

The Valley of Death of Start-ups: A Systematic Literature Review

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Abstract

Purpose: The main factor that contributes to the socioeconomic development of a local territory is entrepreneurship; unfortunately, start-ups in Latin America have high failure rates during the first 5 years of operation, failing to overcome the so-called valley of death. This article aims to determine how literature explains this phenomenon, mapping current knowledge and identifying gaps in the relevant literature.

Design/methodology/approach: A bibliometric analysis was carried out in order to build a state of the art starting from a search equation elaborated with the Citation Pearl Growing technique, which was entered into the SCOPUS and Web of Science (WOS) indexers, then the study of keywords co-occurrence was carried out with the VOSviewer® software, and as a result, the content analysis of 91 articles was performed with ATLAS.ti®.

Findings: The review allowed to classify three clusters: valley of death, causes of the valley of death, and how to overcome the valley of death. This article identifies and reflects on the perception of various authors.

There are still gaps in the literature and this work will allow researchers, legislators, and entrepreneurs to have an approach to information and updated scientific knowledge and to continue with its development, to identify the causes and possible ways to face this phenomenon.

Originality/value: This document offers a mapping of information and scientific knowledge related to the valley of death, referring to the early stage in which enterprises are more vulnerable and tend to fail.

Keywords


Entrepreneurship, valley of death, innovation, failure, systematic literature review.

1. Introduction

Entrepreneurship is an engine of innovation and growth that drives the economic development of a local territory (Aldairany, Omar, & Quoquab, 2018) and avoids the lethargy of the economy (Granadillo, 2017). The Colombian government, considering the role it plays as a governmental moderator between entrepreneurship and the economic growth of the country (Saber, 2018) and seeking to promote the entrepreneurial spirit, issued the Law 1014 in 2006 to promote the culture of entrepreneurship (Congreso de Colombia, 2006) and the law 2069 in 2020, which promotes entrepreneurship in Colombia (Congreso de Colombia, 2020).

Despite state policies, it is difficult for start-ups to survive the valley of death, the reasons for this are not yet completely clear and a consensus on solutions has not been reached (Ellwood et al., 2020). The period known as the valley of death comprises the stage of the first 5 years of entrepreneurship in which start-ups are most vulnerable (Lefebvre, Certhoux, & Radu-Lefebvre, 2020), not allowing them to survive while generating resources from commercialization of the goods and services offered.

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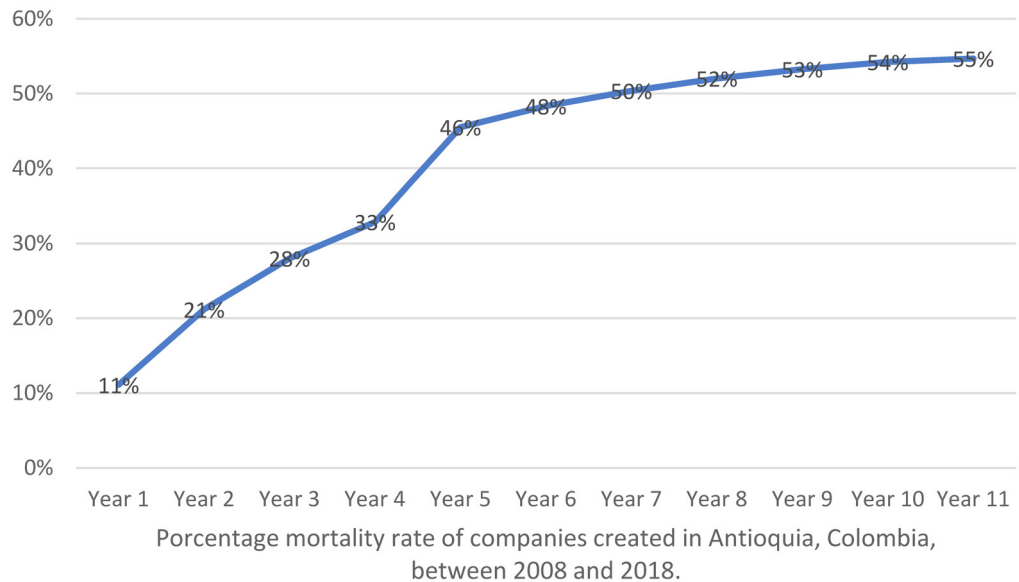
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The mortality of companies created in the department of Antioquia, Colombia, between 2008 and 2018 was 28% in the first 3 years from its creation, 32.87% in the first 4 years,

and 45.50% in the first 5 years, as shown in Figure 1. 60.04% of these closing companies correspond to start-ups (Eduardo, Ortiz, Pablo, & Mejía, 2019).

