y función de utilidad. *Contaduria y Administracion*, *61*(4), 794–814. https://doi.org/10.1016/j.cya.2016.06.004

Pärs, M., & Sander, P. (2015). Valuation practices of intangible assets in Estonia. En *In 2nd International Multidisciplinary Scientific Conference on Social Sciences and Arts SGEM2015* (pp. 549–556).

Pérez-hernández, P., & Calderón-martínez, G. (2014). Análisis de los Procesos de Comercialización de Tecnología en Dos Instituciones de Educación Superior Mexicanas Analysis of the T echnology C ommercialization P rocess in T wo Mexican H igher E ducation I nstitutions. *Journal of Technology Management & Innovation*, *9*(3), 196–209.

Russell, M. (2016). The Valuation of Pharmaceutical Intangibles and Drugs Mark Russell The University of Queensland. *Journal of Intellectual Capital*, *17*(3), 484–506. https://doi.org/10.1108/JIC-10-2015-0090

Saaranto, A. (2016). *A Review of the Methods for Valuing Intellectual Property Rights*. Retrieved from http://sal.aalto.fi/publications/pdf-files/esaa16_public.pdf

Smith, J. A., & Cordina, R. (2015). Patenting and the early-stage high-technology investor: Evidence from the field. *R and D Management*, *45*(5), 589–605. https://doi.org/10.1111/radm.12101

Soranzo, B., Nosella, A., & Filippini, R. (2017). Redesigning patent management process: an Action Research study. *Management Decision*, *55*(6), 1100–1121. https://doi.org/10.1108/MD-04-2016-0226

Sung, T.-E., Jun, S.-P., Kim, S.-G., & Park, H.-W. (2017). A Study on Web-based Technology Valuation System. *Journal of Intelligence and Information Systems*, *23*(1), 23–46.

Svačina, P. (2015). An Empirical Analysis of Factors Affecting Prices of Intangible Assets: A Preliminary Testing in Consumer Durables Sector. *Prague Economic Papers*, *24*(3), 354–363. https://doi.org/10.18267/j.pep.523

Thoma, G. (2013). Quality and Value of Chinese Patenting: An International Perspective. *Seoul Journal of Economics*, *26*(1), 33–72.

Weckowska, D. M. (2015). Learning in university technology transfer offices: Transactions-focused and relations-focused approaches to commercialization of academic research. *Technovation*, *41*, 62–74. https://doi.org/10.1016/j.technovation.2014.11.003

Wirtz, H. (2012). Valuation of Intellectual Property: A Review of Approaches and Methods. *International Journal of Business and Management*, *7*(9), 40–48. https://doi.org/10.5539/ijbm.v7n9p40

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Variables determining the growth of micro and small businesses

Variables determinantes del crecimiento de las micro y pequeñas empresas

LANDAZURI-AGUILERA, Yara†*

Instituto Tecnológico de Sonora

ID 1st Author: *Yara, Landazuri-Aguilera* / **ORC ID**: 0000-0002-7784-2762, **Researcher ID Thomson**: S-6759-2018, **CVU CONACYT ID**: 625073

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Abstract

Both developed and emerging nations share a high proportion of SMEs in their economic structure. For developing countries like Mexico, this situation can represent development opportunities. In this context, the objective of this study is to statistically analyze the relationship between the variables finance, technology, competition and human resources, with the variable dependent on business growth in the micro and small companies of southern Sonora. To do this, we propose a structural model, tested through the model of structural equations with estimated panel data and a contrast of said results through a multiple linear regression model. The sample size reached was 65 companies and the information was collected through interviews. The results through structural equation models and linear regression show that there is a positive and statistically significant relationship between viable technology and competition with business growth, not being so with the variables finances and human resource, when not being significant, concluding that the variables technology and competition explain the behavior of the dependent variable (business growth). The findings are consistent with those found in other research conducted in other countries.

Business growth, Micro and small enterprises, Multivariate analysis

Resumen

Tanto las naciones desarrolladas como las emergentes comparten una alta proporción de Pymes en su estructura económica. Para países en desarrollo como México esta situación puede representar oportunidades de desarrollo. En este contexto, el objetivo del presente estudio consiste en analizar estadísticamente la relación de las variables finanzas, tecnología, competencia y recurso humano, con la variable dependiente crecimiento empresarial en las micro y pequeñas empresas del sur de Sonora. Para ello, se propone un modelo estructural, probado a través del modelo de ecuaciones estructurales con datos de panel estimados y un contraste de dichos resultados a través de un modelo de regresión lineal múltiple. El tamaño de muestra alcanzado fue de 65 empresas y la recopilación de información se realizó mediante entrevistas, Los resultados a través de los modelos de ecuaciones estructurales y regresión lineal demuestran que existe relación positiva y estadísticamente significativa entre las viables tecnología y competencia con el crecimiento empresarial, no siendo así con las variables finanzas y recurso humano, al resultar no significativas, concluyendo que las variables tecnología y competencia explican el comportamiento de la variable dependiente (crecimiento empresarial). Los hallazgos son consistentes con los encontrados en otras investigaciones realizadas en otros países.

Crecimiento empresarial, Micro y pequeñas empresas, Análisis multivariante

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*Correspondence to Author (email: yara.landazuri@itson.edu.mx)
†Researcher contributing first author.

Introduction

Emerging countries in recent years have registered growth rates higher than those of developed countries occupying the top positions worldwide. However, having increased uncertainty about the dynamics of future growth, lower growth rates are expected for 2019 and 2020. During 2017, the global economy showed a high synchrony in growth; economic acceleration occurred in both developed and emerging economies. The acceleration of growth in a context of low inflation and high liquidity resulted in low volatility of global financial markets during that year (CEPAL, 2018).

One of the consequences of the current economic context is the decrease in growth rates and profitability in the more developed countries as a result of the global financial crisis, as well as the depletion of the fiscal impulse in developed countries such as the United States, China, Japan, United Kingdom United and the euro zone. This situation is causing both entrepreneurs and investors to seek to maintain the profitability of their businesses and investments taking advantage of the opportunities offered by other countries. These countries are emerging countries, as indicated by Orgaz, Molina & Carrasco (2011).

Technological advances generate opportunities for growth-oriented organizations of both large organizations and micro and small businesses. However, it is the latter that have the greatest possibility, due to their flexibility, to adapt and respond to the environment in which they operate (Freeman, Clark & Soete, 1982), their capacity for innovation is greater, even when their innovation process is slower, due to the problem that characterizes them. SMEs are a key element for competitiveness and growth; a primary engine of innovation in developing countries.

Business growth is a matter of public agenda every time, that in Mexico 97.6% of companies are micro-sized and occupy 75.4% of employed personnel; 2% are small and 0.4% medium in size. The latter employ 13.5% and 11.1% respectively of the total employed personnel. According to data from the National Survey on Productivity and Competitiveness of Micro, Small and Medium Enterprises (ENAPROCE, 2015).

In Mexico, entrepreneurs are aware of the importance of implementing strategies aimed at strengthening growth that allows them to adapt quickly to market conditions, maintaining a competitive position. Therefore, there are many companies that still maintain defensive or reactive positions that prevent them from reaching the financial, technological, competitive and human resource conditions that favor their development and consolidate their growth.

In concessions for sustainable development Llorens (2019) found the following: official development assistance (ODA) plays an essential role as a complement to other sources of financing for development, particularly in countries whose capacity to attract foreign direct investment it is minimal (p. 91).

Amat & Lloret (2014), show that business growth is explained by factors such as leadership, company culture, business model strategy such as income, costs, investments and financing. Accordingly, Rupasingha & Wang (2017), study access to capital in the growth of small businesses in the United States in a panel of 3,050 counties during the period 1996-2010, and find that loans granted under the Reinvestment Act Community have a statistically significant positive effect on the growth of small businesses in the study. Daza (2016), affirms that the presence of the founder in the decision-making group increases the firm's growth intentions.

On the other hand, Blázquez, Dorta & Verona (2006), in their research results confirm that the variables that measure business growth are total assets, the number of employees, sales volume, net investment, difference between the book value and market value, added value and own funds. Business growth is influenced by both internal and external factors. Within the internal factors it refers to age and size, motivation, ownership structure, knowledge management, and within external factors it subdivides its classification into external factors related to the sectoral environment and external factors of higher or macro level environment; in the first it includes competitors, customers and suppliers, and in the second, demand, technological improvements, accessibility to private loans and government support.

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The knowledge and dissemination of results of applied research in organizations in other countries have proven to be successful with significant results which can contribute fundamentally to accelerate the growth of micro and small companies that converge in a competitive environment, at a clear disadvantage with respect to competitors and large companies. companies that have been installed in the region. Therefore, the question of this research arises. What is the impact that finance, technology, competition and human resources have on business growth in micro and small businesses?

Overall objective

The general objective of this research is to statistically analyze the relationship of the variables finance, technology, competition and human resources, with the dependent variable business growth in micro and small.

Research hypothesis

H1. There is a significant relationship between the administration of finance and the growth of the company.

H2. There is a significant relationship between the use of technology and the growth of the company.

H3 There is a significant relationship between the knowledge of the competition and the growth of the company.

H4 There is a significant relationship between the development of human resources and the growth of the company.

Literature Review

Classical theories defend profit maximization as the main business objective, as well as the pursuit of business growth that allows companies to benefit from the competitive advantages of large companies. Classic theories and pre-established business objectives have been questioned by management theories, since managers have the difficult mission of making growth objectives compatible with the profitability objectives demanded by shareholders (Daza, 2016).

The evolutionary theories of business growth, led by Alchian (1950), point out that the most profitable companies are the ones that grow the most, due to their ability to generate profits. Myers & Majluf (1984) argue that companies prefer internal to external financing due to the existence of information asymmetry between the company and external investors. Hence, the mortality rate of small businesses is higher in developing countries than in developed countries (Arinaitwe, 2006). In addition to this, small businesses must develop specific short-term strategies to safeguard themselves from mortality, due to their high level of risk and their low probability of lasting more than five years (Sauser, 2005).

Regarding the previous results identified in the literature dealing with the growth of micro and small businesses and the factors that contribute to the growth of these, most of these studies tend to focus on the contribution of large companies already consolidated more Than in small business. Perren (1999), identifies four factors that directly influence the performance of microenterprises; motivation for growth, management skills, access to resources and market demand.

