Business Meets Technology

3rd International Conference

Universitat Politècnica de València, Spain
September 23-24, 2021

edUPV
Universitat Politècnica de València

M Rosario Perello-Marín
Conrado Carrascosa López
Daniel Catalá Pérez (Eds.)

GENERALITAT VALENCIANA
Conselleria d'Innovació, Universitats, Ciència i Societat Digital
UNIVERSITAT POLITÈCNICA DE VALÈNCIA
ADE FACULTAD DE ADMINISTRACIÓN Y DIRECCIÓN DE EMPRESAS. UPV
doe Departamento de Organización de Empresas
HOCHSCHULE ANSBACH

Business Meets Technology

3rd International Conference

Universitat Politècnica de València, Spain
September 23-24, 2021

M Rosario Perello-Marín
Conrado Carrascosa López
Daniel Catalá Pérez (Eds.)

edUPV
Universitat Politècnica de València

Congresos UPV
BMT 2021 – 3rd International Conference Business Meets Technology 2021. Valencia (Spain). September 23-24, 2021.

The contents of this publication have been evaluated by the Scientific Committee which it relates and the procedure set out http://ocs.editorial.upv.es/index.php/BMT/BMT2021/about/editorialPolicies

2021, Editorial Universitat Politècnica de València.
www.lalibreria.upv.es Ref.: 6690_01_01_01
ISBN: 978-84-9048-417-3 (print version)
Print on-demand

DOI: https://doi.org/10.4995/BMT2021.2021.14727

Layout
Enrique Mateo, *Triskelion Diseño Editorial*.

BMT 2021 – 3rd International Conference Business Meets Technology 2021

Dear 3rd Business Meets Technology Conference organizers, dear participants, dear readers, thanks for the opportunity to participate in this proceedings' publication. I would like to look back to envision where the future may lead us.

For those who don´t know, this all began more than 10 years ago in a small coffee shop taking notes on a napkin while enjoying a cup of coffee and a piece of cake. Since then, and thanks to the leadership of professors María de Miguel and Bárbara Hedderich, we have been fortunate to see a double UPV-Ansbach international master's degree grow. Since 2009/2010, more than 60 students graduated based on the double degree agreement and we have also developed other types of joint activities such as final master's joint projects and doctoral theses. There have been frequent visits by professors from both institutions, Erasmus agreements, research stays and workshops that ended, a few years ago, in the organization of the first BMT conference.

The first two editions took place at the Ansbach University of Applied Sciences and this time the conference was hold in Valencia, where we all could take the best of all the opportunities that brings sharing time and discussions together. The Universitat Politècnica de València is ranked as the first technical university in Spain and is a leader university in technology, innovation and knowledge transfer to the industry, which contributed to the vibrant discussion on the different topics that the conference addressed such technology and innovation management, operations, entrepreneurship, public policies, sustainability, new management or digital transformation, trends among other that you can find in this proceeding's edition.

I would like to thank professors M Rosario Perelló, Conrado Carrascosa and Daniel Catalá for all the work carried out to organize this conference and also the Management Department (DOE), the Business School and all the professors, students and researchers that participated in this edition.

To be part of the team since the beginning is an honor and it has been our intention to provide the best possible environment to facilitate the academic knowledge exchange and network generation to reinforce Ansbach Hochschule – UPV links and to establish scientist strong basis to organize the 4th BMT conference soon.

All the best,

Prof. Marival Segarra Oña

Vice-Rector for Organization of Studies, Quality, Accreditation and Languages
Universitat Politècnica de València

A year after the COVID-19 pandemic interrupted our lives, paralyzed the real world and plunged us into a parallel world where the Internet, computers and electronic devices were the only way to relate to each other, we observe with a smile on our faces when we realize that once again university campuses are full of students, professors and administrative and service staff. The smile is even bigger when we see the campus of Universitat Politécnica de Valencia full of our students. In the middle of the pandemic we could be paralyzed by the fact of not being able to reach our students as we normally did in face-to-face classes. This situation has made us reflect on where the university has to go. The university is not just about contents; going to university is a life experience and it must be lived. As Aristotle (384-322 B.C.) already discovered, "man is a social being by nature", we are born with the social characteristic and we develop it throughout our lives, since we need others to survive.

Now, one academic year after COVID-19 broke into our lives, we cannot turn our heads without having learned that technology saved the situation and thanks to it companies, employees and customers continued to operate with no downtime. In this context, I would like to welcome the 3rd International Conference "Business meets Technology", a conference organized between the Universitat Politécnica de Valencia and the University of Applied Sciences of Ansbach, a forum where experiences in the field of business administration, management and technology are shared among professors from different countries who participate in it.

The Department of Business Organization welcomes this initiative and as director I congratulate our professors for the organization of the same, I also encourage them to repeat the organization of this conference in future years, remaining as a reference in the field of business management.

Gabriela Ribes Giner

Directora

Departamento de Organización de empresas

Universitat Politècnica de València

The first BMT conference took place at the Ansbach University of Applied Sciences as a result of the fruitful and long relationship that exists between Ansbach University in Germany and our Universitat Politècnica de València. The second edition was also held in the city of Ansbach and this third edition has just been held in our beautiful Valencia at our beloved Polytechnic University of Valencia.

The theme of the conference has been «Business Meets Technology». We confirm that our broad topic has led to a great variety of papers in various areas of science, commerce and arts related to business and technology. We have enjoyed the sessions with the valuable knowledge explained by the speakers that has led us to enrich the exchange of knowledge for all attendees.

When we took over from organizing the third edition of the "Business meets Technology" congress at our University, we only knew part of the challenge that we had before us. When we took over the organization of the congress, we had a lot of uncertainty, especially due to the pandemic. We were aware of the evolution of it and the restrictions that we were suffering due to it. The intention, if the situation allowed it, was to do so under conditions of total presence. We were committed to it because we were aware of the importance of person-to-person communication, of the richness of interpersonal communication and that is why we have been the first face-to-face congress at the UPV after the pandemic. We are very satisfied with the results obtained and we look forward to the next edition, which will be held again in Ansbach.

Many thanks to the Faculty of Business Administration, the Department of Business Organization and the Generalitat Valenciana who have supported this congress.

Rosario Perelló
President-Chair
UPV (Spain)

Conrado Enrique Carrascosa
Secretary-Co-chair
UPV (Spain)

Daniel Catalá
Secretary-Co-chair
UPV (Spain)

BMT21
3rd International Conference
Business Meets Technology.
Valencia, 23rd & 24th September 2021

ORGANIZING COMMITTEE

Dr. Rosario Perelló Marín (Universitat Politècnica de València)
Dr. Conrado Carrascosa López (Universitat Politècnica de València)
Dr. Daniel Catalá Pérez (Universitat Politècnica de València)
Prof. Dr. María del Val Segarra Oña (Universitat Politècnica de València)
Dr. María de Miguel Molina (Universitat Politècnica de València)
Dr. Blanca de Miguel Molina (Universitat Politècnica de València)
Dr. Gabriela Ribes Giner (Universitat Politècnica de València)
Dr. Angel Peiró Signes (Universitat Politècnica de València)
Dr. Esperanza Suárez Ruz (Universitat Politècnica de València)
Dr. Sofía Estellés Miguel (Universitat Politècnica de València)
Dr. Aurelio Herrero Blasco (Universitat Politècnica de València)
Dr. Jésica Moreno Puchalt (Universitat Politècnica de València)
Dr. Elena de la Poza Plaza (Universitat Politècnica de València)
Prof. Dr. Barbara Hedderich (University of Applied Sciences Ansbach)

SCIENTIFIC COMMITTEE

Prof. emeritus Dr. José Albors Garrigós (Universitat Politècnica de València, Spain)
Dr. Ana Isabel Almerich Chulia (Universitat Politècnica de València, Spain)
Dr. Conrado Carrascosa López (Universitat Politècnica de València, Spain)
Dr. Daniel Catalá Pérez (Universitat Politècnica de València, Spain)
Prof. Dr. Barbara Hedderich (University of Applied Sciences Ansbach, Germany)
Prof. Dr.-Ing. Anke Knoblauch (University of Applied Sciences Ansbach, Germany)
Dr. Veiko Lember (Tallinn University of Technology, Estonia)
Dr. Tomáš Mandičák (Technical University of Košice, Slovakia)
Dr. Juan Antonio Marín García (Universitat Politècnica de València, Spain)
Dr. Ing. Peter Mésároš (Technical University of Košice, Slovakia)
Dr. Marta Oller Rubert (Universitat Jaume I, Spain)
Dr. Cristina Peñasco Patón (University of Cambridge, UK)
Dr. Rosario Perelló Marín (Universitat Politècnica de València, Spain)
Dr. Elena de la Poza Plaza (Universitat Politècnica de València, Spain)
Dr. Mikko Rask (University of Helsinki, Finland)
Dr. Gabriela Ribes Giner (Universitat Politècnica de València, Spain)
Prof. Dr. María del Val Segarra Oña (Universitat Politècnica de Valencia, Spain)
Prof. Dr.-Ing. Michael S. J. Walter (University of Applied Sciences Ansbach, Germany)

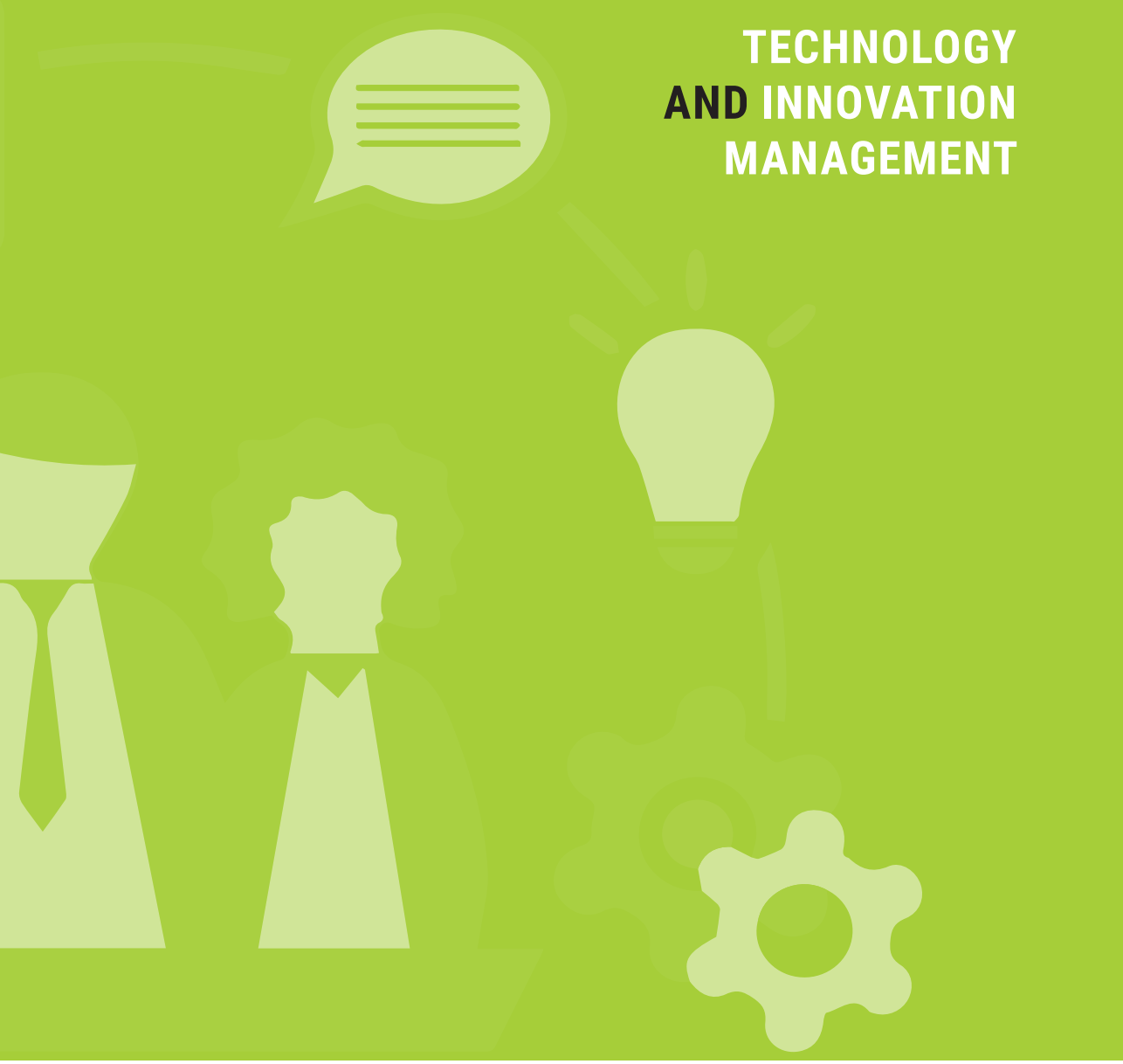
TABLE OF CONTENTS

CULTURAL AND CREATIVE INDUSTRIES

MISCELLANY

BMT21
3rd International Conference
Business Meets Technology.
Valencia, 23rd & 24th September 2021

TECHNOLOGY AND INNOVATION MANAGEMENT



BMT21
3rd International Conference
Business Meets Technology.
Valencia, 23rd & 24th September 2021

SPANISH INNOVATION STRATEGIC PLAN. ANALYSIS OF ITS INSTRUMENTS, IMPACT AND RESULTS

Catalá-Pérez, Daniel [a]; Carrascosa López, Conrado Enrique [b1] and Perello-Marin, M. Rosario [b2]

[a] *Assistant Professor. Universitat Politècnica de València. Dept. Organizacion de Empresas. Spain. (dacapre@ade.upv.es)*
[b] *Associate Professor. Universitat Politècnica de València. Dept. Organizacion de Empresas. Spain. ([b1] concarlo@upvnet.upv.es, [b2] rperell@upvnet.upv.es)*

ABSTRACT: The purpose of this piece of research is to analize public instruments implemented to promote innovation in Spain and the results that were obtained among Spanish innovative companies. Along this paper, the National Innovation Strategy for Science, Technology and Innovation 2013-2020, and its impact, prior to the implementation of the next plan that will cover the period 2021-2027, have been analysed. This piece of research sheds light on the main weaknesses identified in the National Innovation Strategy for Science, Technology and Innovation 2021-2027, and particularly how and where it fails in boosting innovation in Spain. The main conclusions are useful for all involved parts, politicians as part of the public sector (Government), industry and academia as fundamental pillar of the Spanish innovation system.

KEY WORDS: *Innovation; Strategic plan; National innovation systems; Public-private collaboration; Spain.*

1. PURPOSE OF THE PAPER

The purpose of this piece of research is to analize public instruments implemented to promote innovation in Spain and the results that were obtained among Spanish companies.

This work is especially interesting since it analyses National Innovation Strategy for Science, Technology and Innovation 2013-2020, and its impact, prior to the implementation of the next plan that will cover the period 2021-2027.

Thus, this paper includes, on the one hand, a review of the public instruments included in 2013-2020 Spanish Innovation strategic plan, which were supposed to be oriented to boost most advanced interactive innovation models. And on the other hand, it is also analysed Spanish innovation system trends during the same period. As a result, main weaknesses not covered are identified. These weaknesess should be covered in the new National Strategy (2021-2027).

How to cite: Catalá-Pérez, D., Carrascosa López, C. E., and Perello-Marin, M. R. 2021. Spanish innovation strategic plan. Analysis of its instruments, impact and results. In Proc.: *3rd International Conference Business Meets Technology*. Valencia, 23rd & 24th September 2021. 3-15. https://doi.org/10.4995/BMT2021.2021.13730

2. RELATED WORK

The relevant role that innovation plays in economic growth and development and, consequently, in the improvement of the quality of life and welfare of society, is beyond doubt for the literature on the economics of technological change (Hall & Rosenberg, 2010).

One of the main contributions of this evolutionary theory is the concept of innovation system, which was introduced to refer the model of cooperation between government, academia, public research sector and industry that determined the success of an economy (Freeman, 1987; Lundvall, 1992). It can be said that innovation is a collective, cumulative process, dependent on the trajectory and the context, which varies between the different types of actors, companies, industries, regions, etc. (Bach & Matt, 2005; Reid, 2010; Wieczorek & Hekkert, 2012). All these factors, and especially the interactions between all these actors, are essential to explain the way in which knowledge is created and transferred within the innovation process. Thus, different ways imply different innovation models. So, from a systemic approach, public intervention is justified by systemic failures that arise as a result of relational dysfunctions among the agents that make up the innovation system and are present at the innovation process (Borrás 2011; Edler et al. 2016; Fagerberg 2017). Public intervation is articulated by different instruments depending on the innovation model that governments intend to promote.

This piece of research is built based on the Quintuple Helix model. This model, as a more recent and complet evolution of the triple helix model, includes the continuous relationship between industry, government and academia together with civil society and environment (Carayannis et al., 2012, 2018; Carayannis & Campbell, 2010; Maruccia et al., 2020). Thus, the emphasis is placed on a redefinition and strengthening of the role that must play fundamental actors such as the public sector (Kattel & Mazzucato, 2018; Kuhlmann & Rip, 2018), the business sector (Giuliani, 2018) or civil society itself (Rask et al., 2018). From this perspective, proposals such as mission-oriented policies (Mazzucato, 2018) or challenge-oriented (Boon & Edler, 2018) try to give concrete answers to the demands of this new scenario.

Within this context, the relationship of the model with many of the SDGs is evident, not only regarding to social, economic or ecological goals but specifically to 17th SDG, that encourages the creation of alliances between all social agents in order to achieve the rest of the goals.

Since 2000, to a greater or lesser extent, all European countries have implemented innovation policies based on instruments such as R&D collaborative programs, cluster support programs, personnel mobility programs, technological transfer support, networks of technological centers of excellence, spin-offs creation, support programs or promotion of scientific and technological parks (Izsák et al., 2013).

3. DESIGN/METHODOLOGY

For the purpose of this paper, mixed methods have been used. Content analysis of Spanish National Innovation policies and programs combined with more detailed data analysis of innovative results for Spanish industries are used to compare the main trends in the public programs to innovation results.

4. FINDINGS

In the last years, Spanish government has received several recommendations from European institutions highlighting the main problems of the Spanish System of Science, Technology and Innovation (European Council, 2018, 2019). Among these problems are the limited innovation capabilities of Spanish companies and the lack of cooperation between them and universities and research organizations. These weaknesses are structural problems that are affecting the Spanish system since many years ago (Catalá-Pérez & De-Miguel-Molina, 2021).

The fundamental instruments that reflect the innovation policies proposed by the Spanish government and instruments derived from these policies, are included in the Spanish Strategy for Science, Technology and Innovation and the subsequent National Plans for Scientific and Technical Research and Innovation. The National Plans establish the programs and subprograms, their priorities and objectives. On the other hand, Annual Action Programs collect the concrete actions or instruments that arise each year within each of those subprograms.

In 2020 the national strategy for the 2013-2020 period finished, and also the National plan for the period 2017-2020. Among the general goals of this strategy were:

- The impulse of the business leadership in STI activities to increase the competitiveness of the productive fabric. It is in this objective that the promotion of collaboration among the agents of the system takes on special importance through some of its specific objectives:
    - The promotion of business STI activities stimulating business initiatives of great scope and ambition aimed at business leadership in global and highly competitive environments. The strategy explicitly recognizes that this objective requires that the Public Administrations adopt measures to favour public-private collaboration.
    - The promotion of collaborative R&D oriented to the demands of the productive fabric with the realization of public-private collaboration projects. The Public Administrations must act directly on the obstacles that hinder this collaboration, adopting measures aimed at raising the legal quality and security in terms of scientific collaboration and technological development.
- The promotion of STI activities aimed at the global challenges of society. It establishes the need to propose actions that promote the role of Technology Platforms,

Alliances and other agents of the System as communication channels between public and private agents, so that they play a fundamental role in the identification of emerging and convergent technologies, public-private collaboration and the detection of new demands on a global scale.

Based on the work made by Catalá-Pérez and De-Miguel-Molina (Catalá-Pérez & De-Miguel-Molina, 2021) the specific programs and instruments oriented to achieve these goals and, additionally, also oriented to boost interactive innovation models are identified and commented in the following tables (Tables 1 to 4).

Table 1. Public instruments oriented to boost interactive innovation models (I). Source: Based on Catalá-Pérez and De-Miguel-Molina (Catalá-Pérez & De-Miguel-Molina, 2021).

PROGRAM OF PROMOTION OF TALENT AND ITS EMPLOYABILITY		
Priorities in relation to public-private collaboration: Incorporation of researchers and R&D personnel in companies and promotion of mobility between the public and private sectors.		
Training Subprogram	TRAINING OF DOCTORS IN COMPANIES: "INDUSTRIAL DOCTORATES"	Hiring research staff to develop their doctoral thesis in the company itself and be part of an industrial research project or experimental development.
Incorporation Subprogram	"TORRES QUEVEDO" GRANTS FOR THE RECRUITMENT OF DOCTORS IN COMPANIES	Financing of the indefinite hiring of doctors in the private business sector to carry out R&D activities.
	The "Emplea" grants are foreseen in the National plan, to co-finance the hiring of technical personnel in R&D in companies, but not annual programs convened them.	
Mobility Subprogram	Cross-sectoral mobility is considered essential for the promotion of public-private collaboration and the cogeneration and circulation of knowledge. The Plan leaves open the possibility of enhancing this mobility through different mechanisms.	

Table 2. Public instruments oriented to boost interactive innovation models (II). Source: Based on Catalá-Pérez and De-Miguel-Molina (Catalá-Pérez & De-Miguel-Molina, 2021).

PROGRAM OF GENERATION OF THE SCIENTIFIC AND TECHNOLOGICAL KNOWLEDGE AND STRENGTHENING OF THE SYSTEM		
Priorities in relation to public-private collaboration: · Increase the participation of the private sector in the financing of fundamental research through new public-private collaboration formulas. · Increase the participation of the private sector in STI activities, in general, and those carried out by the research institutions of excellence, in particular.		
Knowledge Generation Subprogram	ACTIVITIES OF DYNAMIZATION OF RESEARCH NETWORKS	Financing the creation and consolidation of research networks that generate synergies among system agents.
Subprogram of Institutional Strengthening	CALL FOR THE "CERVERA" NETWORK	Promotion of collaboration between technological and business agents through the accreditation as "Cervera" Centres and Technological Institutes of Excellence to those who stand out for the quality of their scientific-technical research activities and for the impact of their collaborations with the productive fabric.
Subprogram of Research Infrastructures and Scientific-Technological Equipment	The National plan provides funds to ICTS for financing the development and implementation of strategic programs with the objective, among others, of fostering collaboration among agents. They were not convened in all annual programs.	

Table 3. Public instruments oriented to boost interactive innovation models (III). Source: Based on Catalá-Pérez and De-Miguel-Molina (Catalá-Pérez & De-Miguel-Molina, 2021).

BUSINESS LEADERSHIP PROGRAM		
Priorities in relation to public-private collaboration: Promotion of public-private collaboration as mechanisms to accelerate the dissemination and use of knowledge and technologies, the creation of absorption capacities and the valorisation of results. Promotion of strategic projects that mobilize public and private resources and promote the creation of collaboration networks between SMEs, technology centres, PROs and universities. Intensification of instruments aimed at promoting Innovative Public Procurement.		
Subprogram of Business R&D and innovation	R&D PROJECTS and STRATEGIC R&D PROJECTS	Financing of individual R&D projects or in consortium between companies. The strategic ones will have a duration of up to 96 months. They may include the participation, through subcontracting, of universities, public and private research organizations, etc.
	"CERVERA" TRANSFER PROJECTS and "CERVERA" TECHNICAL PROVISION FUND	Financing of business R&D projects in the field of Cervera priority technologies, with the participation of "Cervera" Centres and Technological Institutes of Excellence.
	INNOVATIVE BUSINESS GROUPS (AEI, from Spanish acronym)	Financing of feasibility studies, various projects and expenses of structures of coordination and management of incipient AEIs. The AEIs are the combination, in a geographical space or productive sector, of public or private research and training companies and centres (clusters).
	PROMOTION OF INNOVATION FROM DEMAND AND INNOVATIVE PUBLIC PURCHASE	Financing for the development of innovative products or services through the mechanism of the Innovative Public Purchase.
	The National plan foresees the possibility of PPPs co-financed by the public and business sectors around research priorities. Likewise, instruments such as the Sectoral Strategic Initiatives for Business Innovation, executed as PPPs, are included. They were not convened in all the annual programs.	
Subprogram of Promotion to Enabling Technologies	R&D PROJECTS	Similar to the R&D Projects of the previous Subprogram but in the field of enabling technologies.
Strategic Action "Industry Connected 4.0"	It basically includes financial aid for digital transformation projects, which include STI activities, applied to processes as well as organizational innovations in the field of Industry 4.0.	

Table 4. Public instruments oriented to boost interactive innovation models (IV). Source: Based on Catalá-Pérez and De-Miguel-Molina (Catalá-Pérez & De-Miguel-Molina, 2021).

PROGRAM OF R&D AND INNOVATION ORIENTED TO SOCIAL CHALLENGES.		
Priorities in relation to public-private collaboration: Promotion of public-private collaboration by expanding the scope and impact of the research carried out in universities and PROs. Increase the participation of the private sector in the financing of fundamental research through new PPP formulas.		
R&D actions oriented towards Social Challenges	R&D AND INNOVATION PROJECTS: «CHALLENGES COLLABORATION»	Co-finance the execution, as PPPs, of projects of applied research, experimental development and innovation, always coordinated by a company.
	FUNDS FOR TECHNOLOGICAL PLATFORMS	Financing for the creation and consolidation of the state network of Technology Platforms.
	PROJECTS "CIEN" (National Business Research Consortiums)	Promote research, led by companies and carried out through PPPs, with the aim of mobilizing private investment and have a driving effect on the business fabric. Because of their ambition, duration and organization, they have to tackle long-range problems associated with the challenges of society or cross-cutting, sectoral and strategic problems.
Strategic Action in Health	According to the National plan, the Strategic Action in Health encompasses a set of instruments that, being specific to the health field, contribute to the generation of synergies and complementarities with the actions included in the rest of the programs.	
Strategic Action in Economy and Digital Society	The National plan establishes that the Secretary of State for the Information Society will be able to implement different instruments oriented to the development of strategic areas of innovation and the stimulation of demand, encouraging the creation of PPPs and boosting private investment especially in certain ICT technologies.	

Having analysed the main instruments together with their scope, ICONO platform is consulted in order to identify how this actions have had impact on Spanish industry during the same period.

The ICONO platform, contains a data base complied by the Ministry of Science and Innovation. It collects the information generated by the Spanish Foundation for Science and Technology (FECYT). In the ICONO platform, a system of R&D&I indicators is built to generate information for the different agents of society, providing objective indicators that measure the evolution of technology, science and innovation in Spain.

Research results can be subdivided into 6 families (that includes industry helix and academia helix explicitly): 1) Number of innovative companies; 2) Economic impact of innovative activity; 3) Scientific production WOS; 4) Scientific production SCOPUS; 5) Doctoral theses; and 6) Industrial property.

The most recent and relevant data have been selected within each family in order to assess the national strategy on innovation between the years 2013-2020 and more

specifically the finalized national plan corresponding to the period 2017-2020, therefore the data obtained are presented differentiating between the period 2013-2017 and 2017-present, to facilitate subsequent analysis.

Although the number of innovative companies decreased in the first period of the plan, there was a clear recovery from 2017 until the end of the period (see Figure 1). However, this fact has not clear economic impact, since the % of sales due to innovative products drop down from 2016 to the end of the period (see Figure 2).

As far as the scientific production, the number of papers published in both WOS and SCOPUS increased year by year (see Figures 3 and 5). However, it should be noted that the rate of spending on R&D per number of published papers tend to drop down (see Figure 4), as it happens with the number of PhD thesis within the same period (see Figure 6).

Regarding the protection of innovations, it is important to highlight that although the number of patents granted in Spain has decreased, the tendency for the case of European patents was a clear increment.

As a conclusion, although many instruments have been implemented through the national innovation plan, they do not always result in a clear increase in the Spanish innovation level. On the other hand, it is not clear that the instruments proposed by Spanish Government may reach all companies or that they cover the real needs of the companies and the society.

1. Number of innovative companies.

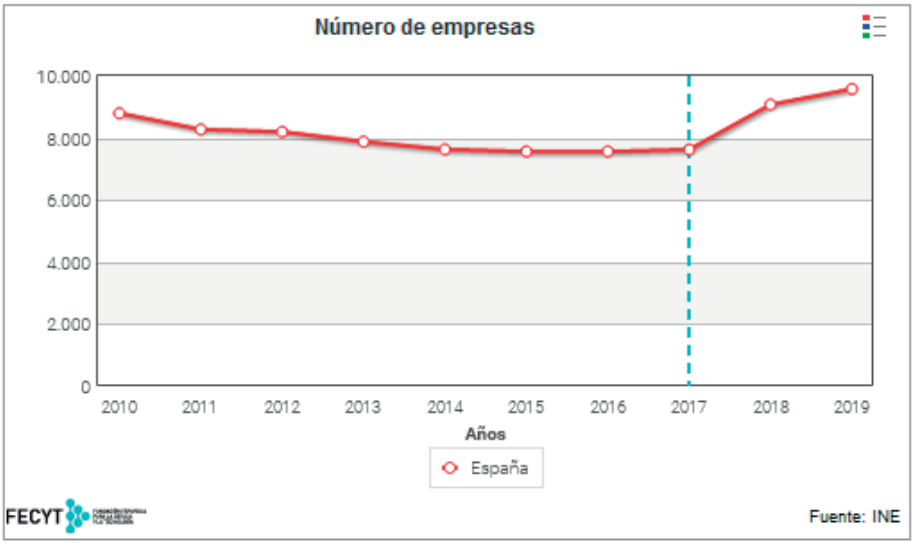


Figure 1. Number of innovative companies. Source: Icono database 2021.

2. Economic impact of innovative activity: Sales of companies with product innovation due to innovative products.

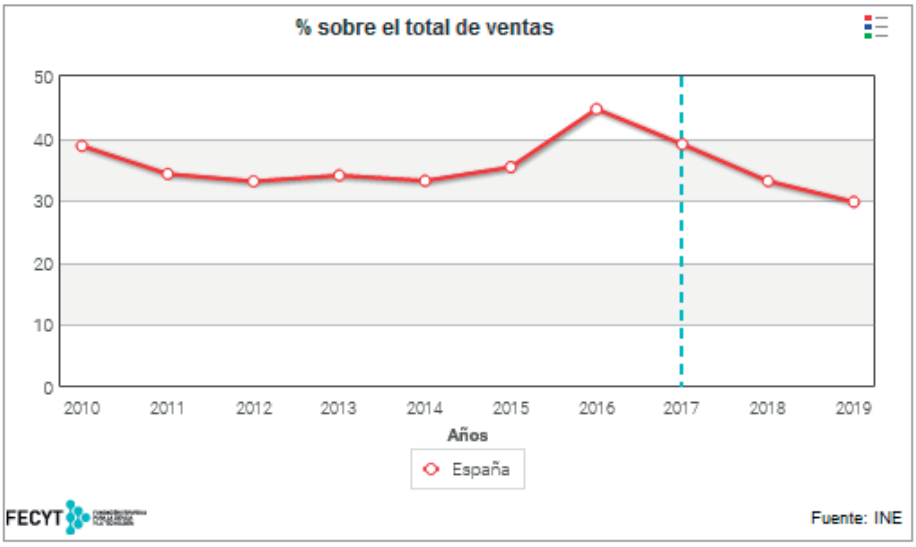


Figure 2. Sales of companies with product innovation due to innovative products (%). Source: Icono database 2021.

3. Scientific production WOS.

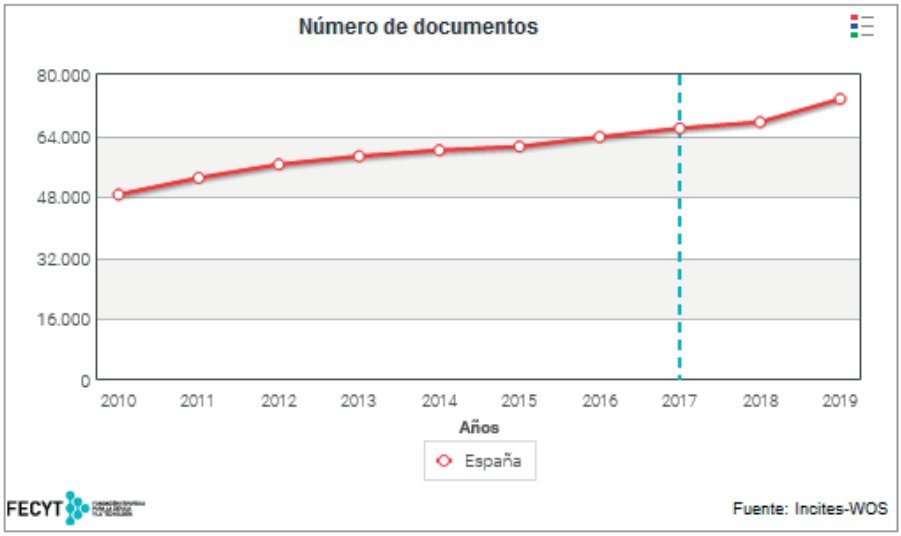


Figure 3. Number of documents in WOS. Source: Icono database 2021.

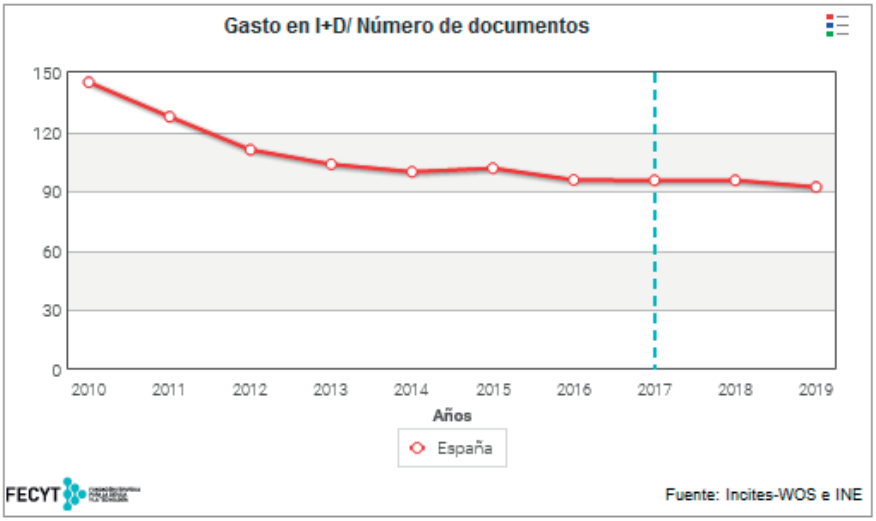


Figure 4. Scientific productivity WOS: Spending on R&D / Number of documents. Source: Icono database 2021.

4. Scientific production SCOPUS.

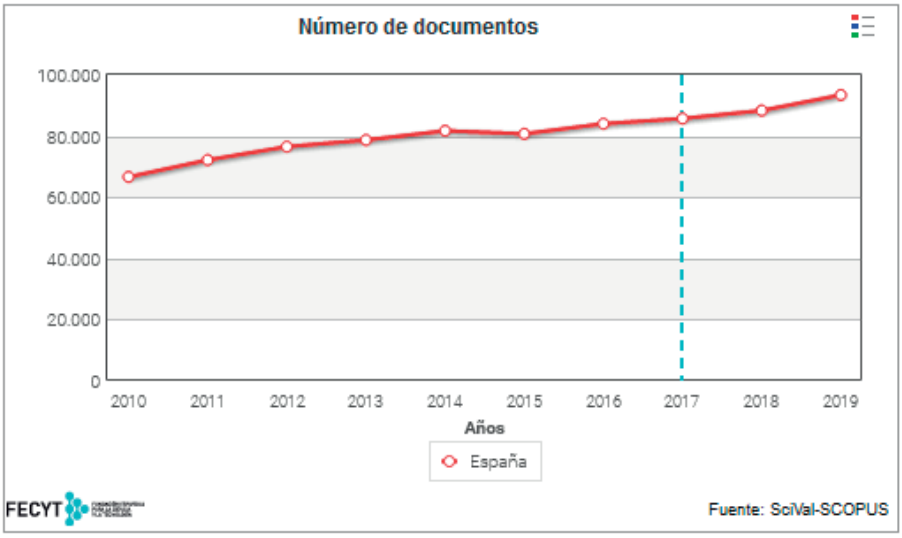


Figure 5. Number of documents in SCOPUS. Source: Icono database 2021.

5. Doctoral theses approved by area of knowledge.

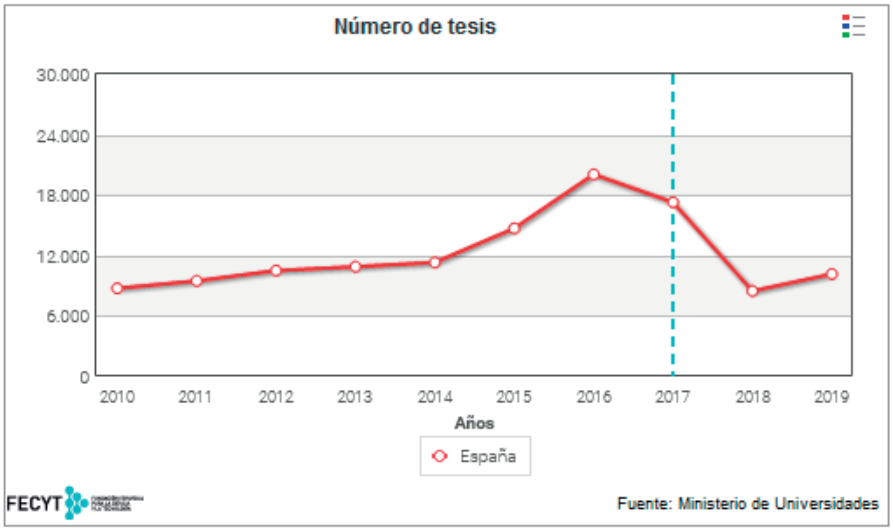


Figure 6. Doctoral theses approved. Source: Icono database 2021.

6. Industrial property Patent concessions with effects in Spain. Total national patent grants.

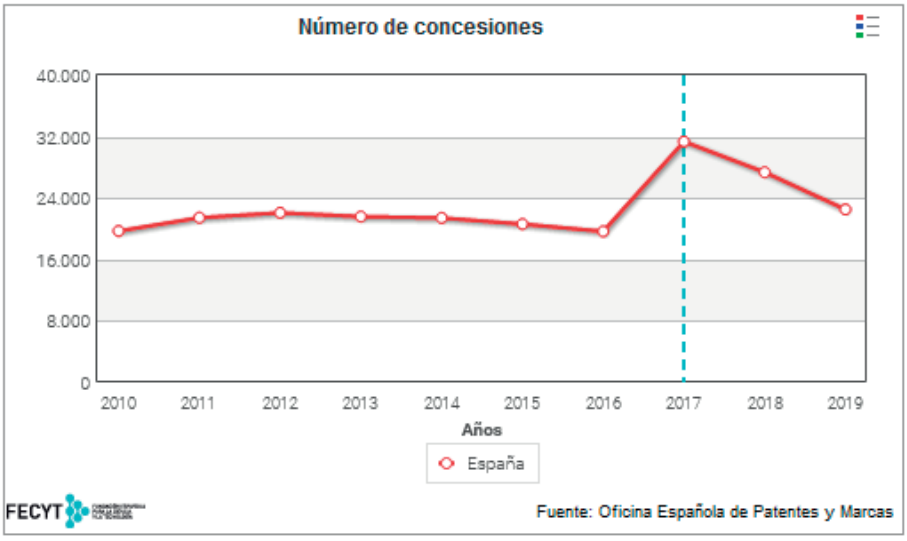


Figure 7. Total national patent grants. Source: Icono database 2021.

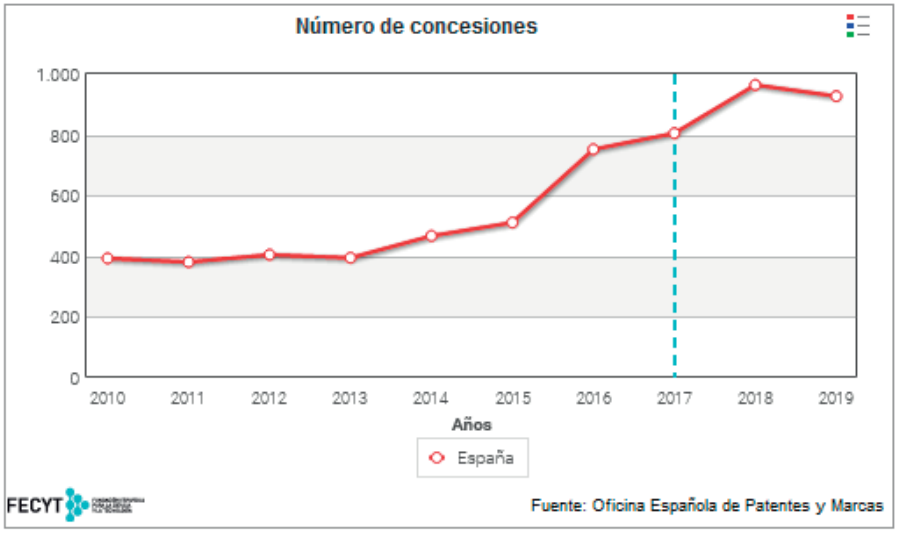


Figure 8. Concessions of European patents of Spanish origin.. Source: Icono database 2021.

5. RESEARCH LIMITATIONS/IMPLICATIONS

As a future research, specific analysis of the impact of Government on the other 4 helixes, not only industry, but also academia, society and environment can be done, opening the scope for the analysed indicators. The selected indicators for thr analysis could be focused on the expected results of the oncoming National Innovation Strategy for Science, Technology and Innovation 2021-27.

6. PRACTICAL IMPLICATIONS:

This piece of research sheds light on the main weaknesses identified in the National Innovation Strategy for Science, Technology and Innovation 2021-2027, and particularly how and where it fails in boosting innovation in Spain. The main conclusions are useful for all, politicians as part of the public sector (Government), industry and academia as fundamental pillar or the Spanish innovation system.

ORIGINALITY/VALUE OF THE PAPER:

This paper shows one of the first attempts to analyse in detail the different helixes of the innovation model aiming to find synergies and boost innovation results.

REFERENCES

Bach, L., & Matt, M. (2005). From Economic Foundations to S&T Policy Tools: a Comparative Analysis of the Dominant Paradigms. In P. Llerena & M. Matt (Eds.), *Innovation Policy in a Knowledge-Based Economy* (pp. 17–45). Springer-Verlag. https://doi.org/10.1007/3-540-26452-3_2

Boon, W., & Edler, J. (2018). Demand, challenges, and innovation. Making sense of new trends in innovation policy. *Science and Public Policy*, *45*(4), 435–447. https://doi.org/10.1093/scipol/scy014

Borrás, S. (2011). Policy learning and organizational capacities in innovation policies. *Science and Public Policy*, *38*(9), 725–734. https://doi.org/10.3152/030234211X13070021633323

Carayannis, E. G., Barth, T. D., & Campbell, D. F. (2012). The Quintuple Helix innovation model: global warming as a challenge and driver for innovation. *Journal of Innovation and Entrepreneurship*, *1*(1), 2. https://doi.org/10.1186/2192-5372-1-2

Carayannis, E. G., & Campbell, D. F. J. J. (2010). Triple helix, Quadruple helix and Quintuple helix and how do Knowledge, Innovation and the Environment relate to Each other? a proposed framework for a trans-disciplinary analysis of sustainable development and social ecology. *International Journal of Social Ecology and Sustainable Development*, *1*(1), 41–69. https://doi.org/10.4018/jsesd.2010010105

Carayannis, E. G., Grigoroudis, E., Campbell, D. F. J., Meissner, D., & Stamati, D. (2018). The ecosystem as helix: an exploratory theory-building study of regional co-opetitive entrepreneurial ecosystems as Quadruple/Quintuple Helix Innovation Models. *R and D Management*, *48*(1), 148–162. https://doi.org/10.1111/RADM.12300

Catalá-Pérez, D., & De-Miguel-Molina, M. (2021). Analyzing Territorial and Sectorial Dimensions of Public–Private Partnerships in Science, Technology, and Innovation policies. *Review of Policy Research*, *38*(1), 113–138. https://doi.org/10.1111/ropr.12405

Edler, J., Gök, A., Cunningham, P., & Shapira, P. (2016). Introduction: Making sense of innovation policy. In J. Edler, P. Cunningham, A. Gök, & P. Shapira (Eds.), *Handbook of Innovation Policy Impact*. Edward Elgar Publishing.

European Council. (2018). *Council Recommendation on the 2018 National Reform Programme of Spain and delivering a Council opinion on the 2018 Stability Programme of Spain* (COM(2018) 408 final). European Comission.

European Council. (2019). *Council Recomendation on the 2019 National Reform Programme of Spain and delivering a Council opinion on the 2019 Stability Programme of Spain* (COM(2019) 509 final). European Comission.

Fagerberg, J. (2017). Innovation policy: rationales, lessons and challenges. *Journal of Economic Surveys*, *31*(2), 497–512. https://doi.org/10.1111/joes.12164

Freeman, C. (1987). *Technology, policy, and economic performance: lessons from Japan*. Pinter Publishers.

Giuliani, E. (2018). Regulating global capitalism amid rampant corporate wrongdoing—Reply to "Three frames for innovation policy." *Research Policy*, *47*(9), 1577–1582. https://doi.org/10.1016/j.respol.2018.08.013

Hall, B. H., & Rosenberg, N. (Eds.). (2010). *Handbook of the economics of innovation*. Elsevier.

Izsák, K., Markianidou, P., & Radošević, S. (2013). *Lessons from a Decade of Innovation Policy*. Publications Office of the European Union.

Kattel, R., & Mazzucato, M. (2018). Mission-oriented innovation policy and dynamic capabilities in the public sector. *Industrial and Corporate Change*, *27*(5), 787–801. https://doi.org/10.1093/icc/dty032

Kuhlmann, S., & Rip, A. (2018). Next-Generation Innovation Policy and Grand Challenges. *Science and Public Policy*, *45*(4), 448–454. https://doi.org/10.1093/scipol/scy011

Lundvall, B.-A. (Ed.). (1992). *National systems of innovation: toward a theory of innovation and interactive learning*. Pinter Publishers.