Figure 1 Evolution of mortality of start-ups in Antioquia from their year of creation.
 Source: own elaboration



In the 11-year period between 2005 and 2016, 43.41% of the start-ups created in this region closed; while in the 10-year period between 2008 and 2018, 39.96% closed as well as 69.73% of companies constituted as a natural person in this same period (Eduardo et al., 2019). This shows that the problem does not evolve in a representative manner despite the efforts of governments to create public policies.

The theoretical background is identified by answering these research questions, reviewing the scientific articles published in the SCOPUS and WOS databases and the gaps to be documented.

This article maps the current state of information and scientific knowledge regarding the valley of death, answering the following questions:

- Q1. What is the valley of death?
- Q2. What are the causes of the valley of death?
- Q3. How to overcome the valley of death?

2. Methodology

In the systematic literature review process, the bibliometric analysis was carried out for building the state of the art starting from a search equation which was entered into the SCOPUS and WOS indexers (Escobar-Sierra, Lara-Valencia, & ValenciaDeLara, 2021), and then the study of keywords co-occurrence was carried out with the VOSviewer® and ATLAS.ti® software, as shown in Figure 2.

Figure 2 Methodology of the systematic literature review
 Source: own elaboration

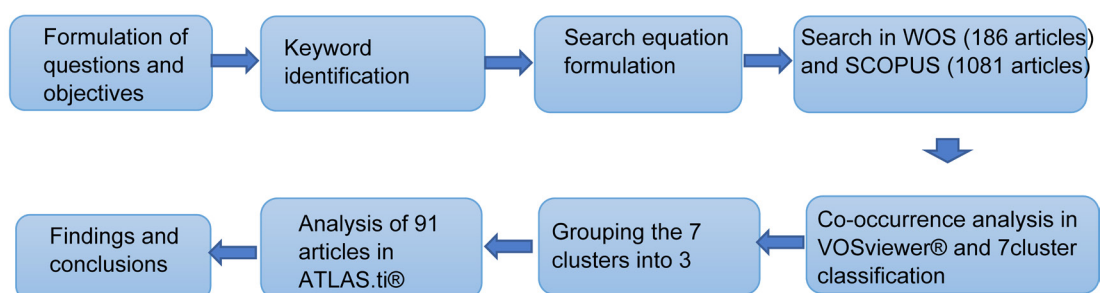


Table 3 Ten most common keywords and co-authorship links distributed by cluster.
 Source: own elaboration.

	Cluster	Code	Term	Occurrences	Co-authorship links
Entrepreneurship	6	6.1	innovation	78	321
		6.2	economics	55	328
		6.3	industry	46	216
		6.4	sustainable development	39	224
		6.5	finance	36	186
Valley of death	7	7	bankruptcy	48	211
	5	5	risk assessment	39	200
Innovation	1	1	information technology	45	198
	2	2.1	investments	38	233
		2.2	technology	36	190

Table 4 lists the 10 keywords with the highest number of occurrences and co-authorship links classified by cluster, including references to indexed articles.

Table 4 Author references for the top ten keywords and co-authorship links and clusters
 Source: own elaboration.