Fernández, García & Ventura (1988), state that business growth allows a company to compare its level of competitiveness in the market, in order to determine a benchmark around which the policies that compose competitive strategies will be established. In order to move forward, companies must move forward making decisions that allow them to find, maintain and expand their market space.

Okpara & Wynn (2007) analyzed the determinants of restrictions for small business growth. The study analyzes the development of micro and small businesses, categorizing the problems of small businesses in administrative, operational, strategic and external. Administrative problems focus on the organizational structure and the ability to obtain and develop the necessary resources, and include issues related to personnel, finance and business management. Operational problems are about distributing resources efficiently and are more common in the functional areas of a company; such as marketing, operations and logistics. Strategic problems include the ability of small entrepreneurs to adjust their products or services to external demand (Harris & Gibson, 2006).

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External problems include infrastructure, corruption, technology and low demand issues.

Empirically, the study of business growth behavior has been linked to the stochastic growth theory enunciated by Gibrat (1931) and better known as the law of proportional effect. Aguilera (2010) attributes the company's growth to strategic management, as it considers it a guide for the fulfillment of the necessary organizational objectives that drive and guide it to evolve. Ynzunza and Izar, (2013) define that in a dynamic and changing environment, where globalization generates opportunities for both SMEs and large companies, increased competition, new technologies and consumer demands for new products are a constant. Croteau & Bergeron (2001) mention that, since there is no recognized universal measure for this concept, organizational performance can be assessed using objective or subjective data, the objective approach refers to the financial data provided by the organization, while the Subjective measures focus on capturing the perception of the respondent, Ravichandran & Lertwongsatien (2005) use operational and market dimensions to measure growth.

Blázquez, Dorta & Verona (2006); Amat & Lloret (2014) affirm that business growth is measured with an increase in total assets, sales volume, income, costs, financing, number of employees, net investment, leadership and business culture. Ynzunza and Izar (2010) consider elements of adaptability, operational efficiency, profitability, customer satisfaction and, of course, organizational growth. Ferrer and Medina (2014) place income and net sales as a substantial variable to be able to succeed, because as a result, an internal analyst can determine if a company is profitable, solid and stable.

On the other hand, studies such as those carried out by Wagner (1992), Dunne and Hughes (1994) and Hart & Oulton (1996) oriented towards management theories, found a negative relationship, so that smaller companies obtain higher growth rates to larger companies. Daza (2016), finds evidence of a relationship between growth and profitability taking the size of the company as a measure of growth between two consecutive periods expressed as a percentage.

Profitability is one of the most relevant factors to determine if a company is growing or if it has withdrawals at any branch or subsidiary, information with which investment decisions are made in new projects for updating or removing production plants from the market.

On the other hand, Fernández, Diaz, Rodríguez & Martinez, (2019), define that financial tools allow small businesses; keep track of your business negotiations, in order to obtain greater productivity and use of your assets, applying a system that feeds the operations of the entity in a more agile and objective way.

Ynzunza & Izar (2010) propose to study the impact of market forces on organizational objectives and a mechanism to achieve superior performance. Likewise, Miles and Snow (1978) consider that companies can emphasize some aspects of administration, such as technological position, innovation, organizational design and human resources management. They conclude that these aspects of management can largely determine the performance and efficiency of a business. Finally, it is important to highlight that, despite the existence of previous empirical evidence that studies the growth of small and medium-sized enterprises, the variables finance, technology, competition and human resources, it was not possible to identify empirical contrast studies that examined the joint interrelation of the variables finance, technology, competition and human resources in Mexico.

Methodology

The cross-sectional, causal and research unit has as an analysis unit the micro and small business of the southern Sonora of the commercial sector, because this sector absorbs just over 55.5% of the population employed in this region and where the number of commercial establishments continue in growth trend mainly in the center and south of the state, locations where the leading entrepreneurs of this activity are concentrated.

Characteristics of the sample and the unit of analysis

The sampling method was not probabilistic, through personalized interviews with the managers, owners or managers of the companies.

The criteria for selecting companies was the number of employees, which according to the Ministry of Economy is a valid benchmark for classification to define the size of organizations. This delimited the population size to a total of 156 commercial companies. The sample size reached was 65, which is acceptable for the statistical model of structural equations. The companies surveyed are mostly small businesses, where 43% are 20 years old. In relation to the people who provided the information, it was primarily the managers, owners and / or administrators, in charge of the company with more than five years of experience in it. 53% of respondents are female and 62% of respondents have a bachelor's degree and 8% have a postgraduate degree, 16% have a technical degree and the rest have a bachelor's degree..

Design of the constructs

The qualitative part was developed through the design of a list of structured questions based on the revised theoretical support in order to explore the subject of study, the dimensions of each construct (independent variables; finance, technology, competition and human resources)) and the dependent variable (business growth), the items that could integrate the instrument were evaluated. For quantitative research, the measurement scales used in previous studies were reviewed first; the appropriate metric referents were selected, adapted to the context and others that had not been previously generated such as technology, competence and human resources, which are part of the questionnaire designed to carry out the investigation were constructed.

For the measurement of all constructs, a Likert scale was used, an ordinal type of five points measured with a range of “totally disagree” to “totally agree” to measure independent variables; finance, technology, competition and human resources and regarding the dependent variable, this was measured by the increase in the number of employees and the investment in new equipment compared to the last three years, in addition to including three items evaluated with a range of "Never" to "always". Finally, and because the literature cites the effect that variables such as the type, size of organization and economic sector could have on the constructs studied, items that provide descriptive and valuable information on these variables were included.

Once the measuring instrument was concluded, several tests of its validity and reliability were carried out through Cronbach's alpha and its application was carried out.

In this investigation, a multiple linear regression analysis and structural equations were performed to contrast the results through the two statistical tools. The main analysis is to examine the relationship between the variables finance, technology, competition and human resources with business growth.

Results

To test the operational hypotheses of this research, a structural model is proposed, testing the similarities of the data obtained through the structural equations model (SEM) through the Smart-PLS with estimated panel data and a contrast of the results to through a multiple linear regression model (MREG) with the support of the SPSS tool. Below is the mathematical equation of the model.

$$Creci = \beta o + \beta 1X1Finan + \beta 2X2Tec + \beta 3 X3Comp + \beta 4 X4RHum + \varepsilon$$

Where Creci represent business growth, and are incorporated as explanatory variables of the period. X1finanzas, X2 technology, X3competencia and X4 human resource. Finally β represent the parameters to be estimated by the models and ε is the error term.

Previous literature has used different indicators to measure growth; Among the most used have been sales, the number of employees and total assets. In this work, the number of employees, investment in total assets, and sales have also been used as a measure of business growth.
Internal consistency was measured through Cronbach's alpha, with the use of the two statistical tools, the values found confirm the validity and reliability of the variables, the linear regression model shows lower results than that of structural equations, however for both they are statistically acceptable, greater than 0.650. The measure of reliability using Cronbach's alpha assumes that the items (measured in Likert scale) measure the same construct and that they are highly correlated.

Variables	Cronbach's alpha MREG1	Cronbach's alpha SEM[2]
Finan X_1	0.657	0.661
Tecno X_2	0.671	0.674
Comp X_3	0.769	0.784
RecHum X_4	0.795	0.810
Increase	0.702	0.677

Table 1 Cronbach's alpha
Source: Own Elaboration (2019)
MREGl[1] Line Regression Model, Structural Equation Model SEM[2]

For this investigation it was necessary to eliminate three items of the finance variable, four of the technology variable, one of the competition variable, three of the human resource variable and one of the business growth dependent variable, because some of them according to the theory did not meet the convergent validity criteria, that is, they were below 0.60 (Falk & Miller, 1992).

The various global measures of the quality of adjustment provide sufficient results to consider the findings as a reliable measure of the representation of the constructs, although the results of the alphas through the two statistical tools show that reliability is outside of the limits accepted by the literature and that consequently it is expected that the results of the model prove little relationship between the variables, even so the results may be sufficient to analyze this relationship.

Convergent validity is considered to exist when the Average Expected Variance (AVE) reaches values greater than 0.50 (Fornell & Larcker, 1981; Chin, 1998). Therefore, according to the theory, the statistical results obtained confirm the existence of convergent validity in the analyzed variables.

Variables	Reliability Composed	Variance extracted (AVE)
Finan X_1	0.767	0.527
Tecno X_2	0.854	0.745
Comp X_3	0.840	0.507
RecHum X_4	0.870	0.629
Increase	0.816	0.528

Table 2 Reliability and validity of the SEM construct
Source: Own Elaboration (2019)

The result of the extracted variance was greater than 0.50; therefore it is statistically acceptable for all the variables of the proposed model.

	MREG model			SEM model	
R			0.549		
R^2			0.302		0.411
R^2 adjusted			0.255		0.371
F			0.167		6.487
Sig.			0.000		
	No estand	Tipif	Sig.	Coef.	P Val.
Coef. βX_1	-.045	-.040	.771	.084	.652
Coef. βX_2	.607	.409	.006	.376	.009
Coef. βX_3	.245	.227	.106	.258	.245
Coef. βX_4	.022	.016	.901	.053	.760
Durbin-Watson			1.962		

Table 3 Summary of the variable relationship analysis
Source: Own Elaboration (2019)

Through the linear regression model, independent variables explain 30.20% of the variability of business growth that is 0.549. With the results obtained from the non-standardized beta coefficients β, the least squares equation of this research was generated, being as follows:

MREG model
$Creci = 0.404 - 0.045Fin + 0.607Tecno + 0.245Comp + 0.022RHum + \varepsilon$

Consequently and according to the equation of the multiple linear regression model (MREG) it is observed that a decrease in the financial variable, the technology variable being the one with the greatest positive impact on business growth, according to the results of the typified coefficients it can be seen that the variable that contributes most to a change in Y (business growth) is the independent technology variable, followed by competition, with a value of $\beta=0.607$ and $\beta=0.245$ respectively, finally the human resource variable turned out to be less significant than the finance variable which has an opposite effect on the model, reflecting a negative sign.

Therefore, the relationship between the variable finance and business growth is negative. The regression results are positive, but not significant for two of the independent variables, although the technology and skills variables do show significant influence at 95% and 90% and positive respectively.