Maruccia, Y., Solazzo, G., Del Vecchio, P., & Passiante, G. (2020). Evidence from Network Analysis application to Innovation Systems and Quintuple Helix. *Technological Forecasting and Social Change*, *161*, 120306. https://doi.org/10.1016/J.TECHFORE.2020.120306

Mazzucato, M. (2018). Mission-oriented innovation policies: Challenges and opportunities. *Industrial and Corporate Change*, *27*(5), 803–815. https://doi.org/10.1093/icc/dty034

Rask, M., Mačiukaitė-Žvinienė, S., Tauginienė, L., Dikčius, V., Matschoss, K., Aarrevaara, T., & D'Andrea, L. (2018). *Public Participation, Science and Society. Tools for Dynamic and Responsible Governance of Research and Innovation*. Routledge. https://doi.org/10.4324/9781351272964

Reid, A. (2010). Systems failures and innovation policy: do national policies reflect differentiated challenges in the EU27 ? Observations from a decade of the European TrendChart on Innovation. In J. Leijten & L. Elg (Eds.), *New Economic Ground For Innovation Policy*. Cultiva Libros.

Wieczorek, A. J., & Hekkert, M. P. (2012). Systemic instruments for systemic innovation problems: A framework for policy makers and innovation scholars. *Science and Public Policy*, *39*(1), 74–87. https://doi.org/10.1093/scipol/scr008

BMT21
3rd International Conference
Business Meets Technology.
Valencia, 23rd & 24th September 2021

EXPERIMENTAL AND NUMERICAL INVESTIGATION OF DISTURBED FLOW PATTERNS BY AN ASYMMETRIC SWIRL GENERATOR

Welsch, Dennis [a1]; Zacharias, Konstantin [a2] and Schlüter, Wolfgang [a3]

[a] *Department of Technology, University of Applied Science Ansbach. Germany.*
([a1] dennis.welsch@hs-ansbach.de, [a2] konstantin.zacharias@hs-ansbach.de,
[a3] wolfgang.schlueter@hs-ansbach.de)

ABSTRACT: In this article a disturbed flow pattern caused by an asymmetric swirl disturbance generator experimentally by laser-Doppler velocimetry (LDV) and numerically by computational fluid dynamics (CFD) is analyzed. From the data collected in experiment and simulation we create, evaluate and compare quantifiable contour and profile plots of the primary flow as well as flow-specific performance indicators in different cross-sections downstream from the disturbance generator. The results show a heavily asymmetric velocity distribution with little to no signs of relaxation over the course of the section of measurements. Significant similarities between measurement and simulation can be observed at small distances downstream from the impediment. Further downstream, with increasing distance, deviations and differences in the flow patterns become more apparent suggesting that the SST turbulence model can only partially reproduce the real flow occurring on the test rig.

KEY WORDS: *CFD; LDV; Asymmetric swirl generator; Flow metering; Performance Indicator.*

1. INTRODUCTION

Pipe systems with elbows, valves, pumps and other devices are found in many industrial applications. All of these elements cause flow disturbances, which lead to different flow patterns besides the fully developed reference profile. Yet, for high accuracy flow measurements, a fully developed flow is mandatory. The knowledge of the disturbance and its relaxation to fully developed flow is important in advising positions for flow meters and estimating volume flow error. The most common elements, such as bends and double-bends out-of-plane, cause rotational velocity fields (swirl) with asymmetric velocity profiles and can have a large impact on flow accuracy (Tawackolian, 2013). Consequently, this flow behavior needs to be emulated in flow meter test benches to approve measurement devices. As a replacement for the current swirl generator in the standards for water meters (OIML R 49) an asymmetric swirl generator as shown in Figure 1 is considered to represent a double bend out-of-plane (Straka *et al.*, 2019).

How to cite: Welsch, D., Zacharias, K., and Schlüter, W. 2021. Experimental and numerical investigation of disturbed flow patterns by an asymmetric swirl generator. In Proc.: *3rd International Conference Business Meets Technology*. Valencia, 23rd & 24th September 2021. 17-25. https://doi.org/10.4995/BMT2021.2021.13595

The purpose of this study is the comparison of experimental results with corresponding CFD-simulation to validate the SST turbulence model and evaluate the potential for the prediction of experimental results with numerical simulations. In this context, performance indicators are calculated to compare the numerical and experimental results with literature references.

2. MATERIALS AND METHODS

2.1 Experimental set-up

All experiments are performed on a test bench in the flow laboratory of Hochschule Ansbach. For the measurement of the flow patterns downstream from the asymmetric swirl disturbance generator a LDV probe which is mounted on a traversing system for automated displacement is used. The necessary optical access to the section of measurements is realized through a window chamber with a transparent pipe with an inner diameter of D=20.0 mm (and radius R). An 80.0 D straight pipe section upstream from the asymmetric swirl disturbance generator ensures a fully developed flow at its inlet which is confirmed by a preliminary LDV measurement without impediments. LDV data is collected at three different cross-sections with normalized distances z/D=8.5, z/D=12.0 and z/D=19.0 downstream from the asymmetric swirl disturbance generator.

At each cross-section the axial velocity component $\overline{w}$ in z-direction and the tangential velocity components $\overline{u}$ and $\overline{v}$ in x- and y-direction are measured respectively in each of the 281 points of the measurement grid shown on the left-hand side of Figure 1. For each grid point the mean velocity components $\overline{u}$, $\overline{v}$ and $\overline{w}$ re computed from a large number of individual samples measured (up to n_{max}=3·10^3) during the measurement time t_{max}=30 s . The set-up for measuring the axial velocity is illustrated on the right-hand side of Figure 1 along with the directions of the chosen coordinate system and the perspective of observation.

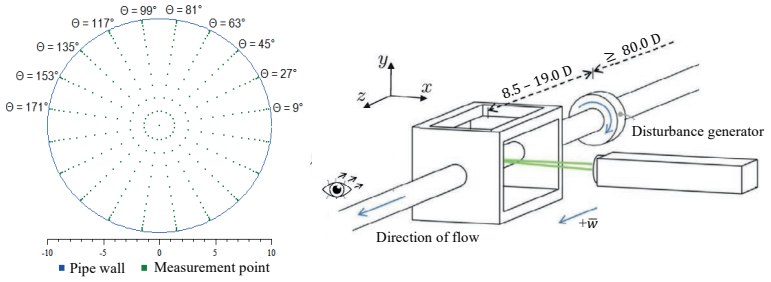


Figure 1. LDV measurement grid with ten profile paths from 9° to 171° (left). Experimental set-up for measuring the axial velocity component (right, own illustration based on Turiso et al., 2018).

2.2 Numerical set-up

The corresponding numerical simulation is performed using the CFD software Simcenter Star-CCM+. In the steady simulation the Reynolds-averaged Navier-Stokes equations are solved by the Segregated Flow Solver using the SST (Menter) k-ω turbulence model. The computational domain has a total length of 570 mm and is depicted in Figure 2. The asymmetric swirl disturbance generator is placed at 6.25 D downstream from the inlet. The volume mesh is realized with a total of 3,508,742 unstructured polyhedral cells including a prism-layer for the near-wall region and a global non dimensional wall distance $y^+<1$. Consequently, the boundary layer is directly resolved in a low-y^+ approach without a wall function. A fully developed turbulent flow matching the experimental boundary conditions is modelled and used as an inlet condition.

In simulation and experiment we consider the same three cross-sections downstream from the modelled disturbance generator for a reasonable comparison (Figure 2).

2.3 Flow conditions

The simulation and all measurement series are conducted with a constant volumetric flow rate of $\dot{Q}$=2.25 m^3/h and a constant water temperature of T=25.0°C. The kinematic viscosity is $\upsilon(25°C)=0.893\cdot10^{-6}$ m^2/s . This results in a volumetric velocity of w_{vol}=1.99 m/s which corresponds to a Reynolds number of $Re=4.5\cdot10^4$.

2.4 Post-processing

Unreliable or erroneous data points from the LDV measurement are identified and evaluated following the method of Hinz (2015) with a criterion of reconstruction of $Tu/\sqrt{n}>\xi$=5.0%, where Tu is the turbulence intensity of any mean velocity component $\overline{\omega}$ and its standard deviation σ_ω and where ξ is the chosen threshold value for admissible standard errors. Measurement points which exceed the threshold are reconstructed by linear interpolation from directly adjacent valid points.

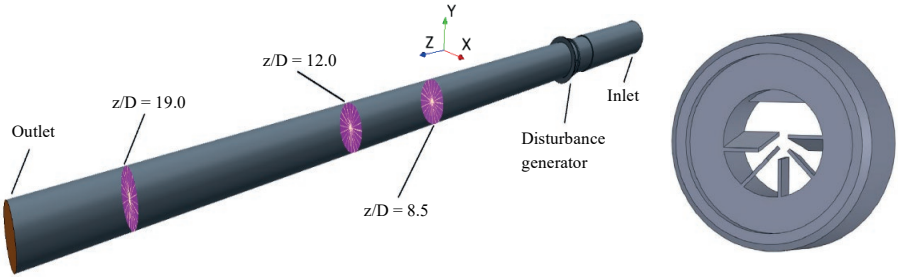


Figure 2: The entire computational domain and the cross-sections considered (left). The asymmetric swirl disturbance generator used (right, Turiso et al., 2018).

Further, the flow-specific metrics K_p, ϕ, K_a and K_{Tu} defined by Yeh and Mattingly (1994) are computed for each cross-sectional plane based on both data sets obtained, LDV measurement and numerical simulation. Each of these performance indicators is obtained as an average value from the profile paths of a cross-section. A more detailed mathematical description can be found in Optolution Messtechnik (2009). For the performance indicators of the LDV data a fully developed turbulent flow profile according to the theory of Gersten and Herwig (1992) is used as a reference profile.

The dimensionless profile factor K_p is a measure of the flatness (K_p<1) or peakness (K_p>1) of the measured or simulated axial flow profile $K_{p,meas}$ compared to a fully developed reference profile $K_{p,ref}$:

$$K_p = \frac{K_{p,meas}}{K_{p,ref}} \tag{1}$$

$$K_{p,meas} = \frac{1}{2 \bullet w_{vol}} \bullet \int_{-1}^{1} \left(\bar{w}_{mid} - \bar{w}\right) d\left(\frac{r}{R}\right) \tag{2}$$

$$K_{p,ref} = \frac{1}{2 \bullet w_{vol,ref}} \bullet \int_{-1}^{1} \left(w_{mid,ref} - w_{ref}\right) d\left(\frac{r}{R}\right) \tag{3}$$

$\overline{w}_{mid}$ and $\overline{w}_{mid,ref}$ are the respective axial velocities at the center of the pipe and $\overline{w}$ and w_{ref} are the respective local axial velocities at the point r/R.

Geometrically, the swirl angle ϕ describes the deviation of a velocity vector from the ideal axial flow direction and thus quantifies the prevailing swirl in a flow. It is computed with the maximum magnitude of the secondary flow $\overline{v}_{xy,max}$ by:

$$\phi = arctan\left(\frac{\bar{v}_{xy,max}}{w_{vol}}\right) \tag{4}$$

The asymmetry factor K_a is a measure of how far the flow profile is offset from the center of the pipe:

$$K_a = \frac{1}{2} \bullet \frac{\int_{-1}^{1} \left(\frac{r}{R} \bullet \bar{w}\right) d\left(\frac{r}{R}\right)}{\int_{-1}^{1} (\bar{w}) d\left(\frac{r}{R}\right)} \tag{5}$$

The dimensionless turbulence factor K_{Tu} is defined as the ratio of the maximum axial turbulence intensity $Tu_{core,max}$ in the core region $-0.2 \leq r/R \leq 0.2$ of the flow and the turbulence intensity $Tu_{mid,ref}$ in the center of the fully developed reference profile:

$$K_{Tu} = \frac{Tu_{core,max}}{Tu_{mid,ref}} \tag{6}$$

3. RESULTS

3.1 Axial flow patterns

The results of the LDV measurement and the simulation are displayed in Figure 3 as normalized contour and profile plots of the axial velocity component $\overline{w}$ at the cross-sections downstream from the asymmetric swirl disturbance generator. The top rows (a), (b), (c) and (g), (h), (i) represent the measured velocity patterns while the bottom rows (d), (e), (f) and (j), (k), (l) belong to the respective numeric solution. Additionally, all profile plots are compared to the fully developed Gersten and Herwig reference profile 'G&H' and the simulated fully developed profile 'Sim FD'.

In the contour plots (a) and (d) at z/D=8.5 we find heavily asymmetric velocity distributions downstream from the disturbance generator which are similar in their basic shape and orientation. The displacement towards the pipe wall in quadrant I and deformation of the kidney-shaped core velocity region is slightly more pronounced in the contour plot of the simulation. Here, the maximum value of the primary flow is reached in profile path 81° in diagram (j) with just 4% difference to the fully developed reference profile. In comparison, the maximum velocity for the measurement at this cross-section is reached in profile path 99° and is 10% lower than the theoretical reference profile according to Gersten and Herwig as illustrated in the corresponding profile plot (g). When comparing the results, it should be noted that the contour plots of the experiment are created by interpolating the discrete data points of the measurement grid. However, the numerical solution uses a much finer computational mesh with more single point values between the defined profile paths. The less defined shape of the core velocity region in contour plot (a) is the consequence of only partially capturing the real flow in the pipe due to low resolution of the chosen grid.

Further downstream, at cross section z/D=12.5, we find a core velocity region in (b) and (e) which has been equally rotated clockwise by approximately 90 degrees. The maximum axial velocity is now reached for both sets of data in the exact same point at x/R = -0.1 und y/R = -0.5 and deviates by 9% for the measurement (previously 10%) and by 6% for the simulation (previously 4%) from the maximum values of the respective reference profiles. For the simulated velocity profile this suggests an increase in flatness with increasing distance from the asymmetric swirl disturbance generator which can also be observed in the more significant differences in the shape of the core flow. In (e) the core flow now occupies a semicircular region in quadrant IV, extending almost over one half of the cross section of the pipe. In the corresponding profile plot (k) the profile paths form an almost even plateau for this region. In comparison, the profile paths of the LDV measurement for this cross-section in (h) are equally flat in the center but fan out less in regions close to the pipe wall. At cross-section z/D=19.0 downstream from the asymmetric swirl disturbance generator the differences between simulation and measurement become more apparent. In contrast to the small core velocity region in (c) the turbulent main flow in (f) is now placed in quadrants I, II and III while receding from the center of the pipe which is also indicated in the profile paths in (l) as a centrally placed local

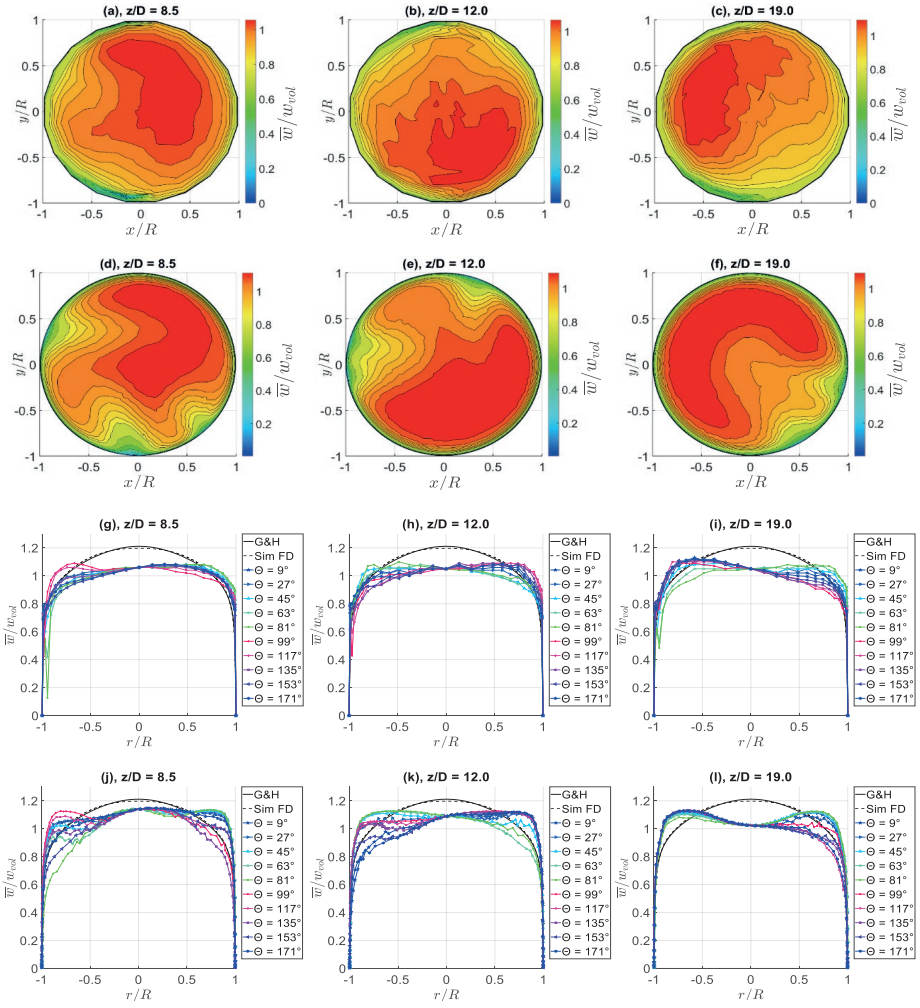


Figure 3: Normalized contour plots of the axial velocity component $\overline{w}$ from the LDV measurement (a), (b), (c) and from the simulation (d), (e), (f). Normalized profile plots of $\overline{w}$ from LDV (g), (h), (i) and from the simulation (j), (k), (l).

minimum. The bundling of the profile paths in the center reflects the approximately radial symmetry of the simulated axial flow profile in quadrants I, II and III. The deviations of the maximum axial velocity from the values of the corresponding reference profile have converged to 5.6% for the measurement and to 6.7% for the simulation. Thus, for the measured velocity distribution a relaxation towards a fully developed profile can be seen (from 10% to 9% to 5.6% deviation). However, both primary flows continue to show a

high degree of turbulence and complexity due to the disturbance of the swirl generator. In a direct comparison of diagrams (c) and (i) with (f) and (l) the significant differences between measurement and simulation are evident. While measurement errors in the LDV are a possible cause for deviating results they often affect only a small number of single measurement points of the grid. The deviations therefore suggest an inadequate modelling of the test rig or simply indicate the limits reached by the selected turbulence model.

3.2 Performance indicators

The following diagrams in Figure 4 depict the flow-specific performance indicators and their respective standard deviation for each cross section downstream from the asymmetric swirl disturbance generator. As a guideline and orientation, the corresponding limit values for a fully developed flow profile are also plotted (gray areas) Optolution Messtechnik (2009). Furthermore, the present results are compared at cross-section z/D=12.0 with selected values from the literature (Turiso et al., 2018) which have been obtained for a similar disturbance generator under slightly varied boundary conditions.

The values for the profile factor in Figure 4 (a) are outside or below the limit value range for an approximately fully developed flow. The highest values, both in the simulation and in the measurement, are reached in the cross-section closest to the disturbance generator downstream at z/D=8.5. The downward trend of the profile factor with increasing distance appears counterintuitive at first but proves consistent with the profile flattening trend observed in Figure 3. It should be noted that low K_p values can also be the result of a displaced core velocity region from the center of the pipe. In the literature we find a profile factor which matches with the present results from the LDV measurement, supporting the plausibility of the calculated values. Overall, the results confirm the interfering influence of the swirl generator on the following flow profile while showing considerable deviations between measurement and simulation.

In contrast, the swirl angle in Figure 4 (b) shows clear parallels between the empirical and numerical sets of data. A similar progressive relaxation of the respective swirl angles can be observed with increasing distance downstream from the disturbance generator, suggesting a decaying behavior of the secondary flow. In the literature a swirl angle ϕ of about 13° is determined which agrees under consideration of the standard deviation at z/D=12.0 with both cases.

The asymmetry factor in Figure 4 (c) shows no predictable trend for either the simulation or the measurement. On average, the axial flow profiles of the simulation have a higher asymmetry factor and are thus more offset from the center of the pipe than the axial velocity profile paths of the measurement which at times even fall into the range of a fully developed flow. A closer inspection of the profile plots, e.g. (k) in Figure 3, reveals individual profile paths that are approximately symmetrical to the center, while other paths intersect the displaced core velocity region only near the wall of the pipe. This results in lower values for the asymmetry factor than one would expect for flows with this level of disturbance and is also the reason for the large standard deviations. The

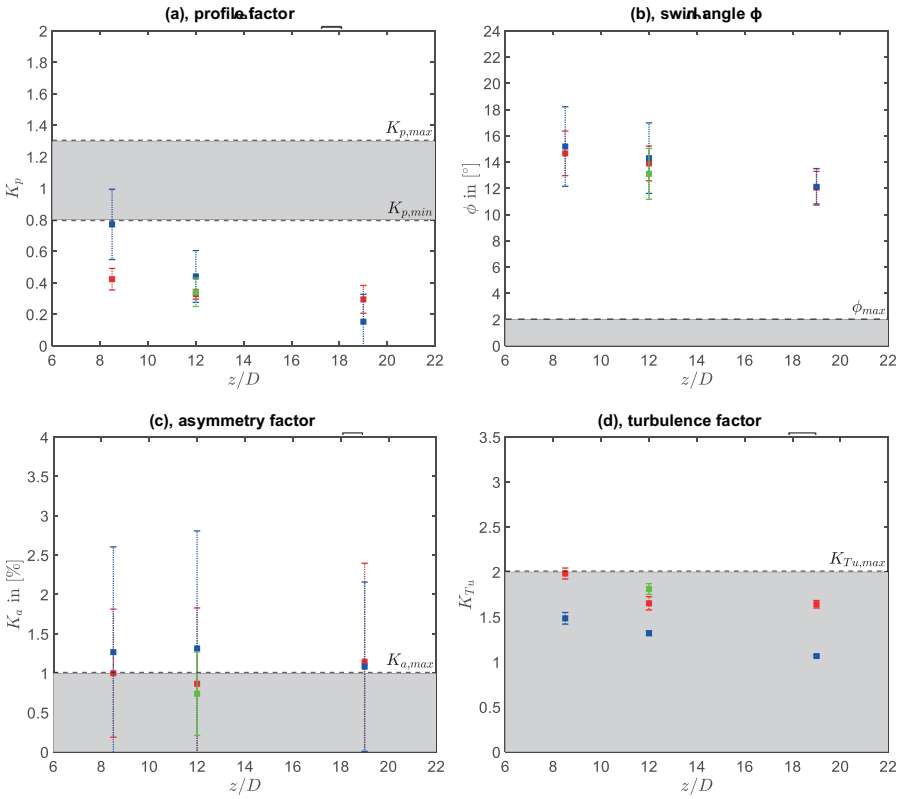


Figure 4. Comparison between LDV measurement ( ), simulation ( ) and previous publica-tion of Turiso et al. [3] ( ) of the performance indicators.

significance of K_a for asymmetrically disturbed flows should therefore be regarded as questionable.

The calculated turbulence factors in Figure 4 (d) fall collectively below the limit for a fully developed flow, with values from the measurement being approx. 30% higher than the values of the simulation across all cross-sections. The characteristic value K_{Tu} can be understood as an estimate of the maximum turbulence intensity occurring in the central region of the pipe. However, in the asymmetric flow field of the disturbance generator the core velocity region is displaced from the center towards the pipe wall. A stronger displacement leads to lower values of K_{Tu} in the considered central region, which is reflected by the deviation between the empirical and numerical values. In the literature we find a value for K_{Tu} which again matches the results from the measurement.

4. CONCLUSION AND OUTLOOK

In this paper, measurements and simulations of a disturbed flow pattern caused by an asymmetric swirl generator were performed. Heavily asymmetric velocity distributions downstream from the swirl generator are found with an increase in flatness in relaxation direction for both cases. In comparison, the profile paths of the LDV measurement are equally flat in the center but fan out less in regions close to the pipe wall. The differences between simulation and measurement become more apparent with increasing distance from the asymmetric swirl disturbance generator. Flow performance indicators obtained from our experiments are in good agreement with the values of Turiso (2018). Comparing measurement and simulation, we see a considerable deviation especially for the profile factor K_p and the turbulence factor K_{Tu}. The results suggest a weakness of the SST turbulence model for asymmetric swirl flows. This is a consequence of the Boussinesq approximation, which assumes isotropic turbulence. However, for further numerical investigations a Reynolds stress equation model (RSM) should be used. This model solves the turbulent transport for all components and should have significantly better accuracy than eddy-viscosity based turbulence models such as the SST turbulence model.

REFERENCES

Gersten, K.; Herwig, G. (1992). Strömungsmechanik. Grundlagen der Impuls-, Wärme- und Stoffübertragung aus asymptotischer Sicht., Vieweg-Verlag, Braunschweig/Wiesbaden.

Hinz, D. F. (2015): Reconstruction of turbulent pipe-flow profiles from laser doppler velocimetry data, *Proceedings of the 15th European Turbulence Conference*, Delft.

Optolution Messtechnik GmbH (2009). Guidelines for the Fluid Mechanical Validation of Calibration Test-Benches in the Framework of EN 1434. Last retrieved May 2021 from https://www.optolution.com/en/service/measurement-services/velocity-profile-analysis-within-the-en-1434/

Straka, M.; Eichler, T.; Koglin, C.; Rose, J. (2019). Similarity of the asymmetric swirl generator and a double bend in the near-field range. *J. Flow Measurement and Instrumentation 70*.

Tawackolian, K. (2013). *Fluiddynamische Auswirkungen auf die Messabweichung von Ultraschall-Durchflussmessgeräten*, Ph.D. thesis, Technische Universität Berlin.

Turiso, M.; Straka, M.; Rose, J.; Bombis, C.; Hinz, D. F. (2018). The asymmetric swirl disturbance generator: Towards a realistic and reproducible standard, *J. Flow Measurement and Instrumentation 60*, S. 144-154.

Yeh, T. T.; Mattingly, G.E. (1994). Pipeflow downstream of a reducer and its effects on flowmeters, *J. Flow Measurement and Instrumentation 5,* S. 181-187.

BMT21
3rd International Conference
Business Meets Technology.
Valencia, 23rd & 24th September 2021

TECHNOLOGY AMONGST THE FIELDS: MINI CAMPUSES AS ENDOGENEOUS GROWTH POLES IN LOWER DENSITY REGIONS – A CASE STUDY FROM THE NUREMBERG METROPOLITAN REGION

Kaiser, Norbert W.

Ansbach University of Applied Sciences, Institute for International Strategy Projects (ISP), Residenzstrasse 8, 91522 Ansbach. Germany. (norbert.kaiser@hs-ansbach.de)

ABSTRACT: The purpose of this paper is to report about the impact of Ansbach University of Applied Sciences' specialized mini campuses on their surrounding rural lower density regions by considering theoretical regional innovation models, spatial planning concepts as well as Ansbach University's mission(s). The approach we use is pragmatic due to the author's scientific publications and the author's professional experience. For that, newer scientific publication to the key words mentioned below are used for an interdisciplinary line of sight, and press releases and internal data provided are qualitatively evaluated for this study's practical part. Our study reveals that Ansbach University's pragmatic local strategy of appropriately placing specialized mini campuses in rural outskirts has remarkable impact on the innovation processes in the lower density region over time. Our mini campuses follow a clear local Triple Helix (TH) innovation strategy by University-Industry-Municipality cooperations, meanwhile tending to focus also Quadruple and Quintuple Helix stakeholder groups. Besides showcasing local innovation processes triggered by our mini campuses the paper thematises rural-urban interaction scenarios due to the threat of shrinking peripheral areas in metropolitan regions. This case study supports policy makers and regional or local deciders by offering ingredients for the set up of local strategies. For universities in low-density areas the paper can be of value for counteracting a brain-drain to metropolitan centers, thus contributing to spatial equal life conditions by giving modern living, studying, researching, working and recreating an attractive local country-side accent.

KEY WORDS: *Mini campus, Smart specialization, Innovation ecosystem, Triple/quadruple/quintuple helix, Rural-urban development.*

How to cite: Kaiser, N. W. 2021. Technology amongst the Fields: Mini Campuses as endogeneous Growth Poles in lower Density Regions – a Case Study from the Nuremberg Metropolitan Region. In Proc.: *3rd International Conference Business Meets Technology*. Valencia, 23rd & 24th September 2021. 27-38. https://doi.org/10.4995/BMT2021.2021.13693

1. INTRODUCTION

The purpose of this paper is to report about the impact of Ansbach University of Applied Sciences' specialized mini campuses[1] on their surrounding rural lower density regions by considering theoretical regional innovation models and rural-urban interaction aspects together with the University's academic missions.

The research question arises due to the challenge of minimizing rural-urban migration within metropolitan regions together with the request for creating competitive local innovation ecosystems. It should be noted that, as being part of a metropolitan region, our approach is different to other situations where mini campuses are launched far away from urban areas[2].

Located in West Central Franconia - a rural low-density NUTS-3 region south-west to the poly-centric core of the Nuremberg Metropolitan Region - Ansbach University of Applied Sciences (Ansbach UAS) has to face a regional situation illustrated through the poly-centric settlement and land use pattern shown in Figure 1. from COTER (2019), based on Piorr et al. (2011):

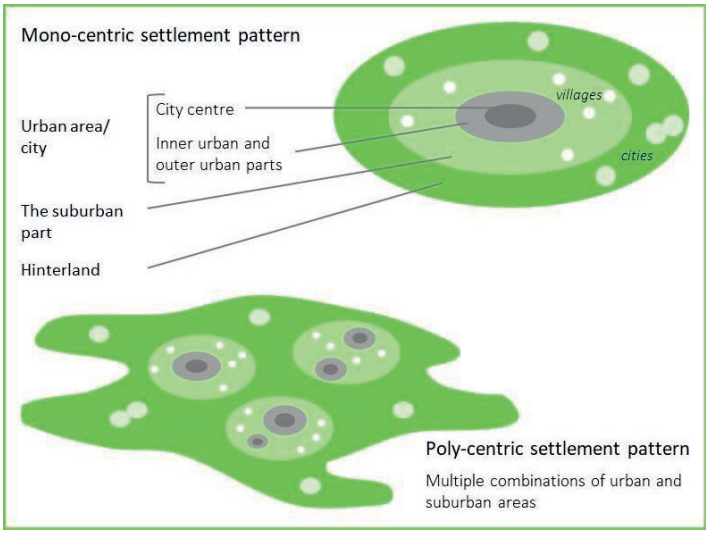


Figure 1. (with permission by COTER/EU 2019).

In their publication COTER report about rural-urban interaction within metropolitan areas and their peripheral outskirts. COTER argues that in a metropolitan region as shown

[1] See Ansbach University of Applied Sciences, https://www.hs-ansbach.de/en/university/branch-offices/, access 17th July 2021.

[2] See Deggendorf Institute of Technology (DIT), https://www.th-deg.de/en/research/technology-campuses, access 17th July 2021.

in Fig. 1 spill-over effects on surround-ding areas are not solely positive. Deciders have to face also e.g. negative impacts like rural-urban migration which means a shrinking of the outer rural areas. By referring to EUROSTAT, COTER note that 2015's EU-28 metropolitan regions contributed to nearly 72% to the European Gross Domestic Product (GDP), whilst less than 60% of the total EU population lived in metropolitan regions at that time. Due to an ongoing rural-urban migration, significantly more people are estimated to move from rural areas to urban regions by 2050, a trend which is confirmed by Maretzke et al. (2021) in their Spatial Planning Forecast 2040 for Germany.

As this trend has an embracing effect on the metropolitan region as an interwoven area, decision makers of all stripes have to develop co-opetitive strategies between cities and rural areas. For propelling the competitiveness of metropolitan regions with a backlash to regional prosperity and international reputation, improving regional and local innovation ecosystems seem to be a strategy worth thinking about.

For that, this paper is structured into three more sections. In Section 2 theoretical models for regional innovation are highlighted: innovation ecosystems, helix models and growth pole theory. Section 3 describes the case itself, aligning results to the theoretical models focused. In Section 4 we report about learnings and ascertain future research needs. Research limitations and future research options will be given shortly in Section 5.

As mentioned, literature to the keywords of this paper is manifold. Therefore, our research approach is pragmatic due to the author's earlier publications (see Kaiser (2019), Kaiser and Bung (2010), Kaiser and Mammen (1999)) and the author's professional background. So, we first take into account relevant newer published papers, studies and books, while the real world picture is given in a second step, leading to our system of mini campuses as an innovative local innovation approach in low density regions.

2. THEORETICAL REGIONAL INNOVATION MODELS

The European Committee of Regions CoR (2016) describe advanced regional innovation ecosystems in their guide about pioneer cities and regions together with their good practices. The guide's regional story telling is based on a set of critical success factors (CSFs)[3] derived from a quick-scan of studies and expert interviews, emphasizing and recognizing the value of scientific study for their classification criteria at all. The guide is useful in the context of the CSFs and the question of their deployment in regions, however all the measures taken in the pioneer regions analyzed cannot simply be rolled out in other regions. In fact, CoR notes that '*pioneering regions are a story altogether*'.

Jackson (2011) gives a definition for innovation ecosystems based on material and human resources which in sum form innovation relevant entities like universities, businesses, clusters, incubators, venture capitalists or business support agencies. The article distinguishes between knowledge and commercial economy for clarifying the

[3] CSFs are (1) vision, (2) actors, (3) policy model, (4) collaborating model, (5) partnering model, (6) resources, (7) physical and digital spaces, (8) innovative instruments and (9) outcomes and results.

question of capital and knowledge flow between those two groups. Along a four phase innovation process – invention, technology demonstration and development (TD&D) and commercialization – Jackson indicates that especially in the TD&D phases investments are low due to uncertainty, defining a 'Valley of Death' for ideas probably never passing the respective resource gap towards market launch.

Sun et al. (2019) investigates the role of government both as planner (top-down regime) and as facilitator (bottom-up regime) for a chinese university science park as innovation ecosystem. The paper emphasizes the role of universities not only as cutting-edge knowledge stimulators but also as important key players in their local innovation ecosystems. Also, intermediaries and social networks are seen as similar important channels for managing knowledge spill-over. Kaiser (2019 & 2020) has scetched the structure of Nuremberg's Metropolitan Region innovation ecosystem as an innovation boiler with relevant intermediaries, clusters and networks for SMEs as well as medium and large firms. The papers also focuses the regional innovation and development process by a set of process-orientated success factors.

Komorowski's study (2019) deals with identifying factors to develop innovation ecosystems, defining them as *'structures that are formed between actors that pursue technology development and innovation as one of their objectives'*. The definition is intentionally kept broad in order to integrate any organized or unorganized innovative patterns or dynamic regional innovation processes. From the results of her survey covering 247 innovation ecosystems throughout Europe, nine criteria are found enabling a rating of innovation ecosystems types by a spider web chart. Also, a cluster analysis of the results identified four archetypes of innovation ecosystems.

As is the case in every management system, also in regional management we have input, operations and output, indicating that overarching governance, human capital, structures, resources and (agile) processes have to be taken into account. To describe those complex innovation scenarios, the Triple Helix (TH) model by Etzkowitz and Leydesdorff (1995) and the Quadruple and Qintuple Helix models derived therefrom are taken as a must to be considered here. The well-known TH model describes regional innovation as a complex process of three intersecting circles representing universities, economy and government. University-industry-government interactions, e.g. as is the case for most science and technology parks or tech clusters, lie within the common intersection of the three. The three circles spiral the construct to new 'heights' due to new roles along a fictous time axis vertical to the three circles. This is the case when the three stakeholder groups innovate their missions, thus keeping the system in transition (Leydesdorff, 2012). In a recent paper, Galvao et al. (2019) show that research on helix models - with the TH model as the most focused on - is unbroken, be it in number of publications or in number of citations. Their cluster analysis of co-cited papers revealed regional policy recommendations such as e.g. active networks and cooperation partnerships as well as entrepreneurial ecosystems for low density regions.

As already indicated, the three stakeholder groups of the TH model might not be sufficient for coping with global innovation demands stamming from a more and more

complex environment. Carayannis and Campbell (2009) have adapted and enlarged the TH model by introducing the public as a new stakeholder group for innovation within their Quadruple Helix (QH) model. As the public is embossed by culture and values, media and social networks can contribute massively to their opinion in nowadays' 21st century. So, in total, both the culture and media based public and media as well as the creative industries are addressed by this QH group fuelling the intertwined helix dynamics. To be short, the QH model calls on involving the public in innovation processes[4], possibly due to their potential for new ideas, the self-image of democracies or the awareness that stakeholder groups accept innovation psychologically better the more they have been involved in the creative beginnings.

A working paper written by Arnkil et al. (2010) goes intensively in this direction. The paper brings in clearly the social dimension and the user driven aspect of the QH model, reporting on several good QH cases e.g. by highlighting Living Labs as R&D&I platforms for involving users. Also, Carayannis et al. (2019) show examples of excellence from Nordic countries with respect to the QH model, while additionally studying Quadruple/Quintuple Helix (Q^2H) Innovation system as an enabler for the circulation of knowledge and a 'spin-doctor' for regional innovation. In this context, as a 5^{th} stakeholder group the (natural) environement is seen as an innovation driver which is of great importance for managing UN SDGs.

As a last regional development model we find essential to focus on Growth Pole Theory developed from the French economist Francis Perroux in 1955. Growth pole theory says that economic growth and development is not balanced equally throughout a region, but takes place around driving nuclei. Driving cores can be universities, (key) industries or e.g. science park (Luger and Goldstein, 1991) leading to agglomeration effects which might be replicated elsewhere in a self-similar way. This is indicated in Figure 2a-c following Rodrigue (2020).

Despite the decades having passed, the growth pole model is still under examination for economically weak(er) developed countries. Examples are works from Benedek (2016), Bere et al. (2015), Jesus and Spinola (2015), ESPON (2014), Iunesco-Heroiu et al. (2013) and Komarovskiy and Bondaruk (2013).

3. TECHNOLOGY AMONGST THE FIELDS – LOCAL INNOVATION BY SPECIALIZED MINI CAMPUSES

In this section, we refer to the various studies from Section 2 by showcasing regional innovation by Mini Campuses.

To begin with, we shortly look back to times where universities had been relevant growth poles according to Figure 2a in Bavaria (regional NUTS-1 level). In the 1960s, their local impact area has been supplemented by Universities of Applied Sciences,

[4] Remark: QH is part of CoR's (2016) critical succes factor 'Collaborating Model'.

emerged as part of a new Bavarian Higher Education (HE) policy. The idea behind had been enriching the Bavarian HE system by application orientated HE institutions, whose profile bridges the gap especially to SMEs by more practice-orientated teaching contents and applied R&D (Figure 2b).

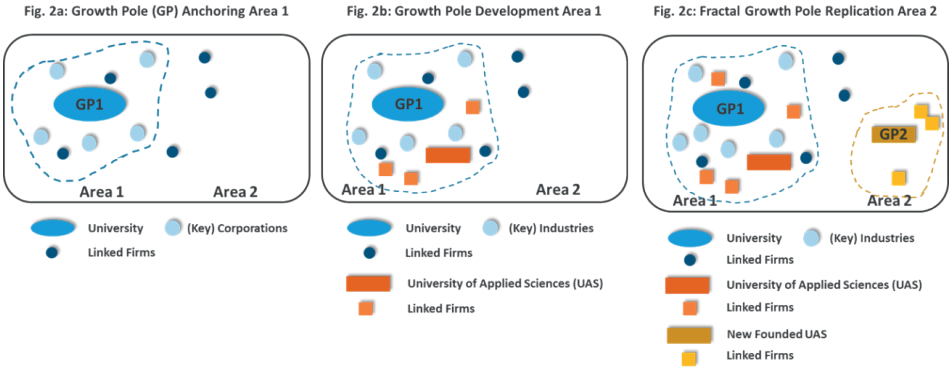


Figure 2a-c. Schematic setting, development and fractal replication of growth poles.

In the 1990s, Bavarian Government again gave their regional HE system a thrust: the existing UASs were topped up by a series of new UASs filling relevant Bavarian sub-spaces of low density or rural character. Ansbach UAS in West Central Franconia, a south-western NUTS-3 region in the Nuremberg Metropolitan Region, is one of them. The self-similar system transfer from center to peripheral regions is schematically scetched in Figure 2c showing the growth pole feature of our university. Figure 2a-c are based on Gavrila-Paven (2017).

Komorowski (2019) identified archetypes for local innovation ecosystems, e.g. the one of a 'Small City' characterized among others by a technology park. Although the 'Small City' archetype may hold for Ansbach City's 40,000 inhabitants and its UAS, chronologically it had been the other way round: Ansbach's centrally posed Innovation and Technology Center (TIZ) was a result from Ansbach's urban innovation strategy together with incubator concepts from Ansbach UAS around 2,000, in these days additionally complemented by a digital business incubator (ANsWERK). In this context, the 'Small City' archetype together with a metropolitan center lying directly 'at the doorstep' makes at least one aspect clear: not only governmental support from outside is key, but also lifting endogenous treasures in 'forests and fields' between local cities of 8,000 to 18,000 inhabitants.

Specialised Mini Campuses, self-similarly replicated (according to Figure 2c) and posed as Higher Education entities in the peripheral outskirts of West Central Franconia, had been an answer to the How-to-question.

Table 1 gives an overview over our four mini campuses, which are appropriately placed close to or in Ansbach's even smaller neighboured cities. Located 'amongst the fields' in that sense, mini campuses can be described in general by the following criteria:

- strategically linked to academic board members of Ansbach UAS
- operationally managed by a responsible management team on site
- clearly delineated from the centered university, but following a specialization strategy according to local and/or international demands either technologically or management-oriented.

Table1. Ansbach UAS's Specialised Mini Campuses and their Local Impact.

Mini Campus	Local City & Residents	Key Partners / Key Networks	Key Impact (selected issues) ...	... refering to ...
Total Productive Management Campus (CETPM)	Herrieden 8.000	City of Herrieden	Image, Radiance and Catchment Area up to National Level	Triple Helix
Polymer Campus	Weißenburg 18.000	Deggendorf Institute of Technology City of Weißenburg Weißenburg-Gunzenhausen County	Appointment as Bavarian Polymer Campus K-Meter Industrial Network	Triple Helix
Smart Energy Campus	Feuchtwangen 12.500	Munich Technical University (TUM) Bavarian Building Academy Feuchtwangen City Ansbach County	New Building Area 'University'; (energy) research involving local residents; Drone Operations (Solar Cell Defect Identification, Fawn Detection and Biodiversity Analysis)	Triple & Quadruple Helix Triple & Quintuple Helix
Intercultural Campus	Rothenburg on the Deaf 10.500	City of Rothenburg Regional Network of Smaller Communities	Endowed Professorship for 5 years; Research Project 'Connected Guest Experience' funded by the German Federal Ministry Program LIFT (LIFT = Performance Improvement and Innovation in Tourism)	Triple Helix

Also, a characteristic feature of mini campuses is their emergence from a significantly and endogenously activated potential:

- For ramping them up, investments in new or refurbished buildings are typically provided by the local cities together with the respective local district, but also private money
- Technological equipment is taken from the University's premises, if possible. In other cases public funding programmes support the establishment of technological facilities
- For operating their campuses, Ansbach university in turn provides the necessary human capital by comprehensive rationalization efforts throughout the university

Other operational expenses are covered by the regional government (Bavarian State) for a starting period of 5 years. For future campus operations exceeding these years, the management team is called to finance a great part of the costs by applied R&D or 3rd mission projects by regional, national or EU funding programmes and/or private budgets allocated to the campuses from local sponsoring associations and local business networks. Based on this cooperative mixture between university, cities, municipalities and government, an impression on mini campus operations can be taken out by the Business Model Canvas of our Smart Energy Campus. Although each campus has their

special features, this canvas can serve exemplarily for the mini campus concept in total (see Figure 3).

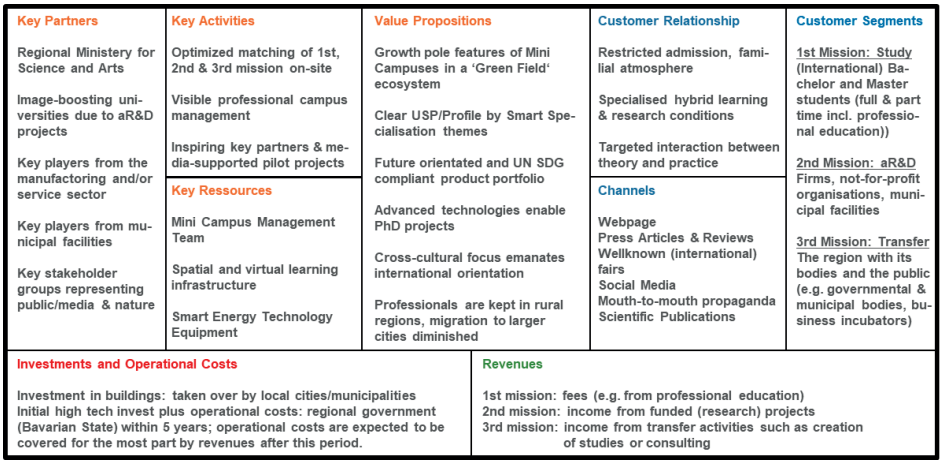


Figure 3.

4. RESULTS AND LEARNINGS FROM THE MINI CAMPUS CONCEPT

Concerning the output of our mini campuses in low-density regions, regional innovation is seen by taking account of the following outcomes in the sense of the TH and Q^2H innovation models:

- Through their HE missions (1^{st} is study, 2^{nd} applied R&D, 3^{rd} transfer to the region) mini campuses actively bundle local, regional and even national stakeholder groups by professional education and applied R&D projects (with industry or local governments or the public)
- Mini Campuses are regarded as new endogenously set up 'growth poles', supporting existing or generating local networks, thus enriching the local innovation ecosystems
- Besides moving into a new building, campuses sometimes may occupy refurbished buildings, which reminds at new innovation districts e.g. reported by van Dinteren and Jansen (2021)
- Recently, one campus is contributing to a newly designated building area designed as a mixed area for residing and businesses. The area will be in close proximity to the campus itself such that energy data from residents can serve as real data for energy research projects
- Campuses could be taken as living labs for society involving the public in local innovation processes, as shown in the QH innovation model.

- More innovation by nature seems graspable and is already partly done by taking into account newest results from one mini campus's drone activities. Animal welfare in forests and fields drives innovations, e.g. successful fawn detection has been carried out from helicopter view, or the demands for radarizing biodiversity will improve airial robot generations. Nature driven innovations are, as mentioned, part of the Quintuple Helix model.