Cluster	Cluster Reference	Code	Term	Term reference
Entrepreneurship	Opportunity motivated by the creation of a company, based on business opportunities (Varela Llamas, 2019)	6.1	Innovation	Entrepreneurship promotes economic growth by introducing innovations and creating skills in markets (Granados, Lizeth, Jiménez, & José, 2020)
		6.2	Economy	The main factor that contributes to the socio-economic development of a local territory is entrepreneurship (Torres Granadillo, 2017)
		6.3	Industry	During the initial stages of development of the industries of some region, the rates of entrepreneurship are a fundamental factor to take advantage of knowledge and promote higher rates of growth (Granados et al., 2020)
		6.4	Sustainable development	Business incubators constitute a very important role in the generation of entrepreneurship dynamics required by economies by promoting the creation of companies that put emphasis on sustainable development (Granados et al., 2020)
		6.5	Finance	Failure in entrepreneurship is related to lack of personal skills, but also with a lack of knowledge and more technical skills, such as finance and accounting (Jaramillo, Orestes, & Bermúdez, 2015)
Valley of death	Early stage in which enterprises are more exposed (Ellwood, Williams, & Egan, 2020)	7	Bankruptcy	In Colombia, much of the entrepreneurial activity is carried out due to necessity, a type of entrepreneurship that in 80% of cases leads to bankruptcy (Castro-sardi, 2018)
		5	Risk assessment	The risky attribution of entrepreneurial work and the perceived acceptance of the risk associated with entrepreneurship, indicates that entrepreneurs have a higher tendency to take risks (Yolima & Urbano, 2019)
Innovation	It is the path of economic growth, through diversification towards new activities with high added value (OECD, 2015)	1	Information technology	Service control is based on interaction with clients from the entrepreneur's expertise through information technology (Morales-gualdrón, nd)
		2.1	Equity Investors	For start-ups to prosper in Latin America, it is necessary for investors to be willing to trust start-up ventures and for countries to strengthen their scientific and technological information (Carolina & Garzón, n.d.)
		2.2	Technology	The State has an interest in strengthening innovation as an essential element in the generation of entrepreneurship, science and technology initiatives (Law 1286 of 2009 on Science and Technology) that really generate transformation in the economic and social development of the country, also allowing those initiatives to endure over time (Milena, Arciniegas, Patricia, & Bedoya, 2011)

From the articles found with the search equation applied to the indexers and after the analysis of occurrence and co-authorship links, 91 relevant articles were selected to be analyzed in the ATLAS.ti® software, where 5 labels oriented to the mega clusters identified with VOSviewer® were incorporated. The labels entered according to each cluster were:

- Valley of death: valley of death, overcoming the valley of death, and causes of the valley of death
- Entrepreneurship: entrepreneurship

- Innovation: with the label innovation

The labels were applied to 91 articles indexed in SCOPUS and WOS obtained with the search equation and refined according to the established clusters.

Within the analysis carried out on these documents, the following words were found with the highest co-occurrence: entrepreneurship, innovation, technology, research, capital, and ecosystem, which are observed in Figure 5.

Figure 5 Keyword co-occurrence cloud.

Source: Own elaboration, 2021, with ATLAS.ti®



As a result of the analysis of 91 articles in ATLAS.ti® — product of the search equation entered in SCOPUS and WOS — 19 codes referring to the causes of the valley of death, 23 referring to overcoming the valley of death, and 11 referring to the valley of death were obtained for a total of 53 codes related to the valley of death, 5839 codes

related to entrepreneurship, and 1423 codes related to innovation. In total, 24 codes relating the valley of death with entrepreneurship, and 32 codes relating the valley of death with innovation were found, as shown in Table 5 and Figure 6.

Table 5 Number of articles that relate the valley of death with entrepreneurship and innovation.
 Source: Own elaboration, 2021, from ATLAS.ti®

	◇ Entrepreneurship ○ 5839	◇ Innovation ○ 1423
◇ Causes of valley of death ○ 19	6	10
◇ Overcome the valley of death ○ 23	16	19
◇ Valley of death ○ 11	2	3

Figure 6 corresponds to a Sankey Diagram, which shows the relationship between keywords in the documents analyzed, identifying that the Valley of Death is related on 3 occasions with Innovation and 2 with Entrepreneurship; Overcoming the Valley of Death is related on 19 occasions with Innovation and 16 with Entrepreneurship; the Causes

of the Valley of Death are related on 10 occasions with Innovation and 6 with Entrepreneurship. This allows identifying the relationship between the Valley of Death, Innovation, and Entrepreneurship according to the articles consulted.

Figure 6 Relation of the valley of death with entrepreneurship and innovation.
 Source: Own elaboration, 2021, from ATLAS.ti®



3. Discussion and findings

The results found put emphasis on the references of

authors who have written about the valley of death (Table 6), what are its causes (Table 7), and how to overcome it (Table 8) according to the objectives of this work.