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SEM model
Creci = 0.084Fin + 0.376Tecno + 0.258Comp + 0.053RHum + ε

Through the method of structural equations, the results of the beta betas all have a positive effect on the business growth variable, through both methodologies the variable of greatest weight in the model is the technology variable and is also the most significant for both. Through the linear regression model, independent variables explain 30.20% of the variability of business growth. The results of the relationships are positive but not significant for three of the independent variables, although the technology variable does show significant and positive influence.

In the previous literature we have found empirical evidence of positive and negative relationship Roodman (2009). The results obtained by Daza (2016) in the LAD model, although they show positive influence between the growth and profitability variables, the goodness of the model is very low and therefore the results are of little consideration in both linear and non-linear models. In this investigation, the results are not the most anticipated, the model adjustments through the two methodologies are low, however they are a contribution to the literature of the study of micro and small companies in Mexico, due to the complexity of the study in these same because of the particular characteristics between one and the other it is difficult to measure their behavior.

	MREG model	SEM model
	Increase	Increase
Finan X_1	1.583	2.808
Tecno X_2	1.644	1.437
Comp X_3	1.790	3.223
RecHum X_4	1.402	1.758

Table 4 Collinearity Statistics
Source: Own Elaboration (2019)

For some researchers it is recommended that the diagnosis of collinearity between constructs or formative dimensions be less than 3.5, which would indicate the absence of multicollinearity (Petter, Straub & Rai, 2007), other works consider acceptable values of VIF below 5, for This research results are lower than 3.5 which leads to confirm the absence of multicollinearity.

As part of the non-parametric tests for this model, the results of the significance of Kolmogorov-Smirnov for each of the independent variables was Sig 0.000; therefore the null hypothesis is rejected. The results show that the distribution contrast is normal through the linear regression method according to the results of the SPSS.

Conclusions

The results show evidence between the technology and competition variables with the business growth of micro and small companies in Mexico located in southern Sonora, measured through multiple linear regression and structural equations. This work provides empirical evidence on the study of business growth in Mexico measured through the variables with the greatest influence of the commercial sector; finance, technology, competition and human resources.

The results show the positive influence of technology on business growth, thus coinciding with the evolutionary theories of business growth, which proposes that companies that adopt more technology are the ones that grow the most, the results were verified through two methodologies contrasting the results with the theory.

Two of the four operational hypotheses of this research were verified through the linear regression models and structural equations, concluding that there is a positive and significant relationship between the use of technology and the recognition of competition with the growth of the company, not being so for the variables finance and human resource.

The law of proportional effect maintains that all companies grow in proportion to their size, and those that have a larger size grow more. This causes companies that exceed the average size of the sector to obtain higher than average growth rates. On the contrary, those of smaller than average size will grow to a lesser extent, gradually decreasing their market share in the sector. In this direction the principle of growth behavior appears (Coad, 2007). The empirical results found in this study also indicate that if companies want to improve their level of growth, they will have to implement strategies for training and employee development.

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For future research, it is considered interesting to make a separation between small and small micro companies and measure growth individually and try to verify whether or not companies that have a larger size can grow according to their proportion or if micro companies tend to take advantage of its position to project and achieve growth at a faster speed.

References

Aguilera Castro, A. (2010). Direccionamiento estratégico y crecimiento empresarial: algunas reflexiones en torno a su relación. Pensamiento & gestión, (28).

Alchian, A. (1950). Uncertainty, evolution, and economics theory. Journal of Political Economy, 58(3), 211–221.

AMAT, O., IRURETAGOYENA, M., & LLORET, P. (2014). Metalquimia: la fuerza de la creativación1. Revista de Contabilidad y Dirección, 19, 131-147.

Arinaitwe, J. K. (2006). Factors Constraining the Growth and Survival of Small Scale Businesses. A Developing Countries Analysis. Journal of American Academy of Business, 8(2), 167-178.

Blázquez, S. F., Dorta Velázquez, J. A., & Verona, M. C. (2006). Factores del crecimiento empresarial. Especial referencia a las pequeñas y medianas empresas. INNOVAR. Revista de Ciencias Administrativas y Sociales, 16(28).

CEPAL, N. (2018). Agenda 2030 y los Objetivos de Desarrollo Sostenible: una oportunidad para América Latina y el Caribe.

Chin, W. W. (1998). The partial least squares approach to structural equation modeling. Modern methods for business research, 295(2), 295-336.

Coad, A. (2007). Testing the principle of 'growth of the fitter': the relationship between profits and firm growth. Structural Change and economic dynamics, 18(3), 370-386.

Cortés, C. B. Y., & Landeta, J. M. I. (2013). Efecto de las estrategias competitivas y los recursos y capacidades orientados al mercado sobre el crecimiento de las organizaciones. Contaduría y administración, 58(1), 169-197.

Croteau, A. M., & Bergeron, F. (2001). An information technology trilogy: business strategy, technological deployment and organizational performance. The journal of strategic information systems, 10(2), 77-99.

Daza Izquierdo, J. (2016). Crecimiento y rentabilidad empresarial en el sector industrial brasileño. Contaduría y administración, 61(2), 266-282.

Dunne, P., & Hughes, A. (1994). Age, size, growth and survival: UK companies in the 1980s. The Journal of Industrial Economics, 115-140.

ENAPROCE. 2015. Difusión de la encuesta nacional sobre productividad y competitividad de las Micro, Pequeñas y Medianas empresas. Obtenido de www.inegi.org.mx/saladeprensa/boletines/2016/especiales/especiale s2016 - 0 -02.pdf

Falk, R. F., & Miller, N. B. (1992). A primer for soft modeling. University of Akron Press.

Fernández G., A.I., García R., R. y Ventura V., .J. (1988). Análisis del crecimiento sostenible por los distintos sectores empresariales. Documento de trabajo de la Universidad de Oviedo, 003/88, pp. 3.

Fernández, S. R., Diaz, L. E., Ch, W. J. R., & Martinez, L. Á. (2019). Influencia de la tecnología e información para el rendimiento de las Mipymes colombianas. Actualidad Contable Faces, 22(38), 25-45.

Fornell, C., & Larcker, D. F. (1981). Structural equation models with unobservable variables and measurement error: Algebra and statistics.

Freeman, C., J. Clark & L. Soete (1982). Unemployment and Technical innovation, London: Pinter.

Gibrat, R. (1931). Les inégalits économiques. Sirey.

Hart, P. E., & Oulton, N. (1996). Growth and size of firms. The Economic Journal, 106(438), 1242-1252.

Myers, S. C. y Majluf, N. S. (1984). Corporate financing and investment decisions when firms have information that investors do not have. Journal of Financial Economics, 13(2), 187–221.

Llorens, F. A. (2019). La localización de los objetivos de desarrollo sostenible y la financiación de la Agenda 2030: el discurso y la realidad. Revista de Fomento Social, 77-104.

Okpara, J. O., & Wynn, P. (2007). Determinants of small business growth constraints in a sub-Saharan African economy. SAM advanced management journal, 72(2), 24.

Orgaz L., Molina L. & Carrasco C. (2011). El creciente peso de las economías emergentes en la economía y gobernanza mundiales. Los países BRIC. Madrid: Documentos ocasionales 1101, Banco de España.

Perren, L. (1999). Factors in the growth of micro-enterprises (Part 1): Developing a framework. Journal of small business and enterprise development, 6(4), 366-385.

Petter, S., Straub, D. W., & Rai, A. (2007). Specifying formative constructs in information systems research.

Ravichandran, T., Lertwongsatien, C., & Lertwongsatien, C. (2005). Effect of information systems resources and capabilities on firm performance: A resource-based perspective. Journal of management information systems, 21(4), 237-276.

Roodman, D. (2009). How to do xtabond2: An introduction to difference and system GMM in Stata. The Stata Journal, 9(1), 86-136.

Rupasingha, A., & Wang, K. (2017). Access to capital and small business growth: evidence from CRA loans data. The Annals of Regional Science, 59(1), 15-41.

Sauser, W. I., Jr. (2005). Starting Your Own Business? Prepare for Success. SAM Management in Practice, 3(1), 1-4.

Ynzunza, C., Izar, J. (2013). Efecto de las estrategias competitivas y los recursos y capacidades orientados al mercado sobre el crecimiento de las organizaciones. Contaduría y Administración, 58 (1), pp. 169-197.

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Impact factors in sustainable economic development

Factores de incidencia en el desarrollo económico sostenible

ACOSTA-MELLADO, Erika Ivett†*, LANZADURI-AGUILERA, Yara and MURILLO-FÉLIX, Cecilia Aurora

Instituto Tecnológico de Sonora

ID 1st Author: *Erika Ivett, Acosta-Mellado* / **ORC ID**: 0000-0003-3526-8923, **Researcher ID Thomson**: X-8807-2019, **CVU CONACYT ID**: 282641

ID 1st Coauthor: *Yara, Lanzaduri-Aguilera* / **ORC ID**: 0000-0002-7784-2762, **Researcher ID Thomson**: S-6759-2018, **CVU CONACYT ID**: 625073

ID 2nd Coauthor: *Cecilia Aurora, Murillo-Félix* / **ORC ID**: 000-0002-2214-9880, **CVU CONACTY ID**: 971874

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Abstract

This study is carried out with the purpose of determining the correlational-causal relationship between the variables sustainable economic development, equitable social development, efficient and participatory institutional development and technology, for this the following methodology was developed: a quantitative study, with a non-experimental design, of transectional cut. The measurement instrument used was the questionnaire, consisting of three independent and one dependent variables, with 71 questions. Each construct contains a series of items that are related to the variable to be measured. The statistical methods that were considered the most appropriate for the analysis of the data collected were: cronbach's alpha, to measure the reliability of the instrument and; the multiple linear regression method for checking the model. The results obtained show that there is a positive relationship between the variables and, with the ANOVA test it was possible to verify that the three independent variables proposed in the theoretical model are statistically significant, since they have a significance level of 0.000, therefore it is considered relevant. The contribution of this research lies in granting the input of strategies to the authorities of the surveyed municipality to help improve their economic conditions.