Summing up, we can say that

- within the cooperative partnering described, our mini campuses develop successful, each within a timeframe according to either endogenous shortcomings or to their (mega-) trend attractiveness as well as the their ability to enhance economic producitivity
- the concept can be regarded as a win-win-situation for all parties or stakeholder groups: Bavarian government is able to take stand to their constitutional promise to create equal life conditions in all areas throughout Bavaria. Local cities and municipalities profit from the image of being an official campus site, thus demonstrating innovativeness towards their local businesses as employers and tax payers, and last but not least Ansbach University for clearly showing a regional strategy worth being supported by local and regional stakeholder groups.

Certainly, there are critical aspects as well. Mini campuses amplify logistics due to the fact that not all academic infrastructure, e.g. a physical library, can be multiplied at campus sites. Also, for a real study experience, a critical mass of students should be visible on-site. Despite the digital age and its opportunities, social proximity seems vital.

Also, the critical mass challenge holds for the number of projects to be acquired to finance operational costs. This might cause a search for projects not even locally, but on higher regional level. As capacitiy is restricted and cannot multiplied to any extent, local demands might then have lower priority. And finally, considering local governmental bodies, the sunk costs of public investors should give a return to the public purse, though public amortization times may be long.

5. RESEARCH LIMITATIONS AND FURTHER RESEARCH OPPORTUNITIES

General limitations are given due to data protection regulations, as far as internal mini campus data are concerned. An interesting research field is in that context e.g. to describe the development phases of mini campuses, in order to sensitize policy makers for occurring obstacles in similar situated campus projects. Also, field analysis seems reasonable to ask businesses for their experience with the campuses or the public in terms of campus image and reputation transferred e.g. by media.

ACKNOWLEDGMENTS

The author likes to thank the Mini Campus teams for the timely provision of relevant information, without violating data protection issues. Also, the author likes to note that research on mini campuses has been triggered by the original idea of establishing an international mini campus in a Chinese business park together with a partner university. The respective research idea had been repeatedly funded by BayChina, the Bavarian Academic Research Center for China located at Bayreuth University, Bavaria, Germany.

AUTHOR'S INFORMATION

Dr. Norbert Kaiser ist Professor for Corporate Planning and Organisation, Innovation & Technology Management and Business Excellence at Ansbach University of Applied Sciences (Ansbach UAS). His working fields are Strategic Management, Innovation and Performance Management, both on corporate and regional level. Over decades Norbert Kaiser has carried out a lot of strategic applied (R&D) projects for business support organisations, technology clusters and his home university fostering innovation in organisations and the Nuremberg Metropolitan Region. Norbert Kaiser has been one of the authors for Ansbach UAS's strategic founding concept in 1996, and had been responsible in the past as the University's Vice President for aR&D and Transfer for over 10 years. Due to his international orientation he is Chief Executive Director of the University's Institute for International Strategy Projects (ISP), focusing in his studies e.g. on Science and Technology Parks in the Digital Age. Besides his scientific work and publications Norbert Kaiser assesses the performance of public and private organisations as an EFQM Global Award Assessor.

REFERENCES

Arnkil R.; Jävensiva A.; Koski P.; Piirainen, T. (2010). Exploring Quadruple Helix. Outlining user-orientated innovation models. *Työraportteja 85/2010 Working Papers*, also Final Report on Quadruple Helix Research for the CLIQ project. University of Tampere, Institute of Social Research. Work Research Center.

Benedek, J. (2016); The role of urban growth poles in regional policy: the Romanian case. *Procedia – Social and Behavioral Sciences 223*, 285 – 290. Elsevier/Science Direct.

Bere, R.C.; Precup, I. B.; Silvestru, C. I. (2015). On Growth Poles from EU Countries in the Framework of Europe 2020. *Procedia Economics and Finance 23*, 920 - 925. Elsevier/Science Direct.

Carayannis, E.G.; Campbell D. F. J. (2009). 'Mode 3' and 'Quadruple Helix': towards a 21st century fractal innovation ecosystem. *International Journal of Technology Management, Vol. 46*, Nos. 3-4.

Carayannis E.G.; Grigoroudis, E.; Campbell, D. F. J.; Meissner, D.; Stamati, D. (2019). The ecosystem as helix: an exploratory theory-building study of regional co-opetitive entrepreneurial ecosystems as Quadruple/Quintuple Helix Innovation Models.

Committee of Regions (2016). Regional Innovation Ecosystems. *European Union CoR guide. Learning from the EU's Cities and Regions*. https://cor.europa.eu/en/events/Documents/7th Summit of Regions and Cities/CoR_guide_on_regional_innovation_Ecosystems.pdf (access 18th July 2021).

COTER Comission for Territorial Cohesion Policy and EU Budget; European Committee of the Regions (2019). *The impacts of metropolitan regions on their surrounding areas*. QG-01-19-812-EN-N; ISBN 978-92-895-1030-1; doi 10.2863/35077.

ESPON (2014). *GROSEE Growth Poles in South East Europe*. Final Report Version 28/02/2014.

Galvao, A.; Mascarenhas, C.; Marques, C.; Ferreira, J.; Ratten, V. (2019); Triple helix and its evolution: a systematic literature review. *Journal of Science and Technology Policy Management JSTPM 10*, 3.

Gavrila-Paven, I.; Bele, I. (2017). *Developing a Growth Pole: theory and reality*. ResearchGate.

Iunesco-Heroiu, M.; Neagu, M.; Burduja, S.; Sandu, D.; Moldovan, C.; Man T.; Rusu, R. (2013). *Growth Poles – The Next Phase*. Romania Regional Development Program.

Jackson, D. J. (2011). *What is an Innovation Ecosystem?* National Science Foundation, Arlington.

Jesus, J. A.; Spinola, N. D. (2015). Six Decades of Growth Theory: A review necessary. *ERSA conference papers* ersa15p343, European Regional Science Association.

Kaiser, N. W.; Mammen, G. H. (1999). *Lernende Regionen – ein Modell für den Einstieg am Beispiel der Stadt Ansbach*. zfo Zeitschrift Führung + Organisation, 2/1999.

Kaiser, N. W.; Bung, P. (2010). *Strategy Focused Management – A Hands-On Strategy Tool for Deciders*. Campus Edition Hochschule Ansbach. Shaker Verlag, Aachen 2010. ISBN 978-3-8322-8759-7

Kaiser, N. W. (2019). *Von der Industrie- zur Metropolregion: Strategisches Management am Beispiel der IHK Nürnberg für Mittelfranken*. Campus Edition Hochschule Ansbach. Shaker Verlag, Düren 2019. ISBN 978-3-8440-6641-8

Kaiser, N. W. (2019). *Vortrag 'Kreative Regionen: Innovations- und Technologiemanagement in der (Metropol-) Region Nürnberg (Fallstudie)'*. 7. Tagung des Chinesisch-Deutschen Forums für Anwendungs-orientierte Hochschulausbildung (CDAH) unter der Organisation der Zhejiang University of Science and Technology, Hangzhou, China.

Kaiser, N. W. (2020). Creative Regions: Innovation and Technology Management in Nuremberg (Metropolitan) Region. Selected CDAH conference paper. *Journal of Zhejiang University of Science and Technology, Vol. 32*, No. 5, Hangzhou, China.

Komarovskiy, V.; Bondaruk, V. (2013). The Role of the Growth Poles for Regional Development. *Journal of Public Administration, Finance and Law*, issue 4/2013.

Komorowski, M. (2019); ECOSYSTEMS IN EUROPE: *First outline of an innovation ecosystem index. A study conducted on behalf of the Digital Transition Partnership*. imec-SMIT-VUB, Brussels. (Remark: SMIT is the research group for Studies on Media, Innovation and Technology at the Vrije University Brussels and imec (Belgium) a intra-university microelectronic centre headquartered in Leuwen, Belgium).

Leydesdorff, L. (2012). *The Triple Helix of University-Industry-Government Relations*. Social Science Research Network SSRN. Electronic copy available at http://ssrn.com/abstract=1996760

Luger, M. I.; Goldstein, H. A. (1991). *Technology in the Garden. Research Parks and Regional Economic Development*. The University of Notrh Carolina Press. Chapel Hill & London.

Maretzke, St.; Hoymann, J.; Schlömer, C.; Stelzer, A.; Raumordnungsprognose 2040. Bundesinstitut für Bau-, Stadt- und Raumforschung BBSR (Federal Institute for Research on Building, Urban Affairs and Spatial Development). BBSR-Analysen KOMPAKT 03/2021.

Piorr, A.; Ravetz, J.; Tosics, I.; *Peri-urbanisation in Europe: Towards a European Policy to Sustain Urban-Rural Futures*. A Synthesis Report. PLUREL consortium, Copenhagen 2011. ISBN 978-87-7903-534-8.

Rodrigue, J.-P. (2020); *The Geography of Transport Systems* 5th Edition. Routledge ISBN 978-0-367-36463-2. See also https://transportgeography.org/contents/chapter2/transport-and-spatial-organization/ growth-poles-theory/

Sun, L. S.; Zhang, Y.; Cao, Y.; Dong, J.; Cantwell, J. (2019). Enriching innovation ecosystems: the role of government in a university science park. *Global Transitions 1*, 104-119.

Van Dinteren, J.; Jansen, P. (2021). *Areas of Innovation*. Innovation Area Development Partnership (IADP), 2021.

BMT21
3rd International Conference
Business Meets Technology.
Valencia, 23rd & 24th September 2021

METHODOLOGY IN 3D LASER SCANNING OF A FARMHOUSE

Moreno-Puchalt, Jésica [a1]; Almerich-Chulia, Ana [a2]; Mesarosova, Alena [b] and Ferrer Hernández, Manuel [c]

[a] *School of Architecture, Department of Continuum Mechanics and Theory of Structures, Universitat Politècnica de València. Spain. ([a1] jemopuc@mes.upv.es, [a2] analchu@mes.upv.es)*
[b] *School of Fine Arts, Department of Sculpture, Universitat Politècnica de València. Spain. (mesarosova.alena@gmail.com)*
[d] *Universitat Politècnica de València. Spain. (manusamu@gmail.com)*

ABSTRACT: The urgent need to improve the quality in the refurbishment of traditional buildings has led to the adoption of many innovative technologies. 3D laser scanning is a non-destructive technique used in the study of architectural heritage. It consists of producing millions of accurate 3D points with a very high point density in a short time. For this reason, it is a valuable alternative or complementary technique for classical topographical measurements based on total station or digital photogrammetry. To get the complete 3D model, multiple shots must be taken from different directions that provide data from all sides of the building. These scans are integrated into a common reference system so that through a process of aligning the information obtained in all the stations, a complete model is achieved in a single file. This model faithfully reproduces the current volume of the building, including its deformations and collapses, and provides very precise information from which to make its geometric survey. With the aim of making a graphic survey of the farmhouse located in the UPV campus, current headquarters of the CEDAT Foundation (Service for Attention to Students with Disabilities), a 3D laser scan was carried out in March 2019. This paper describes the methodology of laser scanning, the specific step during scanning and the possibility of create 2D documentation from 3D model point clouds.

KEY WORDS: *3D modeling; Point cloud data; 3D laser scanner; Digitizing; Reality capture.*

1. INTRODUCTION

The continuous advance in the field of electronics allows us to increasingly access a wide range of solutions and tools that were once unimaginable.

The 3D laser scanner is a clear example of innovation and advancement, being a powerful and incomparable measurement tool that arises from the field of topography and it is more frequently present in the building, refurbishment and architectural heritage sector (Pukanská, 2012).

How to cite: Moreno-Puchalt, J., Almerich-Chulia, A., Mesarosova, A., and Ferrer Hernández, M. 2021. Methodology in 3D laser scanning of a farmhouse. In Proc.: *3rd International Conference Business Meets Technology*. Valencia, 23rd & 24th September 2021. 39-47. https://doi.org/10.4995/BMT2021.2021.13680

It offers multiple advantages in measurement or data collection. These include precision, quality and speed, in addition to its versatility, simplicity and scope. It is a highly efficient tool as it reduces field work time.

As a result of the scan, a point cloud is obtained that represents a copy of reality at a 1:1 scale from which the most diverse information about the generated virtual model can be obtained, such as high resolution orthophotos, measurements in true magnitude, integration of the point cloud in BIM software, virtual tour of the model or even 3D printing (Mesároš & Mandičák, 2017).

Figure 1. 3D laser scanner and placement of spheres in the farmhouse.

The building under study is a farmhouse located in the Polytechnic University of Valencia, called "Mas del Noy". This house is from 1880, it was a farmhouse with two floors where the land was cultivated, it had a well, a doghouse and a small garden with a table under the trees. A ditch ran along the edge of the house and the orchards. This was how it remained until July 1998, when the University ceded the old farmhouse to the CEDAT Foundation. Nowadays it is the headquarters of the Foundation and the Special Employment Center. Its refurbishment, achieving total accesibility, was an arduous task, but currently it is a benchmark within the University (Azulay Ahuir, 2015).

2. METHODOLOGY OF LASER SCANNING

The scanning process can be divided into three stages: scan plan, data collection and data processing.

2.1. Scan plan

A scan plan is a set of information that describes the scope and approach that will be taken to capture the data at the site. A scan plan should be made after setting the project goals.

Many times a scan plan begins with a detailed analysis of what elements need to be captured. In the case of scanning a building for the first time, you will want to capture the position of all the elements. In the case of continuing with a work started previously, it is possible to set specific work areas on which more information needs to be collected.

Identifying the exact target of the items to be analyzed helps the field team to prioritize their efforts and reduce the time spent capturing unnecessary data. With a clear goal in mind, a document can be created that identifies the optimal location for each scanning station.

2.2. Data collection

Before starting the configuration it is important to check that there is a SD card inside the scanner to record the data.

Scan parameters can be changed from settings at any time during scanning. The main parameters include creating a scan project, selecting a scan profile indoor and outdoor and setting resolution and quality.

Figure 2. Data collection at the rear of the building.

It must be taken into account for the location of the reference points that mathematically three common references are needed between two consecutive scans. However, a higher

number of common references per scan will improve the registration results, making it easier and less likely to be error.

The scanner used is Faro Laser Scanner Focus 150. Scene, which is the software that Faro technology uses, allows the union of point clouds by points, by planes or by spheres (FARO Laser Scanner Focus3D, 2019). The spheres used as a markers should not be positioned symmetrically with the building. They must form a polygon around the scanner and have varying distances to it. The ideal thing is to place them at different heights, distances and planes.

The number of stations depends on the size and shape of the building. The scanning time depends on the number of stations, the quality and resolution, the complexity of the scanned building…

2.3. Data processing

The immediate result obtained from the laser scan is a series of point clouds. Each point is represented by coordinates (x,y,z). All point clouds are recorded together in a common coordinate system, resulting in a single point cloud.

Once the complete point cloud is obtained, unnecessary information is eliminated such as people, equipment, surrounding buildings, trees or noise, and then the color is applied (in the case of having scanned in color and not in black and white). Once all the previous steps have been carried out, the project documentation can be prepared by starting the preparation of plans (Tkáč et al., 2018).

3. CASE STUDY: A FARMHOUSE AT POLYTECHNIC UNIVERSITY OF VALENCIA

The main aim in this project is the preparation of ground floor plans to study a possible redistribution of space. The interior on the ground floor and the entire exterior perimeter are scanned. In this way, we can draw the thickness of the walls and the position of windows and doors on facades (Hrozek et al., 2012).

Regarding scan parameters, in our case we chose indoor to 10 meters, resolution 1/5 and quality 4x which took us an approximate scan time of 8 minutes; for outdoor more than 20 meters, resolution 1/4 and quality 4x with an approximate scan time of 12 minutes in color.

We decided that the first position of the scanner will be in the interior, actually it didn't matter if the first position was indoors or outdoors. We started in the old block (current meeting room), as we can see in the Figure 3 positions 1 and 2. We continued in the stairwell area towards the exit door (posititons 3 and 4). The connection of the interior with the exterior is very important and delicated. A mistake in this union will imply that the wall thicknesses will be wrong, among other things. Interconnection through the windows was very complicated only possible through the door. This was a very specific and very important step during scanning. In the exterior we continued around the building

(positions 5 to 14). The total scan time was three hours. This time consisted of installing the scanner, deployment of reference spheres and also changes in positions of the scanner and markers. The positions of the reference points were often different because we had available just five pieces of reference sphere. Due to this, in the union of point clouds we had to also use planes and not only spheres.

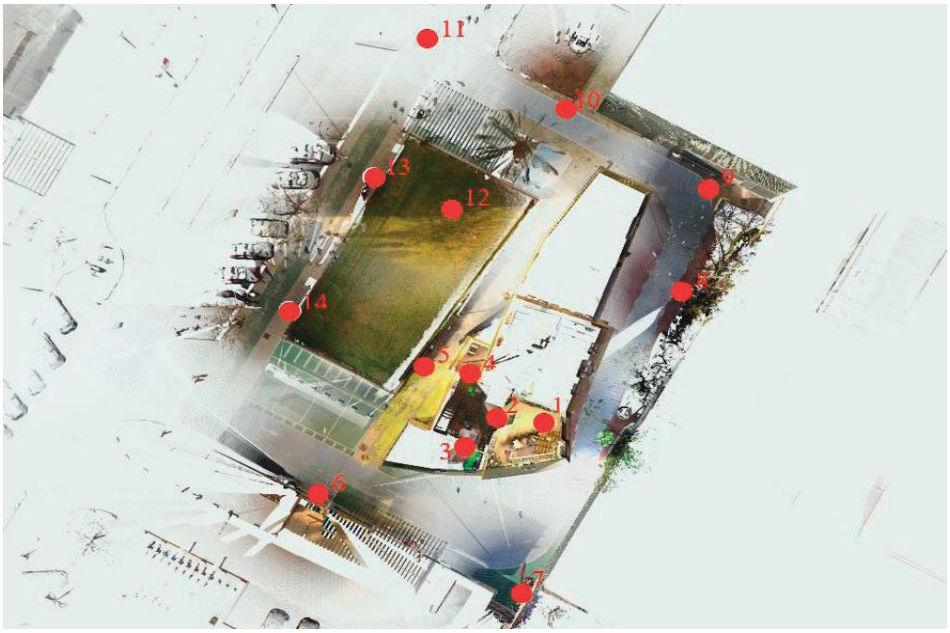


Figure 3. Fourteen positions of the laser scanner.

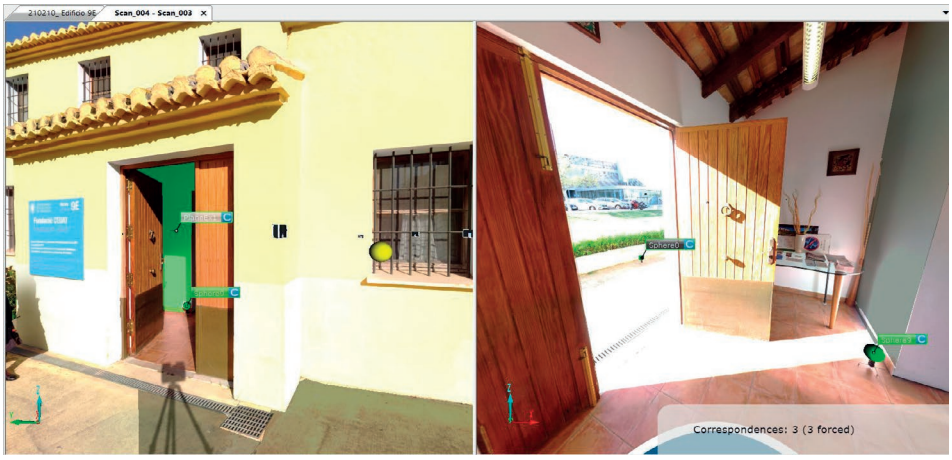


Figure 4. Interconnection between interior and exterior.

We must do the office work once the field work is finished. This work consists of the union of point clouds using Scene software. Each point cloud is joined with the next one by selecting common references that can be spheres, planes or points, as we can observe in Figure 4.

Figure 5. Complete cloud of the farmhouse and its surroundings.

This program offers simple measurements, coloring the point clouds, deleting unnecesari points and export the complete point cloud to various formats. We use the RCP format in order to import the point cloud into a CAD program, the program we work with is Autocad.

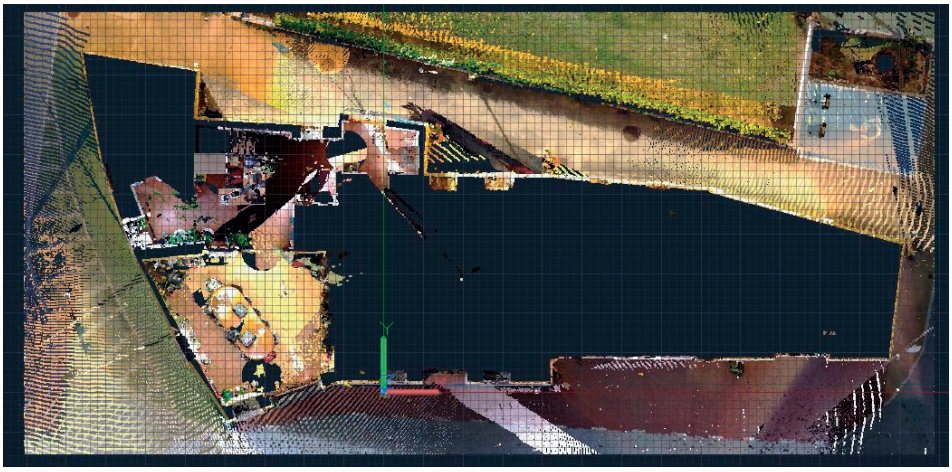


Figure 6. Elimination of redundant points.

This software allows us to make countless sections in the complete point cloud and draw the 2D plans that interest us generating them in a short period of time. Façade, floor plans, sections and details can be elaborated simply by making cuts to the complete cloud and drawing on top of them using them as a template.

Figure 7. Main façade of the building.

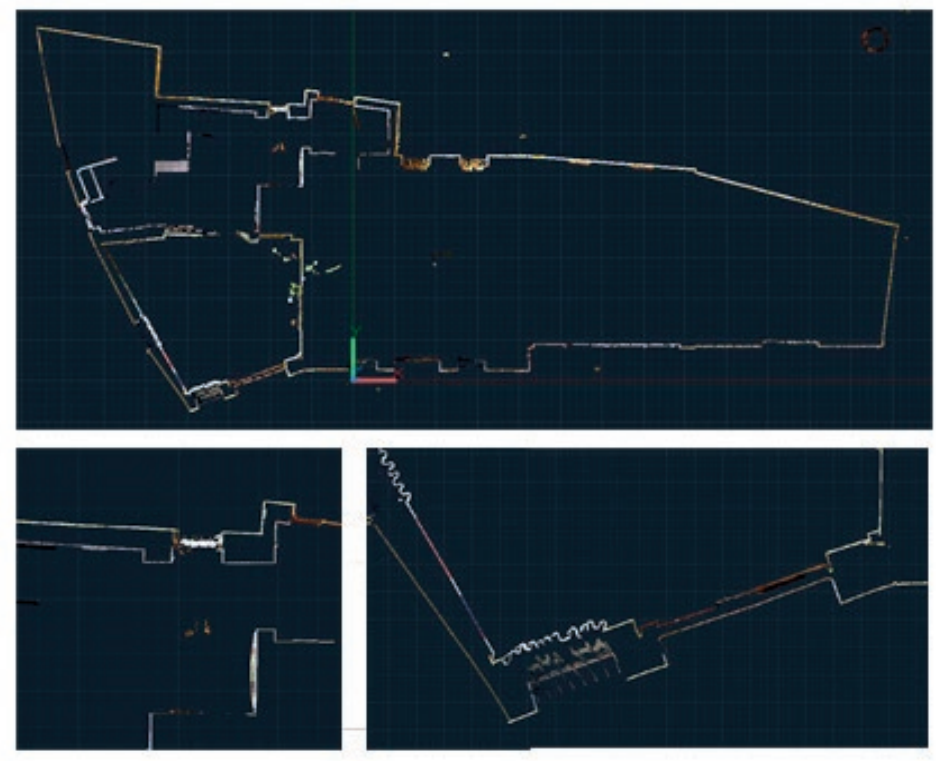


Figure 8. Preparation of floor plan and details.

4. CONCLUSION

This paper shows 3D laser technology as a state-of-the-art tool for drawing with great precision plans of traditional buildings. It has been described step by step how to prepare the graphic documentation of the farmhouse located at the Polytechnic University of Valencia. There is no doubt that the 3D laser scanner is a very effective tool to carry out graphic surveys of the current state of historic buildings.

THE ACKNOWLEDGMENTS

This article shows what has been learned from participating in project supported by Slovak Agency for research and development APVV-17-0549 "Research of knowledge-based and virtual technologies for intelligent designing and realization of building projects with emphasis on economic effiency and sustainability". The cooperation is also planned for project KEGA no. 059TUKE-4/2019 of Slovak Educational Agency "M-learning tool for intelligent modeling of building site parameters in a mixed reality environment" for period 2019-2021.

The 3D laser scanner provided by the Master's Degree in Advanced Architecture, Landscape, Urbanism and Design (UPV) has been used for the study of this farmhouse.

CONFLICT OF INTERESTS

The authors declare no conflict of interest

AUTHOR CONTRIBUTIONS

M-P.J: Conceptualization, Methodology, Formal analysis, Investigation, Writing - original draft, Writing - review & editing, Visualization. **A-C.A**: Conceptualization, Validation, Investigation, Funding acquisition, Writing - review & editing, Visualization, Supervision. **M.A.**: Formal analysis, Methodology, Software; Supervision; Validation. **F.H.M.**: Formal analysis, Methodology, Software; Supervision; Validation.

All authors have read and agreed to the published version of the manuscript.

REFERENCES

Azulay Ahuir, M. (2015). *Rediseño de procesos rutas y asignaciones de trabajo para la distribución de productos en un centro especial de empleo* [Universitat Politècnica de València]. https://riunet.upv.es/handle/10251/55789

FARO Laser Scanner Focus3D. (2019).

Hrozek, F., Sobota, B., & Szabó, C. (2012). Digital preservation of historical buildings using virtual reality technologies. *Open Computer Science*, *2*(3), 272–282. https://doi.org/10.2478/S13537-012-0022-8

Mesároš, P., & Mandičák, T. (2017). Exploitation and Benefits of BIM in Construction Project Management. *IOP Conference Series: Materials Science and Engineering*, *245*(6), 062056. https://doi.org/10.1088/1757-899X/245/6/062056

Pukanská, K. (2012). *3D visualisation of cultural heritage: by using laser scanning and digital photogrammetry: monograph*. Vysoká škola báňská - Technická univerzita Ostrava.

Tkáč, M., Mesároš, P., & Mandičák, T. (2018). *TERRESTRIAL LASER SCANNING-EFFECTIVE TECHNOLOGY FOR CREATING BUILDING INFORMATION MODELS*. *13*(3), 61–72. https://doi.org/10.1556/606.2018.13.3.7

BMT21
3rd International Conference
Business Meets Technology.
Valencia, 23rd & 24th September 2021

ASSESSING THE SENIOR MANAGEMENT SUPPORT AND APPROACH TO BUSINESS DIGITISATION. THE CASE OF TOP FINISH AND SPANISH COMPANIES

Garcia-Ortega, Beatriz [a1]; Galan-Cubillo, Javier [b] and De-Miguel-Molina, Blanca [a2]

[a] *Department of Management, Universitat Politècnica de València. Spain.*
([a1] beagaror@doctor.upv.es, [a2] bdmigu@omp.upv.es)
[b] *Doctoral Program in Business Management, Universitat Politècnica de València. Spain*
(jagacu@doctor.upv.es)

ABSTRACT: Business digitisation represents a milestone for companies' prospects, and senior management support is one of the key aspects for its successful implementation. However, this support through their discourse has been underexplored. This paper contributes in this direction, by taking the cases of the top Finish and Spanish companies listed in the OMXH 25 and IBEX 35 respectively, with Finland at the top of the list of European Union countries in terms of business digitisation and Spain in the average, as benchmarks for examining the letters of top managers in annual reports in relation to their support and drivers approach. The results show that yet in both countries a relevant part of top managers does not show this support, more pronounced in Spanish companies. In addition, the weight of each block of drivers to support business digitisation identified in the literature also differs between the two countries, with the top managers of Finish companies showing a more customer-driven approach, and in the case of Spain a more business-driven approach, whereas sustainability is the least mentioned driver in both cases, as an aspect to improve.

KEY WORDS: *Business digitisation; Digital transformation; Senior management support; Drivers; sustainability; Industry 4.0.*

1. INTRODUCTION

Business digitisation (BD), understood as the digital transformation of business, represents a milestone for companies in their continuity and future success (Bleicher & Stanley, 2016). BD is changing the competitive landscape across industries and prompting companies to rethink their business models (Iansity & Lakhani, 2014), and also involves major changes in our world.

Senior managers play a key role in the task of leading and supporting this digital transformation, and their communication is one of the essential aspects to guide and align their organisation in their strategic goals (Murray, 2013). However, as far as we know,

How to cite: Garcia-Ortega, B., Galan-Cubillo, J., and De-Miguel-Molina, B. 2021. Assessing the senior management support and approach to business digitisation. The case of top Finish and Spanish companies. In Proc.: *3rd International Conference Business Meets Technology*. Valencia, 23rd & 24th September 2021. 49-58. https://doi.org/10.4995/BMT2021.2021.13638

the assessment of this communication in relation to BD support has been underexplored. This paper aims to contribute in this direction, taking as a reference in the context of the European Union (EU) two countries and their top companies listed in their main stock market indices: Finland as the first country in terms of BD according to the ranking in the European Commission's Digital Economy and Society Index (DESI) 2020, and Spain with a score similar to the EU average, and examining the discourse of top managers from the perspective of their support to BD, with two research questions as follows:

- RQ1) To which extent is senior management granting its support to BD in each country?
- RQ2) Under which drivers is senior management addressing this support in each country?

For this, in section 2 we review the concept of BD and appraise the top management support in this task, as well as their letters in the annual reports as a valuable source to convey this support. In section 3 we describe our sample and method. Next, we gather our results in section 4, with final conclusions and future research direction in section 5.

2. THEORICAL BACKGROUND

Business digitisation: The evolution of the concept

The concept of business digitisation, in correspondence with its primary meaning, was originally associated with the transmission of analogic to digital record content, which enables the conversion of paper records into file based digital information stored on computers (Lozic, 2019). However, this concept has evolved and nowadays it is often used interchangeably by academics and practitioners when actually referring to the digital transformation of business, which involves the adoption of digital technology and optimisation to obtain a series of business objectives, related to the own business performance or customer-related goals (Lozic, 2019). Besides, Industry 4.0, also known as the fourth industrial revolution, has extended its initial conception associated to production to this digital transformation of business beyond the smart factory (Ghobakhloo, 2020), integrating aspects such as marketing, interaction with customers or logistics (Liao et al., 2017). In fact, Industry 4.0, digital transformation of business and business digitalisation are frequently used synonymously. Thus, today, as conceived in this research, business digitisation encompasses other interrelated concepts such as digital transformation or Industry 4.0, and at the same time is the basis for new developments such as smart cities or smart transport (Lom et al., 2016; Tang & Veelenturf, 2019).

Senior management support to business digitisation and their letters as a tool to convey this support

Senior management support is crucial in the success of any initiative (Young & Poon, 2013). In particular, in the development of any innovative project, such as BD, top

management must allocate the necessary resources (Cooper & Edgett, 2004), ensure the right coordination of efforts (Cooper & Zmud, 1990), and seek to identify public with the project as a priority for the company (Nah et al., 2001). As middle managers and staff perceive more support from top executives, they will respond with greater commitment and will be more likely to take further risks (Rodriguez et al., 2008). In this line, Sony & Naik (2018) identified the explicit support of senior management as one of the key aspects for the implementation of Industry 4.0.

Furthermore, communication, as a driver to inspire influence and achieve results (Murray, 2013), is one of the key tools for top managers to convey their support. As an initial step, top managers must recognise the strategic relevance of BD, understand how it changes business logic and its potential digital value drivers, and learn to implement it in the right direction (Bleicher & Stanley, 2016). Within top management communication, the literature appraises their letters as a key part of the annual reports (Hyland, 1998), being a valuable tool to convey their message to the entire company and stakeholders. They are voluntary, not subject to particular rules or constraints, permit top managers to direct attention to certain topics and share and interpret information and issues through their lenses (Amernic & Craig, 2006), and provide information on the identified challenges and opportunities for the company (Van Alstine & Barkemeyer, 2014).

Potential drivers for business digitisation

A good number of works refer to the potential drivers to BD (i.e. Bleicher & Stanley, 2016; Tang & Veelenturf, 2019; Bonilla et al., 2018; Kiel et al., 2020; Oesterreich & Teuteberg, 2016; Stock & Seliger, 2016; Gabriel & Pessl, 2016), as a series of factors encouraging companies in this transformation (Horváth & Szabó, 2019), from which we identify three main approaches or blocks: business-related, customer-related, and sustainability-related ones. Within the first block, this digital transformation can be seen as a business opportunity for companies and as a tool to face future challenges by enhancing their competitiveness, efficiency, results or growth, or to improve their interactions. As for customers, it permits to offer them added value and better satisfy their needs, improving the product or service, offering more for less, more customised products or enhancing their experience. Finally, companies may become more sustainable with the help of digitalisation, for instance by reducing emissions or optimising the use of energy and resources.

3. DATA AND METHOD

The European Commission monitors through its Digital Economy and Society Index (DESI) 2020 the overall digital performance and competitiveness of EU countries. Figure 1 shows the ranking of EU countries in business digitization.

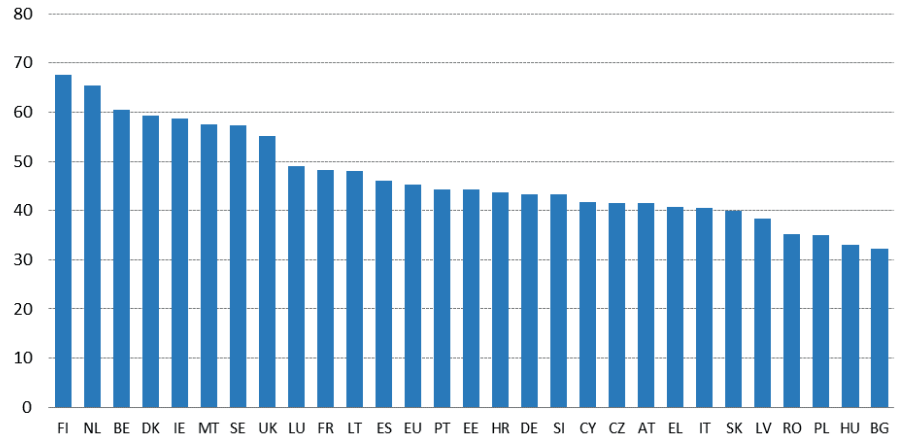


Figure 1. Integration of digital technologies, business digitisation index, 2020. Source: Digital Economy and Society Index (DESI) 2020, European Commission.

For our aim, we took both Finland and Spain as benchmarks to compare the support and motivations of the top managers of companies listed on their main stock index in December 2020 (OMXH 25 and IBEX 35). Finland (FI) is number one on this list, whereas Spain (ES) is by the average of the EU. We downloaded from each company website the annual reports released during the year 2020, aimed at fiscal year 2019, and extracted the introductory letters or statements issued by their Chief Executive Officers or Chairman. The final sample (Tables 1 and 2 in next section) consisted of the 25 companies from the Finish index plus 34 companies of the Spanish index, discarding one company since no annual report was found. Table 1 also includes the classification by industry according to the system adopted by the IBEX 35 (BME, 2019).

Next, to answer our RQ1, we carried out a detailed analysis of each letter through a close reading analytical technique (Amernic & Craig, 2006), with a qualitative and interpretive approach, identifying any content related to BD and evaluating its relevance, emphasis and leverage on the subject, to establish a categorisation with three levels as follows:

- Strong support, meaning explicit relevance, emphasis or leverage on BD
- Weak support, meaning weak relevance, no emphasis or anecdotal mention to BD.
- No support, meaning no mention to BD at all.

Moreover, to address our RQ2, we looked at the stated drivers or motivations mentioned by top managers in supporting BD to assess and compare them between the two countries, classifying them into the three main blocks identified in the previous section.

4. RESULTS AND DISCUSSION

In Tables 1 and 2, we gather the results of our assessment for Finland and Spain, comprehensive of the categorisation of the degree of support of each top manager, and the blocks of drivers addressed.

Table 1. Results for companies in OMXH 25 Index (Finland).

			BD approach		
Industry	Company	Support to BD	Customer driven	Business driven	Sustainability driven
Oil & Energy	Fortum	NO			
	Neste Oil Oyj	STRONG	x	-	-
Basic Mat. Industry & Construction	Cargotec Oyj	STRONG	x	-	-
	Huhtamaki Oyj	STRONG	-	x	-
	Kemira Oyj	NO			
	KONE Oyj	STRONG	x	-	x
	Konecranes	STRONG	x	x	-
	Metsa Board Oyj	NO			
	Metso Outotec	NO			
	Neles Oyj	STRONG	x	-	x
	Nokian Renkaat	NO			
	Outokumpu Oyj	NO			
	Stora Enso Oyj	STRONG	x	x	-
	UPM-Kymmene	NO			
	Valmet	STRONG	x	x	-
	Wartsila	STRONG	x	x	x
Consumer Goods	Kesko	WEAK	x	-	-
	Orion Oyj	NO			
Financial Services	Nordea Bank	STRONG	x	-	x
	Sampo Oyj	WEAK	x	-	-
Technology & Telecommunications	Elisa Oyj	STRONG	x	x	x
	Nokia Oyj	STRONG	x	x	x
	Telia Company	STRONG	x	x	x
	TietoEVRY	STRONG	x	x	-
Real State Services	Kojamo	STRONG	x	x	-

Source: own elaboration from our assessment.

Table 2. Results for companies listed in IBEX 35 Index (Spain).

Industry	Company	Support to BD	BD approach		
			Customer driven	Business driven	Sustainability driven
Oil & Energy	Enagas	NO			
	Endesa	STRONG	x	x	x
	Iberdrola	NO			
	Naturgy	NO			
	Red Eléctrica	STRONG	x	x	x
	Repsol	NO			
Basic Mat. Industry & Construction	Acciona	NO			
	Acerinox	STRONG	x	x	-
	Arcelormittal	NO			
	ACS	NO			
	CIE Automotive	NO			
	Ferrovial	WEAK	-	x	-
	Siemens Gamesa	WEAK	-	x	-
Consumer goods	Almirall	STRONG	x	x	-
	Grifols	NO			
	Inditex	STRONG	x	x	-
	Pharmamar	NO			
	Viscofan	NO			
Consumer services	Aena	WEAK	x	-	x
	IAG	STRONG	-	x	-
	Melia	STRONG	x	x	x
Financial services	B. Santander	STRONG	x	x	-
	B. Sabadell	STRONG	x	-	-
	Bankia	NO			
	Bankinter	STRONG	x	x	-
	BBVA	NO			
	Caixabank	STRONG	x	-	-
	Mapfre	WEAK	-	x	-
Technology & Telecommunications	Amadeus	NO			
	Cellnex	STRONG	-	x	-
	Indra	STRONG	-	x	x
	Telefonica	STRONG	-	x	x
Real State Services	I. Colonial	NO			
	Merlin	NO			

Source: own elaboration from our assessment.

In addition, we represent these results in Figures 2 and 3.

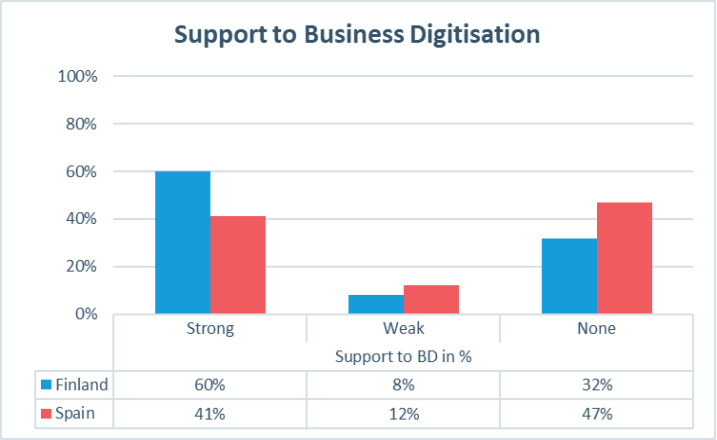


Figure 2. Support to business digitisation by country. Source: own elaboration from our assessment.

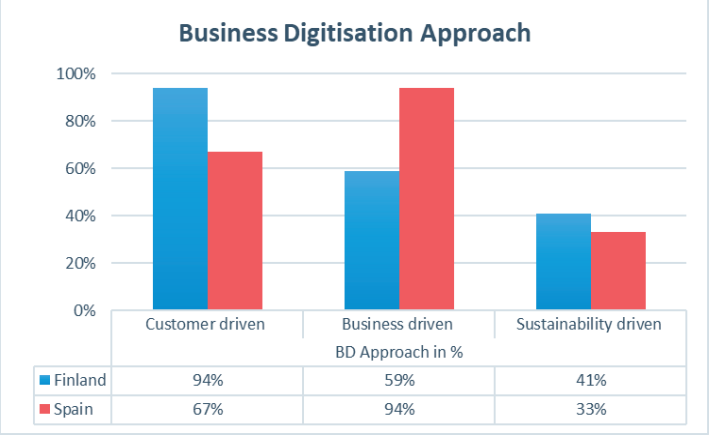


Figure 3. Business digitisation approach by country. Source: own elaboration from our assessment.

Relative to our RQ1, the top management support to BD is not so widespread. Even in Finland, at the top of the EU ranking in terms of BD, 40% of CEOs do not show strong support, and about one third of them do not even mention it. Regarding Spain, in the EU average, about 60% of companies do not show a strong support, and nearly half of them do not refer to it at all. Considering the leverage of business digitisation in the prospects of companies, the relevance of the communication of senior managers in this task, and that these firms are global top players, better positioned to lead this transformation, we observe that the percentage of companies with their top managers showing a strong support is relatively low. We argue that, in many cases, top managers are wasting the

opportunity to align their company toward this strategic objective through their discourse (Murray, 2013), in addition to setting trends within their industry.

Besides, with caution due to the limitations of the sample, these results point to a certain correlation trend between the degree of development of business digitisation in the country and the support given by their top management to it, even though on average many of the Spanish companies are larger.

Moreover, regarding our RQ2, in terms of drivers or motivations exposed by top managers in their business digitisation approach, we note that in the case of Finland top managers are predominantly customer-driven, whereas in Spain they are prominently business-driven. Probably the top Finish companies with more advanced implementation have already extracted more potential in their business performance and are paying further attention to customers. In addition, and coincidentally in both countries, the focus on sustainability is less widespread compared to the other two blocks, even though this is a clear benefit identified in the literature (Gabriel & Pessl, 2016; Kiel et al., 2020), and thus it remains in the debt of these top managers.

5. CONCLUSIONS

In this research, we have presented the digital transformation of companies as a milestone in their prospects and have appraised the importance of senior management support and its communication in the task of fostering this BD. In this direction, we have found that the communication of this support is more extended across the senior management of leading companies in Finland, where business digitisation is more spread, although even in this country it still exists room for improvement. Besides, the prominence of drivers towards this implementation differs between the Finish and the Spanish companies, but coinciding as an aspect for improvement the identification of sustainability as one of the key drivers.

Among the main limitations of this research, we underline that although most of the industries according to the adopted classification are represented in our sample, their representation is uneven and limited for each country, which may influence the overall results obtained. This limitation paves the way for our ongoing research, which aims to consider further companies not listed in these indices, as well as other countries and regions and its evolution over time, in order to further explore and settle the validity of the glimpsed trends identified.

ACKNOWLEDGMENTS

No funding has been received for the development of the research.

CONFLICT OF INTERESTS

We declare no conflict of interests.

AUTHOR CONTRIBUTIONS

Beatriz Garcia-Ortega: Conceptualisation, formal analysis, methodology, coordination and supervision

Javier Galan-Cubillo: Data collection, formal analysis and issuance of original draft

Blanca de-Miguel-Molina: Formal analysis, validation, review & editing

REFERENCES

Amernic, J., & Craig, R. (2006). *CEO-speak: The language of corporate leadership*. McGill-Queen's Press-MQUP.

Bleicher, J., & Stanley, H. (2016). Digitization as a catalyst for business model innovation a three-step approach to facilitating economic success. *Journal of Business Management*, (12).

BME (2019). *Clasificación sectorial bursátil: descripción general y especificaciones por subsector.* Spain, 2019. Accessed: June 18, 2020. https://www.bolsamadrid.es/docs/Acciones/sect.pdf

Bonilla, S. H., Silva, H. R., Terra da Silva, M., Franco Gonçalves, R., & Sacomano, J. B. (2018). Industry 4.0 and sustainability implications: A scenario-based analysis of the impacts and challenges. *Sustainability, 10*(10), 3740.

Cooper, R. G., & Edgett, S. J. (2004). Innovation performance and the role of senior management. Benchmarking innovation best practices. *Strategic Direction, 20*(5), 28–30.

Cooper, R. B., & Zmud, R. W. (1990). Information technology implementation research: a technological diffusion approach. *Management science, 36*(2), 123–139.

Gabriel, M., & Pessl, E. (2016). Industry 4.0 and sustainability impacts: Critical discussion of sustainability aspects with a special focus on future of work and ecological consequences. *Annals of the Faculty of Engineering Hunedoara, 14*(2), 131.

Ghobakhloo, M. (2020). Industry 4.0, digitization, and opportunities for sustainability. *Journal of cleaner production*, *252*, 119869.

Horváth, D., & Szabó, R. Z. (2019). Driving forces and barriers of Industry 4.0: Do multinational and small and medium-sized companies have equal opportunities?. *Technological forecasting and social change*, *146*, 119–132.

Hyland, K. (1998). Persuasion and context: The pragmatics of academic metadiscourse. *Journal of pragmatics*, *30*(4), 437–455.

Iansiti, M., & Lakhani, K. R. (2014). Digital ubiquity:: How connections, sensors, and data are revolutionizing business. *Harvard business review*, *92*(11), 19.

Kiel, D., Müller, J. M., Arnold, C., & Voigt, K. I. (2020). Sustainable industrial value creation: Benefits and challenges of industry 4.0. In *Digital Disruptive Innovation* (pp. 231–270).