Table 6 References of authors who have written about start-ups valley of death
 Source: Own elaboration, 2021, with ATLAS.ti®

Author	Reference
(Uribe, 2019)	The "valley of death" is the combination of lack of liquidity with a chronic discouragement in the entrepreneur, and it is fatal.
(Lefebvre et al., 2020)	The start-up funding gap was dubbed the "Valley of Death," a label that metaphorically describes the most likely outcome of start-ups failing to attract funding during the "nebulous phase" or "corridor" between research and development and commercialization of new products and services.
(Gamarra, 2016)	Some funds offer seed capital and then there is a long "valley of death" to mutual funds. Very few ventures.
(Alunni, 2020)	The "valley of death" refers to the period from when a start-up receives an initial financial contribution to when it begins to generate income. This so-called "valley of death" is therefore a metaphor often used by corporate venture capital investors to describe the funding gap between research and commercialization.
(OECD, 2015).	The gap between the generation of basic knowledge and the subsequent commercialization of this knowledge into marketable products has been commonly identified and is generally known as the "Valley of death" problem.
(Claudia, 2017)	The "valley of death", understood as the time that elapses from when the project begins until when it can cover the operating expenses of the business, that is, the moment when entrepreneurs do not have resources for financing. In this phase, the initial resources are usually own, family and, in some cases, public subsidies.
(Valley, Death, Seen, & Dyna, 2017).	International research groups have found a fortunate expression when calling "Valley of Death" the impossibility that can arise from overcoming a certain level of stage to R&D works.
(Sebastian, 2019)	The "valley of death" is a denomination understood as a stage of stagnation of the initiatives, where a high percentage of projects do not go to the final stages of exploitation, production or commercialization of the innovation.
(Dean, Zhang, & Xiao, 2020)	Valley of death is a term used to describe a gap between the development of new scientific knowledge and the commercial development of new products. In fact, according to industry estimates, four out of five new inventions are never marketed. This is problematic as inventions represent one of the greatest opportunities for the development and launch of brand new products.

Table 7 References of authors who have written about the causes of start-ups valley of death
 Source: Own elaboration, 2021, with ATLAS.ti®

Author	Reference
(Uribe, 2019)	The main reason for business mortality is the lack of sufficient income to survive; added to this problem is the lack of indicators on sales, customers and scope, which has the power to put anyone in check. At no time in business life can you afford to sell little, but if that happens in the path of the "valley of death" it is almost certain that you will have to send a distress signal to the universe to survive.
(Ellwood et al., 2020)	Valley of death occurs during the early stages of innovation, in the transition between original scientific research and commercialization of associated technologies, due to difficulties in securing funding in this phase. Policymakers have tried to close this gap, however, even though governments have increased the availability of financial and managerial support for the Valley of death phase, the challenge of crossing it and securing the first investment remains important in marketing.
(Nemet, Zipperer, & Kraus, 2018)	Promising technologies do not emerge due to weak investment incentives, technical risk, uncertain markets, and the need for large investments. Market failures and innovation system failures lead to a lack of investment in this intermediate stage of innovation.
(Ellwood et al., 2020)	Innovation during the valley of death is characterized by uncertainty about what a new technology will do and future market demand. In such circumstances, we might expect innovation management to be a complex endeavor prone to failure.
(Bosma et al., 2020)	Reasons for ending participation in a business may include lack of profitability, inability to access finance, or the burden of taxes or bureaucracy, or simply human factors.
(Bosma et al., 2020)	The Law for Strengthening Entrepreneurship and initiatives such as the Law for the Promotion and Development of Micro, Small and Medium Enterprises try to promote entrepreneurial activity in different ways using public funds to provide seed capital for entrepreneurial projects. The problem is that this business activity has a high risk of failure and therefore the money could be misallocated. These laws and initiatives also set interest rate caps to provide "low-cost financing" for entrepreneurs, which creates a great distortion in the financial market.
(Bonini, Capizzi, Valletta, & Zocchi, 2018)	Venture capitalists may be reluctant to invest during the early stages of ventures.
(Uribe, 2019)	80% of ventures fail before five years and 90% do not reach a decade due to financial, administrative, and commercial issues, precisely the key aspects that mark the "valley of death." Excessive loan collection periods stifle companies, which must seek expensive financing. This causes financial and operational conflicts for them; at the end they go bankrupt and disappear.
(Alunni, 2020)	University start-ups in the early stages of development often encounter the financial gap that limits their ability to both innovate and market their products or services and end up in the 'valley of death'. In addition, as for any new company, limited human capital, high uncertainty in terms of product and market, volatile development process and weak association ties are also added to the financial gap as the major impediments to a successful development of start-ups.
(Castro-sardi, 2018)	Regarding the context of entrepreneurship in Colombia, only 6% of the companies created continue to operate beyond 3.5 years. Which may be related to the fact that a large part of the entrepreneurial activity is carried out because of necessity, a type of enterprise that, in 80% of cases, leads to bankruptcy. The foregoing deepens the poverty conditions of the population, taking into account that this activity implies a high degree of financial, personal, and social investment.
(Gerardo, Tanoira, Alberto, Valencia, & López, 2020)	Among the most important causes of failure are lack of experience (51.5%), ignorance of the market (30.3%), and little knowledge of financial matters (18.2%). This means that beyond the technical issues in the curriculum, it is important to involve students in entrepreneurship more, for which cooperation between schools, government, and entrepreneurs is essential.
(Agudelo, 2016)	Human capital is fundamental, above all, for the economies of the regions to become more sophisticated, it is supremely important, especially in Latin America. Companies are failing at five years or less because human capital is not prepared. There are many entrepreneurs who have no idea about finances.
(Uribe, 2019)	Mismanagement has always been the Achilles heel of companies, but in the "valley of death" its impact can be enhanced because there is a marked urgency to generate income and maintain cash flow in order to continue operating the business.