Development, Economic, Sustainable

Resumen

Este estudio se realiza con la finalidad de determinar la relación correlacional-causal entre las variables desarrollo económico sostenible, desarrollo social equitativo, desarrollo institucional eficiente y participativo y tecnología, para ello se desarrolló la siguiente metodología: un estudio cuantitativo, con diseño no experimental, de corte transeccional. El instrumento de medición utilizado fue el cuestionario, compuesto por tres variables independientes y una dependiente, con un total de 71 preguntas. Cada dimensión contiene una serie de ítems que están relacionados con la variable que se desea medir. Los métodos estadísticos que se consideraron los más apropiados para el análisis de los datos recolectados fueron: el alfa de cronbach, para medir la confiabilidad del instrumento y; el método de regresión lineal múltiple para la comprobación del modelo. Los resultados obtenidos demuestran que existe una relación positiva entre las variables y, con la prueba ANOVA se pudo comprobar que las tres variables independientes propuestas en el modelo teórico son estadísticamente significativas, ya que tienen un nivel de significancia de 0.000, por lo tanto se considera pertinente. El aporte de esta investigación radica en otorgarles a las autoridades del municipio encuestado un insumo para el planteamiento de estrategias que coadyuven a mejorar sus condiciones económicas.

Desarrollo, Económico, Sostenible

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*Correspondence to Author (email: erika.acosta@itson.edu.mx)
†Researcher contributing first author.

Introduction

In the first section the background is shown and the problem that gives rise to this research is analyzed. Subsequently, the general objective is established, and the delimitations and limitations of the study are described. In the second section the theoretical bases of the article are developed. The third describes the methodological design that, for the purposes of this investigation, is considered appropriate. The fourth section describes the way in which the statistical analysis was carried out and the results obtained from it. The sponsor of the project is mentioned in the fifth section; the conclusions of the study are described in the sixth and finally the references used in this article are incorporated.

Background

During the industrial revolution of the nineteenth century, the world was immersed in the idea of achieving economic growth and there was a great boom in the use of energy resources, creation of factories, etc .; later, the social term was included along with the economic, since the technological and economic advance that was being presented would improve the social life of the world.

But it was in 1930 when specially developed countries, they realized the value and importance in the economic and social growth of natural resources and the environment, both extremely neglected to that date.

Industrial development ends day by day with natural resources, destroys ecosystems, causes the loss of ecological diversity, and reduces the resilience of the planet. Likewise, the depletion of energy resources and raw materials brings the next generation to a total lack of them.

The fact that they have limited natural resources that can be depleted and the desire to grow economically without taking them into account producing serious environmental problems has led countries to consider and discuss more often the problem of achieving social, economic and environmental development as a whole, which they have called sustainable development.

Problem Statement

The economic system based on unlimited exploitation of resources, maximum production, consumption, and profit as the sole criterion of good economic progress is unsustainable. A limited planet cannot provide the resources that this exploitation would require indefinitely. For this reason, the idea has been imposed that a real development must be sought, which allows the improvement of living conditions, but compatible with a rational exploitation of the planet that takes care of the environment.

America is in a productive transformation that increases the intervention of society, seeking to exploit natural resources to improve living standards and conditions. However, this same society knows that the quality of life of the population cannot be improved at the cost of their standard of living, that is why natural capital is essential to achieve productive transformation with equity.

Development processes affect the quality of the environment, for example, water and air pollution decrease the ability of ecosystems to deliver goods and services to the population.

This leads to the integration of different dimensions: the ecological, economic and social, that is, natural resources must be taken care of, rationally exploiting them without neglecting the economic base; In addition to integrating the concept of intragenerational equity, all this in the field of sustainable development.

The term sustainable development means “satisfying the current needs of society without affecting the vital possibilities of the next generations”, García-Colín Sherer (1996). In other words, it is necessary that by obtaining resources from nature to meet present needs, the potential for future development is not affected. This necessarily implies extracting natural resources at rates that do not prevent the regeneration of ecosystems.

The basis of sustainable development is: the structure of incentives, legislation and the management and organization of productive activities. It depends on the systems for assigning property and tenure rights, economic and social incentives, the management of the economy and resources, the role of the State, companies and communities of different types and individuals.

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In Mexico, it is based on a disadvantageous situation, due to long periods of neglect of the environmental education and training of its resources, the promotion of science, technological innovation, business strengthening and the reduction of social and income inequality.

These lags cannot be remedied in the short term, but it will never be too late to start programs that are well oriented to the challenge of undertaking processes that lead to sustainable development in all orders and place the environment above any other material consideration.

In 45 years, a third of the population of the State of Sonora, ceased to be rural and became urban. In 1950, 45.9% of the total population was rural, by 2005 it represented 14.2% (340,800 inhabitants), as a result of emigration as a result of the lack of development opportunities, INEGI (2008).

Difficult access to education, land, productive resources, deterioration of natural resources and marginalization are indicators that stand out in the current situation of rural communities, as well as the need for better basic services.

Taking sustainable development as a frame of reference, the analysis carried out in the previous paragraphs leads to the following research question: Is there a correlational-causal relationship between the dependent variable sustainable economic development and the independent variables: equitable social development, efficient institutional development and participatory and, technology?

Justification

Rural communities are rich in ecological and cultural diversity. The size and complexity of these communities makes it difficult to generalize their problems or their assets, although there are some common ties. For much of its existence, rural communities have relied on the wealth of natural resources in the environment. But in the twentieth century major technological, political and economic changes have brought a profound transformation to agriculture and renewable resource industries and to the rural communities dependent on them.

Some rural communities face a loss of inhabitants, while others, particularly those of high scenic or recreational value, must face the problem of rapid population growth that brings new demands to the ecosystem and traditional ways of life.

For the rural environment, the rapid pace of change brings not only challenges but also opportunities. Somehow, sustainable development aims to handle change that is inevitable, and to do so in a way that is economically valid, environmentally responsible and socially fair. The most successful communities struggle to build on their local strengths and abilities while adopting and adapting new ideas and technologies to the local context.

The application of the principles of sustainable development, within Mexican communities is extremely necessary. Making the inhabitants progress economically and socially using the resources at hand without seriously altering the environment and advancing socially is a colossal task, which should not be long.

The present investigation is considered pertinent, since when carrying out its objective it will be possible to verify the existing relationship between the variables indicated in the research question, derived from the application of the principles of sustainable development. On the other hand, with the development of this document, an antecedent will be generated that, possibly, serves as a reference for other researchers who wish to verify the existence of such a relationship in a rural community in Mexico.

Objective

To determine the correlational-causal relationship between the dependent variable sustainable economic development and the independent variables: equitable social development, efficient and participatory institutional development, and technology, through the use of a statistical model.

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Hypothesis

H1. There is a correlational-causal relationship between the dependent variable sustainable economic development and the independent variables: equitable social development, efficient and participatory institutional development and, technology.

H2. Equitable social development, efficient and participatory institutional development and, technology positively impact sustainable economic development.

Delimitations

Space

This investigation was carried out in one of the thirty-one states that, together with Mexico City, form the United Mexican States, in Sonora, located in the northwestern region of the country, bordering north with Arizona (United States), east with Chihuahua, to the south with Sinaloa and to the west with the Sea of Cortez or Gulf of California (Pacific Ocean).

Specifically, in the community of Etchojoa having an area of 1,220 km². The municipality is located in the south of the State and borders to the north and east with Navojoa, to the south with Huatabampo, to the northwest with Cajeme and to the west with the Sea of Cortez.

The following towns belong to this municipality: Vasconia, Bacame Nuevo, Basconcobe, Buaysiacobe, Bacobampo, Campanichaca, Caurarajaqui (La Soto), Chucarit, Sahuaral, Las Mil Hectareas (Las Miles), Las Playitas, Mochipaco, Mocorúa, San Pedro, Villa Three Crosses, among many others.

Etchojoa means "Cactus House" in Cahita (Etcho: Stenocereus thurberi). Etchojoa is one of the seven villages that make up the May ethnic group, according to the encyclopedia of the Municipalities of Mexico, consulted in August 2019.

Demographic delimitation

Inhabitants of the municipal seat of Etchojoa, within the age range of 25-45 years considered in productive age.

Limitations

The investigation considers three independent variables and one dependent, within the framework of sustainable development, the environmental development variable being outside the scope of this study, since during the work with the Municipality of Etchojoa, it was analyzed independently for the purpose of the implementation of strategic environmental development programs.

Theoretical framework

The modern development perspective not only seeks to raise the levels of well-being of today's human societies but is concerned about the possibility of inheriting a planet with plausible levels of economic, social and environmental health from future generations. Hence, the analysis of human behavior, needs to transform attitudes and redefine the trends that point to massive damage or environmental destruction; the increasingly demanding population, which will affect more food, housing, consumer goods and entertainment focused on economic growth by applying a dramatic pressure on natural resources.

On this principle, the concept of sustainable development emerges whose definition establishes that it is a development that meets the needs of the present without compromising the ability of the future to meet their own.

The conceptual framework of sustainable development presents several approaches depending on the disciplinary approach that addresses it. Thus, for some the important thing is the use of renewable natural resources, in such a way that it does not deplete or degrade and accrue a real reduction of its renewable utility for future generations, keeping constant inventories of natural resources.

Development does not necessarily mean economic growth; the type of economic activity can change without increasing the amount of goods and services. It is said that economic growth is not only compatible with sustainable development, but it is necessary to mitigate poverty, generate resources for development and prevent environmental degradation. The question is the quality of growth and how its benefits are distributed not only the mere expansion.

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Frequently, sustainable development is also defined as development that improves health care, education and social welfare. It is currently admitted that human development is decisive for economic development and for the rapid stabilization of the population. Some authors have further extended the definition of sustainable development by including a rapid transformation of the technological base of industrial civilization; for which they point out that it is necessary that the new technology be cleaner, more efficient and save natural resources in order to reduce pollution, help stabilize the climate and adjust population growth and economic activity.

In the Rio Declaration of 1992, a transcendental commitment was assumed: the adoption of the objective of sustainable development, that is, an economic and social development that includes environmental protection and respect for natural resources, that is equitable and ensures generations to come to access to resources and non-polluting technologies to improve the quality of life worldwide. No country has yet undertaken an integrated sustainable development process.

It is not a technical issue, but a social and political one: it requires mobilizing the necessary resources, giving priority to the new objective, combining government efforts with business and those of civil society, creating awareness of the dangerous and even irreversible thresholds that may arise, build a culture of knowledge and communication that contributes to sustainable development.