Liao, Y., Deschamps, F., Loures, E. D. F. R., & Ramos, L. F. P. (2017). Past, present and future of Industry 4.0-a systematic literature review and research agenda proposal. *International journal of production research*, *55*(12), 3609–3629.

Lom, M., Pribyl, O., & Svitek, M. (2016, May). Industry 4.0 as a part of smart cities. In *2016 Smart Cities Symposium Prague (SCSP)* (pp. 1–6). IEEE.

Lozic, J. (2019). Core concept of business transformation: from business digitization to business digital transformation. *Economic and Social Development: Book of Proceedings*, 159–167.

Murray, K. (2013). *The Language of Leaders: How top CEOs communicate to inspire, influence and achieve results*. Kogan Page Publishers.

Nah, F. F. H., Lau, J. L. S., & Kuang, J. (2001). Critical factors for successful implementation of enterprise systems. *Business process management journal*.

Oesterreich, T. D., & Teuteberg, F. (2016). Understanding the implications of digitisation and automation in the context of Industry 4.0: A triangulation approach and elements of a research agenda for the construction industry. *Computers in industry*, *83*, 121–139.

Ritter, T., & Pedersen, C. L. (2020). Digitization capability and the digitalization of business models in business-to-business firms: Past, present, and future. *Industrial Marketing Management*, *86*, 180–190.

Rodríguez, N. G., Pérez, M. J. S., & Gutiérrez, J. A. T. (2008). Can a good organizational climate compensate for a lack of top management commitment to new product development?. *Journal of Business Research*, *61*(2), 118–131.

M. Sony and S. Naik, "Critical factors for the successful implementation of Industry 4.0: a review and future research direction," Prod. Plan. Control, vol. 31, no. 10, pp. 799–815, 2020.

Tang, C. S., & Veelenturf, L. P. (2019). The strategic role of logistics in the industry 4.0 era. *Transportation Research Part E: Logistics and Transportation Review*, *129*, 1–11.

Van Alstine, J., & Barkemeyer, R. (2014). Business and development: Changing discourses in the extractive industries. *Resources Policy*, *40*, 4–16.

Young, R., & Poon, S. (2013). Top management support—almost always necessary and sometimes sufficient for success: Findings from a fuzzy set analysis. *International journal of project management*, *31*(7), 943–957.

BMT21
3rd International Conference
Business Meets Technology.
Valencia, 23rd & 24th September 2021

TALENT MANAGEMENT AND EDUCATION

BMT21
3rd International Conference
Business Meets Technology.
Valencia, 23rd & 24th September 2021

THE NECESSITY TO MAKE ERRORS: THE CASE OF GERMAN LEARNERS OF SPANISH

Gebhard, Christian Alexander

Ansbach University of Applied Sciences, Residenzstr. 8, 91522 Ansbach, Germany, (c.gebhard@hs-ansbach.de)

ABSTRACT: Learners of foreign languages make errors. There has been much debate over whether these errors are to be viewed as something bad, something wrong or something to be avoided. This paper analyses the efficiency of exercises aimed at avoiding the most frequent mistakes German beginning learners of Spanish make. A comparative study shows that learners who make these exercises improve only over their frequency of orthographic errors, but all other types of errors and the total number of errors remain the same as learners who do not make these exercises.

KEY WORDS: *Foreign language acquisition; Spanish as a foreign language; Error analysis.*

1. INTRODUCTION

Spanish continues to enjoy general popularity as a foreign language at German universities: 6,249 students are learning Spanish at universities in Germany, according to the 2019 Annual Report of the Instituto Cervantes (p. 13). This long-established foreign language has already been extensively studied linguistically from the point of view of error analysis (Fernández, 1997; Vázquez, 1991; Bouwmeester, 2011), and the extensive panorama of teaching materials offers collections of frequent or typical errors (Bachhausen, 2014; Barros, 2003; Wotjiak & Herrmann, 1993; Rudolph & Miquel-Heininger, 2015; Varela Navarro, 2018, and many more). These teaching materials are not based on statistical studies of the absolute frequency of errors, or at least do not cite corresponding investigations as sources. In order to make an objective statement about the frequency of errors, statistical surveys of errors in written text productions in foreign language teaching were conducted at two Bavarian universities (Gebhard, 2016, 2019), which provide insights into the actual needs of learners. Complementary, a didactic concept for dealing with errors in the classroom needs to be elaborated. An error is to be understood here as a deviation from target forms used in teaching materials, which are not evaluated negatively and are seen as characteristics of learners' language systems. An analysis of these so-called interlanguage systems (Selinker, 1972) helps understand

How to cite: Gebhard, C. A. 2021. The necessity to make errors: The case of German learners of Spanish. In Proc.: *3rd International Conference Business Meets Technology*. Valencia, 23rd & 24th September 2021. 61-67. https://doi.org/10.4995/BMT2021.2021.13612

the needs and progress of learners and is used to design appropriate activities in and outside the classroom. Error analysis, as this is generally called, has received its share of criticism, as we shall see in the following section.

2. TRENDS IN FOREIGN LANGUAGE LEARNING THEORIES

The move away from the traditional sanctioning of errors and thus the increasing tolerance of errors in the course of the turn towards a more pragmatic approach to language learning and teaching is based on the development of learning theories over the decades. Contrastive perspectives (Fries, 1945; Lado, 1957) sought to prognose or explain interlanguage systems by comparing learners' first language with the target language. In an individual-constructivist understanding of language learning (Corder, 1967; Selinker, 1972), errors are interpreted as indicators of a given point in a highly individual process of developing an unstable language system. Approaches such as the "negative knowledge" (e.g., Oser, Hascher & Spychiger, 1999) attribute an important positive role to deviations from an arbitrary prescriptive norm. Extensive research on how a positive depiction of errors can support their reduction in the individual learning process has yet to be conducted. Do targeted exercises help to avoid certain errors and thus accelerate the learning process of beginning learners, or should we accept naturally predetermined learning sequences as proposed by Krashen (1981) in his Natural Order Hypothesis? Along these lines, Pienemann suggests that controlled foreign language teaching can only have a limited effect (Teachability Hypothesis, Pienemann 1998) and cannot go against the principles of a processability hierarchy, according to which certain structures can only be understood and learned in a certain sequence (Processability Theory, Pienemann 1984, where he investigated into uninstitutionalized second language acquisition instead of institutionalized foreign language learning, however[1]).

A study of the effectiveness of exercises aimed at reducing common errors was carried out at Ansbach University of Applied Sciences, in which two groups of learners of Spanish at beginner level (A1) were compared.

3. METHOD

In order to investigate the avoidability of errors, it is first necessary to examine the quality of errors. Text productions as part of written exams were analyzed for this aim. Test takers were given a choice of two topics previously touched upon in class to write a short text of 80 words. On the basis of frequent errors obtained from previous analyses, exercises were chosen to treat the corresponding difficulties.

In this comparison study, all controllable characteristics of teaching were kept identical as much as possible: Textbook, teacher, group size, amount of instruction, timing of

[1] We do not claim to uphold Krashens' (1981) untenable distinction between acquisition and learning but use these terms to point out theoretical distinction between second and foreign language acquisition/learning; cf. Königs (2010), whose uses the neutral 'Aneignung' in German, for a further discussion of these terms.

instruction (no extreme off-peak times such as early in the morning or late in the evening), methods of instruction. In the experimental group, exercises addressing the most common errors identified in previous studies were given in the last instructional session before the written test. In the control group, topics related to culture and civilization were covered in the same lesson. The study was conducted in two consecutive semesters (summer semester 2018 and winter semester 2018/2019) in two parallel courses of the same language instructor in each term, but two different instructors in the consecutive terms. In all four courses, the test took place approximately two weeks after the last lesson.

A T-Test was carried out with the total number of errors and the number of errors in each error category, such as morphology, orthography, and syntax, as factors.

4. MATERIAL

The most common errors identified were errors using the orthographic accent, errors in grammatical agreement (especially between noun and adjective), verb forms (e.g., missing diphthongization), missing articles, and prepositions (especially a, en, and de). For these grammatical topics, exercises were compiled from an entertainingly designed grammar exercise book that had not been used in class. All of the exercises chosen were taken from the A1 level of the exercise grammar in order to minimize the amount of unknown vocabulary. These exercises mainly took the form of insertion exercises, in which, for example, endings had to be added or verbs given in brackets had to be inflected. The previously identified lexical errors were not touched upon, since these errors are taken to depend highly on the topic of the text production.

Sample Size

A total of 66 written tests were included in the study. In the summer semester 2018, 32 learners participated in the two courses taught in parallel by the same teacher (experimental group with additional targeted exercises to avoid common errors: $N=14$; control group without exercises: $N=18$); in the winter semester 2018/19, 34 learners participated in the two courses taught in parallel by a different teacher (experimental group: $N=18$; control group: $N=16$).

5. RESULTS

Experimental vs. control group in the summer semester 2018

A Levene's test yields variance homogeneity: $F(1, 30)=0.085$, $p=0.772$, $n=32$. The T-test reveals no statistically significant difference between the experimental and control group taking as factor the total number of errors found in the texts: $T(30)=0.340$, $p=0.340$. The T-value was also calculated for all error categories. In no case significant differences could be detected.

Experimental vs. control group in the winter semester 2018/2019

A Levene's test reveals variance homogeneity: $F(1, 32)=0.076$, $p=0.784$, $n=34$). The T-test reveals no statistically significant difference between the experimental and control group with the total number of errors as factor: $T(32)=-0.115$, $p=0.909$. There are also no differences in any error category, but the condition of variance homogeneity is violated for the number of orthographic errors: $F(1, 32)=5.902$, $p=0.031$. In this case a Welch test yields a statistically significant difference: $T(19{,}949)=2.269$, $p=0.035$. It turns out to be relatively small, with a mean difference of 1.467 (on average, 2.0 orthographic errors were made in the experimental group vs. 3.47 errors in the control group).

Overall analysis (summer semester 2018 and winter semester 2018/19 considered as one group)

The overall consideration of the two groups of the summer and winter semester includes 66 texts and allows for a somewhat more robust statistical analysis. It yields a statistically significant difference between the experimental and control group only for orthographic errors. This highly significant difference ($p=0.008$) turns out to be small: 2.38 errors in the experimental group after exercises vs. 3.70 errors in the control group without exercises (mean difference: 1.32 errors).

6. DISCUSSION

It must be questioned if error prevention by means of exercises prior to a written text is an effective way to avoid other errors than orthographic ones. Neither in the total number of errors, nor in the number of errors in any error category including morphological, syntactical, and lexical errors, can statistically significant differences between the experimental and control groups be observed.

The results can be interpreted as a confirmation of the theories mentioned above, that suggest a predefined sequence of acquisition. The scope of these can thus be considered to be extendable to institutionalized foreign language learning, i.e., instruction. Certain errors are made at a given time because the target-appropriate structures cannot be acquired at that time due to constraints imposed by processability. The improvement in the area of orthographic errors can be interpreted as an indication that orthographic rules can certainly be processed and acquired by beginners. The comparatively uncomplicated orthography of Spanish makes this interpretation seem plausible, but errors are still made.

Another reading of the results is an underpinning of Krashen's distinction between learning and acquisition, according to which explicit learning in an institutional setting does not (necessarily) lead to successful acquisition. For now, this interpretation will be narrowly restricted to the context under study: Highlighting rules and doing exercises to learn these rules approximately two weeks before a written test does not lead to the application of these rules in text production. Possibly, the communicative character of these exercises is too weak, so that the instructional goal of teaching these rules could

not be achieved. Such an interpretation leads to the demand to make foreign language teaching, but also performance assessment, even more communicative and to integrate real situations with a natural communicative need (see Gebhard, 2020 for a proposal for a more communicatively oriented performance assessment that is not based on counting errors). This way, communicative necessity might foster the acquisition of rules.

It is also conceivable that the period of two weeks is too long to observe an effect. In a replication study the distance between exercises and test will be decreased to one week to see whether this makes a difference.

7. CONCLUSION AND OUTLOOK

In light of the current results, it must be concluded that apart from orthographic errors, which might be described as more technical than communicative, certain errors seem to be unavoidable at beginner level, even though the respective target structures have been previously taught. Teaching methods should be adapted even more to a communicative approach that does not necessarily aim at therapeutic measures to avoid errors. By means of metacognitive and metalinguistic components in foreign language teaching, a more efficient individualized approach seems very promising.

In order to investigate how error frequencies might be influenced in a more individualized approach, the effect of reflective interventions will be investigated. As an intervention between a pretest and a posttest, again in the form of written text production, questionnaires address common errors on a person-by-person basis without necessarily focusing on a correction of these errors. They are rather designed to get an insight into learners' awareness of their own errors and learning strategies. Additionally, questions are asked about the source of these errors, such as interference from other previously studied languages or the first language to assess individuals' awareness of their learning process. Broadening the statistical data to analyze frequent errors, the results will show whether general learning sequences in controlled foreign language teaching can be assumed or whether individual acquisition processes have more weight.

ACKNOWLEDGMENTS

No funding has been received for the development of the research.

REFERENCES

Althof, Wolfgang (Hg.) (1999). *Fehlerwelten. Vom Fehlermachen und Lernen aus Fehlern*. VS Verlag für Sozialwissenschaften.

Bachhausen, Ursula (2014). *¡Ya lo tengo! - Typische Spanisch-Fehler sicher vermeiden. Niveau A2 - B2*. Compact.

Barros Díez, Esther (2003). *Dificultades del español para hablantes de alemán*. Prácticos ELE.

Bouwmeester, Christina (2011). *Dritte Fremdsprache Spanisch. Eine empirische Studie über das Spa-nischlernen am Gymnasium*. AVM.

Corder, S. P. (1967). The significance of learner's errors, *IRAL - International Review of Applied Linguistics in Language Teaching, Vol. 5*, pp. 1-4.

Fernández, Sonsoles (1997). *Interlengua y análisis de errores en el aprendizaje del español como lengua extranjera*. Edelsa.

Fries, Charles C. (1945). *Teaching & learning English as a foreign language*. Univ. of Michigan Pr.

Gebhard, Christian (2016). Spanisch an der Hochschule Ansbach. Häufige Fehler in der schriftlichen Produktion. In: Ute Ambrosius & Simon Gollisch (Ed.). *Ansbacher Kaleidoskop* 2016, Shaker, pp. 169–188.

Gebhard, Christian (2019). Häufige Fehler in der schriftlichen Produktion erwachsener Lernender des Spanischen im Anfängerstadium. In: Daniel Reimann, Ferran Robles i Sabater & Raúl Sánchez Prieto (Ed.). *Kontrastive Pragmatik in Forschung und Vermittlung. Deutsch, Spanisch und Portugiesisch im Vergleich*, Narr Francke Attempto, pp. 265-286.

Gebhard, Christian (2020). Das Lernportfolio als Leistungsnachweis im Chinesischunterricht, *CHUN Chinesisch Unterricht Vol. 35*, pp. 86–102.

Krashen, Stephen D. (1981). *Second language acquisition and second language learning*. Prentice Hall.

Königs, Frank G. (2010). Zweitsprachenerwerb und Fremdsprachenlernen: Begriffe und Konzepte. In: H. J. Krumm, C. Fandrych, B. Hufeisen, C. Riemer (Hrsg.): *Deutsch als Fremd- und Zweitsprache: Ein internationales Handbuch*. Walter de Gruyter, pp. 754–763.

Lado, Robert (1957). *Linguistics across cultures. Applied linguistics for language teachers*. University of Michigan Press.

Oser, Fritz; Hascher, Tina; Spychiger, Maria (1999). Lernen aus Fehlern. Zur Psychologie des „negativen" Wissens. In: Wolfgang Althof (Ed.). *Fehlerwelten. Vom Fehlermachen und Lernen aus Fehlern*, VS Verlag für Sozialwissenschaften, pp. 11-42.

Pienemann, Manfred (1984). Psychological constraints on the teachability of languages. In. *Studies in second language acquisition, 6*(2), pp. 186–214.

Pienemann, Manfred (1998). *Language processing and second language development. Processability theory*. J. Benjamins.

Rudolph, Hildegard; Miquel-Heininger, Eva (2015). *Troubleshooter Spanisch. Typische Fehler vermeiden*. Hueber.

Selinker, Larry (1972). Interlanguage, *IRAL - International Review of Applied Linguistics in Language Teaching, Vol. 10*(3), pp. 209–231.

Varela Navarro, Montserrat (2018). *Langenscheidt go smart typische Fehler Spanisch*. Langenscheidt.

Vázquez, Graciela E. (1991). *Análisis de errores y aprendizaje de español/lengua extranjera. Análisis, explicación y terapia de errores transitorios y fosilizables en el proceso de aprendizaje de español como lengua extranjera en cursos universitarios para hablantes nativos de alemán*. Lang.

Wotjak, Gerd (1994). *Typische Fehler Spanisch. 2500 „falsche Freunde" spanisch und deutsch*. 4th ed. Langenscheidt.

BMT21
3rd International Conference
Business Meets Technology.
Valencia, 23rd & 24th September 2021

CHINA COMPETENCE IN EUROPE: WHY IT MATTERS AND HOW TO ACHIEVE IT

Gebhard, Christian Alexander

[a] *Ansbach University of Applied Sciences, Residenzstr. 8, 91522 Ansbach, Germany. (c.gebhard@hs-ansbach.de)*

ABSTRACT: *The MERICS Institute thoroughly depicted the state of the art of China competences in Germany at the beginning of 2018. The report explained why it was important to strengthen these competences and made detailed suggestions on how to do so. This article takes a look at recent developments regarding China competences in Germany and sheds light on the current image of China among mainly small and medium-sized enterprises in Franconia, Northern Bavaria, by means of surveys and two interviews. Suggestions are made on why and how to improve language skills, touching upon the situation in Spain.*

KEY WORDS: *China, Competence, Chinese language skills, SMEs, Franconia.*

1. INTRODUCTION: CHINA'S GRIP ON POWER

The number of countries that are part of the Belt and Road Initiative (BRI, also known as One Road, One Belt initiative, OBOR, or New Silk Road) is growing and put at 139 on all continents by the Council of Foreign Relations[1]. This excludes both Germany and Spain who are more or less affected by the BRI since end points of trade routes are located in Hamburg, Duisburg and Madrid. Both countries have close economic ties with the People's Republic of China (hereafter "China"), facing a trade deficit. China's economic clout on the world stage has long been growing. However, recent political tensions have had economic repercussions. In light of the US-Chinese trade war, some countries may be inclined to question their economic ties with China. Given these developments, China's image in the West seems to be shifting and a focus on politically controversial issues within China and debates over Human Rights have gained more and more attention. Does this trend affect economic ties in general? How is the overall cooperation with China affected? Not only the economy, but also environmental issues are of great concern in dealing with China on a global level.

[1] https://www.cfr.org/blog/countries-chinas-belt-and-road-initiative-whos-and-whos-out.

How to cite: Gebhard, C. A. 2021. China Competence in Europe: Why It Matters and How to Achieve It. In Proc.: *3rd International Conference Business Meets Technology*. Valencia, 23rd & 24th September 2021. 69-77. https://doi.org/10.4995/BMT2021.2021.13613

In contrast with the Chinese economic strategy that is heavily state-driven and thus steered by political interests, conflicting interests can be observed on the European side. Political disagreement between the EU and China is obvious: European views critic of China, although not shared by some member states, are commonly pronounced and mutual sanctions have led to the momentary freezing of the ratification process of the Comprehensive Agreement on Investment (CAI) between the EU and China. The interest in economic ties with China seems to remain strong though: 60% of 585 European companies are looking to intensify their China business due to recent numbers of growth, according to a MERICS report[2]. This is particularly important to know against the backdrop of the Chinese government's strategies for the coming years, explained in its current Five-Year Plan (FYP). China plans to become more and more innovative and turn into the world leader in Artificial Intelligence (AI) and other technological key areas. The goals of FYPs are generally thought to be realistic since the government boast with the structures to steer the country's economy, science and technology towards its goals according to China politics expert Sebastian Heilmann.[3]

China and the EU, Germany and Bavaria

A report on Chinese FDI in Europe shows that China overtook the US as the EU's biggest trading partner and Germany's exports make up the biggest share of EU exports to China (48%). Germany also receives a considerable amount of China's Foreign Direct Investment (FDI)[4]. At the same time, the share of Chinese state-owned enterprises (SOEs) is growing, intensifying a direct reflection of state interests in China's presence in the country. China has been Germany's most important trade partner in 2019 for the fourth consecutive year (Besser et al., 2020) and Chinese businesses are reaching beyond the main international business hubs such as Frankfurt and the like. Mergers and takeovers are common even in less urban areas (Midea acquiring Kuka of Augsburg in 2016 and FCCA Castle Brewery merging with Schlossbrauerei of Au in 2019 are only two of many examples). China going global through its Made in China 2025 strategy may offer chances to gain access to the still restricted Chinese market through Chinese takeovers (Welfens, 2017)[5]. Back in 2019, Bavarian Secretary of Commerce Aiwanger pointed out the key role of Bavarian medium-sized construction companies in the Bavarian-Chinese cooperation.[6]

Expertise on and interest in China: The Franconian Case

Gebhard 2020 looked at small and medium-sized enterprises (SMEs) in Middle Franconia (MF, a region in northern Bavaria) to identify current trends in the context

[2] https://merics.org/de/briefing/eu-us-summits-economic-relations-international-procurement-instrument.

[3] https://merics.org/en/interview/sebastian-heilmann-ccps-next-century.

[4] https://merics.org/en/report/chinese-fdi-europe-2020-update.

[5] https://www.boeckler.de/pdf/p_mbf_report_2017_36_ci_welfens.pdf.

[6] https://www.mittelstandinbayern.de/bayerns-wirtschaftsminister-in-china-chance-fuer-kmu/.

of the BRI. 486 enterprises from different fields of business, industry and trade sectors were invited, with a reminder, to take part in an online survey about the BRI, its image and importance. The low participation rate of 6.3% serves as a first indicator to understand how little interest in the topic and expertise in the field is to be found in SMEs in MF. A look at some of the main findings may help to underline the lack of understanding for China's economic penetration of local markets. 38.7% of respondents indicated that their enterprise was not at all familiar with the BRI. 58.1% did not reply to the question whether the BRI was relevant for their enterprise and 64% were unable to assess the influence of the BRI on their business, whereas a quarter of participants (25.8%) evaluated the consequences of the BRI as positive. When asked whether they would take measures to cope with the BRI, 58.1% did not reply, followed by 32.3% of enterprises indicating that they would not take any measures. At least some interest in the topic can be deduced from the replies to the question whether they would like to learn more about the BRI: 48.4 gave an affirmative reply. Irrespective of whether SMEs in MF will be affected by China's reach for economic influence on the world stage in the long run, the development of the recent years seems to make it plausible to learn about China and its strategic plan.

Interviews

As with online survey, only a small fraction of enterprises replied to the request for an interview. Of three enterprises that did reply positively, only two finally agreed on an appointment for a teleconference interview to talk about China competence at the enterprise. Four main questions for discussion were raised about the company's management of China competence and China's image with the enterprise.

The first of these enterprises with 400 employees is based in a rural area in South-Eastern Franconia and exports raw materials such as natural construction material to China. A small number of employees have had training in intercultural competence with no special focus on China, but are encouraged to take part in courses that deal in particular with Chinese culture and business behavior. There is no formal strategy for enhancing China competence since the enterprise puts no special focus on trade with China at this moment. None of the employees has any knowledge of the Chinese language and correspondence is exclusively dealt with in English. The company sees no necessity to recruit staff with knowledge of Chinese but would rate this positively among future applicants. There is knowledge of the BRI and several employees follow political and economic news about China, but this is happening in no formal context. The BRI is not part of the enterprise's official business strategy. When asked about future prospects of economic ties given political tensions, a desire was pronounced for the CAI to be signed since this would ease trade transactions. The enterprise seeks closer ties with China but is afraid that personal contact is of utmost importance to reach this goal and hopes for less restrictions regarding the pandemic situation in the not-too-distant future.

The second enterprise

So far, it can be summarized that no strategy for China competence is discernible among smaller enterprises in Franconia although these are facing an ever-growing dependency on China; traces of a higher awareness for this topic seems to be found among larger enterprises.

2. CHINA COMPETENCE

The 2018 MERICS report on China competence demanded a strategic promotion of knowledge about China and the 2020 annual report of the Expert Commission for Research and Investigation (EFI) outspokenly reiterated this demand, backed up with data from Germany's economy and joint research projects[7]. Germany, i.e., its enterprises and its people, needs to understand whom it is dealing with. The country sees itself as a location for science. The Federal Ministry of Education and Research (BMBF) initiated a strategy in 2017 and seeks to enhance its promotion of China competence[8], also by means of additional funding programs[9]. One of its declared aims is to bring together expertise on China in a European context. Federal Research Minister Karliczek explains that she wishes to rule out Chinese political interference on German society and research[10], enforcing the general trend to push out Chinese language institutes which have traditionally fostered Chinese language skills around the world and are under the central rule of the Chinese Ministry of Education. Voices that have been accusing Confucius Institutes of carrying out Chinese political propaganda often do not indicate alternatives of how to build up cultural and linguistic expertise from within Germany. At the same time, the Confucius Institute of Nuremberg, the metropolitan center of Middle Franconia, has shown a successful modernizing strategy during the Covid pandemic and has increased the number of cultural activities offered, has raised its number of language course participants to 1693 and HSK (a standardized Chinese proficiency exam) test takers to 108 in the year 2020 (personal communication), in which so many exchange programs organized by German governmental institutions have been cancelled for at least two years. It seems that this institute, in part funded by a German association and offering workshops about controversial topics (see homepage[11]), has a successful route map for promoting knowledge about Chinese language and culture under extraordinary circumstances.

[7] https://www.kooperation-international.de/aktuelles/nachrichten/detail/info/efi-gutachten-2020-deutschland-braucht-mehr-china-kompetenz/.

[8] https://www.bmbf.de/bmbf/shareddocs/pressemitteilungen/de/karliczek-wir-brauchen-mehr-un-china-expertise-in-deutschland.html.

[9] https://www.bmbf.de/foerderungen/bekanntmachung-3684.html.

[10] https://www.bmbf.de/bmbf/shareddocs/pressemitteilungen/de/karliczek-wir-brauchen-mehr-un-china-expertise-in-deutschland.html.

[11] https://www.konfuzius-institut.de/veranstaltungsprogramm/veranstaltungsrueckblick/2021.html.

Aims of projects to foster China competence supported by the BMBF include cooperation with Chinese players in research and educations and an assessment of the existing China competence in Germany. The measures pursuit a promotion of the following skills and knowledge, whose compound it defines as China competence: Knowledge about China's history, its culture, economy, and society as well as language skills and intercultural competences[12], yet different sources put language skills first or last in similar descriptions. These language skills seem to be a particular challenge given the typologic distance between German (or any other Indo-European Language) and Chinese (cf. Guder, 2005a, 2008). The first topics remain marginal at German schools and offers of more in-depth knowledge as well as extracurricular activities related to China are dependent on teachers' personal interests, knowledge, and commitment (Stepan et al., 2018). The following section takes a look at the latter, Chinese language skills, in Germany and other European countries before an outlook is given at the end. Since Spain has declared a strategic association with China (see below), the following thoughts gain relevance in its school curriculums as well.

Chinese Language Skills

Guder (2005b) shows convincingly how it takes more time and effort to study Chinese compared to other (Indo-European) languages due its linguistic typologic difference but also the cultural difference between learners and the target language or culture. Given these differences, it is highly controversial to apply the description of the Common European Framework of Reference for languages to the Chinese language from the perspective of a European learner. This is why Guder and colleagues have worked out the European Benchmarks for the Chinese Language (EBCL)[13] and made detailed suggestions on a curriculum for Chinese, at least for the first levels of language learning. Reaching an advanced level of Chinese may take up to more than 3000 teaching periods, so we can easily reach the following conclusion: The earlier you start, the better.

In 2018, 5,170 students learned Chinese at general schools in Germany (Stepan et al., 2018), compared to 38,000 in France. Klöter (2016) mentions 25 German universities that offer Sinology as a major, with decreasing numbers of students, and seven universities offer Teaching Chinese as a Foreign Language as a major[14]; however, the number of normal universities and universities of applied sciences that offer courses of studies related to China is growing. In their summary of a survey among 26 higher education institutes Guder & Burckhardt (2021) show enormous differences in Chinese language training offered in the framework of Chinese studies and that in a bachelor's program it is unlikely to become proficient in various language skills. What also becomes clear from suggestions from the BMBF, the EFI and Guder's publications is how much cultural and area studies as well as knowledge on modern China are intertwined and dependent

[12] cf. https://www.chin-kobe.de/index.htm.

[13] https://refubium.fu-berlin.de/bitstream/handle/fub188/15346/EBCLxinklxxAppendizesx23Juni2015.pdf?sequence=1&isAllowed=y.

[14] https://www.fachverband-chinesisch.de/chinesisch-als-fremdsprache/lehrerausbildung.

on language skills: It is only through access to sources from within a nation that this nation can be truly understood. Whereas several European countries include Chinese in strategies for their national curriculum, such as the Mandarin Excellence Programme in England, the China Strategy in Scotland, and similar plans in Ireland, the Netherlands and Italy (cf. Fundació Institut Confuci de Barcelona, 2018)[15], Spain seems to be rather hesitant in including fostering Chinese language skills in a national plan. The Ministry of Education mentions a rather blurry general concept of developing language skills, didactic material, and education of language instructors (lamoncloa.gob.es, 2018)[16]. There seems to be a preference for early age education: While the Confucius Institute of Barcelone summarizes with regret that no universities offer Teaching Chinese as a Foreign Language as a course of study (Fundació Institut Confuci de Barcelona, 2018), more than 200 primary and secondary schools offer elective courses in 2019, according to the People Daily[17]. The total number of students enrolled in Chinese courses at official language schools was 2,345 in the year 2018-2019 (Ministry of Education of Spain, 2020)[18] and the overall figure of people who learn Chinese in Spain is put at over 50,000 by the Chinese embassy (personal communication). In Germany, in contrast, only 18 primary schools are listed in the most recent publications of the Chinese Language Association FaCh[19] (fachverband-chinesisch.de, 2020). In summary, both countries might seem a bit behind in international comparison as far as teaching Chinese at state schools is concerned, and they seem to go down different strategic lines with Spain focusing more on early age education. Further numbers for European and other countries can be obtained from Shahar-Büchsel & La Mela, 2019.

3. SUMMARY, SUGGESTIONS AND OUTLOOK

The German government seems ambitious about building up general China competence to deal with its strategic partner in science and research. A mismatch with attitudes among small, medium, and even large enterprises in less urban Middle Franconia is obvious, as these boast with ignorance of the topic. Given a growing economic dependency, understanding China makes sense, and funding programs aimed at dealing with the coming superpower on a level playing field are promising but are not (yet) showing effect in a top-down process. Spain seems to be working out its detailed strategy on how to deal with China, and has a much more promising start as far as building up language skills is concerned. It seems that the experiences and positions of the two countries can be combined into an advantageous handling of China's rise: Given Guder & Burckhardt's

[15] https://www.confuciobarcelona.es/images/La%20ense%C3%B1anza%20del%20chino%20en%20el%20entorno%20europeo.pdf.

[16] https://www.lamoncloa.gob.es/presidente/actividades/Documents/2018/281118-Declaraci%C3%B3n%20Conjunta%20Espa%C3%B1a%20-%20China.pdf.

[17] http://spanish.peopledaily.com.cn/n3/2019/0118/c92122-9539304.html.

[18] http://ntic.educacion.es/cee/informe2020/i20cee-informe.pdf.

[19] https://www.fachverband-chinesisch.de/fileadmin/user_upload/Chinesisch_als_Fremdsprache/Chinesisch_an_Schulen/2020_ChaF_Grundschulen.pdf.

(2021) results and the target of the BMBF to over-regional cooperation in research on and with China, we conclude that Germany must learn from Spain and commence Chinese language training at an earlier stage. At the same time in Spain, the formal study of Chinese at secondary and tertiary level may be broadened through formalized education of Chinese language teachers such as it is beginning to materialize in Germany and other European countries. Staying competitive with a rising power will only be achieved through transfer of knowledge and sharing experiences among European nations. This appears even more important against the backdrop of harsh entry restrictions into China and a drastic decrease in in-person exchange opportunities since the pandemic in at least the medium term. Several European meetings, reports and events of the European Parliament, the European Commission and the European Council might shed some light on the future route map before the EU-China summit at the end of 2021.

ACKNOWLEDGMENTS

No funding has been received for the development of the research.

CONFLICT OF INTERESTS

The sole author of this paper is head of the China Competence Center of Ansbach University of Applied Sciences. He is also the representative of Ansbach's Sister City Jingjiang, Jiangsu, People's Republic of China, in Ansbach.

REFERENCES

Besser, S.; Schmittling, R.; Finkemeier, T.; Nguyen, N.; Zhu, P. (2019). *China-Telegramm. Vol. 02*/20. Köln: Deutsch-Chinesische Wirtschaftsvereinigung.

Gebhard, Christian (2020). Awareness of the Belt and Road Initiative in Small and Medium-Sized Enterprises in Middle Franconia. In Hedderich, Barbara E.; Hedderich, Michael A.; Walter, Michael S. J. (Ed.): *Business Meets Technology 2*, pp. 127-130.

Guder, Andreas (2005a). Chinesisch und der Europäische Referenzrahmen Einige Beobachtungen zur Erreichbarkeit fremdsprachlicher Kompetenz(en) im Chinesischen. *CHUN Chinesisch Unterricht,Vol. 20*, pp. 63–78.

Guder, Andreas (2005b). Kann man das überhaupt lernen? Zur Vermittlung von Chinesisch als distanter Fremdsprache. *Lebende Sprachen, Vol. 2*, pp. 61–68.

Guder, Andreas (2008). Was sind distante Fremdsprachen? Ein Definitionsversuch am Beispiel des Chinesischen. In: Eva Burwitz-Melzer; Wolfgang Hallet; Michael Legutke; Franz-Joseph Meißner; Joybrato Mukherjee; Miriam Kämmerer (Ed.). *Sprachen lernen - Menschen bilden*. Baltmannsweiler. Schneider-Verl. Hohengehren, pp. 69–78.

Guder, Andreas (Ed.) (2015). *European benchmarks for the Chinese language. Version 1.1; levels A1.1, A1+, A2, A2+*. Iudicium.

Guder, Andreas; Bruckhardt, Vincent (2021). Chinesisch spreachen, schreiben, forschen? Ergebnisse einer Erhebung zum Chinesischunterricht in chinawissenschaftlichen Bachelor- und Masterstudiengängen. *CHUN, Vol. 36*, pp. 7-39.

Klöter, Hening (2016). Chinesisch-Sprachkurse in BA-Studiengängen an Hochschulen in Deutschland, Österreich und der Schweiz: Ergebnisse einer Erhebung. *CHUN, Vol. 31*, pp. 51-62.

Shahar-Büchsel, Ulrike; La Mela, Verena (2019). Chinesisch als Schulfach in Deutschland. Potenzial und Gelingensbedingungen. Eine qualitative Studie zur Zukunft des schulischen Chinesischunterricht, *CHUN Chinesisch Unterricht, Vol. 34*, pp. 58–81.

Stepan, M.; Frenzel, A.; Ives, J.; Hoffmann, M. (2018). China kennen, China können. Ausgangspunkte für den Ausbau von China-Kompetenz in Deutschland. *MERICS China Monitor, Vol. 45*. Bonn: Mercator Institute for China Studies.

Internet resources:

https://www.cfr.org/blog/countries-chinas-belt-and-road-initiative-whos-and-whos-out

https://merics.org/de/briefing/eu-us-summits-economic-relations-international-procurement-Znstrument

https://merics.org/en/interview/sebastian-heilmann-ccps-next-century

https://merics.org/en/report/chinese-fdi-europe-2020-update

https://www.boeckler.de/pdf/p_mbf_report_2017_36_ci_welfens.pdf

https://www.mittelstandinbayern.de/bayerns-wirtschaftsminister-in-china-chance-fuer-kmu/

https://www.bmbf.de/bmbf/shareddocs/pressemitteilungen/de/karliczek-wir-brauchen-mehr-un-china-expertise-in-deutschland.html

https://www.bmbf.de/foerderungen/bekanntmachung-3684.html

https://www.kooperation-international.de/aktuelles/nachrichten/detail/info/efi-gutachten-2020-deutschland-braucht-mehr-china-kompetenz/

https://www.chin-kobe.de/index.htm

https://www.fachverband-chinesisch.de/chinesisch-als-fremdsprache/lehrerausbildung

https://www.lamoncloa.gob.es/presidente/actividades/Documents/2018/281118-Declaraci%C3%B3n%20Conjunta%20Espa%C3%B1a%20-%20China.pdf

https://www.fachverband-chinesisch.de/fileadmin/user_upload/Chinesisch_als_Fremdsprache/Chinesisch_an_Schulen/2020_ChaF_Grundschulen.pdf

https://www.confuciobarcelona.es/images/La%20ense%C3%B1anza%20del%20chino%20en%20el%20entorno%20europeo.pdf

http://spanish.peopledaily.com.cn/n3/2019/0118/c92122-9539304.html

http://ntic.educacion.es/cee/informe2020/i20cee-informe.pdf

https://www.konfuzius-institut.de/veranstaltungsprogramm/veranstaltungsrueckblick/2021.html

BMT21
3rd International Conference
Business Meets Technology.
Valencia, 23rd & 24th September 2021

A LITERATURE REVIEW ON SELF-EFFICACY AND STRESS AMONG UNIVERSITY STUDENTS

Oberst, Rebecca[a]; Hedderich, Barbara [b] and de-Miguel-Molina, Blanca [c]

[a] *Universitat Politècnica de València, Spain, Doctoral Program in Business Management and Administration. (rebecca.oberst@web.de)*
[b] *Ansbach University of Applied Sciences, Germany. (barbara.hedderich@hs-ansbach.de)*
[c] *Universitat Politècnica de València, Spain, Department of Business Organisation. (bdemigu@omp.upv.es)*

ABSTRACT: An increasing amount of research is investigating the effects of self-efficacy in various areas. In the academic setup, predominantly, the correlation between self-efficacy and the student's performance is being measured. Stress is another influencing factor on academic performance that has been widely investigated. However, only limited research is available on the direct interdependency between stress and self-efficacy for the academic background, especially in the first semester and over time. This article provides an overview of the literature on the theoretical background to self-efficacy and stress and reviews current studies on the interdependencies of these two factors. The main findings are that there is a moderate to significant negative correlation of self-efficacy on stress and a moderate impact of stress on self-efficacy and that the stress level and self-efficacy of students are changing over time. Based on these insights, and since there is no literature available on the timely development and direct connection between self-efficacy and stress, we suggest further investigating temporal and causal coherence.

KEY WORDS: *Self-efficacy; Stress; First semester; University students.*

1. INTRODUCTION

After finishing school, many pupils choose to study at a university to build the foundation for their careers. Not only is the chosen subject a decisive criterium of where their career path leads; the personal attitude and stress resilience also play a role in succeeding in their careers (Rigotti et al., 2020; Abele & Spurk, 2009; Spurk & Abele, 2013; Converse et al. 2012, Fischer et al. 2016). Already the students' approach in the first semester can give a first indication of their prospective academic outcomes (Pinxten et al., 2019). Numerous studies have investigated the positive relation between the personal attitude in the form of self-efficacy (e.g. Robbins et al., 2004; Jones et al., 2010; Gore, 2006) and academic outcome and the negative impact of stress on the academic outcome (e.g. Zajacova et al., 2005; Varghese et al., 2015; Pascoe et al., 2020). Additionally, several studies (Jerusalem

How to cite: Oberst, R., Hedderich, B., and de-Miguel-Molina, B. 2021. A Literature Review on Self-Efficacy and Stress Among University Students. In Proc.: *3rd International Conference Business Meets Technology*. Valencia, 23rd & 24th September 2021. 79-86. https://doi.org/10.4995/BMT2021.2021.13618

& Schwarzer, 1992; Chemers, 2001; Vaezi & Fallah, 2011) suggest a significant negative correlation between self-efficacy on stress.

The objectives of this paper are threefold. First, theoretical background on self-efficacy and stress is given to provide an overview of their dimensions and introduce the commonly used theories. Second, a literature review is conducted to connect self-efficacy and stress. Pitt et al. (2018) highlighted in their study that especially the start and the end of the first semester is crucial for the timing of stress. As there is only limited scientific research in terms of the change of self-efficacy and stress during the first semester and if the stress level has a direct impact on the students' perceived self-efficacy, the focus of the literature review is on (1) longitudinal data during the first semester/study year and (2) the direct connection between self-efficacy and stress regardless the academic outcome. The third objective is to identify implications for future research.

The structure of this chapter is following the objectives above. After this introduction, the theoretical background to self-efficacy is outlined, followed by the theory to stress. Next, the connection between stress and self-efficacy is clarified, and research is presented that investigated the timely development of stress and self-efficacy. Finally, a conclusion with practical implications is given.

2. SELF-EFFICACY

Since the 1970's Albert Bandura's Social Cognition Theory is a fundamental framework for many researchers to understand human learning and behavior. One core element of this theory is self-efficacy. It is defined as "beliefs in one's capabilities to organize and execute the courses of action required producing given attainments" (Bandura, 1997, p. 3). In other words, what a person believes about their ability is influential on what and how they will try to do it. The higher the self-efficacy of a person, the more likely it is, they will choose more challenging tasks and engage longer in the required activities (Bandura, 1982; Ouweneel et al., 2013). Besides the efficacy beliefs, also the outcome expectancy plays a role in how engaged a person is, as the expected outcome of a particular behavior can motivate or demotivate the person (Bandura, 1997).

Self-efficacy is a multidimensional construct that can be applied to any level of specificity (Luszczynska et al., 2005). Besides the general self-efficacy, which is the belief in one's capability to cope with a variety of universal challenges that influence all areas of life (e.g. Chen et al. 2004), there exist domain- and task-specific efficacy as well. Whereas domain-specific self-efficacy is constrained to a specific area like the organizational or educational settings (e.g. Rigotti et al., 2020), task-specific self-efficacy is even limited to a more granular level and focuses on specific tasks at hand like solving mathematical questions (Lent et al., 1997). Bandura (1986, 1997) noted that the more specific self-efficacy is being measured, the better predictable becomes the outcome of behavior. Contrary to that, Schwarzer (1993) and other researchers focused on developing a more generalized self-efficacy approach, arguing that this broader angle is better suited

for multi-contextual patterns of behavior. Both points of view have their reasonability, as they follow different goals.

According to the Social Cognition Theory (Bandura, 1997), there are four main sources that influence one's self-efficacy:

- (1) enactive mastery experience (prior task-based achievement).
- (2) vicarious experience (observation of others/role models).
- (3) social/verbal persuasion (encouragement by others).
- (4) emotional and physiological states.

How much each of these sources influences individual self-efficacy beliefs can vary depending on contextual factors like ethnicity, gender, discipline of study or personality traits (Usher & Pajares, 2008; Wilson et al., 2007; Alvarez-Huerta et al., 2019).

3. STRESS

One of the emotional/physiological states that is influencing - and is influenced by - self-efficacy is stress. The term stress is used loosely in everyday life and often describes various unpleasant emotional states like frustration, exhaustion, or rush. Existing literature neither has one universal definition of stress. One of the first stress researchers who brought up the term stress, Hans Selye, defined it as a "nonspecific response of the body to any demand, whether it is caused by, or results in, pleasant or unpleasant conditions" (1985, p. 8). Stress can impact individuals both beneficially as well as harmfully. Stress in limited amounts has a positive impact, as it is pushing people towards higher achievements. On the other hand, if a person is suffering under ongoing stress, adverse effects manifest either physically (e.g. headache, stomach pain), psychologically (e.g. anger, anxiety) or behaviorally (e.g. drinking alcohol, weight loss) (Behere et al. 2011; Cohen et al., 2007)

Stress is triggered by traumatic events and major life changes - such as the death of a beloved person or a sexual assault – or by minor daily hassles - like lost keys or an argument with a family member. These environmental triggers are called stressors and are either chronic or acute, depending on their duration (Zajakova et al., 2005). The feelings and thoughts a person has about these stressors and how they can handle them are called perceived stress (Varghese et al., 2015).

Besides the original response theory, Lazarus and Folkman (1984) presented another perspective on stress, stating it is a process whereby a person assesses potential stressors as challenge or threat (primary appraisal) and if latter is the case, the options to cope with this specific event (secondary appraisal). If a stressor is seen as a challenge, the perceived outcome will be a potential growth or gain. If the stressor is appraised as a threat, it might lead to harm, loss or negative consequences, which is in the first step not necessarily stressful for the person. In the secondary appraisal, the person assesses if there are options

and resources to handle the stressor effectively or not. Depending on this answer, the person perceives the situation as stressful or not.

4. LINK BETWEEN STRESS AND SELF-EFFICACY AND TIMELY RELATION

This perception, in turn, is, according to Chemers et al. (2001), the connection between self-efficacy and stress. Individuals with high self-efficacy are more likely to assess a stressor or demand as a challenge instead of a threat. Consequently, they select a more effective strategy for coping with the task or persist longer in managing it. Several studies show a moderate to strong negative correlation between self-efficacy and stress among college students (e.g. Hackett et al., 1992; Solberg & Villarreal, 1997). In non-educational settings, self-efficacy is also named as a personal coping resource factor that has a protective effect against stress (Schwarzer et al., 2005).

Hackett et al. (1992) additionally suggested that there is also a connection in the other direction, stating that stress and anxiety may lead to a depression of students' self-efficacy evaluations. Therefore, the reason is that persons use information about their current feelings and well-being to estimate their capability to perform a task. If they feel anxious, fatigued or stressed, they have fewer beliefs in their efficacy. The other way round, they expect to be more successful when not stressed (van der Bijl, 2001; Pajares, 1996).

As studying is a big transition in life, first semester students are at high risk of suffering under stressful situations. Besides the new housing away from home, family and friends, they have to adjust to college life and face the pressure of academic requirements (Zajacova et al., 2015). Goodman (1993) categorized stress perceived by students in the clusters academic, financial, time or health related, and self-imposed.

Likewise, Pitt et al. (2017) had similar conclusions about the main sources of stressors and additionally investigated the timing of these stressors. Their study suggests that the start and end of the first semester are especially risky for a high level of perceived stress. Different stressors are prevalent at different times during the semester. Edwards et al. (2010) also concluded in their study with nursing students that the stress level varies throughout the three-year program and that a single point of measuring is not sufficient to get a representative picture of stress among students.

Ouweneel et al. (2013) investigated the relationship between changes in or stability of self-efficacy and study engagement and academic outcome within one semester. They suggest that there are changes in the level of some student's self-efficacy and that these changes are related to a change of engagement.