Table 8 References of authors who have written about how to overcome the valley of death.
 Source: Own elaboration, 2021, with ATLAS.ti®

Author	Reference
(OECD, 2015).	A set of incentives aimed at supporting the creation and take-off of new companies with intensive R&D activity during the first seven years after their creation. This initiative has made it possible to position France as the first country in the European Union to adopt mechanisms of this type, with very positive results in terms of generating new R&D-based companies, employment, human capital specialized in innovation, and a reduction in the rate of bankruptcy of young companies.
(Tello Angel, Travez Ana, Molina Franklin, Andrade Patricia, 2018)	Before throwing tools to create a company, which quite possibly goes bankrupt in three months, study mechanisms should be promoted where the small entrepreneur is accompanied in an effective way, whose project is the subsequent end in a real plane accompanied by constant and repeated planning at the level of market variables or dilemmas to be considered: is every idea capable of becoming a company? Can any project become a reality? Where do the state of the art of companies, actions or conceptualizations hang?
(Alunni, 2020)	The investment of corporate risk is very important to overcome the valley of death.
(Agudelo, 2016)	To encourage entrepreneurship, you have to think of policies that increase the ease of doing business; policies that reduce taxes on entrepreneurs and financial actors who invest in ventures that demonstrate that they contribute to economic development, with the payment of taxes or the creation of formal jobs; policies that promote education in entrepreneurship, to people from an early age, articulated with economic development policies, that is, that education in entrepreneurship is passed to the productive stage, so that those ideas generated in the learning process can be materialized with public policies, support for entrepreneurs in all stages of the process can also be guaranteed, since there is currently a gap in Colombia, in which the company is already up and running but does not meet the seniority requirements and other banking demands, for example, and that is where many ventures fall into the valley of death. Well, that is what we must prevent.
(Ellwood et al., 2020)	Successful transition from the valley of death phase would manifest itself by articulating a "credible business proposition" that would attract the next big investment.
(Son, Chung, & Yoon, 2020)	Universities provide various incubation services to make these spin-offs sustainable. For example, the University of North Carolina, Chapel Hill, launched an "office of innovation and entrepreneurship" to support the knowledge, tools, and resources that enable spin-offs to commercialize their business ideas.
(Alunni, 2020)	Corporate risk investing is important to overcome the valley of death
(Son et al., 2020)	The university needs to evaluate and adopt a business incubation model that can actively participate in generating profits from spin-offs, rather than relying on a simple business incubation model that provides spin-offs with business space and advice.
(Bosma et al., 2020)	In Canada, work is being done to support entrepreneurs, reducing taxes and bureaucracy; government programs to promote entrepreneurship, business education at the school stage, business education at the post-school stage, transfer of R&D, commercial and legal infrastructure, internal market dynamics, internal market burdens or entry regulation, cultural and social norms, business financing.
(Ellwood et al., 2020)	Killing projects with no potential early accelerates innovation by focusing R&D on those projects that increase the probability of a successful outcome

4. Conclusions

It is difficult for start-ups to survive the valley of death, the reasons for this are not yet completely clear and a consensus on solutions has not been reached (Ellwood et al., 2020), however, talking about the valley of death refers to the gap that exists between financing and the stage of commercialization of goods or services (Alunni, 2020; OECD, 2015; Lefebvre

et al., 2020; Valle, Muerte, Vistas, & Dyna, 2017; Gamarra, 2016; Dean et al., 2020; Sebastian, 2019) that produces a lack of liquidity in the start-ups (Uribe, 2019; Lefebvre et al., 2020; Claudia, 2017), which does not allow them to have a good organizational structure (Lefebvre et al., 2020) causing discouragement of the entrepreneur (Uribe, 2019), as shown in table 9.