Treviño (2003), quotes Dr. Paolo Bifani, in his work Environment and Development, which believes that multiple definitions of sustainability generally isolate some elements of the conceptual organic body of which they are an integral part, thus Bifani distinguishes and It describes four approaches: the environmentalist, the intergenerational, the sectorial and the economic. This orientation can be argued from the Brundtland report that reads: "We see the possibility of a new era of economic growth that must be based on policies that sustain and expand the resource base of the environment; and we believe that such growth is absolutely indispensable to alleviate the great poverty that continues to accentuate in much of the developing world. " Extreme economic growth is seen as a condition of sustainable development.

On the other hand, it is said that sustainable development must be combined with economic growth, with the strengthening of competitiveness, with better management of nature and biodiversity, as well as with a decrease, in absolute terms, of hazardous emissions. For the environment this conception is committed to a "smart growth" of the economy, assuming that the general pressure on the environment decreases. It is argued that it is natural for humanity to fight for the continued growth of production and consumption. Economic growth is considered vital for the sustainable development of the world.

Other authors have considered within the approaches, the social, institutional and technological dimension. For Díaz (2003), the social dimension of sustainable development consists in recognizing the right to equitable access to common goods for all human beings, in intra-generational and inter-generational terms, both between genders and between cultures..

The social dimension not only refers to the spatial and age distribution of the population, but also refers, in a special way, to the set of social and economic relations that are established in any society and that are based on the region, the ethics that are established in any society and based on religion, ethics and culture itself. Also, this dimension has as a mandatory reference to the population and pays special attention to their forms of organization and participation in decision making. It also refers to the interactions between civil society and the public sector.

Within the institutional dimension, it can be mentioned that sustainability is one of the most powerful challenges, and this implies not only the elaboration of diagnoses and proposals, but also deep transformations at the national, state, and local level, being the last one that lies with greater interest for a viable development, since by incorporating them and taking them into account for higher decisions, they cease to be only recipients of opportunities and are responsible for undertaking ideals that best suit their situation and start their path to development (Enriquez, 2004).

Acceleration of technological innovation and development is required to reduce the natural resource content of certain economic activities, as well as to improve the quality of production.

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The technological dimension implies the search and change towards more efficient technologies in the case of industrialized countries and the development of more efficient and clean technologies in countries of rapid industrialization. In developing countries with agriculture-based economies, it is necessary to develop appropriate and small-scale technologies for increasing agricultural productivity.

Methodology

This section addresses the main elements of the methodology to be developed.

According to Hernández, Fernández, and Baptista (2010), the type of research is non-experimental, this is done without deliberately manipulating the independent variables. It is characterized by being correlational - causal, since it attempts to measure the degree of association between two or more variables in a particular context and the way in which they interact with each other; It also aims to establish the correlation of data to test the hypotheses presented here. With a transectional study, since it focuses on analyzing the level or state of one or several variables at a given time.

The choice of the measuring instrument used was the questionnaire, also called a survey, being a mechanism mostly used to collect data, which consists of a group of questions concerning one or more variables, consisting of 3 independent variables and 1 dependent variable, with A total of 71 questions. Each variable was defined according to the methodology proposed by Wong (2005), each dimension contains a series of questions that are related to the variable to be measured.

The measurement levels used for the items that make up the questionnaire are of order of scale. The scaling method is of the Likert type (1932) in Hernández et al (2010), this refers to a set of items presented in the form of an affirmation or judgment, where the subject or respondent is asked to extinguish his reaction by choosing one of the six points of the scale, and each point corresponds to a numerical value. So that in the end, adding all the scores obtained in relation to the statements, the interviewee obtains a total score. The minimum score for the items was one and the maximum six.

The measures were defined as follows:

1. Null / nonexistent
2. Very low
3. Low
4. Medium / minimum acceptable
5. High
6. Very high

The dimensions of the instrument are:

1. Sustainable Economic Development, (DES).
2. Equitable Social Development, (DSE).
3. Efficient and Participatory Institutional Development (DIEyP)
4. Technology, (T).

The population is the total set of analysis units. The populations must be clearly placed around their characteristics of content, place and time. The study population is composed of 20,666 research subjects, data provided by the H. City Council of Etchojoa at the beginning of the investigation in May 2019.

To determine the sample size, according to Morales (2012), the type of probabilistic sampling was used and within it the simple random was chosen. Knowing the population size, the necessary sample is smaller and its size is determined by the formula:

$$n = \frac{N}{1+\frac{e^2(N-1)}{Z^2\,pq}} \quad (1)$$

where:

n = sample size that you want to know
N = known population size, e, z and pq (or σ2) as before.

$$n = \frac{20{,}066}{1+\frac{0.3^2(20{,}066-1)}{1.96^2\,(.25)}}$$

$$n = 377$$

For the analysis of the data, statistical tests were performed using the IBM SPSS Statistics version 21.0 software. As a first step, the constructs were designed, later the regression model was created and finally the different indicators of the model were analyzed comparing the results obtained, with the parameters suggested for each indicator.

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Results

This section shows the statistical analysis of the data collected on 377 surveys applied in the research process.

As can be seen in Table 1, the results obtained from the cronbach alpha for the variables do not present values below .600, for this reason it is inferred that the results manifest internal consistency; that is, they show correlation between the questions of the instrument.

Dimension	Cronbach's alpha
DES	.902
DSE	.879
DIEyP	.912
T	.831

Table 1 Results of the cronbach alpha calculation
Source: Own elaboration with data from the surveys captured in the IBM SPSS Statistics 21 software, (2019)

The correlation coefficient shows the degree of relationship or association between the study variables. The degree of linear relationship can vary from a perfect negative correlation of -1.0 to a perfect positive correlation of +1.0. The magnitude of the relationship is indicated by the absolute value of the correlation coefficient where, the larger the magnitude of correlation, the stronger the relationship between the variables.

In order to determine the correlation between the variables proposed in the model, Table 2 is presented:

		DES	DSE	DIEyP	T
DES	Pearson correlation	1.00	.636	.497	.507
	Sig. (Bilateral)		.000	.000	.000
DSE	Pearson correlation	.636	1.00	.556	.516
	Sig. (Bilateral)	.000		.000	.000
DIEyP	Pearson correlation	.497	.556	1.00	.477
	Sig. (Bilateral)	.000	.000		.000
T	Pearson correlation	.507	.516	.477	1.00
	Sig. (Bilateral)	.000	.000	.000	

Table 2 Correlations
Note: * The correlation is significant at the 0.05 level (bilateral)
Source Own elaboration with data from the surveys captured in the IBM SPSS Statistics 21 software, (2019)

In Table 3 it can be interpreted that, the corrected R2 of the model indicates that it has a predictive capacity of .459, in this sense Hair (2006) refers that the predictive power of the model is moderate.

The Durbin-Watson test for serially correlated residues can also be observed. This statistic ranges between 0 and 4 and takes the value 2 when the residuals are completely independent. Values greater than 2 indicate positive autocorrelation and those less than 2 negative autocorrelations. It is usually assumed that the residuals are independent if the D-W statistic is between 1.5 and 2.5. The value obtained for this test was 1,485.

In this same Table 3, it is shown that the ANOVA of the resulting model is statistically significant based on the value obtained in the Sig column, where the result is less than 0.05, the value of F greater than 2.4. The null hypothesis that the variability observed in the response variable is explained by chance is rejected and it is admitted that there is some kind of association between the dependent and independent variables. Therefore the model is relevant.

In order to determine if there is collinearity, two procedures were used: 1.) The empirical rule, cited by Kleinbaum, Kupper, and Muller (1988), which consists in considering that there are collinearity problems if any IVF is greater than 10. In Table 3, it can be seen that the value obtained is less than 10. 2). For Belsley (1991), condition indices between 5 and 10 are associated with a weak collinearity, while condition indices between 30 and 100 indicate a moderate to strong collinearity. As can be seen in the results of the "Condition Index" in the model, it is less than 30, so it can be said that there is no multicollinearity problem.

Parameters	Model
Variables selected in the model	Predictors: X1. DSE, X2. DIEyP, X3. T
Dependent variable	DES
R squared corrected	.459
Durbin Watson	1.485
ANOVA	Sig. .000
F	107.168
FIV	1.559
Condition index	19.782

Table 3 Statistical results
Source. Own elaboration with data from the surveys captured in the IBM SPSS Statistics 21 software, (2019)

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Conclusions

For the verification of the research hypotheses, the significance of β less than .005 and the signs obtained in the coefficients typified β were used as a reference.

The hypotheses are confirmed based on the results obtained, shown in Table 4, according to the significance of the betas (β):

H1. There is a correlational-causal relationship between the dependent variable sustainable economic development and the independent variables: equitable social development, efficient and participatory institutional development and, technology.
H2. Equitable social development, efficient and participatory institutional development, and technology positively impact sustainable economic development.

It can also be observed in Table 4, according to the signs of the Coefficients typified β, that all the causal relationships of the model are positive, that is, greater equitable social development presents greater sustainable economic development; to greater efficient and participatory institutional development greater sustainable economic development; to greater technology greater sustainable economic development.

Variables	Significance of Beta (β)	Typified Coefficients β
X1 Equitable Social Development	.000	.446 (+)
X2 Efficient and Participatory Institutional Development	.000	.204 (+)
X3 Technology	.001	.152 (+)

Table 4 Hypothesis check
Source. Own elaboration with data from the surveys captured in the IBM SPSS Statistics 21 software, (2019)

According to the previous results, the variable that contributes least to the model is that of Efficient and Participatory Institutional Development.

References

Belsley, D. A. (1991). Conditioning diagnostics. John Wiley & Sons, Inc.

De México, E. D. L. M. (2005). Enciclopedia de los Municipios de México. Instituto Nacional para el Federalismo y Desarrollo Municipal. local. gob. mx/work/temples/enciclo/mexico/municipios.

Díaz-Bautista, A., Aviles, J. A., & Chimal, M. A. R. (2003). Desarrollo económico de la frontera norte de México. Observatorio de la economía latinoamericana, 29-36.

Enríquez Villacorta, A. (2004). Gobernabilidad democrática: una agenda para avanzar al desarrollo en América Latina. Alternativas para el Desarrollo, (87), 1-14.

García-Colín Scherer, L., & Ephussi, B. (1996). Energía ambiente y desarrollo sustentable:(el caso de México).

Hair, Joseph F., William C. Black, Barry J. Babin, & Rolph E. Anderson (2006), Multivariate Data Analysis, Englewood Cliffs, NJ: Prentice Hall.