Bernacki et al. (2015) also assessed self-efficacy at different points of time during a self-regulated learning program. They came to the result that it is changing continuously based on prior efficacy judgement accuracy and fluency.

5. CONCLUSION

Even though there is some literature investigating single aspects of self-efficacy and stress, no concrete research explicitly explores the impact of stress on self-efficacy in the academic setting without considering the performance outcome. Neither was there longitudinal data linking the two concepts of self-efficacy and stress. Hence, this can be seen as a potential field of research in the future.

If a direct correlation between stress and self-efficacy can be found, stress management seminars for first semester students might be a practical implication to reduce their perceived stress level, increase their academic self-efficacy and hence improve their academic outcome and, consequently, their chances to obtain better jobs. Besides the performance, good stress management skills and a high level of self-efficacy are valuable benefits in the vocational setting and increasingly crucial for talent requisition.

ACKNOWLEDGMENTS

No funding has been received for the development of the research.

CONFLICT OF INTERESTS

No potential conflict of interest was reported by the authors.

AUTHOR CONTRIBUTIONS

The conceptualization of this paper was discussed between all of the authors, because this research is part of Mrs. Oberst's PhD program and Mrs. Hedderich and Mrs. de-Molina-Miguel are her advisors. The investigation and writing was conducted by Mrs. Oberst. Mrs. Hedderich and Mrs. de-Molina-Miguel supervised, reviewed and validated the research.

REFERENCES

Abele, A. E., & Spurk, D. (2009). The longitudinal impact of self-efficacy and career goals on objective and subjective career success. *Journal of Vocational Behavior, 74*, 53–62. https://doi.org/10.1016/j.jvb.2008.10.005

Alvarez-Huerta, P., Larrea, I., Muela, A., & Vitoria, J. (2019). Self-efficacy in first-year university students: a descriptive study. Headache.

Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory*. Englewood Cliffs, NJ: Prentice Hall.

Bandura, A. (1997). *Self-efficacy: The exercise of control*. W H Freeman/Times Books/ Henry Holt & Co.

Behere, S.P., Yadav, R. & Behere, P.B. (2011) A comparative study of stress among students of medicine, engineering, and nursing. *Indian Journal of Psychological Medicine, 33*(2), 145–148.

Bernacki, M. L., Nokes-Malach, T. J., & Aleven, V. (2015). Examining self-efficacy during learning: Variability and relations to behavior, performance, and learning. *Metacognition and Learning, 10*(1), 99–117. https://doi.org/10.1007/s11409-014-9127-x

Chemers, M.M., Hu, L., & Garcia, B.F. (2001). Academic self-efficacy and first year college student performance and adjustment. *Journal of Educational Psychology, 93*, 55-64.

Chen, G., Gully, S. M., & Eden, D. (2004). General self-efficacy and self-esteem: Toward theoretical and empirical distinction between correlated self-evaluations. *Journal of Organizational Behavior, 25*, 375–395. https://doi.org/10.1002/job.251

Cohen, S., Janicki-Deverts, D., & Miller, G. E. (2007). Psychological stress and disease. *JAMA, 298*(14). 1685-1687.

Converse, P. D., Pathak, J., DePaul-Haddock, A. M., Gotlib, T., & Merbedone, M. (2012). Controlling your environment and yourself: Implications for career success. *Journal of Vocational Behavior, 80*(1), 148-159. https://doi.org/10.1016/j.jvb.2011.07.003

Edwards, D., Burnard, P., Bennett, K., & Hebden, U. (2010). A longitudinal study of stress and self-esteem in student nurses. *Nurse education today, 30*(1), 78–84. https://doi.org/10.1016/j.nedt.2009.06.008

Goodman, E.D. (1993). How to handle the stress of being a student. *Imprint, 40*,43.

Gore, P. A. (2006). Academic Self-Efficacy as a Predictor of College Outcomes: Two Incremental Validity Studies. *Journal of Career Assessment, 14*(1), 92–115. https://doi.org/10.1177/1069072705281367

Hackett, G., Betz, N. E., Casas, J. M., and Rocha-Singh, I. A. (1992). Gender, ethnicity, and social cognitive factors predicting the academic achievement of students in engineering. *Journal of Counseling Psychology 39*(4): 527–538.

Jerusalem, M., & Schwarzer, R. (1992). Self-efficacy as a resource factor in stress appraisal processes. In R. Schwarzer (Ed.), Self-efficacy: Thought control of action, 195–213. Hemisphere Publishing Corp.

Jones, B. D., Paretti, M. C., Hein, S. F., & Knott, T. W. (2010). An analysis of motivation constructs with first-year engineering students: relationships among expectancies, values, achievement, and career plans. *Journal of Engineering Education, 99*, 319–336. https://doi.org/10.1002/j.2168-9830.2010.tb01066.x

Lazarus, R. S. & Folkaman, S. (1984). *Stress, appraisal and coping*. New York, N. Y.: Springer.

Lent, R. W., Brown, S. D., & Gore, P. A., Jr. (1997). Discriminant and predictive validity of academic self-concept, academic self-efficacy, and mathematics-specific self-efficacy. *Journal of Counseling Psychology, 44*(3), 307–315. https://doi.org/10.1037/0022-0167.44.3.307

Luszczynska, A., Scholz, U. & Schwarzer, R. (2005). The General Self-Efficacy Scale: Multicultural Validation Studies. *The Journal of psychology, 139*, 439-57. https://doi.org/10.3200/JRLP.139.5.439-457

Ouweneel, E., Schaufeli, W. B., & Le Blanc, P. M. (2013). Believe, and you will achieve: changes over time in self-efficacy, engagement, and performance. *Applied psychology. Health and well-being, 5*(2), 225–247. https://doi.org/10.1111/aphw.12008

Pajares, F. (1996). Self-efficacy beliefs in academic settings. *Review of Educational Research 66*(4): 543–578.

Pascoe, M. C., Hetrick, S. E. & Parker, A. G. (2020). The impact of stress on students in secondary school and higher education. *International Journal of Adolescence and Youth, 25*(1), 104–112. https://doi.org/10.1080/02673843.2019.1596823

Pinxten, M., Van Soom, C., Peeters, C. et al. (2019). At-risk at the gate: prediction of study success of first-year science and engineering students in an open-admission university in Flanders—any incremental validity of study strategies?. *European Journal of Psychology and Education, 34*, 45–66. https://doi.org/10.1007/s10212-017-0361-x

Pitt, A., Oprescu, F., Tapia, G., & Gray, M. (2018). An exploratory study of students' weekly stress levels and sources of stress during the semester. *Active Learning in Higher Education, 19*(1), 61–75. https://doi.org/10.1177/1469787417731194

Rigotti, T., Korek, S., & Otto, K. (2020). Career-related self-efficacy, its antecedents and relationship to subjective career success in a cross-lagged panel study. *The International Journal of Human Resource Management, 31*(20), 2645–2672. https://doi.org/10.1080/09585192.2018.1460858

Robbins, S. B., Lauver, K., Le, H., Davis, D., Langley, R., & Carlstrom, A. (2004). Do psychosocial and study skill factors predict college outcomes? A meta-analysis. *Psychological Bulletin, 130*, 261–288. https://doi.org/10.1037/0033-2909.130.2.261.

Schwarzer, R. (1993). *Measurement of perceived self-efficacy: Psychometric scales for cross-cultural research*. Berlin: Freie Universität Berlin, Institut für Psychologie.

Schwarzer, R., Boehmer, S., Luszczynska, A., Mohamed, N., & Knoll, N. (2005). Dispositional self-efficacy as a personal resource factor in coping after surgery. *Personality and Individual Differences, 39*, 807-818.

Selye, H. (1985) The nature of stress. *The Best of Basal Facts, 7*, 3-11.

Spurk, D., & Abele, A. E. (2013). Synchronous and time-lagged effects between occupational self-efficacy and objective and subjective career success: Findings from a four-wave and 9-year longitudinal study. *Journal of Vocational Behavior, 84*, 119–132. https://doi.org/10.1016/j. jvb.2013.12.002

Solberg, V. S., & Villarreal, P. (1997). Examination of self-efficacy, social support, and stress as predictors of psychological and physical distress among Hispanic college students. *Hispanic Journal of Behavioral Sciences, 19*(2), 182–201. https://doi.org/10.1177/07399863970192006

Usher, E. L., & Pajares, F. (2008). Sources of self-efficacy in school: Critical review of the literature and future directions. *Review of Educational Research, 78*, 751-796. https://doi.org/10.3102/0034654308321456

Vaezi, S., & Fallah, N. (2011). The Relationship between Self-Efficacy and Stress among Iranian EFL Teachers. *Journal of Language Teaching and Research, 2*, 1168-1174. https://doi.org/10.4304/jltr.2.5.1168-1174

van der Bijl, J. J., & Shortridge-Baggett, L. M. (2001). The Theory and Measurement of the Self-Efficacy Construct. *Scholarly inquiry for nursing practice, 15*(3), 189-207.

Varghese, R., Norman, T.S. & Thavaraj, S. (2015). Perceived Stress and Self Efficacy Among College Students: A Global Review. *International Journal of Human Resource Management and Research, 5* (3), 15-24.

Wilson, F., Kickul, J., & Marlino, D. (2007). Gender, Entrepreneurial Self-Efficacy, and Entrepreneurial Career Intentions: Implications for Entrepreneurship Education. *Education, 31*(3), 387–406.

Zajacova, A., Lynch, S.M., Espenshade, T.J. (2005). Self-Efficacy, Stress, And Academic Success in College. *Research in Higher Education, 46*(6), 677-706. https://doi.org/10.1007/s11162-004-4139-z.

BMT21
3rd International Conference
Business Meets Technology.
Valencia, 23rd & 24th September 2021

SUSTAINABLE ENTREPRENEURSHIP, ENTREPRENEURSHIP AND GENDER

BMT21
3rd International Conference
Business Meets Technology.
Valencia, 23rd & 24th September 2021

BIBLIOMETRIC ANALYSIS OF VENTURE TEAMS OF TECHNOLOGY-BASED FIRMS

Ribes-Giner, Gabriela [a1]; Moya-Clemente, Ismael [a2] and Alzate-Alvarado, Ana Lucía [a3,b]

[a] *Faculty of Business Administration and Management, Universitat Politècnica de València, Camino de Vera s/n 46022 València. Spain. ([a1] gabrigi@omp.upv.es, [a2] imoya@esp.upv.es)*
[b] *Centro de Desarrollo del Espíritu Empresarial, Universidad Icesi, Calle 18 No. 122 – 135, Cali, Colombia. (alalzate@icesi.edu.co)*

ABSTRACT: Due to its growing impact on the economic development of countries, research on venture teams in new technology-based firms - TBFs has been increasing in recent years, seeking to identify the success and failure factors of this type of firms, given their high mortality rates. This paper analyzes the changes that have occurred in the intellectual structure of this discipline through the bibliometric analysis of research on the theme of venture teams in the new TBFs. The information collected was extracted from the main collection of the Web of Science (WoS) and SCOPUS databases from 1987 to 2020. The Nvivo and VOSviewer softwares are used to perform the initial analyzesas well as the analysis of citations, co-citations, co-authorship, etc. The advances associated with the main authors, sources and countries, the general citation structure and the development of this field are presented. The results show a growing publication trend as of 2009, seeing a higher production of articles between 2014 and 2019. USA is the most influential country, followed by UK and Italy. The"Journal of Business Venturing" and "Technovation" are the most influential sources. The main contribution of this work is to show the evolution of this theme, so that researchers can use it in the future in their theoretical and research frameworks.

KEY WORDS: *Bibliometric analysis; New technology-based firms; Teams.*

1. INTRODUCTION

The new technology-based firms (TBFs) according to Litan and Song (2008), are defined as those that have a business model strongly rooted in the development and application of a new technology, and have a positive impact on the economic development of the countries. They are objects of interest due to their ability to create high-quality employment, generate knowledge, make innovations, and energize industries thanks to their disruptive technologies (Colombo & Grilli, 2005; Song et al., 2008). They are characterized by being agile and having the ability to operate in a world with a volatile,

How to cite: Ribes-Giner, G., Moya-Clemente, I., and Alzate-Alvarado, A. L. 2021. Bibliometric analysis of venture teams of technology-based firms. In Proc.: *3rd International Conference Business Meets Technology*. Valencia, 23rd & 24th September 2021. 89-96. https://doi.org/10.4995/BMT2021.2021.13695

uncertain, complex and ambiguous context (Xing et al., 2019), facing the uncertainty of both potential demand and technology (Sommer et al., 2009).

Its high mortality rates have made some researchers get interested in identifying the most determining factors of its success and failure. Song et al. (2008) found that the survival rate of TBFs established between 1991 and 2000 in USA after 4 years was 36%, falling to 21.9% at 5 years. In their research, they defined 24 success factors, grouped into 3 large groups: the market and the opportunity, the venture team, and the resources employed. In this same study, it was found that successful TBFs were founded by venture teams of between 2 and 5 members, and not by individual entrepreneurs. These entrepreneurs had more prior experience working together, had previously held similar roles, and had been involved in fast-growing companies competing in the same industry as the nascent TBF.

Other entrepreneurship researchers have focused their efforts on relating the characteristics of new entrepreneurs and the performance of TBFs (Shrader & Siegel, 2007). Aspelund et al. (2005) for example, affirm that for the venture team of the TBFs to be effective, it does not depend only on its size but also on how it is constituted. In addition, the previous business experience of the founders of the TBFs is decisive in the performance.

With the intention of identifying the works that have had a greater impact on the investigation of the venture teams of the TBFs and to analyze the changes that have occurred in the intellectual structure of this field, a bibliometric analysis is presented, showing the main authors, countries and journals that investigate this theme.

On the other hand, in order to establish thematic associations between scientific works, and to be able to identify the existing relationships between the key ideas of the different authors who write on this theme, maps were used that allowed visualizing elements such as: bibliographic coupling, co-citation, and co-authorship. Bibliometric maps serve as an organizing tool and analysis of scientific information and their objective is to show the structure and evolution of the field of scientific research, such as the research activity of the most representative researchers, the intellectual group of leading journals, the indication of similarity of important topics and concepts, etc. These maps are used to help users better understand the domain's area of interest and address their information needs clearly (Yu et al., 2018; Sampieri Cabrera & Trejo Rodríguez, 2015).

2. THEORETICAL BACKGROUD

Chandler et al. (2005), affirm that operating in complex, dynamic and uncertain conditions imposes a greater demand for work on the venture team of new firms, with a direct influence on performance. Jin et al. (2016) carried out the first meta-analysis to examine the relationship between the composition characteristics of the venture team and the performance of the TBFs; affirming that higher levels of human capital (in terms of

education, experiences, knowledge and skills) allow venture teams to better face the labor demands of new companies immersed in this context.

According to Xing et al. (2019), the effectiveness of venture teams has a high incidence on the success of their firms. In their study on technology-based firms, and observing the effect of the characteristics of venture teams on their good performance, they found that it is important to analyze the skills, personality and needs of the business team at different stages of the process; in such a way that they can exploit their competitive advantage and focus on effective results, especially in a dynamic context.

Eliakis et al. (2020) examinies the characteristics that affect the performance of a mature and constantly growing technologically innovative enterprise, finding that a number of characteristics pertaining to both the profile of the entrepreneurial team, as well as of the employees, significantly affect company survival and growth in this context. The most important characteristics of the entrepreneurial team are: perseverance and passion for long-term goals, flexibility, prior work experience in the same industry of the new firm, team size (the more members that take part in the founding team, the greater is the probability of survival for a new venture), team heterogeneity, entrepreneurial experience.

De Mol et al. (2019) conducted a study with high-tech startups, to investigate how the average level of business passion and the diversity of passion of venture teams contribute to the performance of the firm in the short and long term. They found, among other things, that encouraging teams to discuss passion in the firm's operating agreement, and to address known mechanisms to address interpersonal conflicts productively, can help lessen conflict in later stages of the company, when they are taken strategic decisions that impact performance.

Birley and Stockley (2000) state that despite the existence of many studies about the venture team and its impact on the growth of companies from the organizational, strategic and psychological perspective; the dialogue is incomplete, and they suggest that studies on this issue should be delved in order to know the how and why of their successes and failures. Eliakis et al. (2020) and Bolzani et al. (2019) state that despite the fact that the venture team is a subject that has grown substantially in interest to researchers, the literature is quite fragmented.

3. METHODOLOGY

The bibliometric method allows us to analyze a specific research field and build a general image of it, taking into account articles, journals, authors, institutions and countries (Merigó et al., 2015).

There are different bibliometric indicators such as quantitative indicators of scientific activity, where the number of publications is included, thus measuring the productivity of the researcher; and impact indicators, based on the number of citations obtained by the works, and that characterize the importance of tha mentioned production, based on the recognition granted by other researchers (Merigó et al., 2018; Bordons & Zulueta, 1999).

To perform the bibliometric analysis of this study, the main collection of the Web of Science (WoS) database was consulted using the following search equation: THEME: ((“New Technology Ventures” OR “Technology Entrepreneurship” OR “Tech start up” OR “Tech startup” OR “High tech Start up”) AND (“team” OR “funding team”)), finding 28 documents. Additionally, the same search strategy was executed in the main collection of the SCOPUS database: TITLE-ABS-KEY ((“New Technology Ventures” OR “Technology Entrepreneurship” OR “Tech start up” OR “Tech startup” OR “High tech Start up”) AND (“team” OR “funding team”)). In this occasion, 77 documents were recovered.

Duplicates were eliminated, resulting in 83 documents in total, published between 1987 and September 2020, of which 51 are Journal Articles, 29 are works published in the Proceedings of a Congress and 3 are Books. With these results, the bibliometric analysis was performed.

The bibliometric analysis was carried out, graphically mapping the bibliographic material using the VOSviewer software, which collects the data and builds up maps in terms of bibliographic coupling, citation, co-citation, co-authorship and co-occurrence of keywords (Merigó et al., 2018). In order to identify the main terms most frequently found in the performed systematic data search, the NVivo software (version Release 1.3) was used. This software is used for qualitative and mixed methods research, and facilitates comparison and identification of different relationships in the data (Bergeron & Gaboury, 2019).

4. FINDINGS

Publications and citation structure

When identifying the general panorama of the main publications about the venture teams of the new TBFs between 1987 and September 2020, and analyzing the changes that have occurred in the intellectual structure of this discipline, it was found that there is not much literature published about the venture teams in the new TBFs. However the annual number of published documents has been gradually increasing, having published 72.3% of the documents between 2010 and 2020.

To facilitate the identification of these terms, a word cloud graph was used. The most widely used works in searches were: team, technology, entrepreneurhip, start, business, tech, management, among others.It is important to point out that the terms: “team”, “technology” and “entrepreneurhip” begin to be used more often from 2004, finding that it is from 2009, when their use increases more significantly, which indicates that the the theme of venture teams in TBFs is beginning to gain relevance among researchers.

Main authors and countries

When carrying out the analysis of the most productive authors, it is found that authors like Knockaert M. and Bjornali E.S. are highlighted with five and four publications,

respectively. All the other authors have two publications on this theme, and are classified in the ranking after considering the number of citations per author. Of the 13 authors who have published the most, three receive more than 100 citations, with Clarysse B. at the top of the list with over 300.

When analyzing the countries with more publications on new TBFs' venture teams, USA has more works with 34 publications and 771 citations, followed by UK, Italy and Belgium, with 9, 7 and 6 publications, and 280, 295 and 381 citations, respectively.

Main sources

The leading sources in publishing documents related to new TBFs' venture teams were: "ASEE Annual Conference and Exposition, Conference Proceedings", "Journal of Business Venturing", "Technovation" and "Proceedings - International Conference on Software Engineering", with 7, 3, 3 and 3 publications, respectively. "Journal of Business Venturing" and "Technovation" had an h index of 3. Despite "ASEE Annual Conference and Exposition, Conference Proceedings" having the most publications, its h index was 2.

5. CONCLUSIONS

The number of published documents has gradually increased since 2004, with more documents being published between 2010 and 2020. This can be explained due to the interest aroused in recent years to understand the key success factors of this type of firms (among which are venture teams), given their strong impact on socio-economic development and their high business mortality rates.

When carrying out the analysis of the most productive authors, it is found that Kockaert M. (Belgium) and Bjornali ES (Norway), are the authors with the biggest number of publications, but they are not the most influential, because Clarysse B. (Belgium) and Li H. (United States), received many more citations, even though they published fewer documents.

USA is the most productive country for publications on this subject, with an annual number of documents well above the rest of the countries, followed far behind by UK, Italy, Belgium and Norway.

An analysis of the citation structure of the most published sources in the area was carried out, defining the h index for each of them. In this ranking, it is observed that "ASEE Annual Conference and Exposition, Conference Proceedings" is the source that has the largest number of documents published on this theme, but it is not the most influential, because it did not receive the biggest number of researcher citations. The most relevant sources in this regard are "Journal of Business Venturing" and "Technovation".

This theme is becoming a field of growing interest for researchers, entrepreneurs, and even for governments in the design of their public policies.The main contribution of this work is to show the evolution of this topic, so that researchers can use it in the future in their theoretical and research frameworks. For example, topics such as entrepreneurship,

venture capital, technology entrepreneurship, business growth, and innovation could be further explored.

It is expected that, with the evolution of research in the technological field, similar dynamics of knowledge creation will occur that will contribute to growing the field of research of venture teams and their influence on new technology-based firms even more.

CONFLICT OF INTEREST

The authors declare not to have any competing financial, professional, or personal interests from other parties.

AUTHOR CONTRIBUTIONS

Ribes-Giner Gabriela: Conceptualization, Methodology, Investigation, Writing - Review & Editing Supervision. *Moya-Clemente Ismael:* Conceptualization, Methodology, Investigation, Writing - Review & Editing Supervision. *Alzate-Alvarado Ana Lucía:* Formal Analisis, Resources, Data Curation, Writing - Original Draft, Writing - Review & Editing, Visualization.

REFERENCES

Aspelund, A., Berg-Utby, T., & Skjevedal, R. (2005). Initial resources' influence on new venture survival: a longitudinalstudy of new technology-based firms. *Technovation, 25*, 1337-1347. https://doi.org/10.1016/j.technovation.2004.06.004

Bergeron, D., & Gaboury, I. (2019). Challenges related to the analytical process in realist evaluation and latest developments on the use of NVivo from a realist perspective. *International Journal of Social Research Methodology, 23*(3), 355–365. doi: https://doi.org/10.1080/13645579.2019.1697167

Birley, S., & Stockley, S. (2000). Entrepreneurial Teams and Venture Growth. En D. L. Sexton, & H. Landström (Edits.), *The Blackwell Handbook of Entrepreneurship* (Vol. First Edition, págs. 287–307). Blackwell Publishers Ltd. https://doi.org/10.1002/9781405164214.ch14

Bolzani, D., Fini, R., Napolitano, S., & Toschi, L. (2019). Entrepreneurial Teams: An Input-Process-Outcome Framework. *Foundations and Trends® in Entrepreneurship, 15*(2), 56–258. https://doi.org/10.1561/0300000077

Bordons, M., & Zulueta, M. Á. (1999). Evaluación de la actividad científica a través de indicadores bibliométricos. *Revista Española de Cardiología, 52*(10), 790–800. https://doi.org/10.1016/S0300-8932(99)75008-6

Chandler, G. N., Honig, B., & Wiklundb, J. (2005). Antecedents, moderators, and performance consequences of membership change in new venture teams. *Journal of Business Venturing, 20*, 705–725.

Colombo, M. G., & Grilli, L. (2005). Founders' human capital and the growth of new technology-based firms: A competence-based view. *Research Policy, 34*, 795–816.

de Mol, E., Cardon, M. S., de Jong, B., Khapova, S. N., & Elfring, T. (2019). Entrepreneurial passion diversity in new venture teams: An empirical examination of short- and long-term performance implications. (E. Inc., Ed.) *Journal of Business Venturing*. https://doi.org/10.1016/j.jbusvent.2019.105965

Eliakis, S., Kotsopoulos, D., Karagiannaki, A., & Pramatari, K. (2020). Survival and Growth in Innovative Technology Entrepreneurship: A Mixed-Methods Investigation. *Administrative Science, 10*(3), 39. https://doi.org/10.3390/admsci10030039

Jin, L., Madison, K., Kraiczy, N. D., Kellermanns, F. W., Crook, T. R., & Xi, J. (2016). Entrepreneurial Team Composition, Characteristics and New Venture Performance: A Meta-Analysis. *Entrepreneurship Theory and Practice, 41*(5), 743–771. https://doi.org/10.1111/etap.12232

Litan, R. E., & Song, M. (2008). From the Special Issue Editors: Technology Commercialization and Entrepreneurship. *Journal of Product Innovation Management, 25*, 2–6. https://doi.org/10.1111/j.1540-5885.2007.00279.x

Merigó, J. M., Gil Lafuente, A. M., & Yager, R. R. (2015). An Overview of Fuzzy Research with Bibliometric Indicators. *Applied Soft Computing, 27*, 420–433. https://doi.org/10.1016/j.asoc.2014.10.035

Merigó, J. M., Pedrycz, W., Weber, R., & de la Sotta, C. (2018). Fifty Years of Information Sciences: A Bibliometric Overview. *Information Sciences, 432*, 245–268. https://doi.org/10.1016/j.ins.2017.11.054

Perianes Rodríguez, A., Olmeda Gómez, C., & Moya Anegón, F. (2010). Detecting, Identifying and Visualizing Research Groups in Co-authorship Networks. *Scientometrics, 82*, 307–319. https://doi.org/10.1007/s11192-009-0040-z

Sampieri Cabrera, R., & Trejo Rodríguez, M. Á. (2015). Mapas Bibliométricos como Herramienta en la Organización y Análisis en Ciencia. *Revista de Educación Bioquímica - REB, 34*(4), 93–97.

Shrader, R., & Siegel, D. S. (November de 2007). Assessing the Relationship between Human Capital and Firm Performance: Evidence from Technology-Based New Ventures. *Entrepreneurship: Theory and Practice, 31*(6), 893–908. doi: https://doi.org/10.1111/j.1540-6520.2007.00206.x

Sommer, S. C., Loch, C. H., & Dong, J. (2009). *Managing Complexity and Unforeseeable Uncertainty in Startup Companies: An Empirical Study*. Institute for Operations Research and the Management Sciences (INFORMS). Maryland, USA: Organization Science 20 (1). https://doi.org/10.1287/orsc.1080.0369

Song, M., Podoynitsyna, K., Van Der Bij, H., & Halman, J. I. (2008). Success Factors in New Ventures: A Meta-analysis. *The Journal of Product Innovation Management*, 7–27. https://doi.org/10.1111/j.1540-5885.2007.00280.x

Sonnenwald, D. H. (2007). Scientific collaboration. *Annual review of information science and technology, 41*(1), 643–681. https://doi.org/10.1002/aris.2007.1440410121

Xing, Y., Liu, Y., & Boojihawon, D. K. (2019). Entrepreneurial team and strategic agility: A conceptual framework and research agenda. *Human Resource Management Review*. https://doi.org/10.1016/j.hrmr.2019.100696

Yu, D., Xu, Z., & Wang, W. (2018). Bibliometric analysis of fuzzy theory research in China: A 30-year perspective. *Knowledge-Base d Systems, 141*, 188-199. https://doi.org/10.1016/j.knosys.2017.11.018

BMT21
3rd International Conference
Business Meets Technology.
Valencia, 23rd & 24th September 2021

SUSTAINABLE ENTREPRENEURSHIP IN EDUCATION THROUGH SCIENCE MAPS

Vásquez-Peñafiel, Maria-Stefanie [a, b] and Perello-Marín, María-Rosario [c]

[a] *Occasional Professor, Escuela Politécnica Nacional. DESODEH – SIGTI. Ecuador. (maria.vasquez@epn.edu.es)*
[b] *phD Candidate. Universitat Politècnica de València. Dept. Organizacion de Empresas. Spain.*
[c] *Associate Professor. Universitat Politècnica de València. Dept. Organizacion de Empresas. Spain. (rperell@upvnet.upv.es)*

ABSTRACT: The promotion of innovation and entrepreneurship is part of the major national and global goals since Agenda 2030 in 193 countries. Additionally, with global warming and the pandemic caused by COVID-19, these goals became strategies for global reactivation, prioritizing the environment, social and economic aspects to create resilient and conscious organizations. Educational institutions, for their part, must assume the role of articulating in a multidisciplinary way the requirements of society through their knowledge to achieve generational changes giving solutions to existing problems. This article's main objective is to show the different research fronts related to sustainable entrepreneurship in education and their relationships before and after the pandemic to identify the different areas in which research is being conducted, their interconnections, and their evolution. For this purpose, a bibliometric analysis was carried out through science maps, covering three timeframes: (2006–2014), no relevant data before 2004, (2015-2019) Agenda 2030 was signed, (2020-today) COVID-19 pandemic. The results show profound changes in traditional trends, as well as the emergence of emerging trends.

KEY WORDS: *Sustainable entrepreneurship; Science maps; Education.*

1. PURPOSE OF THE PAPER

Sustainable entrepreneurship has been gaining more relevance in recent years; however, this term was already coined since the end of the 20th century, when companies started to contribute substantially to the improvement of environmental quality. Initially, the private enterprise learned to handle ecological legislation on the cleaning up of pollution. It then cooperated in implementing policies to ensure pollution prevention by improving the eco-efficiency and resource-productivity of its operations.

How to cite: Vásquez-Peñafiel, M. S., and Perello-Marín, M. R. 2021. Sustainable entrepreneurship in education through Science Maps. In Proc.: *3rd International Conference Business Meets Technology*. Valencia, 23rd & 24th September 2021. 97-110. https://doi.org/10.4995/BMT2021.2021.13668

From an academic perspective, Keijzers (2002) already foreshadowed a new shift in sustainable enterprises. They moved from environmentally friendly production methods towards truly sustainable entrepreneurship by complying with co-operation and assuming their responsibilities. Governments, for instance, started to create new agendas for this transformation considering that energy-related issues, resource stocks dissipation, encroachment on scarce land are still unresolved issues.

Thus, sustainable entrepreneurship went from being considered solely economic to considering aspects such as the environment and society without neglecting the prosperity of companies in financial terms. However, the effects of sustainable development on entrepreneurship and investments are still discussed. (Aravossis, 2004).

Over the years, several authors have emphasized the diversification of the studies that have emerged in recent times; however, these are found in various specialized topics such as politics, environmental sciences, sociology, economics, education, among others (Muñoz & Cohen, 2018; Schaefer et al., 2015). Here the main question arises: What are universities doing to promote sustainable entrepreneurship? What are they planning to do? It is well known from studies that entrepreneurship, especially innovation-based entrepreneurship, is a vital strategy for economic growth (Decker et al., 2014; Haltiwanger et al., 2013; Santillán Salgado et al., 2015; Zamora-Boza, 2018).

Thus, sustainable entrepreneurship must be included in national and local agendas of government, industry, and academia, given the current situation in the face of COVID-19, global warming, and the recession that will accompany these events that have devastated economies and business. (Hanaoka et al., 2018).

The main purpose of this article is to learn about the evolution of studies on sustainable entrepreneurship in the educational field, identifying the different trends, especially emerging ones, that have appeared over time. In other words, we intend to carry out a temporal analysis of the evolution of sustainable entrepreneurship in education. The time horizon for this analysis will be from 2006 until the year 2021.

2. RELATED WORK

Sustainable development was defined for the first time by the World Commission on Environment and Development in 1987 as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (p. 41). From there, several branches have been developed around this definition.

On the other hand, sustainable entrepreneurship was defined based on the idea that this type of entrepreneurship was basically focused on environmental problems and solutions. (Hall et al., 2010). This concept evolved to a broader approach that led to a new conceptualization. It was no longer conceived only as a solution to problems but as a form of "building back better" (Shepherd & Williams, 2019), reconsidering processes, strategic planning, products, and the business itself. This reconsideration, from a self-reflective point of view, aware of the impact of its activity from an environmental and

social point of view, and not only with an economic lean (Sarango-Lalangui et al., n.d.), receiving a lot of attention from different fields of research, leading to a wide range of definitions as well.

Sarango-Lalangui (2018) identified 15 keywords related to the term: ecological entrepreneurial and entrepreneur, green entrepreneur, environmental entrepreneur, and entrepreneurial standout. In this sense, it is pertinent to review the different notions of sustainable entrepreneurship of authors most cited in the field of study to create a sense of orientation, considering the possible variants for this term. Table 1 shows the diversity of concepts and notions about sustainable entrepreneurship where the presence of the three key factors: economic, social, and environmental, is emphasized.

Table 1. Most cited authors (own elaboration).

	Authors	Cited by	Definition	page.
1	Dean, T.J., McMullen, J.S. (2007)	619	"The process of discovering, evaluating, and exploiting economic opportunities those are present in market failures which detract from sustainability, including those that are environmentally relevant."	58
2	Schaltegger, S., Wagner, M.(2011)	603	"Sustainable entrepreneurship (or ecopreneurship) deals with entrepreneurial companies that develop and successfully spread sustainability orientated innovations primarily in niche markets, but subsequently also in the mass market."	222
3	Cohen, B., Winn, M.I. (2007)	596	"The examination of how opportunities to bring into existence future goods and services are discovered, created, and exploited, by whom, and with what economic, psychological, social, and environmental consequences."	35
4	Hockerts, K., Wüstenhagen, R. (2010)	477	"The discovery and exploitation of economic opportunities through the generation of market disequilibria that initiate the transformation of a sector towards an environmentally and socially more sustainable state"	482
5	Klewitz, J., Hansen, E.G. (2014)	476	"Their entire business model is based on combining ecological and social issues with economic success (e.g., organic and fair-trade products), meaning that social and/or environmental goals can have the same, sometimes even higher priority than economic goals. "	63
6	Shepherd, D.A., Patzelt, H. (2011)	379	"A focus on the preservation of nature, life support, and community in the pursuit of perceived opportunities to bring into existence future products, processes, and services for gain, where the gain is broadly construed to include economic and non-economic gains to individuals, the economy, and society"	142
7	Kuckertz, A., Wagner, M. (2010)	278	"Sustainable entrepreneurs manage to the "triple bottom line by balancing economic health, social equity, and environmental resilience through their entrepreneurial behavior. "	524
8	Pacheco, D.F., Dean, T.J., Payne, D.S. (2010)	223	"We view sustainable entrepreneurship as the discovery, creation, evaluation, and exploitation of opportunities to create future goods and services that are consistent with sustainable development goals."	58
9	Young, W., Tilley, F. (2006)	214	"An innovative, market-oriented and personality-driven form of creating economic and societal value by means of break-through environmentally or socially beneficial market or institutional innovations."	226
10	Lans, T., Blok, V., Wesselink, R. (2014)	159	"Those who proactively facilitate latent demands for sustainable development"	37

Sustainable entrepreneurship is a multidisciplinary sub-discipline in the organizational field that has been considered trendy in recent years. The most studied topics were related to social and economic development (Cabeza Ramírez et al., n.d.). However, related work regarding the evolution of sustainable entrepreneurship has been developed (Anand et al., 2021; Huertas González-Serrano et al., n.d.; Iqbal & Kousar, 2019; Moya-Clemente et al., 2021; Sarango-Lalangui et al., n.d.; Stefan Schaltegger et al., 2016; Song et al., 2009; Terán-Yépez et al., 2020; Thananusak, n.d.) but keeping it from a social and business perspective, discarding education in their analysis.

The university in society plays a more profound role than just transmitting knowledge; it must help communities grow and achieve common goals for its improvement, which is part of a larger academic conversation that is currently taking place worldwide (González-Pernía et al., 2015). Traditionally, however, education scholars focus on business education through business schools or environmental sustainability through other faculties, leaving aside the relationship across these two disciplines (Lans et al., 2014).

It is then intended to address those issues from which research on sustainable entrepreneurship has been conducted from the field of education to highlight patterns and trends in the study of this field.

3. METHODOLOGY

For the temporal analysis, bibliometric techniques were used to map sustainable entrepreneurship to identify the different topics through nodes, and trends through clusters, considering the evolution of research in different periods (Robledo-Fernández et al., 2020).

To carry out the present study, we started by determining a database to collect articles, where Scopus database was used as a reference, as it is a robust database that provides access to a higher number of indexed journals, allowing sorting in different ways (Anand et al., 2021; Robledo-Fernández et al., 2020).

In this paper, as our focus was on 'sustainable entrepreneurship,' we decided to omit other keywords such as social, environmental, and ecological entrepreneurship, as we assume sustainability deals with all three areas. We limited the selection of articles by using Boolean signs to only those related to the educational field. The search string used in Scopus was narrowed down as: "sustainable entrepreneurship" OR "sustainable entrepreneur" OR "sustainable entrepreneurial" AND education." Finally, only scientific production of articles and book chapters was selected, which resulted in 52 articles.

Data preprocessing was performed with VOSviewer once the information had been extracted from the database; the detection of duplicates and errors in the spelling of keywords, authors, and reviews were taken into account (Garfield, 1994).

Accordingly, Figure 1 shows the evolution of the number of articles on sustainable entrepreneurship in the field of education. As we can see, scientific production has

had several highs and lows, but we consider two important milestones to be taken into account. In 2015 the international agreement of the 2030 Agenda was signed, which includes 17 Sustainable Development Goals (SDG). On the other hand, at the beginning of 2020, World Health Organization declared a pandemic due to the situation generated by Covid-19. Thus, we will section the temporal study to mark the trends from 2006 to 2014, 2015 to 2019, and 2020 to 2021.

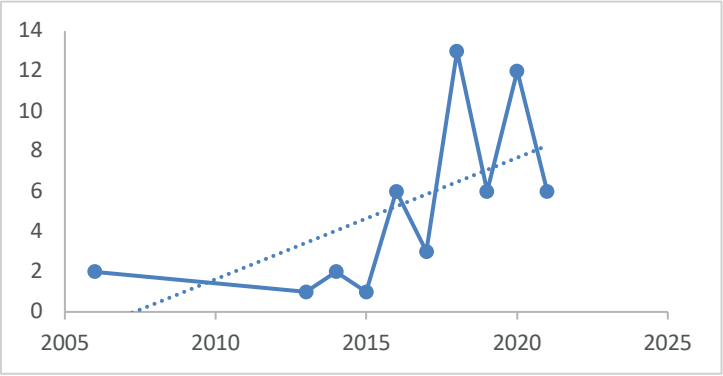


Figure 1. Articles by year (Own elaboration).

For identifying the most relevant nodes and their associations, the associative strength method was used (Robledo-Fernández et al., 2020), resulting in the clusters generated by the program. The types of analysis used in the research were those of co-occurrence for all keywords considering network and overlay visualization, citation by authors, and co-authorship between countries.

4. FINDINGS

In the bibliometric network generated, similarity measures were applied to normalize the co-occurrence values of keywords. Multivariate clustering techniques were used to identify homogeneous groups. The data obtained in science maps were presented in links and distributed as nearby points in a multidimensional space (Galvez, 2018). The results of using VOSviewer software showed three trends based on the clusters.

According to Figure 2, the red cluster represents studies on aspects concerning students and planning; the blue cluster corresponds to teachers and higher education. Finally, the green cluster corresponds to business and innovation. It could be affirmed that the trends have been constant since there are no distances between the clusters nor few connections, so there is no evidence of emerging trends.

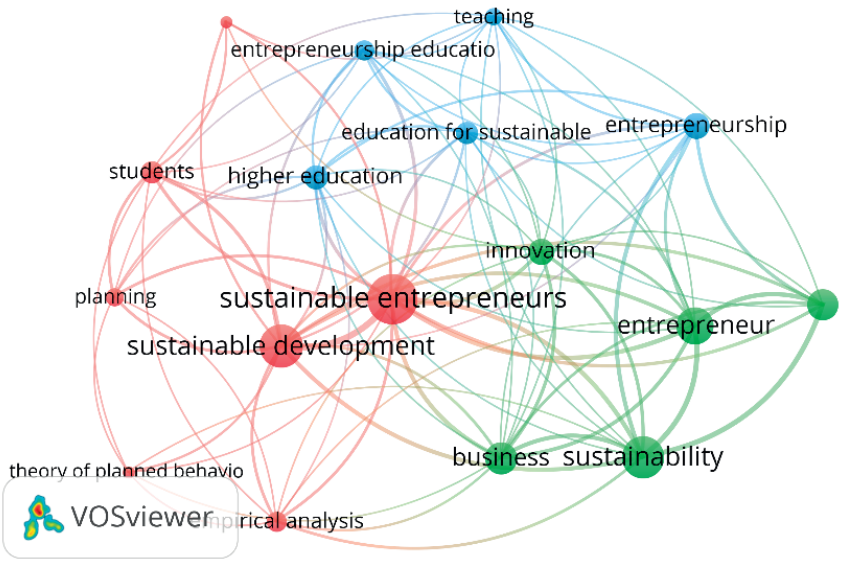


Figure 2. Trends in sustainable entrepreneurship.

Co-authorship has been studied to investigate the structure of scientific collaborations (Liu et al., 2005); in this particular case, we considered the analysis between countries to determine possible collaboration networks between the different countries researched in this field. Following the limited number of articles, Figure 3 shows the likely research groups working in this area, forming four clusters since a minimum of two papers are considered to generate the link.

Figure 3. Collaborative networks between countries.

On the other hand, Figure 4 uses citation to identify the intellectual structure of scientific disciplines, which is given when two items are cited (Patricio & Mario, 2015). For the present study, all the documents in the database with at least ten citations were considered, with Lans, Blok, Ploum, and Omta being the most representative.

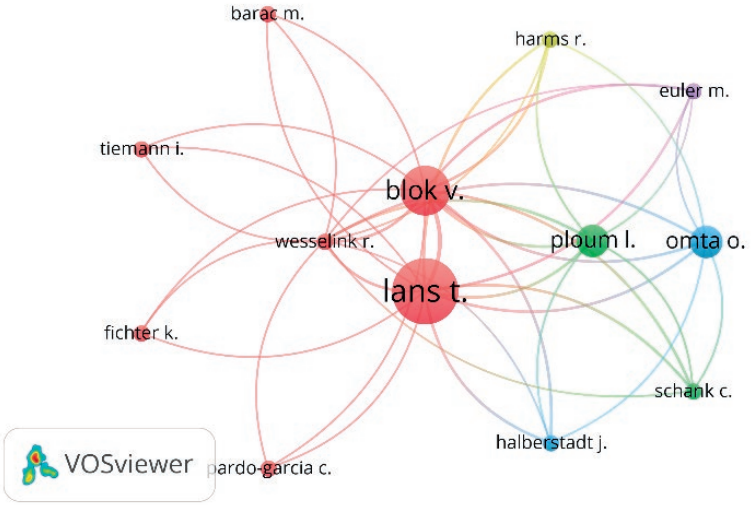


Figure 4. Most cited authors.

Finally, following the objective of this research, a temporal analysis is presented, segmented into three time periods, considering as milestones the signing of Agenda 2030 and the pandemic caused by Covid-19.

A. Timeframe: 2006-2014

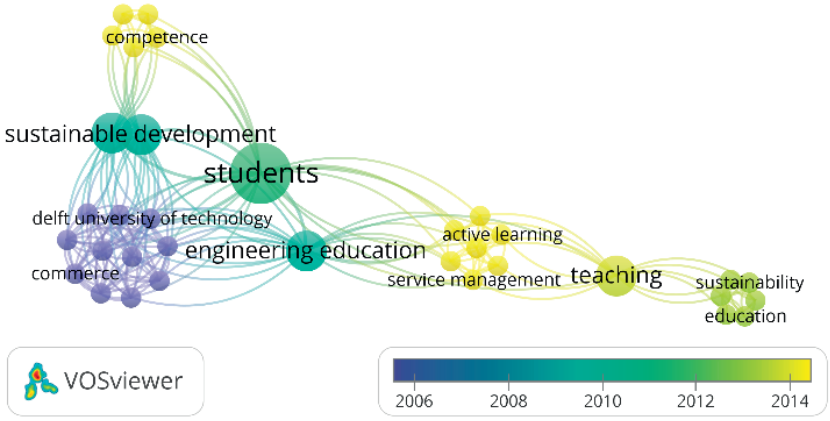


Figure 5. Temporal Analysis from 2006 to 2014.

In this period, students are relevant in identifying a trend in education in sustainable entrepreneurship (SE), but they are primarily focused on sustainable development and engineering education. Education for sustainability is an emerging trend that appears in this period. Its evolution is clearly defined since it can be observed that in 2006 SE studies in education were based on economic-commercial and social aspects (purple nodes). Subsequently, studies focused on higher education institutions in engineering careers (light blue nodes), and as a new trend (in yellow), we find teaching-learning methodologies and entrepreneurship education.

The research that stands out in these topics is (Lans et al., 2014) and (Bonnet et al., 2006).

B. Timeframe: 2015-2019

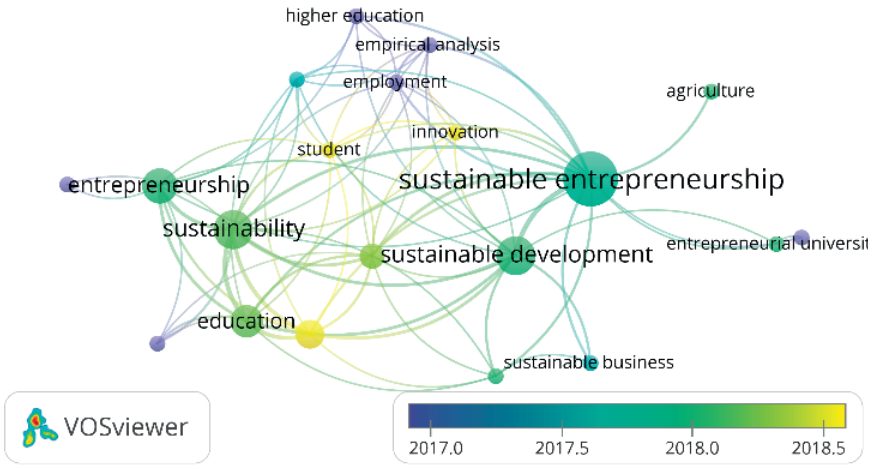


Figure 6. Temporal Analysis from 2015 to 2019.

In the second time frame, we can already consider new interactions in the educational SE field of action. Human resources, innovation, and the United Nations are terms that begin to be studied. However, since we do not have a defined item as in the previous period, trends have stabilized in items "students" and "higher education." On the other hand, new emerging trends appeared, such as "agriculture" and the "entrepreneurial university." Finally, shown in Figure 6, the evolution of this period marks a change from the fields related to higher education and sustainable development as a sequence of studies of the previous timeframe towards studies focused on entrepreneurship and innovation.