Table 9 References from authors who have written definitions of the valley of death.

Source: own elaboration 2020

Definition of valley of death	Gap between financing and commercialization	Lack of liquidity	Lack of structure	Entrepreneur discouragement
Author				
(Alunni, 2020)	X			
(OECD, 2015).	X			
(Lefebvre et al., 2020)	X	X	X	
(Valle et al., 2017) pp.	X			
(Gamarra, 2016)	X			
(Dean et al., 2020)	X			
(Sebastian, 2019)	X	X		
(Claudia, 2017)		X		
(Uribe, 2019)		X		X

The main causes of the valley of death in entrepreneurship are the lack of risk investment (Nemet et al., 2018; Bonnin Roca & O'Sullivan, 2020; Bosma et al., 2020; Ellwood et al., 2020; Alunni, 2020); the lack of market knowledge – which produces commercial uncertainty that directly affects sales and thus the cash flow of the company (Uribe, 2019; Ellwood et al., 2020; Alunni, 2020; Gerardo, Tanoira, Alberto, Valencia, & López, 2020), turning the lack of

resources into a snowball that affects other areas such as human resources, not allowing to have the suitable and trained personnel for the required functions (Bosma et al., 2020; Gerardo et al., 2020; Alunni, 2020; Castro-sardi, 2018; Agudelo, 2016) – among others such as mismanagement (Uribe, 2019; Agudelo, 2016; Gerardo et al., 2020), fiscal or bureaucratic burden (Bosma et al., 2020; Ellwood et al., 2020), and lack of profitability (Laverde et al., 2019).

Table 10 References of authors who have written about the causes of start-ups valley of death.

Source: own elaboration 2020

Cause of the valley of death	Lack of market knowledge - lack of sales	Lack of risk investment	Lack of profitability	Tax or bureaucratic burden	Human Factors	Management failures
Author						
(Uribe, 2019)	X					X
(Ellwood et al., 2020)	X	X		X		
(Gerardo et al., 2020)	X				X	X
(Alunni, 2020)	X	X			X	
(Nemet et al., 2018)		X				
(Bosma et al., 2020)		X	X	X	X	
(Bonini et al., 2018)		X				
(Agudelo, 2016)					X	X
(Castro-sardi, nd)					X	

To overcome the valley of death, entrepreneurship must be trained to have specialized human capital for this work (OECD, 2015; Agudelo, 2016; Son et al., 2020; Bosma et al., 2020; Tello Angel, Travez Ana, Molina Franklin, Andrade Patricia, 2018), promote risk investment (Alunni, 2020; Agudelo, 2016; Bosma et al., 2020; Ellwood et al., 2020), create public policies that favor entrepreneurship and decline of taxes (OECD, 2015; Agudelo, 2016; Bosma et al., 2020), make the access of businesses to banking more flexible (Agudelo, 2016; Bosma et al., 2020; Jaime & Uribe, 2018), and put emphasis on the commercial infrastructure

and the business plan of the enterprises (Bosma et al., 2020; Awais & Tipu, 2019). For their part, Paul Ellwood and others go further, proposing to sacrifice early projects with little potential to focus R&D on those with the best chance of success (2020), while Hosung Son indicates that it is necessary to evaluate and adopt a model incubation program that can actively participate in the generation of profits for companies at an early stage, instead of relying on a simple business incubation model that provides them with spaces and business advice (2020).

Table 11 References of authors who have written about how to overcome the valley of death.
 Source: own elaboration 2020

How to overcome the valley of death	Public policies	entrepreneurship training	Encourage risk investment	Tax decrease	Flexibility of banking requirements	Trade infrastructure
Author						
(Alunni, 2020)			X			
(OECD, 2015).	X	X				
(Agudelo, 2016)	X	X	X	X	X	
(Bosma et al., 2020)	X	X	X	X	X	X
(Tello et al, 2018)		X				
(Ellwood et al., 2020)			X			
(Son et al., 2020)		X				
(Jaime & Uribe, 2018)					X	

With the previous mapping of the current state of information and scientific knowledge regarding the valley of death, its causes, and how to overcome it, this article will allow researchers, legislators and entrepreneurs to approach the information and updated scientific knowledge and continue with its development, promoting local socio-economic progress, providing the necessary elements so that enterprises last over time and do not fail in the valley of death.

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