Hernández Sampieri, R., & Collado, C. F. C. y Baptista Lucio, P. (2010). Metodología de la Investigación. 5ta Edición McGraw-Hill.

Instituto Nacional de Estadística, Geografía e Informática, Censo General de Población y Vivienda 2008. México 2008.

Kleinbaum, D. G., Kupper, L. L., y Muller, K. E. (1988). Applied Regression Analysis and Other Multivariate Methods: Student's Partial Solutions Manual. PWS-Kent.

Likert, R. (1932). A technique for the measurement of attitudes. Archives of psychology.

Treviño, A. R. (2003). El Desarrollo Sustentable: Interpretación y Análisis. Revista del Centro de Investigación de la Universidad la Salle, 6(21), 55-55.

Vallejo, P. M. (2012). Tamaño necesario de la muestra: ¿Cuántos sujetos necesitamos? Estadística aplicada, 24(1), 22-39.

Wong, P. (2005). Propuesta metodológica para el análisis estratégico participativo de desarrollo local-regional. México: Centro de Investigación en Alimentación y Desarrollo, AC (CIAD, AC).

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Challenges of the environmental management of Mining in Mexico

Retos de la Gestión Ambiental de la Minería en México

RIVERA-ACOSTA, Patricia†* & MARTINEZ-TORRES, Rosa Elia

Tecnológico Nacional de México, Instituto Tecnológico de San Luis Potosí

ID 1st Author: *Patricia, Rivera-Acosta* / **ORC ID**: 0000-0002-8254-0005, **Researcher ID Thomson:** X-2388-2019, **CVU CONACYT ID**: 232611

ID 1st Coauthor: *Rosa Elia, Martinez-Torres* / **ORC ID**: 0000-0001-8936-9207, **Researcher ID Thomson:** X-3124-2018, **CVU CONACYT ID**: 953355

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Abstract

Mexico has a high potential in terms of mineral resources, promoting investment, employment generation and strong fiscal contributions; mining activity at the national level has incorporated strategies that also allow it to comply with environmental protection requirements, so it recognizes that sustainable development allows it to harmonize this economic growth, with the right of future generations to achieve their well-being. Based on the descriptions provided in a Focus Group composed of the members of Minera Tierra Adentro, environmental challenges are identified that the Mexican Mining and Metallurgical Industry faces with respect to the fulfillment of goals derived from the Sustainable Development Goals (UN, 2015). Therefore, the objective of this work is to describe the main environmental challenges currently faced by mining companies in Mexico, to contribute as a sector oriented towards sustainability. The methodology, of qualitative nature, includes documentary research and the analysis of different sources of information through its reading and reflection, the Focal Group is also used as a technique for the collection of information.

Sustainable development, Mining and Metallurgical Industry, Remediation, Environmental challenges.

Resumen

México tiene un alto potencial en cuanto a recursos minerales, promoviendo inversión, generación de empleo y fuertes contribuciones fiscales; la actividad minera a nivel nacional ha incorporado estrategias que además, le permiten cumplir con requerimientos de protección al ambiente, por lo que reconoce que el desarrollo sustentable le permite armonizar este crecimiento económico, con el derecho de las generaciones futuras para alcanzar su bienestar. A partir de las descripciones que se proporcionan en un Grupo Focal integrado por los miembros de Minera Tierra Adentro, se identifican retos ambientales que la Industria Minero-metalúrgica Mexicana afronta con respecto del cumplimiento de metas que se derivan de los Objetivos de Desarrollo Sostenible (ONU, 2015). Por lo cual, el objetivo de este trabajo es, describir los principales retos ambientales que en la actualidad deben contrarrestar las empresas mineras de México, para contribuir como un sector orientado a la sustentabilidad. La metodología, de corte cualitativo, comprende la investigación documental y el análisis de distintas fuentes de información a través de su lectura y reflexión, se utiliza además, el Grupo Focal como técnica para la recolección de la información.

Desarrollo sostenible, Industria Minero-metalúrgica, Remedición, Retos ambientales

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*Correspondence to Author (email: erika.acosta@itson.edu.mx)
†Researcher contributing first author.

Introduction

The Mining and Metallurgical Industry is considered an economic factor in the world, so its importance cannot be ignored, which leads nations to study more friendly and sustainable processes, since by nature, their extraction usually impacts the environment . Mexico has a high potential in terms of mineral resources and the sector continues to give positive results in investment, job creation and strong fiscal contributions. Beyond its economic participation, the social scope of mining extends to 24 states of Mexico with a direct or indirect incidence in 83 million Mexicans, in short the incursion and development of this activity is a lever for economic development and society (CAMIMEX, 2006 and 2019).

Sustainability has become an essential asset and a trend for companies in any sector, although nowhere else than in mining, that is why understanding this commitment is emerging as an essential part of a business strategy; In the same way, companies are increasingly aware of environmental impacts, hence mining is one of the most important sources of pollution to the environment.

Mining in Mexico carries out its operations within the concept of sustainable development and respects environmental legislation through the application of additional tools such as: ISO standards, environmental auditing, socially responsible company, environmental certifications, etc. (CAMIMEX, 2006)

Theoretical foundation

Definitions and dimensions of Sustainability

In 1992 at the United Nations Conference on Environment and Development (UNCED), also called the "Earth Summit", the fact that environmental protection and natural resource management must be integrated into the socio-economic issues of poverty and underdevelopment. The Brundtland Commission (1987) demonstrated that social, environmental and economic needs must balance each other in order to obtain long-term sustainable results.

In this report, the concept of sustainable development is disseminated as "one that responds to the needs of the present equally, but without compromising the chances of survival and prosperity of future generations". It also states that poverty, equality and environmental degradation cannot be analyzed in isolation, placing poverty as one of the causes and consequences of environmental problems.

This concept assumes that the economic, social and environmental objectives of development must be defined in terms of sustainability with their dimensions: economic, social and environmental (figure 1):

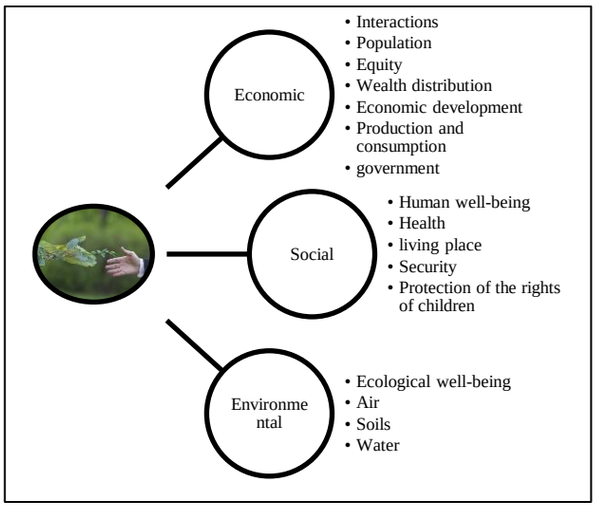

Figure 1 Sustainability Dimensions
Source: Own elaboration based on CMMAD (1987)

Background and Principles of Sustainability

Sustainable development is defined in the report Our Common Future, published by the World Commission on Environment and Development in 1987 as "one that meets current needs without compromising the ability of future generations to meet their own needs" (cited by Gómez, 2012, p.61).

However, this definition of almost 30 years ago has become obsolete, because that long-awaited future has become our present, where the effects of climate change are already being lived and the amount of resources that the new generations will have are uncertain, natural resources they are running out and being consumed at a faster rate than the earth is capable of regenerating them (Belda, 2018).

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According to Hernández (2009), economic development has been responsible for this situation, privileging an industrial model that pursues high growth rates causing the deterioration of nature, which has its origins for more than 200 years with the Revolution Industrial.

In 1983-1984, the UN and UNEP created the World Commission on Environment and Development, the Brundtland Report called Our Common Future (1987), which specifically talks about sustainable development, is prepared. In the UN Millennium Development Goals (2000), objective seven was to ensure environmental sustainability.

Sustainable Development Goals

Likewise, at the United Nations Organization (UN) in September 2015, the 2030 Agenda for Sustainable Development was approved at a historic summit held in New York City, which stands out as a momentous agenda as it states that " it will serve as an action plan for the international community and national governments to promote prosperity and common welfare in the next 15 years".

This agenda sets out 17 sustainable development objectives (SDGs), with 169 goals of an integrated and indivisible nature that contemplate the dimensions: economic, social and environmental, of those objectives are mentioned those related to the environmental dimension and which in this document are consecutively numbered:

1. Clean water and sanitation
2. Affordable and clean energy
3. Innovation and infrastructure industry
4. Sustainable cities and communities
5. Responsible production and consumption
6. Weather action
7. Life of terrestrial ecosystems

Each objective has goals that must be achieved by 2030, hence various initiatives of international organizations have been presented in order to unify the process of implementation, development, communication and evaluation of these practices offered different tolos

Global Reporting Initiative

One of the most important initiatives is the one carried out by the Global Reporting Initiative (GRI) which aims to be used by companies to prepare sustainability reports that include three dimensions: economic, environmental and social. It refers to the universal principles of the Global Compact, related to the environmental management of companies: a) they will maintain a preventive approach that favors the environment, b) they will promote initiatives that promote greater environmental responsibility and, c) they will favor the development and the diffusion of environmentally friendly technologies.

International Council on Mining & Metals (ICMM)

Promotes among its members, practices focused on sustainable development and responsible production of minerals and metals. The associated companies must apply the ten principles of sustainable development of the ICMM:

1. Apply ethical business practices, sound corporate governance systems and transparency to support sustainable development.
2. Integrate sustainable development in the strategy and decision-making processes in companies.
3. Respect the human rights, cultures, customs and values of employees and communities affected by our activities.
4. Implement strategies and effective risk management based on scientific knowledge.
5. Apply continuous improvement in our health and safety performance with the aim of zero damage.
6. Seek continuous improvement in our environmental performance (water, energy management and use, climate change).
7. Contribute to the conservation of biodiversity and the protection of soils and water resources.
8. Facilitate and support the design, use, reuse, recycling and responsible disposal of our products (metals and minerals).
9. Contribute to the economic, social and institutional development of the communities and countries where our operations are located.

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10. Commit proactively with the main stakeholders on sustainable development challenges and opportunities. Prepare annual report of environmental, economic and social performance using the GRI.

In this context we can see that there is a direct connection between the scope of the Global Compact, the Sustainable Development Goals, the GRI indicators and in a similar way, with the ten principles of sustainable development of the ICMM.