Relevant research in this cluster in this cluster are: (Anderson et al., 2017; Fichter & Tiemann, 2018; Halberstadt et al., 2019; Hosseininia & Ramezani, 2016; Kucharčíková et al., 2018; Ploum et al., 2018)

C. Timeframe: 2020-2021

These years are marked by the pandemic caused by Covid-19, which affected all fields of study. Although the time is short considering the rest of the time frames, a considerable increase in the number of papers can be noted, taking into account that the time elapsed is only one and a half years for publications.

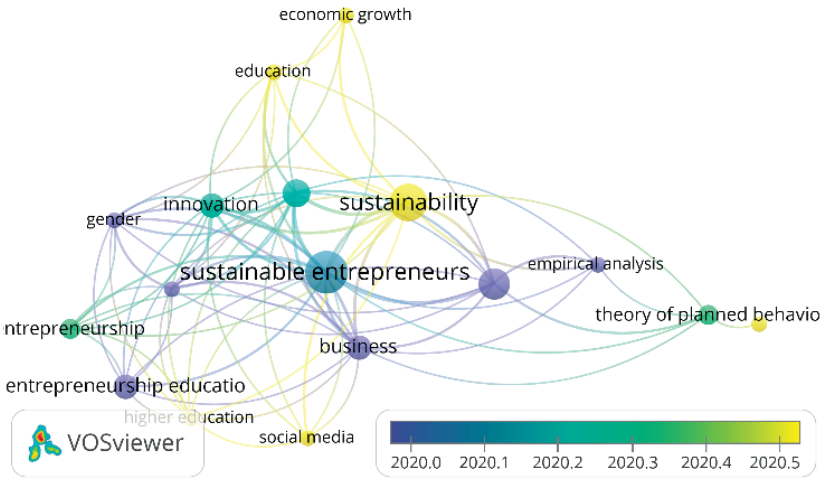


Figure 7. Temporal Analysis from 2020 to 2021.

However, unlike other years, sustainable entrepreneurship has evolved towards topics that were not previously referenced, such as social media, gender, and economic growth, which we can attribute to the pandemic. Also, the change in the map shows the existing centrality between the clusters that have traditionally remained. Nodes such as sustainable entrepreneurship, empirical analysis, business, entrepreneurship education, and higher education, with their respective links, are shown in Figure 7.

In this time frame, the following studies are important: (Butkouskaya et al., 2020; Pardo-Garcia & Barac, 2020; Sher et al., 2020).

5. RESEARCH LIMITATIONS AND IMPLICATIONS

The limitations of this study are the use of just one database. While it is a robust database, it merely represents a part of the scientific production on the topic. Additionally, it only considers articles in English, so publications in other languages are not considered.

On the other hand, the limited number of articles does not allow for an exhaustive search of related terms, implying more accurate processing in relation to word co-occurrence.

Future research can include all documents from another database and other languages to better understand which of them are crucial to sustainable entrepreneurship research development. Furthermore, having a compressive state of the art of sustainable entrepreneurship in education can lead to the development of a model in which educators could achieve SDGs and create a real opportunity to build back better economies considering social, environmental, and economic insights.

6. PRACTICAL IMPLICATIONS

Having a clearer understanding of how academia could help reach SDGs and reconsidering how we prepare students may also help us review what we want HEIs or other educational institutions to do and be in the 21st century.

7. VALUE OF THE PAPER

The lack of published papers in this multidisciplinary field indicates a knowledge gap that still needs to be investigated. There are reviews of literature regarding sustainable entrepreneurship. Still, it is only limited to the economic and business sphere, leaving aside education, which is essential for the growth of a society.

The goals of the 2030 Agenda are set, and COVID-19 has generated profound changes in all areas of knowledge. It is crucial to make fundamental reconsiderations to create resilient and profitable economies in accordance with the natural and social resources available. Educational institutions, having an essential role in the generation of knowledge, are the best suited to start integrating these fields in people's minds and achieve long-term generational changes.

This study can contribute to future work in entrepreneurship, business administration, education, and sustainable development as there are several studies of each field but very few in this multidisciplinary field. On the other hand, this research is highly valued by policymakers, authorities, and academic entities. This information sets a precedent for the later construction of programs and policies for preparing and maintaining high-quality education, including sustainable entrepreneurship.

CONFLICT OF INTERESTS

The authors declare no conflict of interest

REFERENCES

Anand, A., Argade, P., Barkemeyer, R., & Salignac, F. (2021). Trends and patterns in sustainable entrepreneurship research: A bibliometric review and research agenda. *Journal of Business Venturing*, *36*(3), 106092. https://doi.org/10.1016/j.jbusvent.2021.106092

Anderson, A., Loomba, P., Orajaka, I., Numfor, J., Saha, S., Janko, S., Johnson, N., Podmore, R., & Larsen, R. (2017). Empowering smart communities: Electrification, education, and sustainable entrepreneurship in IEEE Smart Village Initiatives. *IEEE Electrification Magazine*, *5*(2), 6–16. https://doi.org/10.1109/MELE.2017.2685738

Aravossis, K. G. (2004). Sustainable development and its impact on entrepreneurship and investments. *Waste Management and the Environment II*.

Bonnet, H., Quist, J., Hoogwater, D., Spaans, J., & Wehrmann, C. (2006). Teaching sustainable entrepreneurship to engineering students: the case of Delft University of Technology. *European Journal of Engineering Education*, *31*(2), 155–167. https://doi.org/10.1080/03043790600566979

Butkouskaya, V., Romagosa, F., & Noguera, M. (2020). Obstacles to sustainable entrepreneurship amongst tourism students: A gender comparison. *Sustainability (Switzerland)*, *12*(5), 1–15. https://doi.org/10.3390/SU12051812

Cabeza Ramírez, L. J., Sánchez-Cañizares, S. M., & Fuentes-García, F. J. (n.d.). *Past Themes and Tracking Research Trends in Entrepreneurship: A Co-Word, Cites and Usage Count Analysis*. https://doi.org/10.3390/su11113121

Cohen, B., & Winn, M. I. (2007). Market imperfections, opportunity and sustainable entrepreneurship. *Journal of Business Venturing*, *22*(1), 29–49.

Dean, T. J., & McMullen, J. S. (2007). Toward a theory of sustainable entrepreneurship: reducing environmental degradation through entrepreneurial action. *Journal of Business Venturing*, *22*(1), 50–76.

Decker, R., Haltiwanger, J., Jarmin, R., & Miranda, J. (2014). The role of entrepreneurship in us job creation and economic dynamism. In *Journal of Economic Perspectives* (Vol. 28, Issue 3). https://doi.org/10.1257/jep.28.3.3

Fichter, K., & Tiemann, I. (2018). Factors influencing university support for sustainable entrepreneurship: Insights from explorative case studies. *Journal of Cleaner Production*, *175*, 512–524. https://doi.org/10.1016/J.JCLEPRO.2017.12.031

Galvez, C. (2018). Co-word analysis applied to highly cited papers in Library and Information Science (2007-2017). In *Transinformacao* (Vol. 30, Issue 3, pp. 277–286). Pontifícia Universidade Católica de Campinas. https://doi.org/10.1590/2318-08892018000300001

Garfield, E. (1994). Scientography: Mapping the Tracks of Science. *Current Contents: Social & Behavioural Sciences*.

González-Pernía, J. L., Jung, A., & Peña, I. (2015). Innovation-driven entrepreneurship in developing economies. *Entrepreneurship and Regional Development*, *27*(9–10), 555–573. https://doi.org/10.1080/08985626.2015.1075602

Halberstadt, J., Schank, C., Euler, M., & Harms, R. (2019). Learning sustainability entrepreneurship by doing: Providing a lecturer-oriented service learning framework. *Sustainability (Switzerland)*, *11*(5). https://doi.org/10.3390/SU11051217

Hall, J. K., Daneke, G. A., & Lenox, M. J. (2010). Sustainable development and entrepreneurship: Past contributions and future directions. *Journal of Business Venturing*, *25*(5), 439–448. https://doi.org/10.1016/J.JBUSVENT.2010.01.002

Haltiwanger, J., Jarmin, R. S., & Miranda, J. (2013). Who creates jobs? Small versus large versus young. In *Review of Economics and Statistics* (Vol. 95, Issue 2). https://doi.org/10.1162/REST_a_00288

Hanaoka, C., Shigeoka, H., & Watanabe, Y. (2018). Do risk preferences change? Evidence from the Great East Japan Earthquake. *American Economic Journal: Applied Economics*, *10*(2), 298–330. https://doi.org/10.1257/app.20170048

Hockerts, K., & Wüstenhagen, R. (2010). Greening Goliaths versus emerging Davids - Theorizing about the role of incumbents and new entrants in sustainable entrepreneurship. *Journal of Business Venturing*, *25*(5), 481–492. https://doi.org/10.1016/J.JBUSVENT.2009.07.005

Hosseininia, G., & Ramezani, A. (2016). Factors influencing sustainable entrepreneurship in small and medium-sized enterprises in Iran: A case study of food industry. *Sustainability (Switzerland)*, *8*(10). https://doi.org/10.3390/SU8101010

Huertas González-Serrano, M., Sanz, V. A., & Jacobo González-García, R. (n.d.). *Sustainable Sport Entrepreneurship and Innovation: A Bibliometric Analysis of This Emerging Field of Research*. https://doi.org/10.3390/su12125209

Iqbal, J., & Kousar, S. (2019). Sustainopreneurship: A new world order. In *Handbook of Research on Managerial Practices and Disruptive Innovation in Asia*. https://doi.org/10.4018/978-1-7998-0357-7.ch018

Keijzers, G. (2002). The transition to the sustainable enterprise. In *Journal of Cleaner Production* (Vol. 10). www.cleanerproduction.net

Klewitz, J., & Hansen, E. G. (2014). Sustainability-oriented innovation of SMEs: A systematic review. *Journal of Cleaner Production*, *65*, 57–75. https://doi.org/10.1016/J.JCLEPRO.2013.07.017

Kucharčíková, A., Mičiak, M., & Hitka, M. (2018). Evaluating the effectiveness of investment in human capital in e-business enterprise in the context of sustainability. *Sustainability (Switzerland)*, *10*(9). https://doi.org/10.3390/SU10093211

Kuckertz, A., & Wagner, M. (2010). The influence of sustainability orientation on entrepreneurial intentions - Investigating the role of business experience. *Journal of Business Venturing*, *25*(5), 524–539. https://doi.org/10.1016/J.JBUSVENT.2009.09.001

Lans, T., Blok, V., & Wesselink, R. (2014). Learning apart and together: Towards an integrated competence framework for sustainable entrepreneurship in higher education. *Journal of Cleaner Production*, *62*, 37–47. https://doi.org/10.1016/J.JCLEPRO.2013.03.036

Liu, X., Bollen, J., Nelson, M. L., & Van De Sompel, H. (2005). *Co-Authorship Networks in the Digital Library Research Community*.

Moya-Clemente, I., Ribes-Giner, G., & Chaves-Vargas, J. C. (2021). Sustainable entrepreneurship: An approach from bibliometric analysis. *Journal of Business Economics and Management*, *22*(2), 297–319. https://doi.org/10.3846/jbem.2021.13934

Muñoz, P., & Cohen, B. (2018). Entrepreneurial Narratives in Sustainable Venturing: Beyond People, Profit, and Planet. *Journal of Small Business Management*, *56*. https://doi.org/10.1111/jsbm.12395

Pacheco, D. F., Dean, T. J., & Payne, D. S. (2010). Escaping the green prison: Entrepreneurship and the creation of opportunities for sustainable development. *Journal of Business Venturing*, *25*(5), 464–480. https://doi.org/10.1016/J.JBUSVENT.2009.07.006

Pardo-Garcia, C., & Barac, M. (2020). Promoting employability in higher education: A case study on boosting entrepreneurship skills. *Sustainability (Switzerland)*, *12*(10). https://doi.org/10.3390/SU12104004

Patricio, Á.-M., & Mario, P.-M. (2015). Análisis de la producción y de la visibilidad científica de Ecuador en el contexto andino (2000-2013). *El Profesional de La Información*, *24*(5), 577–586. https://doi.org/10.3145/epi.2015.sep.07

Ploum, L., Blok, V., Lans, T., & Omta, O. (2018). Toward a Validated Competence Framework for Sustainable Entrepreneurship. *Organization and Environment*, *31*(2), 113–132. https://doi.org/10.1177/1086026617697039

Robledo-Fernández, J. C., Del Río-Cortina, J. L., & Rodríguez-Arias, C. A. (2020). La Estrategia: Un Análisis de su Evolución desde la Cienciometría. *Saber, Ciencia y Libertad*, *15*(2). https://doi.org/10.18041/2382-3240/saber.2020v15n2.6722

Santillán Salgado, R. J., Domínguez, E. G., & Perales, N. A. H. (2015). El perfil del emprendedor que apoyan los fondos de capital privado/capital emprendedor en México. *Contaduria y Administracion*, *60*, 149–174. https://doi.org/10.1016/j.cya.2015.08.011

Sarango-Lalangui, P., Lucia, J., Santos, S., & Hormiga, E. (n.d.). *The Development of Sustainable Entrepreneurship Research Field*. https://doi.org/10.3390/su10062005

Schaefer, K., Corner, P. D., & Kearins, K. (2015). Social, Environmental and Sustainable Entrepreneurship Research: What Is Needed for Sustainability-as-Flourishing? *Organization and Environment*, *28*(4). https://doi.org/10.1177/1086026615621111

Schaltegger, S., & Wagner, M. (2011). Sustainable entrepreneurship and sustainability innovation: categories and interactions. *Business Strategy and the Environment*, *20*(4), 222–237.

Schaltegger, Stefan, Hansen, E. G., & Lüdeke-Freund, F. (2016). Business Models for Sustainability: Origins, Present Research, and Future Avenues. *Organization and Environment*, *29*(1), 3–10. https://doi.org/10.1177/1086026615599806

Shepherd, D. A., & Patzelt, H. (2011). The New Field of Sustainable Entrepreneurship: Studying Entrepreneurial Action Linking "What Is to Be Sustained" With "What Is to Be Developed." *Entrepreneurship: Theory and Practice*, *35*(1), 137–163. https://doi.org/10.1111/J.1540-6520.2010.00426.X

Shepherd, D. A., & Williams, T. A. (2019). Spontaneous Venturing. In *Spontaneous Venturing* (Issue January 2020). https://doi.org/10.7551/mitpress/11470.001.0001

Sher, A., Abbas, A., Mazhar, S., & Lin, G. (2020). Fostering sustainable ventures: Drivers of sustainable start-up intentions among aspiring university students in Pakistan. *Journal of Cleaner Production*, *262*. https://doi.org/10.1016/J.JCLEPRO.2020.121269

Song, R., Xu, H., & Cai, L. (2009). *A Multilevel Collaboration Network Analysis*. https://doi.org/10.3390/su11195172

Terán-Yépez, E., Marín-Carrillo, G. M., Casado-Belmonte, M. del P., & Capobianco-Uriarte, M. de las M. (2020). Sustainable entrepreneurship: Review of its evolution and new trends. *Journal of Cleaner Production*, *252*. https://doi.org/10.1016/j.jclepro.2019.119742

Thananusak, T. (n.d.). *Science Mapping of the Knowledge Base on Sustainable Entrepreneurship, 1996-2019*. https://doi.org/10.3390/su11133565

World Commission on Environment and Development. (1987). Report of the World Commission on Environment and Development: Our Common Future (The Brundtland Report). *Medicine, Conflict and Survival*, *4*, 300.

Young, W., & Tilley, F. (2006). Can businesses move beyond efficiency? The shift toward effectiveness and equity in the corporate sustainability debate. *Business Strategy and the Environment*, *15*(6), 402–415. https://doi.org/10.1002/BSE.510

Zamora-Boza, C. S. (2018). La importancia del emprendimiento en la economía: El caso de Ecuador. *Espacios*, *39*(7).

BMT21
3rd International Conference
Business Meets Technology.
Valencia, 23rd & 24th September 2021

GENDER EQUALITY IN IBEX 35

Fontoba-Jordá, Mariola [a]; Herrero-Blasco, Aurelio [b1] and Perello-Marín, M. Rosario [b2]

[a] *Universitat Politècnica de València. Dept. Organizacion de Empresas. Spain. (mariolafontoba2@gmail.com)*
[b] *Associate Professor. Universitat Politècnica de València. Dept. Organizacion de Empresas. Spain. ([b1] rperell@upvnet.upv.es, [b2] aurelio.herrero@doe.upv.es)*

ABSTRACT: Gender equality is a debate that is becoming more and more integrated into everyday life, both politically, economically and socially. This paper analyses the situation of gender equality in 10 Spanish listed companies in IBEX 35, the Spanish stock market index par excellence. Specifically, 10 companies from different sectors were chosen in order to find out, firstly, whether there are differences in behaviour between industries within their organisations in this area. Secondly, various common indicators are proposed to be sought in the non-financial reports of the companies, in order to subsequently compare the transparency of data and the way in which they are communicated offered by each of the selected corporations.

KEY WORDS: *Gender equality; Female leadership; Glass ceiling; Salary gap; IBEX 35.*

1. INTRODUCTION AND PURPOSE

The aim of this paper is to analyse the current situation of gender equality at the workplace in IBEX 35 companies. Specifically, the analysis consists of identifying and analysing common elements declared through the non-financial reports from 10 listed companies from different business sectors. All the elements come from public reports. The objective of this piece of research is to find out whether there is gender parity in management, if men and women have equal employment opportunities, and how the selected companies report on these issues within their reports.

Companies which were selected according to the criterion of diversification of the sector of activity are shown in Table 1.

Table 1. Companies chosen for analysis.

Acciona	Banco Santander	Inditex	Iberdrola	Telefónica
Pharmamar	Aena	Siemens Gamesa	Mapfre	Cie Automotive

How to cite: Fontoba-Jordá, M., Herrero-Blasco, A., and Perello-Marín, M. R. 2021. Gender Equality in IBEX 35. In Proc.: *3rd International Conference Business Meets Technology*. Valencia, 23rd & 24th September 2021. 111-118. https://doi.org/10.4995/BMT2021.2021.13699

2. LITERATURE REVIEW

The composition of corporate governance bodies has been a much-studied issue in recent years, showing that, globally, men predominate in the top positions of the most influential companies, with women being under-represented. However, many countries in Europe have followed the example of Norway, where a rule came into force in 2008 that the boards of directors of listed companies should have approximately 40% of the under-represented sex (Kirsch, 2018).

As for the Spanish situation, specifically in the main benchmark index known as the IBEX 35, a different reality is obtained, with no penalties for companies that do not reach 40% female representation (De Amicis, Bennouri, & Falconieri, 2020). The IBEX 35 revises its composition every 6 months, thus integrating the most traded companies in the secondary market, being the most representative and significant ones in the Spanish economy.

As listed companies, they publish their annual accounts and reports in a fully public manner, being influenced by the rules of both the Government and the CNMV, the supervisory body of the index.

Among the regulations issued by the Government, it is worth highlighting the existence of Law 11/2018 on non-financial information, which obliges them to declare the total number of employees by sex, type of contract, average remuneration and evolution by gender, in addition to reporting on the existing wage gap in the organisation and other non-financial matters (Ley 11/2018 de 29 de diciembre).

In terms of how the Spanish labour market is governed, it is worth noting that it is a country in which women were late to enter the labour market. In addition, they have mostly been employed in part-time jobs in order to be able to reconcile their working life with tasks such as caring for the family, domestic chores and other burdens that women have historically had to bear (Campos García, 2021).

There are various studies on the composition of company boards, where three levels of influences are differentiated: macro, medium and micro level. For the macro level, it is defined that the inclusion of women in this category depends on institutional, normative and cultural factors. At the medium level, the behaviour of the organisation itself and the type of industry concerned are analysed. Finally, a micro category highlights the importance of how board appointments are made, influenced by both social factors and corporate culture (Kirsch, 2018).

Closely related to the glass ceiling is the term pay gap, defined as the average difference between the gross hourly earnings of men and women (Comisión Europea, 2020). To clarify its definition, the CEOE states that there are two categories of gap: adjusted and unadjusted. The former takes into account the socio-economic differences between workers, in addition to those related to the job, using a statistical calculation method that makes its results more reliable. On the other hand, the so-called gross, or unadjusted, measures the average wage differential without taking into account the

above-mentioned variables, and therefore without being calculated using statistical methods (CEOE, PWC, 2019). The most frequently used methodology is the Oaxaca-Blinder methodology, which assumes that the gender pay structures are a priori different, thus stating the need to estimate two separate models by gender (Santero Sánchez, Castro Núñez, Vega Catena, & Gómez Gómez, 2016).

3. METHODOLOGY

The methodology used in this project is qualitative, taking into account a literature review and a case study with specific companies. The approach used to achieve the proposed objective consists of looking for a series of key elements in the various public sustainability reports of the 10 selected companies in order to conclude which is the most transparent in this area. In this way, Table 2 proposes the content to look for in each public report provided by the companies analysed.

Table 2. Key indicators.

Pay Gap percentage	Method of calculating the Pay Gap	Representation of women in leadership positions	Average remuneration by category and gender
Actions that encourage gender equality	Goals related to gender equality within the company	Other data of interest	Additional data: net turnover

4. FINDINGS

Following the stipulated methodology, key information is extracted from each non-financial report published in 2019 by each company. Table 3 is included in the annexes related to the information in this section as a summary.

Firstly, the only corporations that differentiate between adjusted and gross pay gap are Telefónica, Banco Santander and Mapfre, including the method of calculating their adjusted pay gap indicator. The company that reports the largest pay gap is Pharmamar, but there is no record of how it obtained this value or any other additional information. In this section, it is noteworthy that Siemens Gamesa reports a wage gap value above unity, at 114%. The company explains in its report that women are paid more on average than men, due to the fact that they hold positions of greater responsibility. However, there is little female participation in the management, which may lead to erroneous conclusions about the company's diversity and the inclusion of women in its workforce.

Pharmamar, Mapfre and Cie Automotive stand out as the companies with the highest number of female directors. Cie Automotive is traditionally a male-dominated company due to its sector, whereas senior management is almost equally represented by both genders.

Iberdrola and Inditex are the least transparent companies analysed, as they do not provide information on average remuneration broken down by gender and professional category, nor do they mention the method used to calculate the wage gap, and in fact Iberdrola does not even provide specific data on this matter. In addition, there are companies such as Cie Automotive and Pharmamar that do not provide additional information on activities carried out to promote gender equality or other useful aspects in this area.

On the other hand, the company that provides the most information is Telefónica, as it specifies its calculation method and all the other components studied. Mapfre and Banco Santander are not far behind, since they differ from the rest of the companies that do not state how the percentage of the pay gap indicated is obtained, hindering the proposed analysis.

With regard to proposed targets for female representation, most companies aim to achieve 30% of women in senior positions in the short term, while others do not even make a statement on this issue.

The net turnover figure has been included in order to make a comparison not only at the level of sustainability reports, but also in terms of revenues obtained, degree of transparency and good practices in terms of diversity and gender equality. Specifically, Banco Santander and Telefónica are the entities which obtain the most revenue from sales/services, and which, furthermore, have also been classified as the most transparent and complete in this area. However, Inditex is the third group with the highest profits, and provides hardly any information in comparison with its aforementioned peers.

In short, it is difficult to make a global comparison of the companies proposed, as each one reports different data or is not transparent about the calculation method used to obtain the pay gap. However, it is notable that Telefónica is the organisation with the most comprehensive report on gender equality in its workforce.

5. CONCLUSIONS

As has been verified, and in response to the objectives set out, it can be concluded that there is no gender equality in the IBEX 35. Firstly, it is observable that in the management bodies, women represent on average 23,61%, compared to 76,39% of male managers. This fact allows us to reflect on the opportunities enjoyed by both genders in the world of work, where the existence of the glass ceiling and the wage gap are highlighted. Furthermore, the wage gap declared by companies remarks the fact that there is a pay problem in organisations, and an exhaustive scientific and statistical analysis of this issue is necessary in order to discover its possible causes and solutions.

With regard to the transparency of the listed companies, it should be noted that only 3 of the 10 companies selected report the method for calculating the wage gap, providing greater reliability regarding the rest of the elements declared and their veracity. Furthermore, not all of them include additional elements to the minimums proposed

by Law 11/2018, once again hindering exhaustive analyses of the internal and external actions of these companies in terms of equality and diversity. Additionally, based on the findings of the analysis, it does not appear a priori that there are differences in diversity behaviour explained by the business sector concerned.

In conclusion, these data show that the talents of half of the population, represented by women, are being wasted. For a full, fair and developed economy, it is desirable to harness diversity and ensure equal opportunities, and that this is reflected in the country's leading multinationals, as they are a further indicator of a nation's level of development, not only economically, but also in terms of their acts of corporate social responsibility. It is also vital to take into consideration the expectations of stakeholders and the way modern business operates, which are increasingly in favour of social causes and demand greater corporate involvement in corporate social responsibility acts, backed up by facts and not just promises that help to wash the face of companies.

6. RESEARCH LIMITATIONS/IMPLICATIONS

Due to the limited scope of the project, it has only been possible to analyse 10 of the 35 companies that make up the Spanish stock market index in question. It would be interesting to be able to carry out a global comparison of all the companies that make up the IBEX 35, as well as to update it after the consequences of the global pandemic, COVID-19.

In addition, the selected companies do not use homogeneous methods in their pay gap calculations, making it difficult to reliably compare the results and conclude which company is the most committed to gender equality. Moreover, most of them do not even mention how they obtain this percentage, further obscuring the transparency analysis.

REFERENCES

Campos García, I. (2021). The COVID-19 Scenario in Terms of Gender: A Preliminary. *Sustainability*. Recuperado el 17 de julio de 2021

CEOE, PWC. (2019). *Análisis de la brecha salarial de género en España.* Recuperado el 17 de julio de 2021, de https://www.pwc.es/es/publicaciones/diversidad/analisis-brecha-salarial-genero-espana-ceos-pwc.pdf

Comisión Europea. (13 de enero de 2020). *Comprender la brecha salarial de género: definición y causas.* Recuperado el 17 de julio de 2021, de Noticias Parlamento Europeo: https://www.europarl.europa.eu/news/es/headlines/society/20200109STO69925/comprender-la-brecha-salarial-de-genero-definicion-y-causas

Comisión Nacional del Mercado de Valores. (2020). *Código de buen gobierno de las sociedades cotizadas.* Recuperado el 17 de junio de 2021, de http://www.cnmv.es/DocPortal/Publicaciones/CodigoGov/CBG_2020.pdf

De Amicis, C., Bennouri, M., & Falconieri, S. (2020). Welcome on board: A note on gender quotas regulation in Europe. *Economics Letters*. Recuperado el 18 de junio de 2021.

Kirsch, A. (2018). The gender composition of corporate boards: A review and research agenda. *The Leadership Quartely*, 346-364. Recuperado el 17 de junio de 2021

Santero Sánchez, R., Castro Núñez, B., Vega Catena, P., & Gómez Gómez, N. (2016). Participación femenina en puestos directivos y desigualdad salarial. Un análisis en el mercado laboral español. *Estudios de Economía Aplicada*. Recuperado el 17 de julio de 2021, de https://www.redalyc.org/pdf/301/30143731008.pdf

LEGAL REFERENCES

España. Ley 11/2018, de 28 de diciembre, por la que se modifica el Código de Comercio, el texto refundido de la Ley de Sociedades de Capital aprobado por el Real Decreto Legislativo 1/2010, de 2 de julio, y la Ley 22/2015, de 20 de julio, de Auditoría de Cuentas, en materia de información no financiera y diversidad. Boletín Oficial del Estado, 29 de diciembre de 2018, núm. 314, pp. 129833 a 129854. Recuperado el 17 de julio de 2020 de https://www.boe.es/eli/es/l/2018/12/28/11

ANNEXES

Table 3. Comparison of key indicators in each company.

	Pay Gap percentage	Method of calculating the Pay Gap	Representation of women in leadership positions	Average remuneration by category and gender	Actions that encourage gender equality	Goals related to gender equality within the company	Other data of interest	Additional data: net turnover
ACCIONA 2019	5% overall.	Neither the method nor the concepts taken into account are indicated.	Management team: 15.25%. Board of Directors 27.3%.	No data for female managers under 31, although there is data for males.	1. Global Diversity Management and Diversity Committees. 2. Management Development Programme for Women of High Potential.	By 2020: increase the presence of women in leadership and management positions to 23%.	In the top 25 of the Refinitiv Diversity & Inclusion Index.	7,190,589 thousand euros.
B. SANTANDER 2019	2% overall.	Comparison between salaries of men and women with the same job, level and function.	Management team: 23%. Board of Directors 40%.	Includes individual remuneration of directors, but not on a comparative level by gender.	Signatories to the UN Women's Empowerment Principles.	By 2025: 30% representation of women in senior positions and 0% pay gap.	Difference between "gender pay equity" (2%) and "pay gap" (31%). Bloomberg Gender-Equality Index leader for three consecutive years.	56.785.000 thousand euros.
INDITEX 2019	0,2% overall.	Neither the method nor the salary concepts applied are indicated.	Not found.	Not found.	Salta Project. Position of "Chief Diversity Officer. Collaboration agreement to raise awareness of gender-based violence.	No information provided as they report no wage gap.	Inclusion in Bloomberg Gender Equality Index 2019.	28.286.000 thousand euros.
IBERDROLA 2019	Not specifically found. They talk about 100% equal pay.	Neither the method nor the wage items applied are indicated.	Management team: 20%. Board of Directors: 43%.	Not found.	Adherence to the Women's Empowerment Principles (of the UN). Promotion of women's sport "Universo Mujer Programme".	No information provided as they report 100% equal pay.	Inclusion in Bloomberg Gender Equality Index 2019.	4,566,641 thousand euros.
TELEFÓNICA 2019	Adjusted: 3.1% overall. Gross: 19.1% overall	Indicated. Mathematical regression model for the adjusted gap. In consideration: total annualised base salary, variable incentives, salary in specie and long-term incentives.	Management team: 26%. Board of Directors: 30%.	Found by gender, age and position.	Global Diversity and Inclusion Policy 2017. Programmes to promote opportunities for young women, such as Inspiring Girls.	30% of women managers by 2020. Promoting programmes that contribute to the reduction of the gender digital divide.	Inclusion in the Bloomberg Gender Equality Index 2019, and for 3 consecutive years.	48,422,000 thousand euros

	Pay Gap percentage	Method of calculating the Pay Gap	Representation of women in leadership positions	Average remuneration by category and gender	Actions that encourage gender equality	Goals related to gender equality within the company	Other data of interest	Additional data: net turnover
PHARMA MAR 2019	22% overall.	Neither the method nor the wage items applied are indicated.	Management team: 43%. Board of Directors: 27.3%.	Found by gender and job title.	Not found.	Not found.	Not found.	85.819 thousand euros.
AENA 2019	12% in Senior Management, no other is specified for the overall staffing level.	Neither the method nor the wage items applied are indicated.	Management team: 22.82%.Board of directors: 26.67%.	Found by job title, not gender.	Project "Women fly high" and "Women in Transport". Paid parental leave policies.	30% women on the board by 2020.	Equality Plan supervised by the Joint Committee. Protocol for responding to situations of sexual harassment.	4,443.560 thousand euros.
SIEMENS GAMESA 2019	They report 114%. Women are paid more than men.	Takes into consideration the basic and variable salary, no further information is given.	Management team: 16%. Board of Directors: 23%.	Found by gender, age and job title.	Promoting women in technology and robotics through the programme "Robots for girls too".	30% of women managers by 2020. Promoting programmes that contribute to the reduction of the gender digital divide.	Not found.	10.277.879 thousand euros.
MAPFRE 2019	3,06% overall.	Indicated. Distinction between gross and adjusted pay gap. The adjusted one takes into account professional	Management team: 30%. Board of Directors: 33%.	Found by gender, age and job title.	Participation in Target Gender Equality.	45% women in positions of responsibility, not explicitly in managerial positions.	Not found.	5.188.028 thousand euros.
CIE AUTOMOTIVE 2019	5% overall.	Comparison between average remuneration for work of equal value between genders.	Management team: 40%. Board of Directors: 15%.	Not found.	2019 Corporate Diversity Plan. Protocol for the prevention of harassment at work.	Not found.	Not found.	3.461.052 thousand euros.

BMT21
3rd International Conference
Business Meets Technology.
Valencia, 23rd & 24th September 2021

EXPLORING SMES CROWDFUNDING SOLUTIONS THAT CAN GENERATE TRUST

De-Miguel-Molina, María [a1]; De-Miguel-Molina, Blanca [a2];
Peiró Signes, Ángel [a3] and Segarra Oña, Marival [a4]

[a] *Universitat Politècnica de València, Camino de Vera s/n, 46022 Valencia, Spain,*
([a1] mademi@omp.upv.es, [a2] bdemigu@omp.upv.es, [a3] anpeisig@omp.upv.es, [a4] maseo@omp.upv.es)

ABSTRACT: *In accordance with the sustainable development goals, it is necessary to increase the access of SMEs to financial services. Crowdfunding has been imposed as an alternative to other traditional financial sources, being an "umbrella" covering the financing of projects and initiatives by various individuals (the crowd) through the Internet. Within the concept, four types are included: Donation, Reward-based, Lending and Equity. The concept of "trust" is a key element in online transactions, reducing the information asymmetries and uncertainty. The generation of trust in crowdfunding can be derived from different components that we will analyze: a) The platform used (and the company that supports it); b) The promoter; c) The quality of the information; d) The investor's disposition and familiarity with the instrument; and e) The network around the promoter and / or the project. In addition, female entrepreneurs generate more trust and would have the opportunity to attract professional local investors (lead investors), through better information on their initiative. That is why, through a content analysis, we will propose the best type and components combination, within the framework of a project based on the SMEs of Bogotá (Colombia).*

KEY WORDS: *Crowdfunding; Trust; SMEs; Digital platforms; Investors.*

1. INTRODUCTION

In accordance with the sustainable development goals, it is necessary to increase the access of SMEs to financial services (SDG 9, Target 9.3) (United Nations, 2015). Specially in some countries, the lack of credit access can led to look for informal solutions with high interests. New solutions, like crowdfunding, can be an alternative for SMEs to obtain credit, but it would be necessary a trustable environment for its success. The generation of trust in crowdfunding can be derived from different components that we will analyze: the platform used (and the company that supports it), the promoter, the quality of the information, the disposition of the investor and his familiarity with the instrument, and the network around the promoter and / or the project.

How to cite: De-Miguel-Molina, M., De-Miguel-Molina, B., Peiró Signes, Á., and Segarra Oña, M. 2021. Exploring SMEs crowdfunding solutions that can generate trust. In Proc.: *3rd International Conference Business Meets Technology*. Valencia, 23rd & 24th September 2021. 119-124. https://doi.org/10.4995/BMT2021.2021.13288

In our case, we will focus on Colombian SMEs. Some of the most used crowdfunding platforms in the country are Indiegogo, Kickstarter, Vaki, La Chèvre, Ideame or Help. Collaborative financing in Colombia has been regulated by Decree 1357 of 2018 (Presidencia de Colombia, 2018). This only includes the collaborative financing of loans and shares, not those of donations and rewards that could operate, but with less legal certainty. Collaborative financing companies for P2P or P2B (equity) had to meet certain requirements, the first being created by the Colombian Stock Exchange itself (www.a2censo.com), which can provide more confidence as it is subjected to limitations and a constant control. However, a revision of the regulations was requested to give it greater flexibility and include other crowdfunding options.

Thus, Decree 1235 of 2020 (Presidency of Colombia, 2020), included several reforms. Among others: a) the possibility of creating a system for registering operations on the securities that have been issued within the platform, allowing investors to register operations on their securities. Additionally, it increases the investment amounts; b) the inclusion of collection services; and, c) the possibility of crowdfunding by donation.

In this work we would explore how the literature has analysed the way the different components of trust can influence crowdfunding to propose a model for Colombian SMEs.

2. BACKGROUND

Informal credit was already a recurring problem in many countries (World Bank, 2020) that has been aggravated by the Covid-19 pandemic (Weller, 2020; OIT & CEPAL, 2020). However, working in the informal sector increases uncertainty and the risk of poverty (CEPAL, 2020), so other more affordable formal alternatives are necessary.

Crowdfunding has been imposed as an alternative to other traditional financial sources, being an "umbrella concept" covering the financing of projects and initiatives by various individuals (the crowd) through the Internet (Gierczak et al., 2015). Within the concept, four types are included (Moysidou & Hausberg, 2020):

- Donation (donation), without reward or symbolic.
- Reward-based, non-pecuniary (prototype) or intangible (experience).
- Loan (lending), in exchange for interest.
- P2P or P2B (equity), through shares or benefits.

For Andrikopoulos (2020), crowdfunding allows supporting social projects of companies and is based on the social relationships between the members of a community and their shared values. In addition, this solution can increase financial inclusion, improving the scope of SDGs 5 and 9, by ensuring access to financial resources for women and microenterprises (United Nations, 2015).

3. METHODOLOGY

In Figure 1 we see how crowdfunding has been studied in the business area from different perspectives, but we will focus on the concept of "trust" which is a key element since it presupposes that the person responsible for this initiative will behave in a certain way. This is especially relevant in online transactions, reducing information asymmetries and uncertainty.

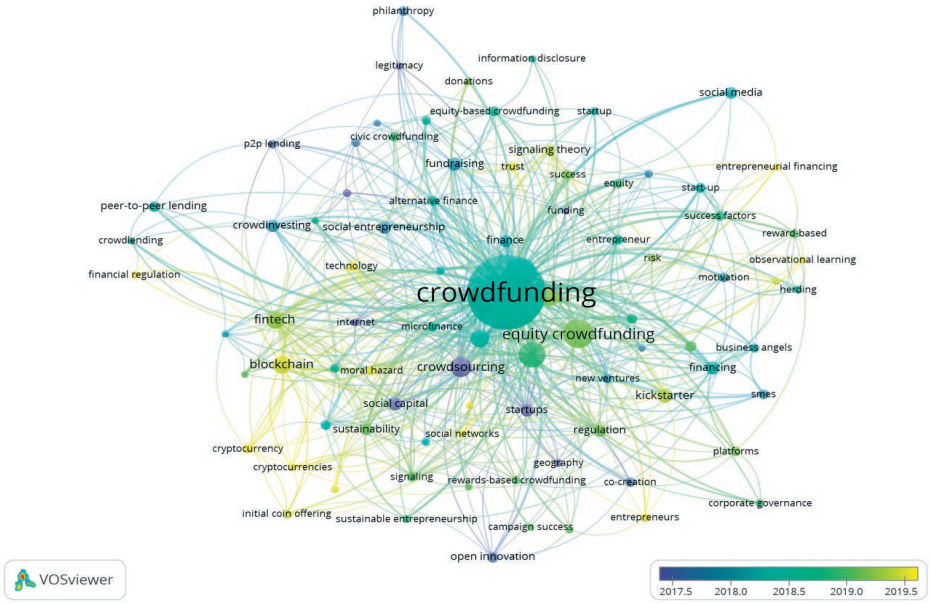


Figure 1. Co-occurrences of "crowdfunding". Own elaboration based on Van Eck and Waltman (2020).

That is why, through a content analysis, we will explore the best type and components combination, within the framework of a project in the downtown area of Bogotá, for a crowdfunding platform that supports informal companies and micro-SMEs.

Findings

In this first analysis, we have explored some literature around the components of trust in crowdfunding: the platform used (and the company that supports it), the promoter, the quality of the information, the disposition of the investor and his familiarity with the instrument, and the network around the promoter and / or the project.

The platform used, it is the key element in generating trust for most authors. For Strohmaier, Zeng and Hafeez (2019), the success of these platforms depends on the

information they provide throughout the process, before, during and after the crowdfunding campaign.

In the case of the promoter, we want to observe the influence of gender in building trust (SDG 5). For Zhao, Xie & Yang (2020), female entrepreneurs generate more confidence and would have the opportunity to attract professional local investors (lead investors), through better information on their initiative. The information that these platforms collect is one of the main elements that give investors security and confidence. This perspective would also help to contribute to gender equality, ensuring the full and effective participation of women and equal opportunities (SDG 5, Target 5.5) (United Nations, 2015).

In relation with the familiarity with crowdfunding, different authors emphasize that familiarity with the instrument favors trust. In this way, having used previously crowdfunding platforms, having sought information about crowdfunding projects and having contributed money in crowdfunding, predispose to having more confidence to contribute money in a crowdfunding (Strohmaier, Zeng & Hafeez, 2019). Gefen (2000), in the case of ecommerce, demonstrated how familiarity with an online seller and the processes that they follow with their clients, influence trust.

Regarding the network around the promoter and / or the project, Cai, Polzin and Stam (2019) pointed out that trust with the promoters makes investors willing to take the risk of investing in the projects, while those who have already sponsored other projects of the same promoter are motivated mainly by the sense of duty to continue supporting the entrepreneur. In other words, we are not talking about isolated projects but about a network that is woven between promoters and investors, also in crowdfunding.

Research limitations/implications

Our first analysis has been an exploration on the components of trust but we need to check if the literature on the topic can be applied in the case of SMEs in Bogotá. The final objective is to provide an alternative that would allow to improve financial inclusion in countries where there is high informality to obtain credit, as is the case in Colombia, so crowdfunding can be an alternative to access to financial resources that encourage greater formality.

4. CONCLUSION

The use of crowdfunding by Colombian SMEs has not been explored before, therefore we want to analyse which could be the best type of crowdfunding for SMEs in the downtown area of Bogotá and how the different components of crowdfunding can contribute to give trust in this case. In Colombia, crowdfunding could be an alternative to improve financial inclusion and encourage greater formality as there is high informality to obtain credit. This contribution could add value not only to the knowledge around crowdfunding but also to the Colombian SMEs that would access to more formal financial resources.

ACKNOWLEDGMENTS

This work is carried out within the framework of the Adsideo Project, "Needs analysis for the design and implementation of a crowdfunding solution that supports informal companies and micro-SMEs in the downtown area of Bogotá (AD2009)", coordinated by Professor Blanca de Miguel.

CONFLICT OF INTERESTS

None

AUTHOR CONTRIBUTION

María de Miguel: Conceptualization; Methodology; Formal analysis; Roles/Writing - original draft; Blanca de Miguel: Data curation; Supervision; Funding acquisition; Project administration; Ángel Peiró: Validation; Writing - review & editing; Marival Segarra: Investigation; Resources.

REFERENCES

Andrikopoulos, A. (2020) Delineating social finance. *International Review of Financial Analysis*, 70, 101519.

Cai, W.; Polzin, F. & Stam, E. (2019). Crowdfunding and Social Capital: A Systematic Literature Review. *Working Paper Series*, *19*(05). Utrecht University of Economics. https://doi.org/10.2139/ssrn.3361748.

CEPAL (2020). *Panorama Fiscal de América Latina y el Caribe, 2020. La política fiscal ante la crisis derivada de la pandemia de la enfermedad por coronavirus (COVID-19)*. LC/PUB.2020/6-P, Naciones Unidas, Santiago.

Gefen, D. (2000). E-commerce: the role of familiarity and trust. *Omega, 28*(6), 725-737.

Gierczak, M.M.; Bretschneider, U.; Haas, P.; Blohm, I.; Leimeister, J.M. (2015). Crowdfunding – Outlining the New Era of Fundraising. En: Gajda, O. & Brüntje, D. (Eds.), *Crowdfunding in Europe – State of The Art in Theory And Practice*; FGF Studies in Small Business and Entrepreneurship (pp. 7-23). Cham: Springer Science y Business Media.

Moysidou, K. & Hausberg, J.P. (2020). In crowdfunding we trust: A trust-building model in lending crowdfunding, *Journal of Small Business Management*, *58*(3), 511-543, https://doi.org/10.1080/00472778.2019.1661682.

OIT & CEPAL (2020). *La pandemia por COVID-19 podría incrementar el trabajo infantil en América Latina y el Caribe*. Nota técnica Nº 1. Accesible en www.ilo.org/americas/publicaciones/WCMS_747653/lang--es/index.htm (consulta junio 2021).

Presidencia de Colombia (2018). *Decreto 1357, de 31 de julio de 2018, por el cual se modifica el Decreto 2555 de 2010 en lo relacionado con la actividad de financiación colaborativa*. Accesible en https://www.portafolio.co/uploads/files/2018/08/01/DECRETO%20CROW.pdf (consulta mayo 2021).

Presidencia de Colombia (2020). *Decreto 1235, de 14 de septiembre de 2020, por el cual se modifica el Decreto 2555 de 2010 en lo relacionado con las reglas para la emisión en el mercado de valores, se reglamenta el artículo 2 del Decreto Legislativo 817 de 2020 y se dictan otras disposiciones*. Accesible en https://dapre.presidencia.gov.co/normativa/normativa/DECRETO%201235%20DEL%2014%20DE%20SEPTIEMBRE%20DE%202020.pdf (consulta mayo 2021).

Strohmaier, D.; Zeng, J.; Hafeez, M. (2019). Trust, distrust, and crowdfunding: A study on perceptions of institutional mechanisms, *Telematics and Informatics*, 43. https://doi.org/10.1016/j.tele.2019.101252.

United Nations (2015). *Sustainable Development Goals*. Accesible en https://www.un.org/sustainabledevelopment/ (consulta mayo 2021).

Van Eck, N.J. & Waltman, L. (2020). *VOSviewer Manual* (version 1.6.14). University of Leiden.

Weller, J. (2020). *La pandemia del COVID-19 y su efecto en las tendencias de los mercados laborales*. Documentos de Proyectos (LC/TS.2020/67), Comisión Económica para América Latina y el Caribe (CEPAL), Santiago.

World Bank (2020) *La economía en los tiempos del Covid-19*. LAC Semiannual Report. World Bank, Washington DC. Accesible en https://openknowledge.worldbank.org/handle/10986/33555 (consulta junio 2021).