Sustainable Development and Environmental Management

The Report of the United Nations Environment Program (UNEP, 2010) promotes the greening of economies to achieve sustainable development; The green economy initiative offers solutions that improve human well-being, reduce inequalities and help rebuild the economy on a sustainable basis. Its objective is to help countries that request it to achieve ecological economies as a way towards sustainable development. Conceptually, sustainable development is linked to environmental management, which promotes the rational use of natural resources and the protection of the environment.

Finally, we must add that the environmental dimension of sustainability refers to the impacts of an organization on living and inert natural systems, including ecosystems, soil, air and water. It is divided into nine goals aimed, among other things, at halting and reversing land degradation, curbing the loss of biological diversity, recovering degraded forests and increasing reforestation and ecosystem restoration.

In turn, the environmental indicators cover performance in relation to the inflows (materials, energy, water) and outflows (discharged emissions, waste).

They also include performance in relation to biodiversity, legal environmental compliance and other relevant data such as expenses of an environmental nature or the impacts of products and services, adding the following environmental aspects: materials, energy, water, biodiversity, emissions, discharges, waste, products and services, regulatory compliance, transportation and finally general aspects (UN, 2011).

Aspects to consider in the Mining and

Metallurgical Industry.

A. Mining environmental liabilities

One of the most worrying situations related to mining is the Mining Environmental Liabilities (PAM), in much of the world. It refers to the "environmental impacts generated by abandoned mining operations with or without an identifiable owner or operator and, where no closure of mines regulated and certified by the corresponding authority has been made" (Oblaser and Chaparro, 2008).

The United States Environmental Protection Agency (EPA)[1] defined as abandoned mining sites, those lands, waters and basins contaminated or damaged by the extraction, benefit or processing of ores [2] and minerals The term abandoned mining site includes those areas where mining activity is temporarily inactive.

In the context of the Economic Commission for Latin America and the Caribbean (ECLAC) it is described that MAPs present or may present a safety or contamination risk for both human health and the environment (Oblaser and Chaparro, 2008: 12 ; Saade, 2014). In the case of Mexico, the Ministry of Environment and Natural Resources (SEMARNAP) defines PAMs as: "those sites contaminated by the release of hazardous materials or wastes that were not promptly remedied to prevent the dispersion of pollutants, but which imply an obligation of remediation ".

[1] *Enviromental Proteccion Agency*
[2] https://es.thefreedictionary.com/menas . Parte del filón que contiene minerales útiles que requieren un proceso de elaboración para poder ser utilizados en la industria. E.g. bauxita, mena de aluminio

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B. Remediation

Consequently, the mining activity, the removal of soils, the extraction of rocks and minerals, the deposit of waste, the construction of mining facilities can have a strong impact on ecosystems, on land and aquatic life during the operation. mining and also after the abandonment of it.

The environmental impact can be defined as modifications that the human being causes, generating ecological imbalance (SEMARNAT, 2013), the evaluation of these impacts, supposes conditions to which the activities that trigger unbalance must be subjected.

These impacts, within their evaluation, require a thorough review of methods in their processes. In the Mining Industry, this review and implementation of activities that counteract or minimize environmental impacts is known as remediation (Martínez and Rivera, 2017).

Remediation is a set of activities that are articulated to modify the state of alteration caused. Other concepts are linked: restoration, rehabilitation, all aimed at promoting the restoration of ecological processes (Arranz and Alberruche 2008).

Methodological Foundation

Minera Tierra Adentro (MTA), a small administrative, technical and operational consulting firm for the Mining and Metallurgical Industry, intervenes in a particular way with companies in the sector providing, through its members, experience in technical, operational, administrative and legal solutions, participating reliably with the safety and environmental aspects; installed in the capital city of San Luis Potosí, Mexico, it is made up of a selected team of highly qualified multidisciplinary earth science professionals.

As part of a collaborative work, subject to a line of environmental management research, the authors, participating in the generation of scientific knowledge of the MTA team, set the standard for the realization of a Focal Group that promotes the dissemination of information as agents of change within the mining-metallurgical sector.

Contextualization

The environmental damage that the Mining and Metallurgical Industry can cause, is reflected in deterioration of natural resources and ecosystems, which in addition, is not considered as the environmental cost of production, so its remediation is not formally described, prevailing as debt with the society (Melo, 2011).

As part of the awareness that MTA promotes with its clients and in favor of knowledge generation, an investigation is structured about the challenges that are required to strengthen the environmental strategies of companies in the mining-metallurgical sector. These challenges must be aligned with the global efforts that organizations have developed to recover the natural environment.

Justification

Mining activity produces prosperity and economic development, but the environmental impact on terrestrial ecosystems cannot be avoided. In light of the current challenges of mining, it is important for the sector to improve its approach to sustainability in its three dimensions: environmental, economic and social.

Problem statement

Industrial mining processes cause adverse effects on soil, air and water in the ecosystems where the companies in the sector are located. The sustainability agenda in mining is expanding, the industry has a lot to lose if it does not understand and manage the global trend, such as increasing pressure on natural resources, progressive demands for transparency and global action on climate change which affects all intensive companies.

Overall objective

Describe the main environmental challenges currently faced by Mexican mining companies, to contribute as a sustainability-oriented sector.

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Methodology

To achieve the objective, the use of a constructive-interpretative methodology is proposed, based on qualitative epistemologies that imply highlighting knowledge as human production generated from realities related to knowledge, building on experiences, in this case of personnel involved with mining and environmental aspects, to achieve articulations between theoretical foundations and real aspects through scientific research, to achieve understandable descriptions of the events studied (Hamui and Varela, 2013). The method used for this is the Focus Group.

Focus group

To facilitate the discussion and promote a practical and effective theoretical foundation to be disseminated in the mining-metallurgical sector, the knowledge and experience of people involved in it is explored. To do this, a focus group is being developed and conducted (Hamui and Varela, 2013) where in an opinion space, aimed at capturing explanations of observable and quantitative data captured from the environment, through previously prepared questions, collective information is obtained that It involves a variety of attitudes, solutions, experiences and beliefs of the participants so that through qualitative interpretations, constructivist descriptions of the knowledge of relevant environmental aspects that the Mining and Metallurgical Industry lives today are obtained, and which in this document are called Challenges

The focus group is made up of the researchers, who direct the activity and, based on the experience of the rest of the participants, describe the results; the Director of MTA mining engineer with more than 50 years of experience in the field, founder and main partner of the firm, a mining engineer expert in safety and environment with 45 years of experience, an industrial engineer, specialist in planning of mining work with 10 years of experience in this industry; a civil engineer, with more than 35 years of experience in mechanical metal construction, management and sales, collaborating as a representative of MTA with foreign sustainable cutting equipment, for the mining industry.

Information Collection Instrument

Based on the theoretical foundations about sustainability and Sustainable Development Goals, questions arise that support this research and are presented in the Focus Group. The description that the members backed by their experience and knowledge provide to each questioning, gives the structure of the challenges that the mining industry faces as the organisms have indicated as viable paths to recover the environment.

In this way, questions are raised regarding the current actions that impact the environment and that align with the sustainability foundations described in the 2030 Agenda (UN, 2013), from which they have been extracted and re-numbered to fulfill the purpose of this document, those related to environmental damage.

These questions are presented in plenary so that the members respond according to their own experiences and different experiences in the field; Some of these are presented below for the purpose of preparing this document, being the most representative and generally involving the selected SDGs:

1. With respect to guaranteeing free water (SDG 1) of impurities and accessible to all, considering mining-metallurgical processes that cause shortages and poor quality, in addition to the risk of impact to groundwater, how does the mining industry promote remedy or rehabilitate wells, clean, prevent droughts?

2. Does the mining industry have financial support that promotes investments in infrastructure (SDG 3, 4, 5) both from the same company (starting and withdrawing) and to empower communities by achieving increased productivity in income, improvements in health aspects, of health, education, urbanization, that allow to be more resistant to climatic and sustainable changes?

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3. Do the processes of the Mining and Metallurgical Industry (SDG 5), consider alternatives for the channeling of waste, in addition to the dams dam, called environmental liabilities (PAM); In addition, do they consider supplies and raw materials less aggressive than the current ones, such as cyanide (gold separation), spaces for safekeeping, handling and use of hazardous material? Is the exploitation of the mineral resource projected for the use of future generations?

4. Does the Mining and Metallurgical Industry consider processes that involve explosives that allow the disturbance to the earth to be minimized and thus also achieve an effective conservation of terrestrial ecosystems (SDG 6 and 7)?

Results

The findings of the mining experts and environmental mining topics, subject in order of the questions expressed above, are described below and in an integrated manner. The analysis and interpretation of the information obtained, was in charge of the researchers, however their descriptions were reviewed by the experts, so as not to generate trends or misrepresent some data. The main challenges, which are described below, emanate from the interrelation that is made both in the questions, and in the literary foundation expressed in this document, and are:

A. Input reduction (water):

Problematic:

PAMs can cause contamination of surface and groundwater and represent a risk of changing the hydrological and / or hydrogeological regime. The pollution is due to the release of toxic substances contained in mining waste and, from mining works, open pit and underground mines. The major source of such contaminants are reagents used in the processing of minerals. With each passing year, water becomes a more critical problem for the mining sector, as the laws of minerals decrease, more water is needed to extract the same amount of ore, which increases the water needs in the industry. At the same time, the demand for water is increasing worldwide, driven by population growth, industrial development, the expansion of low-risk agriculture and the increase in per capita consumption (WWAP, 2019).

Strategy expressed by the participants:

Water scarcity is not the only problem facing mining companies, in some regions ice melting, storms, have the potential to generate excess water, increasing the risk of tributary leakage. Faced with these challenges, mining companies must improve their approach or sustainable strategy of water management, that is to use innovative ways to reduce, reuse and recycle water in regions with scarcity; Contain and treat wastewater to prevent spills or contamination of downstream water flows and monitor (digitally) their use and purity.

They add that by using water in various mining site activities, an action in favor is the diversion of surface water and pumping of the underground, in this way mining operations can reduce both the quantity and quality available for aquatic ecosystems and other industrial users and municipal. These pumping and channeling, would allow it to be also used to supply the diverse needs of mineral processing, dust suppression, etc., being able to avoid droughts of the tributaries and maintain the level in the wells. This would also lead to not affecting the slopes and streams, which feed the flora and fauna.