Zhao, Y., Xie, X.; Yang, L. (2020). Female entrepreneurs and equity crowdfunding: the consequential roles of lead investors and venture stages. *International Entrepreneurship and Management Journal*. https://doi.org/10.1007/s11365-020-00659-w

BMT21
3rd International Conference
Business Meets Technology.
Valencia, 23rd & 24th September 2021

CULTURAL AND CREATIVE INDUSTRIES

BMT21
3rd International Conference
Business Meets Technology.
Valencia, 23rd & 24th September 2021

LIVE MUSIC, THE NEW, SAFER AND MORE EFFECTIVE PILL ON THE MARKET. A CASE STUDY WITH HEMODIALYSIS PATIENTS IN A HOSPITAL

Serrano Soliva, Miriam[a]; Carrascosa López, Conrado Enrique [b]

[a] *Conservatorio profesional de música. Universitat Politècnica de València. Spain. (miriserrano@hotmail.com)*
[b] *Universitat Politècnica de València. Spain. (concarlo@upvnet.upv.es)*

ABSTRACT: People are more vulnerable to presenting anxiety, depression, nervousness, unfavorable quality of life, when they face situations that can threaten their life. Among these situations we find the disease, medical treatments and surgical interventions as the main ones on the list. When people get sick they endure very big and sudden changes in their lives, income, aggressive treatments, endure physical pain, these changes usually generate an unfavorable mood situation to face the disease, and in most cases worsen the previous clinical situation. Throughout history there has always been an awareness of the positive effects that music produces on people and society. Music is applied in education, in the expression of emotions, and also in the healing of patients and in many other situations. We can say that music and medicine are two closely related disciplines, with music being increasingly used as an adjuvant in different pathologies. The objective of our study was to verify the effect of classical music heard live on patients, in this case kidney patients undergoing hemodialysis (HD), who have listened to live music while receiving treatment at the Manises hospital.

KEY WORDS: *Music therapy; live music; hemodialysis.*

1. INTRODUCTION

Anxiety (A), depression (D), health-related quality of life (HRQL), are concepts that are directly related to people's health. A and D are almost always in the environment of another disease, since the limitations, worries or life changes that it produces are the main triggers. On the other hand, HRQoL is a much broader concept that encompasses several dimensions, physical, mental, and social, and is used to assess the general well-being of patients. The patient with chronic kidney disease (CKD) is frequently diagnosed with anxiety and depression. Both the emotional state that anxiety produces, as well as the multiple disorders that depression entails, can become chronic and lead you to lose the ability to take care of daily tasks and obligations (Palacios, 2014). Generally, they also present a HRQL lower than the reference values of the general population.

How to cite: Serrano Soliva, M., and Carrascosa López, C. E. 2021. Live music, the new, safer and more effective pill on the market. A case study with hemodialysis patients in a hospital. In Proc.: *3rd International Conference Business Meets Technology*. Valencia, 23rd & 24th September 2021. 127-134. https://doi.org/10.4995/BMT2021.2021.13688

There are many works prior to our research where these concepts have been valued in different pathologies, and many of these studies have been carried out through music therapy, where they have shown the great beneficial impact that music has in reducing stress levels, anxiety and depression. (Arias, 2007; Guyton & Hall, 1967; Lamping, 2004; Abram, 1969; De-Nour, 1970; Antoci, 2016; Augé et al., 2015; Firmeza et al., 2017; Serrano & Carrascosa, 2020; Cukor et al., 2008). However, we did not find studies where the application of music was done directly with musicians and live music on kidney patients, our research is based mainly on this fact.

We have evaluated the effect of classical music heard live on anxiety, depression and quality of life in kidney patients undergoing hemodialysis treatment. We also try to provide data and verify whether classical music can reduce the high levels of anxiety and depression that surround this disease as part of the treatment. We also verify whether this direct and "in situ" intervention during hemodialysis treatment has an effect on the quality of life of patients.

2. METHODOLOGY

We conducted the research through a group randomized clinical trial, 90 patients agreed to participate. They were randomized into an intervention group (IG) and a control group (CG). The IG listened to 30/45 minutes of live classical music in two of the three weekly HD sessions for 1 month. The CG followed his usual treatment.

Different individual scales of the kidney disease quality of life test (KDQOL-SF) were analyzed at two time points, baseline (start) and later (end) of the musical intervention in both groups. At the same time, grades A and D were also analyzed before (pre) and after (post) the musical intervention in both groups, using the Hospital Anxiety and Depression (HAD) scale.

The analysis was performed using a mixed linear regression model, with independent variables (age, sex, months in treatment, Kt / v, Hemoglobin (Hb)) and dependent variables (HAD scale score and individual KDQOL-SF scale scores).

Musical intervention

The music application is done live and directly and not through recordings, with sessions of between 30 and 45 min each. There are 4 sessions per week for 1 month. All the participating musicians are professionals, orchestral musicians and conservatory teachers. A great diversity of chamber groups are organized and works from different periods and styles are played, from Bach, Beethoven or Mozart, to current music by groups such as Queen or other famous Spanish groups. It was organized in such a way that all patients could listen to the same groups and the same musical pieces, thus avoiding any bias.

3. RESULTS

120 patients were selected for the study, 92 agreed to participate and the sample was finally reduced to 90, one patient was eliminated due to death and the other due to hospital transfer. The clinical and demographic characteristics of the patients included in this study are specified in Table 1.

Table 1. Clinical and demographic characteristics of the population included in the study.

	CG Group (n = 43)	IG Group (n = 47)
Age (years)		
Average (SD)	75,81 (9,67)	73,53 (10,91)
Median (IQR)	79 (70,5; 83)	75 (67; 81,5)
Sex		
Male n (%)	22 (51,16%)	18 (38,30%)
Female n (%)	21 (48,83%)	29 (61,70%)
Intervention months		
Average (SD)	60,47 (41,10)	63,34 (52,35)
Median (IQR)	49 (30,5; 89)	59 (23; 86)
Kt/v		
Average (SD)	1,54 (0,18)	1,48 (0,38)
Median (IQR)	1,54 (1,45; 1,69)	1,40 (1,30; 1,60)
Serumhemoglobin (g/dl)		
Average (SD)	11,56 (1,05)	11,32 (1,12)
Median (IQR)	11,60 (10,80; 12,15)	11,30 (10,70; 12,15)
Serumalbumi (g/dl)		
Average(SD)	3,87 (0,42)	3,77 (0,43)
Median (IQR)	4 (3,8; 4)	4 (3,6; 4)
Systolic blood pressure (mmHg)		
Average (SD)	133,98 (28,49)	137,34 (20,13)
Median (IQR)	139 (117; 153,5)	140 (122,5; 150)
Diastolic bood pressure (mmHg)		
Average (SD)	56,09 (12,25)	58,70 (12,17)
Median (IQR)	58 (46,5; 64)	57 (49,5; 65)
Type of vascular access		
CVC n (%)	9 (20,93%)	8 (17,02%)
AVF n (%)	34 (79,07%)	39 (82,98%)

CG, control group;IG, intervention group;SD, standard deviation;IQR, interquartile range;AVF, arteriovenous fistula;CVC, central venous catheter.

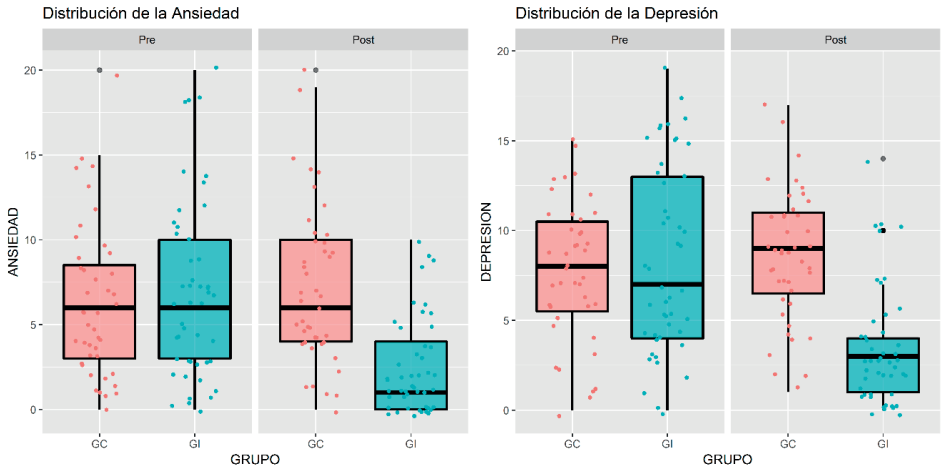
The results of the statistical analysis in terms of HRQoL show that the difference between the time before and after the IG with respect to the CG increased the mean score (pm) significantly in 18 of the 21 scales of the test (Table 2).The results indicate that the control and intervention groups have evolved differently between the two time instants, and that this difference in evolution is significant in 18 scales of the test.

Table 2. ResultsKDQOL-SFscale.

		Mean (SD)			
Variable	Group	Pre-intervention	Post-intervention	Estimation* (CI 95%): Interaction time×group	*p*-value
Symptoms and problems	CG	64,63 (18,27)	63,07 (16,88)	15,78 (10,00 - 21,56)	**<0.001**
	IG	66,31 (17,97)	80,54 (13,09)		
Effects of kidney disease	CG	42,51 (21,05)	39,31 (18,60)	14,96 (9,16 - 20,76)	**<0.001**
	IG	45,88 (24,11)	57,64 (19,10)		
Burdenkidneydisease	CG	29,79 (14,99)	26,59 (15,79)	16,36 (7,76 - 24,96)	**<0.001**
	IG	30,31 (25,60)	43,48 (23,99)		
Employmentsituation	CG	38,37 (21,37)	44,18 (19,54)	-5,81 (-12,20 - 0,57)	0.078
	IG	38,29 (23,80)	38,29 (25,98)		
Cognitivefunction	CG	23,56 (17,83)	24,49 (17,86)	-17,52 (-24,60 - 10,44)	**<0.001**
	IG	25,10 (24,44)	8,51 (10,37)		
Quality of social relationship	CG	16,89 (14,78)	17,36 (14,11)	-14,22 (-20,55 - 7,89)	**<0.001**
	IG	22.69 (23.45)	8,93 (10,42)		
Sexual function	CG	14,53 (28,46)	13,95 (28,50)	7,76 (1,59 - 13,93)	**0.016**
	IG	30,05 (37,37)	37,23 (41,82)		
Quality of sleep	CG	51,80 (22,14)	49,94 (23,32)	21,59 (15,13 - 28,05)	**<0.001**
	IG	50,47 (26,03)	70,21 (22,56)		
Social support	CG	68,21 (18,83)	68,21 (16,98)	4,61 (-2,93 - 12,15)	0.234
	IG	72,69 (27,01)	77,30 (22,90)		
Personal attitude	CG	85,17 (21,34)	84,59 (23,43)	8,29 (1,98 - 14,59)	**0.012**
	IG	79,52 (25,19)	87,23 (17,77)		
Satisfaction	CG	80,23 (20,33)	79,45 (20,52)	4,32 (-0,07 - 8,71)	0.057
	IG	74,82 (23,28)	78,36 (18,03)		
Physicalfunction	CG	29,76 (26,79)	28,25 (27,03)	26,08 (19,32 - 32,84)	**<0.001**
	IG	30,31 (26,23)	54,89 (27,17)		
Physical role	CG	25,00 (40,08)	29,65 (40,18)	46,41 (28,09 - 64,72)	**<0.001**
	IG	26,06 (38,64)	77,12 (39,29)		
Pain	CG	43,60 (34,78)	36,04 (31,49)	41,92 (29,04 - 54,79)	**<0.001**
	IG	42,44 (31,84)	76,80 (30,87)		
General health	CG	33,72 (13,23)	31,86 (13,00)	11,96 (7,14 - 16,78)	**<0.001**
	IG	30,42 (20,79)	40,53 (19,62)		
Emotionalwell-being.	CG	54,60 (23,83)	51,07 (24,36)	29,57 (21,13 - 38,01)	**<0.001**
	IG	53,61 (30,73)	79,66 (20,88)		
Emotional role	CG	70,54 (45,54)	55,81 (47,54)	43,09 (22,92 - 63,26)	**<0.001**
	IG	58,15 (46,86)	86,52 (31,59)		
Social function	CG	61,62 (28,53)	50,87 (28,66)	43,20 (32,40 - 54,00)	**<0.001**
	IG	52,39 (31,67)	84,84 (23,15)		
Vitality	CG	28,95 (24,21)	23,48 (21,14)	25,46 (18,62 - 32,30)	**<0.001**
	IG	35,00 (27,28)	55,00 (24,71)		
Changes	CG	43,60 (22,55)	36,04 (22,02)	15,53 (4,67 - 26,40)	**0.006**
	IG	50,53 (30,16)	58,51 (28,68)		
General health(Total)	CG	44,41 (18,68)	39,53 (15,88)	23,39 (15,26 - 31,52)	**<0.001**
	IG	45,31 (24,92)	63,83 (19,95)		

The estimate reflects the interaction between the time instant and the group, obtained through mixed linear regression models. More specifically, the estimate indicates the difference between the temporal evolution (post-intervention time minus pre-intervention time) of the IG with respect to the temporal evolution of the CG for each of the study variables. In this case, a positive estimate indicates that the variable has increased its value in the IG after the intervention and in a greater amount than in the CG.

On the other hand, when analyzing the dependent variables A and D at the two moments in time, it is also observed how CG and IG evolve differently and diverge with the progression of time. In Figure 1 it can be seen that at the post-intervention time there is a decrease in the degree of anxiety and depression in the IG and a slight increase in the degree of anxiety and depression in the CG, starting from a similar level of anxiety and depression. Statistical analysis using mixed linear regression models (Table 3) also confirms that this divergence in the evolution of both groups is significant. Specifically, anxiety in the IG undergoes a significant decrease (p<0.001) that differs by 5.35 points with respect to the difference in anxiety in the CG between the two time instants. On the other hand, depression in the IG undergoes a significant decrease (p<0.001) that differs by 5.88 points with respect to the difference in depression in the CG between the two time instants.



Box-whisker graph showing the distribution of Anxiety and Depression levels for the control group (CG, red) and the intervention group (IG, green) in the two time instants analyzed (pre and post-intervention).It is observed how the values of both levels are considerably reduced in the IG after applying the intervention but instead increase slightly in the CG.

Figure 1. Distribution of Anxiety and Depression for groups.

Table 3. Temporal evolution of Anxiety and Depression levels for the control group (CG) and the intervention group (IG).

		Mean (SD)			
Variable	Group	Pre-intervention	Post-intervention	Estimation* (CI 95%): Interaction time × group	*p*-value
Anxiety	GC	6,30 (4,50)	7,18 (4,71)	-5,35 (-6,74 - -3,96)	**<0,001**
	GI	6,95 (5,20)	2,48 (2,76)		
Depresion	GC	7,69 (3,87)	8,58 (3,66)	-5,88 (-7,20 - -4,55)	**<0,001**
	GI	8,40 (5,22)	3,40 (3,24)		

4. CONCLUSIONS

Music and medicine have been united since ancient times, this therapeutic union has grown little by little according to the beliefs and customs of different societies, until what we know today as music therapy.

Music has become a complementary therapeutic tool, a powerful stimulus for our brain (Sacks, 2006). Thanks to new neuroimaging techniques such as functional Magnetic Resonance for example (functional MRI), we are beginning to discover what happens in a normal brain when music is played, and how the structure and function of the brain can be modified with music training (Miranda et al., 2017). In recent years, interest has grown in using music as a therapeutic tool for neuronal rehabilitation. Novel methods based on music have been developed to improve deficits of different types and pathologies. For example, music therapy has been used in children and adolescents with autism and dyslexia. (Geretsegger et al., 2014; Flaugnacco et al., 2015), in adults affected by cerebrovascular accident (Altenmüller & Schlaug, 2015), Parkinson's disease (Bloem et al., 2015), also in Oncology, ICU, Surgery, even in patients with kidney disease undergoing hemodialysis treatment (Konopacki, 2016).

Most of these studies assess the therapeutic effect of music and the effect that it produces on anxiety, stress, pain, however the musical application in most cases has not been carried out in a direct way but ina passive way through recorded music. One of the innovations of our study is the fact that classical music has been performed live in the hospital itself, while the patients received HD treatment. This direct contact, both visual and auditory, we believe could enhance the effect produced and should be the subject of future studies.

The results of the research show that music can significantly reduce the levels of anxiety and depression in kidney patients without the need to take chemical drugs, likewise we have also shown that with this type of musical intervention, it improves the quality of life related to Self-perceived health in patients with chronic kidney disease.

Music is harmless to health, it is an art, a gift of life, it is the most natural medicine and without side effects. Its constant and regular use within hospitals would allow us to save on other types of chemical drugs, in addition to improving the motivation of both patients and health personnel through it. We hope that in the not too distant future it will

be used as a regular part of treatment in various pathologies, perhaps this is the most human value of music: to be used as a tool to help heal.

ACKNOWLEDGMENTS

To the entire group of doctors and nurses in the hemodialysis unit, who have made this study possible and who have made us feel like part of their team. To all the musicians for their great involvement and totally disinterested collaboration.

REFERENCES

Abram H. S. (1969). The psychiatrist, the treatment of chronic renal failure, and the prolongation of life. II. *The American journal of psychiatry, 126*(2), 157–167. https://doi.org/10.1176/ajp.126.2.157

Altenmüller, E., & Schlaug, G. (2015). El regalo de Apolo: nuevos aspectos de la musicoterapia neurológica. *Progreso en la investigación del cerebro, 217*, 237–252.

Antoci, P. V. (2016). *Musicoterapia: una Propuesta de Intervención para Disminuir el Dolor en Pacientes con Cáncer* (Doctoral dissertation). https://repositorio.uesiglo21.edu.ar/handle/ues21/12730

Arias Gómez, M. (2007). Música y neurología. *Neurología, 22*(1), 39–45.

Augé, P. M., Mercadal-Brotons, M., & Resano, C. S. (2015). Efecto de la musicoterapia en el estado anímico y calidad de vida de un grupo de mujeres supervivientes de cáncer de mama. *Psicosociología, 12*(1), 105. https://revistas.ucm.es/index.php/PSIC/article/download/48907/45633

Bloem, B. R., de Vries, N. M., &Ebersbach, G. (2015). Non pharmacological treatments for patients with Parkinson's disease. *Movement Disorders, 30*(11), 1504–1520.

Cukor, D., Coplan, J., Brown, C., Friedman, S., Newville, H., Safier, M., Spielman, L. A., Peterson, R. A., & Kimmel, P. L. (2008). Anxiety disorders in adults treated by hemodialysis: a single-center study. *American journal of kidney diseases: the official journal of the National Kidney Foundation, 52*(1), 128–136.

De-Nour A. K. (1970). Psychotherapy with patients on chronic haemodialysis. *The British journal of psychiatry: the journal of mental science, 116*(531), 207–215.

Firmeza, M. A., Rodrigues, A. B., Melo, G. A. A., Aguiar, M. I. F. D., Cunha, G. H. D., Oliveira, P. P. D., &Grangeiro, A. S. D. M. (2017). Control of anxiety through music in a head and neckoutpatient clinic: a randomized clinical trial. *Revista da Escola de Enfermagem da USP, 51* https://doi.org/10.1590/s1980-220x2016030503201

Flaugnacco, E., Lopez, L., Terribili, C., Montico, M., Zoia, S., &Schön, D. (2015). Music training increases phonological awareness and reading skills in developmental dyslexia: a randomized control trial. *PloS one, 10*(9), e0138715.

Geretsegger M, Elefant C, Mössler KA, Gold C. Music therapy for people with autism spectrum disorder. *Cochrane Database of Systematic Reviews 2014*, Issue 6. Art. No.: CD004381. https://doi.org/10.1002/14651858.CD004381.pub3.

Guyton, A. C., & Hall, J. E. (1967). *Tratado de fisiología médica* (No. QP34. 5 G8918 2001). Interamericana. https://doi.org/10.1053/j.ajkd.2008.02.300

Konopacki, A. C. (2016). Does Music Therapy Reduce Anxiety Levels in End-Stage Renal Disease Patients Undergoing Hemodialysis? https://digitalcommons.pcom.edu/pa_systematic_reviews/278/#:~:text=https%3A//digitalcommons.pcom.edu/pa_systematic_reviews/278.

Lamping, D. (2004). Health-related quality of life in chronic renal failure. *Supportive care for the renal patient*, 63-74. https://researchonline.lshtm.ac.uk/id/eprint/11033

Melo, G. A. A., Rodrigues, A. B., Firmeza, M. A., Grangeiro, A. S. D. M., Oliveira, P. P. D., &Caetano, J. Á. (2018). Intervención musical sobre la ansiedad y parámetros vitales de pacientes renales crónicos: ensayo clínico aleatorizado. *Revista Latino-Americana de Enfermagem, 26*. https://doi.org/10.1590/1518-8345.2123.2978

Miranda, M. C., Hazard, S. O., & Miranda, P. V. (2017). La música como una herramienta terapéutica en medicina. *Revista chilena de neuro-psiquiatría, 55*(4), 266-277 http://dx.doi.org/10.4067/s0717-92272017000400266

Oliver Sacks, El poder de la música, *Cerebro*, *129*(10), octubre de 2006, pp. 2528–2532. https://doi.org/10.1093/brain/awl234

Palacios Sanz, José Ignacio: "El Concepto de Musicoterapia a través de la Historia", en *Revista Electrónica de LEEME* (Lista Europea de Música en la Educación), Nº 13, Mayo 2004. http://musica.rediris

Sanz, M. G., & de Pedro Gómez, J. E. (2014). ¿Puede la musicoterapia disminuir los niveles de ansiedad y de estrés de los pacientes sometidos a hemodiálisis durante sus sesiones? *Evidentia: Revista de enfermería basada en la evidencia, 11*(46), 14. https://dialnet.unirioja.es/ejemplar/380449

Serrano Soliva, M., & Carrascosa López, C. (2020). Hemodiálisis musical para mejorar la ansiedad y depresión. *Itamar. Revista de investigación musical: territoriospara el arte.* No. 6, pp. 302–316. https://ojs.uv.es/index.php/ITAMAR/article/view/17965/1575

Verdes Moreiras, M. D. C., & Fernández de Juan, T. (1994). Aplicación de un programa de Musicoterapia en pacientes portadores de Insuficiencia Renal Crónica con Tratamiento de Hemodiálisis. *Revista cubana de psicología, 11*(1), 89-96.

BMT21
3rd International Conference
Business Meets Technology.
Valencia, 23rd & 24th September 2021

THE STRATEGIC VALUE OF ATTRACTIVE INFLUENCERS FOR ADVERTISING COMUNICATION: THE INFLUENCE OF PARASOCIAL INTERACTION PROCESSES ON THE PERSUASIVE EFFECT OF BRAND PLACEMENTS

Gröner, Patrick M. [a]; Hedderich, Barbara E. [b]

[a] *University Hospital Erlangen, Universitätsstraße 21-23, 91054 Erlangen, Germany. (Patrick.Groener@uk-erlangen.de)*
[b] *Ansbach University of Applied Sciences, Residenzstraße 8, 91522 Ansbach, Germany. (barbara.hedderich@hs-ansbach.de)*

ABSTRACT: *Although brand placements can be seen more and more frequently in social media channels of so-called "influencers", current brand placement research has rarely focused on the persuasive influence of these media characters. The "Balance Model of Product Placement Effects" of Russell and Stern (2006) began to integrate both, the recipient and the recipient's specific perception of the media context, into brand placement research. The result of these considerations is a triadic connection between the recipient, the acting media characters and the placed brands. Adressing this, the following study investigates the mediating influence of cognitive phenomenon of parasocial interactions to an influencer of a YouTube make-up tutorial as well as her specific attitude/valence towards the brands in her immediate context. Brand perception, purchase intention and actual purchase of the presented brand were measured as dependent variables of advertising effectiveness.*

KEY WORDS: *Strategic advertising communication, Social media, brand placements, Parasocial interactions, Balance model.*

1. PURPOSE OF THE PAPER

The purpose of this piece of research is to find out if brand placements in online formats such as YouTube channels have a positive advertising effect on the placed product (Gröner, 2020).

This paper also attempts to integrate the effect of other media-psychological influencing variables (character attractiveness and physical addressing style of the media character as well as the valence between brand and media character) into this

How to cite: Gröner, P. M., and Hedderich, B. E. 2021. The Strategic Value of Attractive Influencers for Advertising Comunication: The Influence of Parasocial Interaction Processes on the Persuasive Effect of Brand Placements. In Proc.: *3rd International Conference Business Meets Technology*. Valencia, 23rd & 24th September 2021. 135-144. https://doi.org/10.4995/BMT2021.2021.13616

field of research (Knoll et al., 2015; Gröner, Raul & Bayram, 2018) and to support them empirically.

2. THEORETICAL FRAMEWORK

In order to empirically examine the strategic value of attractive influencers for the advertising industry with regard to the communication instrument of brand placements (cf. Gröner, 2020) in the sense of Russell and Stern (2006), one must deal with two relevant aspects. How do the recipients perceive the influencer and what is the relationship between the influencer and the brand presented?

In response to the first question, the media-psychological phenomenon of parasocial interactions, or PSI for short, offers a substantial explanatory approach. Klimmt et al. (2006, p. 302) conceptualize PSI as the "viewers' responses to media personae as being composed of different cognitive, emotional, and/or behavioral processes […]. These processes follow on initial impression formation (or persona recognition), can emerge into different interaction patterns, can change dynamically within the course of media exposure, and are strongly influenced both by persona and viewer variables". This differentiated conceptualization of the independent affective, cognitive, and conative PSI processes during the actual reception (Gröner, 2021) is thereby based on the two-level model of parasocial interaction (cf. Schramm & Knoll, 2015). According to this model, in addition to the obtrusiveness, persistence, and (physical, character or plot) attractiveness of the persona, the persona's principal behaviors, such as direct addressing, have a major influence on the emergence of PSI. The stronger the addressing of the persona is perceived by the recipient, the more intense PSI the recipient should experience (Gröner et al., 2018) and the more attractive the media character should be perceived (Path *a* and *b*; Figure 1). In this context, several studies have already demonstrated that perceived character attractiveness has a positive influence on the emerging PSI (Knoll et al., 2015), which means that character attractiveness consequently has a mediating influence of perceived address on PSI (Path $a \times c$; Figure 1).

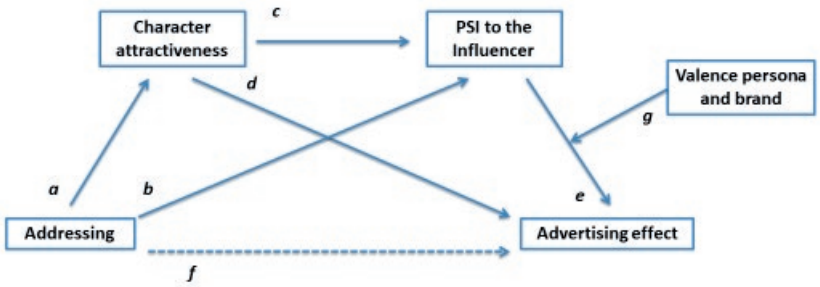


Figure 1. Assumed mechanism of action.

According to Knoll et al. (2015), the accumulated impressions and experiences with the persona are stored in the viewer's memory as a relational schema in the form

of an individual PSI profile. In this context, a specific coupling of two stimuli (e.g., persona and brand) can lead to an association of both schemas (Knoll et al., 2015; Gröner, 2018) whereby strong PSI should have a positive effect on advertising impact (Pathbrand perception, purchase intention and actual purchase behavior; Path *e*; Figure 1) (Colliander & Dahlén, 2011; Knoll et al., 2015). Above all, actual purchasing behavior has hardly been analyzed in this field of research.

With regard to the question of the relationship between media character and brand, Russell and Stern (2006) name two relevant factors influencing advertising effects. One is the intensity of the relationship, i.e. whether both are strongly or weakly associated with each other by the recipient. Secondly, the valence of the relationship, i.e. whether the media character likes the placed brand or not. According to the "Balance Model of Product Placement Effects" (Russell & Stern, 2006), this means in detail that intensive parasocial interactions with a persona with positively evaluated character attractiveness have an advertising-promoting effect on the impact of brand placements above all when the connection between persona and brand is of positive valence (Path *g*; Figure 1) (Russell & Stern, 2006). "Following this reasoning, the media character – brand relationship (strength/valence) exerts a moderating influence on the described process depicted by a vertical arrow influencing the consumer's reactions toward the brand PSI" (Path *g*; Figure 1) (Schramm & Knoll, 2015, p. 560). Figure 1 summarizes the predicted mechanism of action.

3. METHOD AND STUDY DESIGN

A 2 × 2 between-subjects experimental design with the experimental factors of physical addressing (high vs. low) and valence between persona and brand (positive vs. negative) allow for the investigation of the predicted mechanism of action.

The setting of a YouTube make-up tutorial was chosen as a stimulus for various reasons. On the one hand, branded products are an essential part of this social media setting, which minimizes reactance effects with regard to the brand message. On the other hand, in this media segment it is possible to produce an authentic stimulus oneself with comparatively little effort. In addition, the content can be adapted exactly to the research design and an unknown media character can be selected. During the 8 minutes and 23 seconds long self-produced YouTube make-up tutorial, the persona uses a foundation, concealer, powder, bronzer, watercolor powder, blush, eyebrow pencil and mascara of the Douglas brand and visibly interacts with the brand placements for 80 seconds (see Figure 2).

By filming the persona synchronously with two cameras from different perspectives throughout the entire film production (frontal vs. 35° offset to the side), it is possible to produce two identical tutorials that differ only in their physical addressing. In the variant with strong physical addressing, the camera is directed frontally at the YouTuber's face, while in the condition with weak physical addressing, the persona can be seen in profile, offset by 35° to the side. Especially in the frontal camera perspective, the persona looks directly into the camera in order to address the recipient physically via eye contact.

Unlike in comparable studies, the experimentally varied angle is lower than 45° (cf. Dibble et al., 2016) or 90° (cf. Hartmann & Goldhoorn, 2011), because it is essential for the make-up tutorial of such a YouTube format that the recipients can see both halves of the face as well as the pair of eyes of the persona. Thus, the manipulation is less than in the studies Dibble et al. (2016) or Hartmann and Goldhoorn (2011).

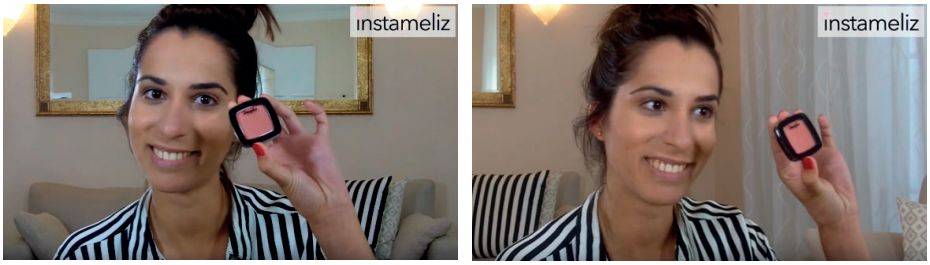


Figure 2. Experimental manipulation of physical addressing.

The frontal orientation of the camera on the face of the persona in the left picture is intended to make the recipients feel strongly physically addressed. The synchronously recorded scene in the right image shows the persona from a camera perspective that is shifted by 35° and is intended to lead to a weaker perception of physical addressing.

At the end of the video, the persona evaluates the Douglas products used. This evaluation represents the second experimentally manipulated factor, the valence between persona and brand. For this purpose, two different recordings were produced in which the YouTuber perceives the brand products in opposite ways. In the positive version, the persona praises both quality and price of the branded products. In the negative condition, the products are evaluated exactly the opposite way. Both scenes last 24 seconds and are also recorded from two perspectives. For the purpose of high internal validity, the physical addressing of the persona is kept as constant as possible in both versions. This results in four identically YouTube clips that differ only in the camera perspective and the valence between persona and brand.

After the reception of the make-up tutorial on the YouTube platform itself, all study participants were asked to complete an identical questionnaire. On the last page of the questionnaire, each participant received an original Douglas discount coupon worth 10% off their entire purchase as an incentive. The discount coupon could be redeemed once for a limited period of time at the local Douglas store in Ansbach and was valid exclusively for Douglas own-brand products. Due to a barcode on the back of the coupon, it was possible to link the purchase in the Douglas store with the questionnaires of the study participants.

4. PARTICIPANTS

In total, the sample comprises 460 women from the district of Ansbach aged between 16 and 46 (M=24.39, SD=6.66). From a geographical point of view, all participants had the chance to use the discount voucher at the Douglas store in Ansbach.

5. RESULTS

By using two manipulation checks (one-factor ANOVAs), a differentiated perception of the experimentally varied variables (addressing by the persona p <0.001, η2=0.27 and valence between influencer and brand p <0.001, η2=.43) can be statistically confirmed. In the following empirical results, the focus is on cognitive PSI. In all figures, the labeled effect sizes are set at the significance level of * p <0.05; ** p <0.01; and *** p <0.001.

Data were analyzed using the SPSS macro PROCESS by Hayes (2013). To test the predicted model in a large context, multiple serial mediation is computed with the two mediators of character attractiveness and cognitive PSI (Hayes, 2013, Model 6). By multiplying the three path coefficients a, c, and e, one can calculate the indirect effect of addressing via character attractiveness to the cognitive PSI and finally on brand perception ($a \times c \times e$ =0.01) (Hayes, 2013). For the calculated indirect effects, a bootstrapping analysis for cognitive PSI results in a confidence interval of 0.003 to 0.024. As the calculated confidence interval does not contain the numerical value zero, the indirect effect is significant at a 95% confidence level (Figure 3) Based on a strong perceived addressing, a positive mediating effect via character attractiveness on brand perception could be proven ($a \times d$ =0.03; 95% KI=[0.002,.067]). Based on a highly rated addressing, this effect is furthermore mediated by the cognitive PSI ($b \times e$ =0.02; 95% KI=[0.005,0.041]). Viewers with a low perceived addressing rated brand perception more negatively (.13) than recipients with a high perceived addressing ($[a \times d]+[a \times c \times e]+[b \times e]+f$). Moreover, this effect is due to the significant direct effect of addressing on brand perception (f).

The moderating influence of valence on the impact of cognitive PSI on advertising effectiveness was statistically tested using moderated mediation (Hayes, 2013, Model 14). For this purpose, valence between persona and brand acts as a moderator variable (g). The results of this analysis suggest an interaction with valence between persona and brand on brand perception. This means that recipients with at least moderate perceived valence between persona and brand experience a more intensive brand perception. This positive influence is additionally strengthened as the moderator becomes more pronounced (g).

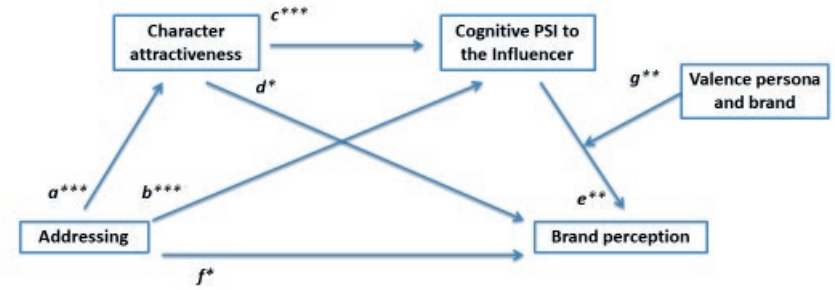


Figure 3. Empirically measured mechanism of action for cognitive PSI on brand perception.

Furthermore, participants who feel more strongly addressed by the persona have a higher purchase intention (0.21) than study participants with a low perceived addressing ($[a \times d]+f$). On one hand, this relationship is due to the direct positive influence of strongly perceived addressing (f). On the other hand, mediated by an increased character attractiveness, a more intensely addressing leads to a greater purchase intention ($a \times d$=0.10; 95% KI=[0.059,.158]).

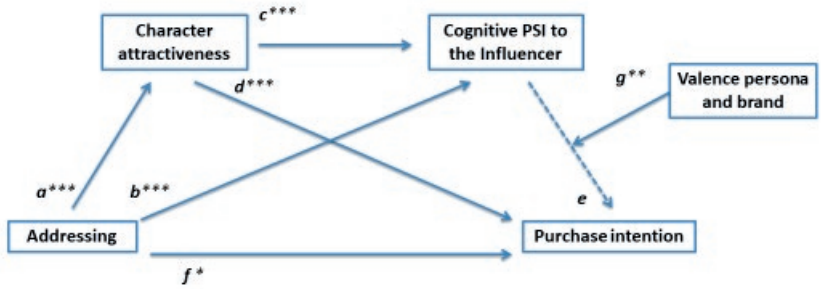


Figure 4. Empirically measured mechanism of action of cognitive PSI on purchase intention.

Once again, moderated mediation (Hayes, 2013, Model 14) is used to explore the moderating effect of valence (g). If the valence between persona and brand is judged to be negative (very low), cognitive PSI have a negative influence on perceived purchase intention. Under these conditions, the stronger the mediating cognitive PSI, the lower the purchase intention. However, if the valence is rated at least high (positive), recipients have an increased purchase intention. Consequently, a moderating effect can be confirmed.

A mediating influence of character attractiveness ($a \times d$) or cognitive PSI ($[a \times c \times e]$ or $[b \times e]$) on actual purchase behavior cannot be confirmed (Figure 5). Similarly, no moderating effect of valence on purchase intention could be detected.

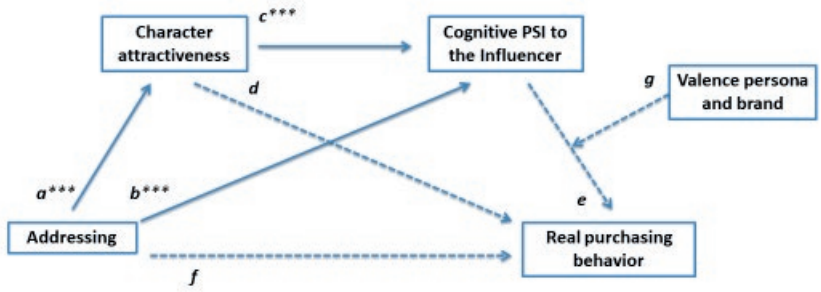


Figure 5. Empirically measured mechanism of action of cognitive PSI on actual purchase behavior.

6. DISCUSSION, LIMITATIONS AND CONCLUSION

The methodological orientation of the presented study and the findings generated by it succeed in expanding the state of brand placement research by integrating additional influencing variables and linking the effect to specific conditions. The results also illustrate the economic significance of brand placements (Gröner, 2020).

Thus, one focus of the presented study is on the exploration of physical address as an influencing factor on the persuasive effect of parasocial interactions. The comparatively small experimentally varied angle of 35° in the videos thus contributes to a high external validity. Accordingly, even smaller nuances in the physical orientation of the persona are registered by the recipients and generate significant differences in the perception of the media character and consequently a measurable influence on the advertising impact.

Here, brand perception proves to be resistant to a negative expression of the moderator. Only in the case of highly cognitive PSI a positive valence between the persona and the brand is likely to lead to a more intensive brand perception. Accordingly, the brand image built up over the long term is not damaged by one negative evaluations of the influencer. In the case of cognitive PSI, a positive relationship between persona and brand can only improve it.

Contrary to this, in the case of strong PSI, the valence between persona and brand can influence the purchase intention both positively and negatively. Obviously, the influencer here assumes the role of an expert, to whose judgment the consumer is guided depending on the polarity of the moderator. If, for example, the valence of the relationship is negative, strong cognitive PSI will lead to a reduced purchase intention; in contrast, a positive valence with strong cognitive PSI will intensify the purchase intention. Because the observed effect only occurs with particularly intensive PSI, the findings obtained confirm the underlying "Balance Model of Product Placement Effects" (Russell & Stern, 2006).

Compared to more easily detectable brand perception effects, the purchase intention is therefore based on a more detailed processing process that includes information about the nature of the relationship between persona and brand. Due to experimental design, however, it must be emphasized that the measured mechanisms of action are only based on short-term effects, which is why no statements can be made about any long-term effects. Although the study design meets the requirements of Schramm and Knoll (2015) and, in addition to purely cognitive effect levels with the research of actual purchase behavior also devotes itself to the strongly neglected conative effect levels of brand placements, an influence on actual purchase behavior cannot be proven.

Although the media context of a YouTube make-up tutorial proves to be particularly fruitful for the underlying research, there are also limitations and methodological criticism to the study design. First, cross-gender effects can be excluded due to the all-female sample. Although, recipients prefer to choose male personae for interaction, strong cross-gender effects between female media characters and male viewers or vice versa may lead to particularly intense parasocial interactions. In addition, the stimulus is comparatively short (8 minutes and 23 seconds), giving female viewers significantly less time to build strong PSI with the persona compared to a TV series. These conditions may lead to a limited variance of the measured PSI, which in turn may affect the persuasive mechanisms of action arising. Here, it would be interesting to observe the development of PSI to an influencer over a longer period of time using multiple YouTube videos.

Furthermore, the measurement of real purchase behavior leads to a number of problems. Although every test participant was able to use the voucher, only 15 women did so. This corresponds to only 3.3% of the total sample. There are several potential reasons for this reticence in purchasing behavior. Firstly, the discount vouchers issued competed with other Douglas discount campaigns throughout Germany, where discounts of up to 20% were offered. The discount level of the coupons handed out during the study was therefore significantly lower at 10%. An influence of the actual purchase behavior on part of these other discount actions is therefore very close. Furthermore, cosmetic products belong to a comparatively higher price segment, which means that not every participant in the study, which tends to be a student sample, possibly was able to afford the branded products.

Due to the stimulus selected, the persuasive effect mechanisms of the "Balance Model of Product Placement Effects" (Russell & Stern, 2006) can be extended to a previously unexplored non-fictional media format in the online sector. In doing so, current findings of reception and effects research are incorporated around important media psychological influence variables (Knoll et al, 2015).

For the advertising industry, it can finally be stated that brand placements of established brands in YouTube formats are suitable for influencing brand perception and purchase intention. This could possibly be due to the fact that YouTubers are perceived as more unbiased towards brand products than media characters in conventional advertising formats (Colliander & Dahlén, 2011). Questions such as, "What is the speaker's relation to the product? How authentic is it? Is the speaker's intention to sell me the product for any material reason, or to help me with his true experience?" (Colliander & Dahlén, 2011,

p. 315) therefore play a rather subordinate role for the viewer during the reception of such media channels.

Due to the potential danger posed by negative reviews on part of the persona, it seems essential for modern brand communication to take the content created by popular YouTube channels seriously and to react to if necessary. If these potential risk factors are taken into account, YouTubers are ideally suited as contemporary brand ambassadors for influencing and further developing modern marketing strategies (cf. Gröner 2020).

AUTHOR CONTRIBUTIONS

Patrick M. Gröner: Conceptualization, Investigation; Methodology, Formal analysis, Writing. Barbara E. Hedderich: Project Administration, Supervision, Review & Editing.

REFERENCES

Colliander, J., & Dahlén, M. (2011). Following the Fashionable Friend: The Power of Social Media Weighing Publicity Effectiveness Of Blogs versus Online Magazines. *Journal of Advertising Research, 51*(1), 313-320.

Dibble, J. L., Hartmann, T., & Rosaen, S. F. (2016). Parasocial Interaction and Parasocial Relationship: Conceptual Clarification and a Critical Assessment of Measures. *Human Communication Research, 42*(1), 21-44.

Gröner, P. M., Raul, C., & Bayram, S. (2018). Persuasion in social media channels: The influence of user-generated content on the reception and effect of online advertising. Poster at the 1st International Conference of the University of Applied Sciences Ansbach (25th to 27th January 2018).

Gröner, P. M. (2018). Political Communication - The Impact of Entertainment Television on the Perception of Political Parties. In B. Hedderich, M. S. J. Walter & P. M. Gröner (Eds.), *Business Meets Technology. Proceedings of the 1st International Conference of the University of Applied Sciences Ansbach* (P. 5-8). Aachen: Shaker-Verlag.

Gröner, P. M. (2020). Brand Placements als werbewirtschaftliches Kommunikationsinstrument: Historie und kommerzielle Bedeutung. In U. Ambrosius & P. M. Gröner (Hrsg.), Ansbacher Kalei-doskop 2020 (S. 116-135). Aachen: Shaker-Verlag.

Gröner, P. M. (2021). The Use of Artificial Intelligence in Higher Education Teaching - Social Robots as Assistant Professors. In B. Hedderich, M. A. Hedderich & M. S. J. Walter & (Eds.), Business Meets Technology. *Proceedings of the 2nd International Conference of the University of Applied Sciences Ansbach* (P. 26-29). Aachen: Shaker-Verlag.

Hartmann, T., & Goldhoorn, C. (2011). Horton and Wohl Revisited: Exploring Viewers' Experience of Parasocial Interaction. *Journal of Communication, 61*(6), 1104-1121.

Hayes, A. F. (2013). *Introduction to Mediation, Moderation, and Conditional Process Analysis: A Regression-Based Approach.* New York: Guilford Press.

Klimmt, C., Hartmann, T., & Schramm, H. (2006). Parasocial Interactions and Relationships. In J. Bryant, & P. Vorderer (Eds.), *Psychology of entertainment,* 291-314. Mah-wah: Lawrence Erlbaum Associates Publishers.

Knoll, J., Schramm, H., Schallhorn, C., & Wynistorf, S. (2015). Good Guy vs. Bad Guy – The Influence of Parasocial Interactions with Media Characters on Brand Placement Effects. *International Journal of Advertising, 34*(5), 720-743.

Russell, C. A., & Stern, B. B. (2006). Consumers, Characters, and Products. A Balance Model of Sitcom Product Placement Effects. *Journal of Advertising, 35*(1), 7-21.

Schramm, H., & Knoll, J. (2015). Modeling the Impact of Parasocial Interactions with Media Characters on Brand Placement Effects. *Journal of Promotion Management, 21*(5), 548-565.

BMT21
3rd International Conference
Business Meets Technology.
Valencia, 23rd & 24th September 2021

PROPOSING AN ANALYSIS OF CULTURAL POLICIES AND THEIR IMPACT ON THE ECONOMIC DEVELOPMENT OF COUNTRIES: THE CASE OF GERMANY AND SPAIN

Gómez-Reyes, Flor Marleny [a1]; Catalá-Perez, Daniel [b1];
De-Miguel-Molina María [b1] and Manrique-Hernández Elizabeth [c]

[a] *Universitat Politècnica de València, Programa de Doctorado en Administración y Dirección de Empresas, Camino de Vera, s/n. 46022, Valencia. España. (flogore@doctor.upv.es)*
[b] *Universitat Politècnica de València, Departamento de Organización de Empresas, Camino de Vera, s/n. 46022, Valencia. España. ([b1] dacapre@ade.upv.es, [b2] mademi@omp.upv.es)*
[c] *University British Columbia, 2329 West Mall, Vancouver, BC Canada V6T 1Z4. (jemanriq@mail.ubc.ca)*

ABSTRACT: This article aims to analyze whether the cultural policies of Germany and Spain are moving towards knowledge and innovation, and how these policies affect the economic development of their countries. The methodology that we will apply will be the Qualitative Comparative Analysis; the data that we will use will be taken from the Compendium of Public Policies and Trends. We have decided to analyze Germany and Spain cases because they have the following requirements: Being a member of the OECD, member of the Compendium of Cultural Policies and Trends. In addition, Germany has been chosen for being a benchmark in terms of economic development. This research is important because cultural and creative industries, as well as public policies on them, have evolved in recent years, and new trends in research on cultural policies are moving towards the concepts of knowledge and innovation. The European Innovation Scoreboard 2021 affirms the relationship between the most innovative countries and the economic development of these countries. Therefore, the objective of this research is to analyze whether the cultural policies of Germany and Spain are moving towards knowledge and innovation, and how these policies affect the economic development of their countries.