B. Reduction of inputs (Energy)

Problematic:

Mining and metal processing can be processes that consume excessively energy, which represents a significant source of air pollution, for example, the use of diesel fuel, used in trucks and excavators, electricity is used to power large equipment ore grinding and refining and smelting of various minerals, such as in Mexico, copper, aluminum, lead, silver, gold, zinc, among others.

Strategy expressed by the participants:

The mining industry is developing and using a series of strategies and technologies to reduce the environmental impacts derived from the entry of energy, these involve strong budgetary items, since changes must be made, that is, updating the mining equipment, from the extractive, to those of mineral processing, adopting even new houses or firms that already have sustainable equipment, with smaller dimensions and with greater operational capacity.

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Which by their design, in addition, contain the generated emissions, so these are minimal and in their process they are purified, reducing air and soil pollution.

C. Ticket reduction (earth disturbance)

Problematic:

Currently mined sites disturb a small fraction of the total land area of the earth. Achieving fractures in buildings or problems associated with the use of soil, since they can suffer both an impact from pollution, vibration and erosion and degradation, since it has its origin in the drag of the material contaminated by the wind and pollution due to inadequate disposal of waste and chemicals in mining operations.

Erosion and degradation of soils is due to the exposure of removed and processed materials, the destruction of the existing protective plant layer and also by the disposal of mining waste on the surface, considered PAM.

Another situation associated with the PAMs is the dragging of particulate material by the action of the wind that could contaminate the soil and affect people or animals by inhalation, ingestion or dermal contact (Parodi, 2010).

Strategy expressed by the participants:

Establish an adequate legal framework under a defined institutionality, as a fundamental element for the necessary policies to be applied to mitigate, remedy or avoid specific sites, expansions or concentration of previously untreated or previously separated MAP.

They express that at this point, the need for exchange and updating of mining equipment for more friendly and sustainable technology is reinforced, having to create important budget items to achieve this point. Erosion remediation would be minimized since the separation and refining of minerals would be more effective with more specialized equipment than the current ones, the handling, use and storage of reagents would be minimal and the waste would become a usable product in different industries ; with it, even the landscape would improve.

D. Output reduction

Problematic:

Mine wastes include solids, water and air particles, which can vary significantly in their composition and the potential for environmental pollution; In addition, the large volumes of waste produced in most mining sites cannot be hidden, they are well dammed, the so-called PAM.

Mining activities are carried out in a relatively small area, however related infrastructure and pollution of activities have the potential to affect the health of entire ecosystems, as well as reduce their ability to provide the necessary assets for human and environmental well-being. This includes the purification of water and air, the decomposition of waste materials that may be compromised when ecosystems are saturated by high levels of pollution.

Strategy expressed by the participants:

In addition to preventing contamination of soil, water and air, waste management plans are required to select and design suitable storage facilities to minimize the expansion of these (dam dams, PAMs).

The sector must adopt less aggressive processes, this includes the use of reagents and various supplies, which may derive from the adoption of foreign methods or give rise to investigations, which must also be sponsored and endorsed by the sector; companies must create links with research institutions and allow them to function as on-site laboratories.

Conclusions

The impact that emanates from mining-metallurgical activities, during its operation to ecosystems and terrestrial lives can remain after the abandonment of the mine temporarily or permanently.

Mining can have or express a high level of sustainability, according to the analysis of the results of the focus group, provided that the sector develops and integrates practices that reduce the environmental impact of its operations, with low measures, medium and high degree of complexity depending on the impact you want to avoid or minimize.

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In order to reduce the consumption of water and energy, minimize the disturbance of the land, the production of waste, prevent the contamination of soil, water and air and, in turn, the closure of mining units are effective as well as recovery activities, global efforts are required, where government, business, society, even individuals, actively participate without politicizing the efforts applied.

To be more environmentally sustainable, mining operations must be carried out in a way that minimizes their impact on the environment and leaves mined sites in an acceptable state for reuse for people or ecosystems.

In this document, we tried to concentrate the closest challenges facing the Mining and Metallurgical Industry, described by world organizations.

An important general observation described in this focal activity is that environmental damage is a result of centuries of exploitation without supervision and controls based on rigorous standards, so it can be referred to as a high cost, for not having considered good practices, even for not having allowed scientific research that exposed knowledge of both the benefits, and the destruction caused by the sector in the environment, as well as the opportunities for updating both new theories, processes, equipment and technologies and more environmentally friendly.

References

Arranz, J., Alberruche, E., (2008). Minería, medio ambiente y gestión del territorio. España: Gráficas Monterreina.

Belda, Ignacio, 2018. *Economía circular. Un nuevo modelo de producción y consumo sostenible.* Madrid :Tébar Flores.

Cámara Minera de México. (2019). *Informe Anual.* Cd. de México: CAMIMEX.

CMMAD. (1987). *Informe de la Comisión Mundial sobre el Medio Ambiente y el Desarrollo.* Nairobi: Asamblea General .

CNUMAD. (1992). Conferencia de las Naciones Unidas sobre el Medio Ambiente y Desarrollo., (pág. 2).

Gómez, T. (2012). RSE y desarrollo sustentable. En: Raufflet, E., Lozano, J., Barrera, E. y García, C. eds., *Responsabilidad social empresarial*, 1st ed. Naucalpan de Juárez, México: Pearson

Hamui, A., Varela, M., (2013). La técnica de grupos focales. Universidad Nacional Autónoma de México.

Hernández, B. (2009). *La función estratégica de la comunicación en el desarrollo sustentable. Xico, Veracruz un ejemplo de aplicación.* Tesis Doctoral. Universidad Veracruzana. México. Recuperado de: http://www.eumed.net/tesisdoctorales/2010/tbhh/Antecedentes%20y%20perspectivas%20del%20desarrollo%20sustentable.htm

International Council on Mining & Metals. (17 de mayo de 2019). Obtenido de https://www.icmm.com/website/publications/pdfs/commitments/181126_performance-expectations.pdf

Martínez, R., Rivera, P., (2017). Articulación de los objetivos de Desarrollo Sostenible y la Legislación Ambiental en la Industria Minera. REMINEO: México.

Melo, R., (2011). Evaluación de un pasivo ambiental metalúrgico. UASLP: México.

Moran, Robert. (23 de julio de 2013). *Observatorio de Conflictos Mineros de América Latina.* Obtenido de https://www.ocmal.org/robert-moran/

Organizacion de Naciones Unidas. (2011). *Guia para la elaboracion de Memorias de Sostenibilidad* . México .

ONU-MÉXICO. (12 de septiembre de 2017). Metas de los Objetivos de Desarrollo Sostenible. Cd. de México.

Parodi, P. (2010). Gestión de los costos ambientales en la actividad minera. *Foro virtual de contabilidad ambiental y social. Centro de Modelos Contables (CECONTA),* (págs. 1-18). Buenos Aires.

ISSN 2410-342X

PNUMA. (2010). *Informe anual* . Nairobi: Sección de servicios de publicación de la ONU.

Saade, Hazin Miryam. (2014). *Buenas Practicas que favorezcan una mineria sustentable. La problemática en torno a los pasivos ambientales en Australia, el Canadá, Chile, Colombia, los Estados Unidos, México y el Perú.* Santiago de chile : ONU-CEPAL.

SEMARNAT, (2007). *La Carta de la Tierra.* México, D.F.: Secretaría del Medio Ambiente y Recursos Naturales. Recuperado de: http://biblioteca.semarnat.gob.mx/janium/Documentos/Cecadesu/Libros/202455.pdf

Tretreault, Darcy. (Septiembre 2013). La Megamineria en México, Reformas estructurales y resistencia. *Letras Verdes. Revista Lationamericana de Estudios Socioambientales No. 14*, 214-.

WWAP. (2019). *Informe Mundial de las Naciones Unidas sobre el desarrollo de Recursos Hidricos 2019. No dejar a nadie atras.* París: UNESCO.

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Surname (IN UPPERCASE), Name 1st Author†*, Surname (IN UPPERCASE), Name 1st Coauthor, Surname (IN UPPERCASE), Name 2nd Coauthor and Surname (IN UPPERCASE), Name 3rd Coauthor

Institutional Affiliation of Author including Dependency (No.10 Times New Roman and Italic)

International Identification of Science - Technology and Innovation

ID 1st Author: (ORC ID - Researcher ID Thomson, arXiv Author ID - PubMed Author ID - Open ID) and CVU 1st author: (Scholar-PNPC or SNI-CONACYT) (No.10 Times New Roman)

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ID 3rd Coauthor: (ORC ID - Researcher ID Thomson, arXiv Author ID - PubMed Author ID - Open ID) and CVU 3rd coauthor: (Scholar or SNI) (No.10 Times New Roman)

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Abstract (In English, 150-200 words)

Objectives
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* Correspondence to Author (example@example.org)
† Researcher contributing as first author.

Introduction

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General explanation of the subject and explain why it is important.

What is your added value with respect to other techniques?

Clearly focus each of its features

Clearly explain the problem to be solved and the central hypothesis.

Explanation of sections Article.

Development of headings and subheadings of the article with subsequent numbers

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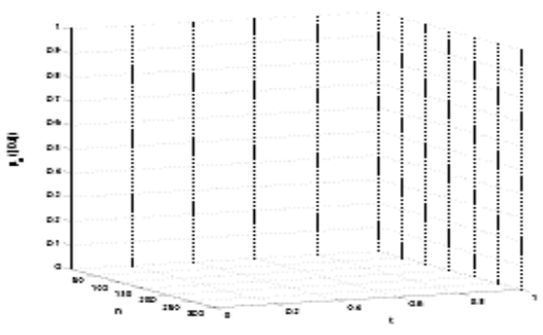

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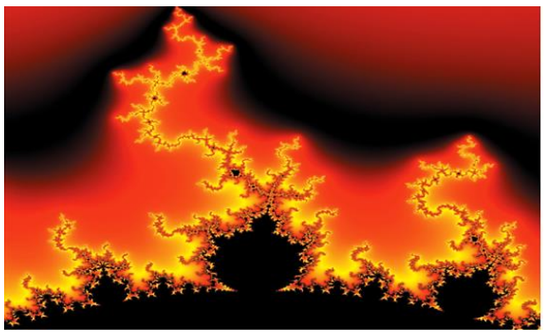

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