KEY WORDS: *Cultural Policy; Cultural and creative industry; Economic development; Innovation; OECD.*

1. INTRODUCTION

The cultural and creative industry and its policies have evolved in recent years, through the development of the concept of culture, cultural industry and creative industry, until reaching the current trend of cultural and creative industries (Souza, 2006; UNCTAD, 2010; UNCTAD, 2015). Thus, the literature shows that cultural policies should be oriented

How to cite: Gómez-Reyes, F. M., Catalá-Perez, D., De-Miguel-Molina M., and Manrique-Hernández E. 2021. Proposing an analysis of cultural policies and their impact on the economic development of countries: the case of Germany and Spain. In Proc.: *3rd International Conference Business Meets Technology*. Valencia, 23rd & 24th September 2021. 145-151. https://doi.org/10.4995/BMT2021.2021.13777

towards the concepts of knowledge and innovation (Taylor Buck & While, 2017; Landoni et al., 2020). These two concepts have become determining factors in the development and enhancement of the economic development of the European countries (European Innovation Scoreboard, 2019).

Based on the above, the purpose of this research is to analyze whether the cultural policies of Germany and Spain are aimed at strengthening knowledge and innovation in cultural and creative industries, and to analyze the impact of these cultural policies on the economic development of their countries.

Germany and Spain have been selected for this analysis based on the following criteria: 1. they are member countries of the OECD and 2. they are member countries of the compendium of cultural policies and trends. Furthermore, Germany is a world benchmark in economic development (Haarich, 2005).

The OECD (2005) affirms that the cultural and creative industries have an impact on the territorial and local development of countries, as well as the importance of culture in the globalized knowledge economy.

The compendium of cultural policies and trends will be the reference framework for the analysis of cultural policies in Germany and Spain. This compendium was initiated in 1998 by the Council of Europe's (CoE) Steering Committee for Culture. Subsequently, it was registered at the Chamber of Commerce in Amsterdam. "Until the 31.12.2020 the Boekman Foundation, the institute for arts, culture and related policy in the Netherlands was the Compendium's Coordinator. Since the 1st of January 2021 the Kulturpolitische Gesellschaft e.V. (Bonn, Germany) is the new Coordinator of the Compendium of Cultural Policies & Trends and therefore responsible for the daily management of the project" (Compendium of Cultural Policies & Trends, 2021).

Its mission is to generate added value to cultural policies for governments and society, generating knowledge, comparisons, statistics, among other factors. The association seeks to facilitate the international exchange of knowledge and provide support in the formulation of cultural policies (Compendium of Cultural Policies & Trends, 2021).

2. FRAMEWORK OF REFERENCE FOR THE ANALYSIS OF CULTURAL POLICIES IN GERMANY AND SPAIN

The compendium of cultural policies and trends has the same structure for all member countries (currently 43 countries), which is presented in Table 1, and contains 7 thematic chapters, 32 dimensions and their respective descriptions.

The cultural policies of Germany and Spain will be analyzed based on the information from the compendium of cultural policies and trends, thus facilitating the process of comparison between the two countries. In this review, we will analyze which cultural policies are oriented towards knowledge and innovation in the cultural and creative industries.

Based on the above, the impact that these cultural policies have on the GDP of Germany and Spain will be investigated, with the aim of analyzing the correlation between cultural policies and the economic development of these countries.

Table 1. Components of the cultural policy compendium.

Thematic chapters	Dimension	Sub dimension
1. Cultural Policy System	1.1. Objetives, main features and background	Description
	1.2. Domestic governance system	1.2.1. Organisational organigram
		1.2.2. National authorities
		1.2.3. Regional authorities
		1.2.4. Local authorities
		1.2.5. Main non-governmental actors
		1.2.6. Transerval co-operation
	1.3. Cultural institutions	1.3.1. Overview of cultural institutions
		1.3.2. Data on selected public and private cultural institutions
		1.3.3. Public cultural institutions: trends and strategies
	1.4. International cooperation	1.4.1. Public actors and cultural diplomacy
		1.4.2. European / international actors and programmes
		1.4.3. NGO'S and direct professional cooperation
2. Current cultural affairs	2.1. Key developments	Description
	2.2. Cultural rights and ethics	Description
	2.3. Role of artist and cultural professionals	Description
	2.4. Digital policy and developments	Description
	2.5. Cultural and social diversity	2.5.1. National / Intenational intercultural dialogue
		2.5.2. Diversity education
		2.5.3. Media pluralism and content diversity
		2.5.4. Language
		2.5.5. Gender
		2.5.6. Disability
	2.6. Culture and social inclusion	Description
	2.7. Societal impact of arts	Description
	2.8. Cultural sustainability	Description
	2.9. Other main cultural policy issues	Description
3. Cultural and creative sectors	3.1. Heritage	Description
	3.2. Archives and libraries	Description
	3.3. Performing arts	Description
	3.4. Visual arts and crafts	Description
	3.5. Cultural arts and creative industries	3.5.1. General developments
		3.5.2. Books and press
		3.5.3. Audiovisual and interactive media
		3.5.4. Music
		3.5.5. Design and creative services
		3.5.6. Cultural and creative tourism

4. Law & legislation	4.1. General legislation	4.1.1. Constitution
		4.1.2. Allocation of public funds
		4.1.3. Social security frameworks
		4.1.4. Tax laws
		4.1.5. Labour laws
		4.1.6. Copyrigth provisions
		4.1.7. Data protection laws
		4.1.8. Language laws
		4.1.9. Other areas of general legislation
	4.2. Legislation on culture	4.2.1. General legislation on culture
		4.2.2. Legislation on culture and natural heritage
		4.2.3. Legislation on performance and celebration
		4.2.4. Legislation on visual arts and crafts
		4.2.5. Legislation on books and press
		4.2.6. Legislation on audiovisual and interactive media
		4.2.7. Legislation on design and creative services
5. Arts and cultural education	5.1. Policy and institutional overview	Description
	5.2. Arts in schools	Description
	5.3. Higher arts and cultural education	Description
	5.4. Out-of-school arts and cultural education	Description
	5.5. Vocational and professional trainning	Description
6. Cultural participation and consumption	6.1. Policies and programmes	Description
	6.2. Trends and figures in cultural participation	Description
	6.3. Trends and figures in household expenditure	Description
	6.4. Culture and civil society	Description
7. Financing and support	7.1. Public funding	7.1.1. Indicators
		7.1.2. Expenditure on government level
		7.1.3. Expenditure per sector
	7.2. Support programmes	7.2.1. Strategies, programmes and other forms of support
		7.2.2. Artist's funds
		7.2.3. Grants, awards, scholarships
		7.2.4. Support to professional artists' associations or unions
	7.3. Private funding	Description

Source: own elaboration based on compendium of cultural policies and trends (2021).

The contents of each chapter are described below: the first chapter describes the scope of a country's cultural policy system, including the main characteristics and elements, policy objectives, developments over the years, and the relationship between the different levels of government. The second chapter describes the latest advances in digitization, diversity and sustainability.

The third chapter contains sectoral specific information on policies, measures, debates and developments. The fourth chapter provides an overview of a country's legal system for the formulation of cultural policies, comprising general laws that affect culture and sector-specific legal provisions, such as legislation on books and the press. The fifth chapter refers to national initiatives and the different forms of artistic and cultural education: artistic education in schools, higher artistic education, extra-curricular artistic and cultural education, and professional and vocational training.

The sixth chapter, relates the cultural assistance, describes the role of the cultural center, the tendencies and figures for cultural participation and the household expenses in culture. Finally, the seventh chapter contains tables and descriptions on public cultural financing (including specific spending by sector and government), private cultural financing and cultural support programs such as artist funds, scholarships and awards (Compendium of Cultural Policies & Trends, 2021).

3. SPECIFICATION OF THE RESEARCH

Innovation is based on public policies that support it to be able to exist. At the same time, public policy needs innovation that is in constant transformation and adapts to new realities and to be at the forefront of changing issues (Bardash, 1980).

For this, the main objective of the research is to verify that cultural policies in Spain and Germany respond to certain dimensions of innovation in order to develop the cultural and creative industries in those countries.

4. METHODOLOGY

The methodology to be implemented is based on taking each thematic chapter and dimension, analyzing whether the dimension of the compendium is related to the dimensions of innovation.

The period that is going to be considered is 2015 to 2021 because, 2015 was the year when the Sustainable Development Objectives were issued and the territories are Germany and Spain.

The main focus of the analysis of the cultural policies of Germany and Spain relies on the dimensions of innovation of the cultural and creative industries, which is described in Table 2.

Table 2. Dimensions of Innovation.

Dimension	
Human Resources	Innovators
Attractive Research Systems	Linkages
Digitalisation	Intellectual Assets
Finance And Support Firm	Employment Impacts Sales
Firm Investments	Sales Impacts
Use Of Information Technologies	Environmental Sustainability

Source: own elaboration based on European Innovation Scoreboard (2019).

5. PROPOSAL

This analysis is based on the statement of UNESCO (2013) where the impact of public policies of cultural and creative industries on the economic development of countries is raised, likewise the OECD (2005) maintains that these cultural policies contribute as much to economic and social development of the territories.

Although the analysis will focus on developed countries and members of the European Union, the conclusions drawn from this research and the best practices analyzed in Germany and Spain will serve as the basis for the construction of the compendium of cultural policies in Colombia, with the structure that is shown in Table 1.

It should be noted that currently no developing or Latin American country is part of the compendium of cultural policies and trends, and we are sure that this research taken from countries of the European community and leaders in innovation, such as Germany (Compendium of Cultural Policies and Trends, 2021: 6), will help countries like Colombia to improve their cultural policies and, therefore, the economic and social development of this country.

The criteria are summarized as follows in Table 3:

Table 3. Proposed criteria for the analysis.

Criteria	Description	Germany	Spain
OCDE members	There are 37 country members of the OCDE who are committed to certain requirements to develop their countries	Germany is member of the OCDE	Spain is member of the OCDE
Compendium of Cultural Policies and Trends (CCPT)	There are 43 country members of the CCPT who have the same thematics and dimensions for the analysis of Cultural Policies.	Germany is member of the OCDE	Spain is member of the OCDE
Developed country	Countries that are benchmark for different regions such as Europe and Latin America and that still have certain comparability with each other.	Germany is a world benchmark in economic development in Europe.	Spain is a benchmark for the Latin American developing world such as Colombia

Source: own elaboration (2021).

6. IN CONCLUSION

The research literature on the analysis and evaluation of cultural policies shows how the cultural and creative industries are evolving towards the concepts such as knowledge and innovation; for this reason, it is important to analyze whether cultural policies from Alemania and Spain are being directed towards innovation and the development of cultural and creative industries and therefore the economic development of countries.

As a result of this analysis, the best practices identified with respect to cultural policies in Germany and Spain will be taken as examples to be followed for developing countries such as Colombia.

In Latin America there is no compendium of cultural policies like the one coordinated by Germany, so this research could allow developing countries to get closer to organizing, designing, and implementing their cultural policies with the same design of the compendium, so that in the future cultural policies could be comparable at a global level.

REFERENCES

Bardach, J., Roberts, D. M., RUSSELL YALE, M. D., Rosewall, D., & Mooney, M. (1980). and Palate Repair On Facial Growth In Rabbits. *Cleft Palate Journal*, *17*(4).

European Innovation Scoreboard. (2019). European Innovation Scoreboard 2019. In *European Innovation Scoreboards (EIS)*. https://doi.org/10.2873/340166

Haarich, S. N. (2005). Diferentes sistemas de evaluación de las políticas públicas en Europa: España, Alemania y los países del Este. *Revista Española de Control Externo*, 61–87.

Landoni, P., Dell'era, C., Frattini, F., Messeni Petruzzelli, A., Verganti, R., & Manelli, L. (2020). Business model innovation in cultural and creative industries: Insights from three leading mobile gaming firms. *Technovation*, *92–93*(January 2017), 102084. https://doi.org/10.1016/j.technovation.2019.102084

Souza, C. (2006). Public policies: A literature review | Políticas públicas: Uma revisão da literatura. *Sociologias*, (16), 20–45. https://doi.org/10.1590/s1517-45222006000200003

Taylor Buck, N., & While, A. (2017). Competitive urbanism and the limits to smart city innovation: The UK Future Cities initiative. *Urban Studies*, *54*(2), 501–519. https://doi.org/10.1177/0042098015597162

UNCTAD. (2010). *Creative Economy report 2010. A feasible development option*. Switzerland.

UNCTAD. (2015). Creative economy outlook and country profiles: Trends in international trade in creative industries. In *Harvard Business Review* (Vol. 8). Retrieved from http://unctad.org/en/Docs/ditc20082cer_en.pdf%5Cnhttp://www.oecd.org/dataoecd/35/56/2101733.pdf%5Cnhttp://unctad.org/en/pages/PublicationWebflyer.aspx?publicationid=1595%5Cnhttp://www.isc.hbs.edu/Innov_9211.pdf

UNESCO. (2013). Textos fundamentales de la Convención de 2005 sobre la Protección y la Promoción de la Diversidad de las Expresiones Culturales. In *Manifestaciones Culturales*. Retrieved from http://unesdoc.unesco.org/images/0026/002607/260710s.pdf#page=14

BMT21
3rd International Conference
Business Meets Technology.
Valencia, 23rd & 24th September 2021

THE INTERNATIONAL WIND BAND CONTEST «CITY OF VALENCIA» AS HISTORICAL AND CULTURAL HERITAGE: ANALYSIS OF THE INNOVATIVE PERFORMED REPERTOIRE FROM THE TUBA CHAIR

Monteagudo Mañas, Javier [a1]; Carrascosa López, Conrado Enrique [a2] and Hernández Farinós, José Pascual [b]

[a] *Universitat Politècnica de València, Spain. ([a1] jamonmaa@doctor.upv.es, [a2] concarlo@upvnet.upv.es)*
[b] *Conservatori Superior de Música "Joaquin Rodrigo" de València. Spain. (hernandez_josfar@gva.es)*

ABSTRACT: The role that composers have granted to the tuba within their works for symphonic wind band has undergone a great evolution since the end of the last century, which is reflected in a greater presence of solos and other outstanding excerpts for this instrument. This article aims to make a first approach to the bulk of symphonic wind band repertoire from the part of the tuba, with the aim of searching, selecting and analysing the most outstanding excerpts, and presenting an innovated proposal compilation. Since this work belongs to a larger research, it establishes a beginning from the study of the composers and their most performed works in a special event which represents a milestone in the Valencian musical culture: the International Wind Band Contest «City of Valencia».

KEY WORDS: *Tuba; Symphonic wind band; Symphonic band repertoire; International Wind Band Contest «City of Valencia»; Solo excerpt.*

1. INTRODUCTION

From the first pieces written for band at the end of the 19th Century to the great symphonic works of the 21st Century, passing through the entire 20th Century, the symphonic band has undergone a very important evolution and expansion in many ways, above all, in terms of organology and repertoire performed. In this sense, it has also unfolded a new potential as far as concrete writing for the instruments is concerned and the tuba has been no exception. It has now established itself as a solo instrument on a par with any other in the symphonic ensemble, for which composers have dedicated extensive and virtuosic "solo" passages. And what better stage to show it than the International Wind Band Contest «City of Valencia» (CIBM).

How to cite: Monteagudo Mañas, J., Carrascosa López, C. E., and Hernández Farinós, J. P. 2021. The International Wind Band Contest «City of Valencia» as historical and cultural heritage: analysis of the innovative performed repertoire from the tuba chair. In Proc.: *3rd International Conference Business Meets Technology*. Valencia, 23rd & 24th September 2021. 153-161. https://doi.org/10.4995/BMT2021.2021.13665

During the 19th Century, the most important characteristics that stand out in how composers treated the tuba in their works are aspects such as the register, where the voice of the tuba is basically kept within the staff, which turns out to be like a 4th trombone that doubles other instruments. Do not forget that the most immediate predecessors of the tuba are the serpentone and the ophicleide, which played the lowest voice in the instrumental ensembles (bass) and its tessitura was not as low as it was later achieved with the tuba (Bevan, 1978). A work in which this writing for tuba can be appreciated is *Valencianes* (1909) by Eduardo López-Chavarri (1871-1970), chosen by the organization of the International Wind Band Contest «City of Valencia» as a compulsory work for the special section B in 1985. Other examples are: Amilcare Ponchielli's (1834-1886) *Sinfonia per banda* (1872), performed as a free choice work in the 3rd section of the 2000 edition of the CIBM, where below the woodwind instruments only the tuba is heard doubling the voice of the horns; and Salvador Giner's (1832-1911) *El Festín de Baltasar* (1893), with fragments where the tuba doubles the melody of the low woodwind instruments (bassoon and bass clarinet).

The compositions for band of the first half of the 20th Century represent for the tuba an evolution as far as its individuality is concerned, that is to say, the authors not only have the tuba as the main rhythmic-harmonic support, but they also write outstanding passages of certain technical difficulty. As an example, we can mention the Joaquin Rodrigo's (1901-1999) work performed at the CIBM, *Per la Flor del Lliri Blau* (1934), and *Lincolnshire Posy* (1937) by Percy A. Grainger (1882-1961), which also introduces interventions marked as "solo" and doubles the tuba line in two octaves, achieving greater sonorous depth.

In the second half of the 20th Century, the tuba continues to acquire greater prominence within the symphonic ensemble and to develop in the aspects mentioned above, while the band's staff continues to expand. From the 60's onwards, the most important increase in original literature for band up to that moment took place, which has not stopped growing exponentially since then. In this period it is very difficult to cite specific works, so any piece by David Maslanka (1943-2017), James Barnes (1949-), Eric Whitacre (1970-), John Mackey (1977-), Bert Appermont (1973-), Philip Sparke (1951-), Mario Bürki (1977-), Franco Cesarini (1961-), José Suñer or Teo Aparicio, just to name a few. All of them played in the International Wind Band Contest «City of Valencia».

In this 21st Century, the tuba has joined the writing of emerging musical currents, such as randomness and other new languages, which have expanded its possibilities, not only soloistic, but also in groups. This can be seen represented in the repertoire of the CIBM with works such as *Ghost Train* (1995) by Eric Whitacre (1970-) or *Màscares* (2017) by Voro Garcia (1970-), for example.

At the same time, the tuba has established itself as a soloist instrument at the level of any other in the symphonic band, for which composers have dedicated extensive and virtuosic "solo" passages, extracting from it all its lyrical-expressive potential and an amazing versatility in different planes (register, dynamics, character, etc.). Some

of these composers have even given prominence not only to one tuba, but on several occasions to two or even three of them. Works by Gregory Fritze (1954-), Ferrer Ferran (1966-) or Francisco Tamarit (1941-) clearly show some examples that will be discussed below.

An innovative study: collection of excerpts for tuba

The following study aims to make a first approach to the symphonic repertoire for band from the tuba part, in order to search, select and analyze the most outstanding fragments, and to present a proposal for classification, given the great void that exists in the literature for this instrument in this field. Since the work belongs to a larger research, a beginning is established from the study of the composers and their most performed works within the context of the International Wind Band Contest «City of Valencia», which represents a reference in the musical culture, not only in Valencia, but around the world.

For this, some previous studies will be marked, on which this research is supported and promoted, what objectives it pursues and from which hypothesis it starts. Then, the work process carried out will be commented and, finally, what results are extracted from all this, as well as the approach of possible future research.

Related work: The theoretical framework

The studies carried out by the same team of researchers who signed this research (Monteagudo, Carrascosa and Hernández; 2019 and 2020), the rest of the existing works on the repertoire performed in the International Wind Band Contest «City of Valencia» are, or very specific in some cases, on the participation of a certain band (Oriola, 2014); not very significant in others, with a merely narrative approach to its general history (Astruells, 2001); and in all, incomplete, collecting research on the repertoire performed in a short period of time, between 1886 and 1897, (Asensi, 2013). Only one previous book has been found, edited in two volumes, which reviews everything that happened in the CIBM until 2011, including the repertoire (Ruiz, 2011), but now in 2021 it is also incomplete.

Regarding the works that study the classification of the repertoire for band, in general, and those that do so from the part of an instrument in particular, we present below those selected in four large groups:

- First, the studies on the repertoire for symphonic band, specifically, those that focus their research on what works to compile and how to classify them. Of particular note is Towner's study presented in 2011 which updates the earlier one by Gilbert in 1993 and the first one by Ostling in 1978.
- Secondly, the studies that collect excerpts of works for band by instruments other than the tuba, such as flute, trumpet, saxophone or bass clarinet, among others.

Averett's work in 2010, which collects 586 trumpet excerpts in works for wind band of the twentieth century, stands out as outstanding.

- Then, the studies on tuba band excerpts. This group is the one that most interests the research and where the great lack of scientific material has been found, since only the study of Harvey in 2007 collects some tuba excerpts, extracted only from works by American composers, and, prior to this, the work of Berman in 1981 selecting thirty-two works that have outstanding excerpts for the tuba.
- And, finally, to point out a study comparing and analyzing the role played by the tuba in large ensembles, i.e.: orchestra, brass band and wind and percussion ensemble (Taylor, 2013).

After the study and analysis of the commented works, it can be deduced that, just as in other instruments more exhaustive and varied research has been carried out in relation to the role they play within the symphonic-band ensemble (not all the works have been exposed, but there are many more), this is not the case of the tuba. And even less if we relate it including the repertoire of Spanish composers.

2. OBJECTIVES AND HYPOTHESES

At this point, the main objectives to be achieved with this research are presented, which, deductively exposed, would be as follows:

1. To collect the most recent original symphonic repertoire for band, taking as space and time the International Wind Band Contest «City of Valencia» and the period from 1979 to the present.
2. To expand other previous studies incorporating more material and, above all, including Spanish composers.
3. To select the works with "solo" excerpts for tuba.

Given the gap in the scientific literature regarding the study of the role of the tuba in symphonic works for band and, given the exponential increase in the repertoire for this group since the late twentieth century, we propose a hypothesis that "tests" the role of the tuba in this repertoire. For example, searching for and selecting the most outstanding passages: in this case, the tuba solo excerpts.

3. METHODOLOGY: SELECTION, ANALYSIS AND CLASSIFICATION OF THE MATERIAL

Taking the repertoire listed in a previous research (Monteagudo, Carrascosa and Hernández; 2019) as the main and only source of study, we have extracted only the original works for band from a total that adds up to 1,068 pieces, that is, about 476 works. This document has been decided not to be included here due to its length, but it

can be officially consulted in an article published by Ediçoes Colibri[1]. Of this original total, 173 titles were performed as compulsory works in the different sections into which the competition was and is divided[2] and the rest (303) as works of free choice by the participating bands.

In the following, these works have been analyzed through different ways, in order to identify, select and extract the most outstanding tuba passages:

1. listening to recordings;
2. the study of the score;
3. contact with composers (as far as possible);
4. discussions with band conductors, teachers, tuba soloists and other experts;
5. and taking into account the results of other research on tuba repertoire (e.g., Berman, 1981; and Harvey, 2007).

Next, we have extracted the fragments of the tuba line marked by the composers with terms such as: *solo*, *soli*, *solo divisi* or others of this type, in which there is no doubt that the tuba is important.

For the organization and presentation of the "solo" excerpts, it has been decided to classify them according to an aesthetic and musical texture criterion, resulting in the following groups:

A) Short "solo" interventions

B) Solos

C) Cadential solos and *fermatas*

D) More than one voice: *Solo Divisi*, *Soli*, 2 Tubas and 3 Tubas.

In the first group, the small "solo" interventions have been classified. They are short soloistic designs (two or three bars, generally), where the tuba intervenes with the theme, and short melodic-rhythmic links, also "a solo". To illustrate this group, the following examples are presented (Table 1).

[1] Monteagudo Mañas, Javier; Carrascosa López, Conrado E.; and Hernández Farinós, José P. (2020): "The evolution of the wind band repertoire in Valencia: case study of the International Wind Band Contest «City of Valencia»". In VVAA: *Our Music/Our World: Wind Bands and Local Social Life.* Lisboa: Ediçoes Colibri. pp. 443-460.

[2] The number of sections into which the CIBM is divided has changed considerably throughout its history, especially in the first decades, in relation to aspects such as: the type of band (civil or military), the geography (regional, national and international), the number of seats, the musical-performance requirements, etc. (Galbis, 1999).

Table 1. Short "solo" interventions.

	Composition	
Author	Title	Year
Amando Blanquer	*Ritual i Dances d'Algemesí*	1982
Andrés Valero	*Polifemo*	2000
Teo Aparicio	*Symphony Nº1 "Asgard"*	2002
Luis Serrano	*Little Suie for Wind Band*	2008
Óscar Navarro	*Expedition*	2011
Óscar Navarro	*Hispania*	2013

The following group of "solos" (Table 2), gathers the excerpts where the tuba intervenes with a more extensive passage, granting the composer an outstanding momentary protagonism. Some examples are the excerpts from the works by:

Table 2. "Solos".

	Composition	
Author	Title	Year
Amando Blanquer	*Concierto para Banda*	1971
Carlos Suriñach	*Soleriana*	1972
Rafael Talens	*Cosmos*	1979
Martin Ellerby	*Paris Sketches*	1994
James Barnes	*Symphony Nº3 "The Tragic"*	1997
Francisco Bort	*Llegendes*	2000
Andrés Valero	*Symphony Nº2 "Teogónica"*	2003
Luis Serrano Alarcón	*Memorias de un hombre de ciudad*	2003
Manuel Angulo	*Concerto Grosso*	2006
Francisco Bort	*Variacions Iròniques*	2007
Ferrer Ferran	*Pinocho*	2008
J. Gonzalo Gómez Deval	*La Batalla de Rande*	2008
J. Gonzalo Gómez Deval	*Handàq*	2009
J. Gonzalo Gómez Deval	*Meigas*	2009
Óscar Navarro	*Libertadores*	2010
Gregory Fritze	*A Day in Valencia*	2011
Ferrer Ferran	*Concert per a Banda*	2013
José Suñer	*Symphony Nº3 "Phobos"*	2013
Gregory Fritze	*Bocetos de Cullera*	2014
J. Gonzalo Gómez Deval	*Astrofísica*	2014
José Alamá	*Fases*	2016
Luis Serrano Alarcón	*Second Symphony for Wind Orchestra*	2017
Fco. Martínez Gallego	*La Rosa del Desierto*	2018
José Suñer	*Soulful Stones*	2018

In the third group, we find the cadential solos, in which the tuba is recreated in much more extensive passages performing cadences or fermatas, almost as if they were framed within a concert between tuba soloist and band. It is worth mentioning the indications of the composers in these moments:

Table 3. Cadential "solos" and *fermatas*.

	Composition		
Author	Title	Year	Indication for tuba
Juan Pérez Ribes	*La Flor del Taronger*	1991	"solo a placer"
Francisco Grau	*Capricho Mediterraneo*	2002	"sin rigor de compás"
Luis Serrano Alarcón	*Marco Polo: La ruta de la seda*	2006	"lento ad libitum"
J. Gonzalo Gómez Deval	*Dragón Elliot: poema sinfónico a un dibujo*	2011	"solo" (several *tempo* changes until a *cediendo*)
Fco. Martínez Gallego	*Miraculum*	2015	"rubato"
Ferrer Ferran	*Quartum Milliarium*	2016	"Cadenza"

And finally, a group composed by the excerpts where several tubas are soloists, with two or even three of them taking part:

Table 4. More than one tuba: *Solo Divisi, Soli*, 2 or 3 tubas

	Composition		
Author	Title	Year	Characteristics
Rafael Talens	*Obertura Rítmica*	1990	Basically a "solo" for one tuba, but at the end a 2nd tuba supports the cadenza
Ferrer Ferran	*La sombra del cruzado*	1999	The tuba section plays a "soli" excerpt
Francisco Tamarit	*Vientos…*	2003	A passage for two solistic tubas in the 3rd movement
Gregory Fritze	*Flor de Azahar: Concert for Band*	2006	A fugue for three solistic tubas in the last movement
Ferrer Ferran	*Symphony Nº4 "Coloso"*	2011	The tuba section plays a "soli" excerpt
José Suñer	*El jardín de las Hespérides*	2015	Includes an excerpt marked as "only one" for two voices
Gregory Fritze	*Vadit Super Pozolum*	2016	Passage for two solistic tubas in the 4th movement

4. RESULTS AND DISCUSSION

The results drawn from this research show a significant increase in the interest of contemporary composers to include tuba solos in their works for band (in any of the forms previously discussed), which gives the instrument an increasingly greater prominence within the ensemble. Statistically proven, it can be said that 42 of the 476 works analyzed contain at least one tuba solo excerpt and, in a high percentage, performed in the period

2000-2019. In addition, the analysis of the results yields one more and very significant difference, since to a large extent these pieces are the creation of Spanish composers. All these data can be seen in the following graph:

Although this study may seem merely anecdotal, comparing it for example with the soloist role played by other instruments such as the flute, trumpet, saxophone or clarinet, it is believed that it represents a real commitment to the value of an instrument such as the tuba within the symphonic-band repertoire. An innovated and very valuable contribution that increases and enriches the catalog of music for band, not only nationally, but also internationally.

5. LIMITATIONS AND FUTURE INVESTIGATIONS

In this study we have only considered the repertoire performed in a specific event, such as the International Wind Band Contest «City of Valencia», and within a specific time frame, 1979 to 2019. Even taking into account that it is an annual event, internationally renowned, very well attended and on whose stage hundreds of fundamental works for the wind band literature have been performed and premiered, it must be recognized that some important titles have been left out, which also include tuba "solos". Nevertheless, the time frame analyzed does represent the years in which most original compositions for band have been performed and, therefore, the "solos" written for tuba within them.

Possible future research could analyze, perhaps in a similar way, the repertoire for symphonic band played in other international events, such as congresses, festivals or competitions, extracting possible "solos" for tuba and expanding a compendium that collects unpublished material in this regard. It is sure to be of great use for teachers who teach repertoire classes in conservatories, tuba players and musicians in general who want to learn more about this instrument in the symphonic band.

ACKNOWLEDGMENTS

No funding has been received for the development of the research.

CONFLICT OF INTERESTS

There is not any conflict of interests in these research.

REFERENCES

Asensi Silvestre, E. (2013). *Música, mestre! Les bandes valencianes en el tombant del segle XIX*. Valencia: Publicacions Universitat de València.

Astruells Moreno, S. (2001). "Historia del Certamen de la Feria de Julio de Valencia: desde sus orígenes hasta 1930". In *Música y Pueblo*, nº108, pp. 15-16. Valencia: Federación de Sociedades Musicales de la Comunidad Valenciana.

Averett, M. W. (2010). *Trumpet Excerpts from the wind band literature.* Doctoral Thesis. Indiana: Ball State University.

BerMan, E. M. (1981). *Performance Tasks Encountered in Selected Twentieth-Century Band Excerpts for Tuba: Their Identifiation, Categoriza- tion, and Analysis*. Doctoral Thesis. New York: New York University.

Bevan, C. (1978). *The Tuba Family*. London: Faber and Faber Limited.

Gilbert, Jay Warren (1993): *An evaluation of compositions for wind band according to specific criteria of serious artistic merit: a replication and update.* Doctoral Thesis. Illinois: Northwestern University.

Harvey, B. M. (2007). *Essential Excerpts for Tuba from Original Works written for Wind Ensemble.* Tesis doctoral. Chapel Hill (NC): University of North Carolina.

Monteagudo Mañas, J.; Carrascosa López, C. E.; & Hernández Farinós, J. P. (2020). "The evolution of the wind band repertoire in Valencia: case study of the International Wind Band Contest «City of Valencia»". In AAVV: *Our Music/Our World: Wind Bands and Local Social Life.* pp. 443-460. Lisboa: Ediçoes Colibri.

Oriola Velló, F. (2014). "Las bandas militares en la España de la Restauración (1875-1931)." In *Nassarre: Revista aragonesa de musicología*, Vol. 30/1, pp. 163-194. https://ifc.dpz.es/recursos/publicaciones/34/92/06oriola.pdf

Ostling, Eric (1978): *An evaluation of compositions for wind band according to specific criteria of serious artistic merit.* Doctoral Thesis. Ames (IA): University of Iowa.

Ruiz Cerveró, A. (2011). *Una historia irrepetible en el mundo musical. El Certamen Internacional de Bandas de Música «Ciudad de Valencia».* Vol. I- -II. Valencia: Piles Editorial.

Taylor, Alexander R. (2013). *"Playing heavy metal": a comparative study of the role of the tuba in the orchestra, brass band and wind ensemble.* Doctoral Thesis. UK: School of Creative Arts, University of Newcastle.

Towner, C. (2011). *An evaluation of compositions for wind band according to specific criteria of serious artistic merit: a second update.* Doctoral Thesis. Lincoln, (NE): University of Nebraska.

MISCELLANY

BMT21
3rd International Conference
Business Meets Technology.
Valencia, 23rd & 24th September 2021

EVOLUTIONARY PROCESS OF THE "BORN GLOBALS" – A LITERATURE REVIEW

Garcés Bautista, Jose Luis [a]; Estelles-Miguel, Sofia [b1]; Peris-Ortiz, Marta [b2] and Valero Cordoba, Gladys Mireya [d]

[a] *Business Administration Program. Universidad Autónoma de Bucaramanga. Colombia (jgarces2@unab.edu.co).*
[b] *Departamento de Organización de Empresas. Universitat Politècnica de València. España. ([b1] soesmi@omp.upv.es, [b2] mperis@doe.upv.es)*
[d] *Economic, Administration and business Dean. Universidad Pontificia Bolivariana Seccional Bucaramanga. Colombia. (gladys.valero@upb.edu.co)*

ABSTRACT: *New theories of internationalization and their methodologies propose the union of two or more companies to satisfy requirements in international markets. Joint ventures, international licenses, foreign investors or even the basic operation of exporting and importing are a clear example of these. Furthermore, these theories aim to carry out processes to insert regions in a more global context. The present work presents a bibliographic review of companies known as "Born Global". A study of this concept has been developed over time and organized as follows: Beginning of the term in the 90s, evolution in the 2000s, and academic boom between 2010 and 2020. Early results show that Born Globals' arise to a large extent from companies with high-tech innovation products and software products, productivity and competitiveness level indicators are expected to improve for business and technology.*

KEY WORDS: *Born Global; Internationalization; Entrepreneurship.*

1. INTRODUCTION

The study of "Born Global" companies explains new concepts of internationalization through the analysis of various theories addressing the creation of companies in the global sphere. This leads to solve issues only at the global level, since the companies respond exclusively to those markets and are not interested in local or national ones. The present work presents a literature review, divided as follows: Creation, evolution and academic boom of the Born Global concept. The methodology used for this paper was a search of terms in Googlescholar, academic databases such as Scielo, Scopus and Redalyc, with a qualitative and correlational approach, by using words like Born Globals, international entrepreneurship, new international companies. Each section of this paper includes a brief

How to cite: Garcés Bautista, J. L., Estelles-Miguel, S., Peris-Ortiz, M., and Valero Cordoba, G. M. 2021. Evolutionary Process of the "Born Globals" – A Literature Review. In Proc.: *3rd International Conference Business Meets Technology*. Valencia, 23rd & 24th September 2021. 165-175. https://doi.org/10.4995/BMT2021.2021.13501

literature review, implications, and recent contributions for the definition of Born Globals Companies.

2. BEGINNINGS OF THE "BORN GLOBAL" TERM: THE 1990´S

The first attempt to define a global company is found in Ohmae (1991), who indicates that there are global companies which have abandoned their national identity and operate on a world scale as entities without a country. Similarly, Oviatt & McDougall (1994) propose the integration of internationalization, entrepreneurship and strategy, in search for the explanation of an "emerging phenomenon" known today as Born Global companies.

For their part, Madsen & Servais (1997) affirm that the Born Global phenomenon has been part of the literature related to internationalization processes of companies. They indicate that this phenomenon is opposed to the traditional models of internationalization, concluding that the "Born Global" companies grow in a different way.

3. EVOLUTION OF THE TERM "BORN GLOBAL": THE 2000´S

In this decade we find evolution of the concept by understanding the emergence of Born Global companies, learning from practical cases and considering management models adapted to them. In a first approach, Harveston, Kedia & Davis (2000) studied the leading role of managers of this type of companies. They conclude that Born Global companies have managers with more geocentric mentalities than managers of firms with gradual globalization. Managers of the former have broader international experience than managers of the latter.

In Hodgkinson (2000) we find a practical case of the process of internationalization of small and medium enterprises in Asia, concluding that scarce financial and management resources of SMEs seem to make globalization only possible for large companies. As a result, policies should be focused towards updating of technology and general management skills of SMEs, envisioning Born Global companies as an opportunity.

Similarly, Bell, McNaughton & Young (2001) provide clear evidence of the rapid and dedicated internationalization of Born Global companies. These are generally smaller companies that go international from the start or close to it. At this point, they identify the existence of Born Global companies and explore some of the circumstances that have led to their rapid and dedicated internationalization. Therefore, it may be concluded that the authors seek to clarify the difficulty in understanding Born Global, by also considering "reborn" companies. These last ones explain the transition from a traditional company to a global company.

Rasmussen & Madsen (2002), based on empirical studies on the export behavior of companies, indicate that many companies do not develop in incremental stages with respect to their international activities. Therefore, personality, skills and capacities of the entrepreneurs are included as research topics to examine their impact on the birth and

development of these companies. This study introduces Born Global companies as a type of international companies, rather than being considered a "phenomenon".

Zahra & George (2002) approximate their definition of global enterprises in a process of discovering and creatively exploiting opportunities outside domestic markets in search for competitive advantage. Hashai & Almor (2004) conclude that the internationalization process of 'world-born' companies can be characterized by a gradual increase in their commitment to foreign markets.

Accordingly, Campbell - Hunt & Chetty (2004) carry out a systematic analysis of the degree to which traditional or global companies are moving towards internationalization, and how they differ in strategies, motivations and previous capacities. Knight & Cavusgli (2005) state that these companies are born from the need generated by internationalization looking for quick solutions in a global market, without considering local ones. In the same way, these can be small companies usually oriented towards technology that operate in international markets since their foundation.

At the end of this decade, the literature presents case studies in the United Kingdom and in Central America (Kudina et al., 2008; Lopez et al., 2009). These indicate that a distinctive characteristic of the companies in the study is that they perform most of their research and development at an international level. To a large extent, UK companies considered as Born Global (usually software) have a competitive advantage through differentiation in the global market. One consequence of the role of differentiation is that most companies need to have considerable funds to invest in technology development, which is an additional barrier to new competition. Likewise, an exploratory study of the software industry in Costa Rica was developed to help companies seek business opportunities on being born global versus regional. In that order, the study showed that a Born Global company might be constituted internationally to aim at a market in the United States, but for different circumstances concentrates its efforts mainly towards Central and South America; while at the same time, responding to needs from a local point of view (Lopez et al., 2009).

4. ACADEMIC BOOM OF THE "BORN GLOBAL": 2010 TO 2020

This decade saw Born Global at its peak, with summarized information of real cases throughout the planet. At the same time, research articles are presented with literature reviews, state of the art, and managerial profiles, among others.

Tanev (2012) shows recent research on companies that are "Born Global", providing relevant information for entrepreneurs and senior management of new technology companies. Pettersen & Tobiassen (2012) indicate that most of the research on Born Global companies analyze them from a perspective of their legal foundation, while there are also studies that show that international companies go through long periods of pre-foundation, which probably affect growth and internationalization processes. These companies spent a long time developing their technologies prior to being founded.

Uner et al. (2013) state that the question of whether export barriers present significant differences between companies has not been addressed and conclude that export barriers vary according to the different stages of internationalization.

The results suggest that the perceived barriers differ mainly for companies in the national commercialization stage, versus pre-export stage and Born Global companies.

Cavusgli et al. (2015) make a descriptive research and conclude that Born Global companies represent an optimistic contemporary trend for international business, in which any firm, of any size or base of experience or resources, can actively participate in cross-border trade.

Servantie (2015) demonstrates how an SME can be internationalized from its conception. The author states that SMEs do not find institutional support adapted to their needs and, therefore, seek rapid growth in the market since Born Global companies have an established niche. They tend to solve defined needs or opportunities and maintain close relationships with their clients. In this way, the transition from traditional SMEs to Born Global, becomes a strategy for growth and survival.

Zander et al. (2015) indicate that despite its growing importance, the understanding of Born Global companies remains incomplete. Comprehending how and why these companies develop and implement their internationalization strategies, and what makes them successful, becomes an essential topic. Mendez (2015) makes a parallel between the UPPSALA companies and the Born Global, explaining the "modus operandi" of the internationalization process of the former. The author focuses on the early creation of the global companies, which are oriented towards international markets, omitting stages in the overall process.

Lin et al. (2016) study the evolution of exchange of Born Global companies in the Zhejiang province in China. The main factor analyzed is the relationship of managers with their networking, considered a trigger for growth in the global market. Aspects studied include high level of training, qualifications, experience in the sector and a strong inclination towards innovation of managers. Ughetto (2016) examines the relationship between entrepreneurs' human capital and their perception of how venture capital can positively affect it.

Saucedo-Espinosa, et al. (2016) explain the primary role that all organizations must fulfill, such as their Corporate Social Responsibility. From this perspective, authors consider the role of Born Global companies, understanding them as a new type of companies.

Etermad (2017) explains the life cycle of international companies, allowing to skip some growth stages (and understanding Born Global as the result of a correct assimilation of stages that respond to the global market). The authors postulate the relevance of broad managerial skills and experience. However, they mistakenly present the Born Global as a stage to evolve towards transnational companies.

García–Cabrera et al. (2017), in a case of Born Global companies in Spain, present a study of 242 young manufacturing SMEs with a successful degree of exporting unique and highly innovative products, and achieving a position in the international market. This study indicates a favorable environment for the creation of Born Global, in such a way as to encourage new ventures on this field. Vargas (2017) presents essential characteristics for companies in the process of internationalization, specifically Born Global. The author indicates that strategic direction must be coherent with the internationalization process, based on the conclusion that you must fully understand the target market you are entering.

In the same way, García–Lillo et al. (2017) present a bibliometric analysis of the study of Born Global companies, indicating the importance of research of this type of companies. They conclude that the symbiosis between Born Global and the internationalization process is considered necessary and key for both parties.

Fong et al. (2017) identify the essential resources and barriers that these companies may have when operating. Among them are high financial resources necessary to smoothly operate and high specialization of the international market. As challenges, they present ignorance of the target market, little logistics structure, high costs inherent to the production process and precarious networking.

Similarly, they dedicate a section to identify the strengths of this study, including product design and quality, a primary intangible indicator, and the creation of clusters at the local level. Lopez (2017) concludes that these types of companies are based on a key variable: TIME, since they show an early and accelerated growth in their process of internationalization.

Øyna & Alon (2018) indicate that Born Global companies will play an active role in the business economy. Hence, understanding their characteristics for the generation of this type of entrepreneurship, and the variables and factors that contribute to success are of great relevance for the academic and productive sectors. Bojorquez & Bojorquez (2018) make it possible to determine whether an SME can be global or achieve the category of global when its operation area´s is mainly the local market and its strategic intention is to operate locally.

Chhotray et al. (2018) present a real case example of Born Global in Sweden, making a case about the need for high professional and academic skills in managers of these types of companies. By means of this experience, they have been able to position them with a vision of being world leaders in their field. The relevance about this topic is that is has been proved that productivity and attitude within the labor dynamics is consistent with this vision, thanks to the empowerment of collaborators.

Hull et al. (2019) carry out surveys of 321 startups of Born Global companies in Chinese cities, characterized by their innovation, diversity of information and attractiveness in globalization. They conclude that although there is a large population of incipient entrepreneurs (micro-entrepreneurs), whose businesses pave the way for Born Global Companies, they have a greater probability of not being able to be sustainable over time and increase the mortality rate of companies in this country.

This occurs due to the in-depth lack of awareness of all internationalization processes, allowing a decline that leads to their liquidation. Evers et al. (2019) conclude with a conceptual research framework that permits the understanding of orientations at strategic levels of international companies, compared to Born Global companies.

Finally, Ferguson et al. (2019), analyzing Swedish companies, conclude that the rapid strategy of "aggressive" global internationalization from the beginning of operation does not guarantee a greater constant growth of the organization, versus a gradual entry into global markets,

McCormick & Somaya (2020) present the advantages of promoting Born Global since these ventures overcome the logistical and infrastructure difficulties of their countries of origin. This is because they are strategically located, count with enough resources and tend to export their products instead of producing locally.

Nguyen et al (2020) propose an internationalization model to accelerate new ventures towards the export of their products, with a focus on boosting capacities and improvements in terms of operation within production. Andersson et al. (2020) explain that their basis for achieving sustainable growth "Business Maturity" is characterized by continuous internationalization. Therefore, to maintain a competitive position through products whose niches are international is required, along with a focus in the market, both reactive and proactive.

In this way, the creation of value for customers is facilitated. These activities are financially supported by constant reinvestment in international marketing activities. Romanello et al. (2020) propose a parallel between China and Italy, considering that both countries´ economic approach generates internationalization opportunities. China promotes main internationalization opportunities to present a focus on cluster networks due to their local context. In the Italian economy, these strengths are presented through the innovation of products that become attractive to the global market. They indicate that despite how different these two economies may be, there is an environment conducive to the development of Born Global companies based on government support.

Wadeson (2020) concludes that Born Global companies must be studied from the perspective of the internationalization process, in order to transition from its definition as a phenomenon to a type of entrepreneurship, and in coherence with the innovation and development process, access to financial capital and demand in global markets.

Fong et al. (2020) conclude in their work that due to the number of SMEs in Mexico, they see their relevance in the creation of employment, economic innovation, managerial skills and economic development. However, these series of benefits are not perceived at all levels, which leads the authors to propose achieving it from the standpoint of Born Global emergence.

Weerawardena et al. (2020) aim to show that companies in the international market can relate administrative innovation to product innovation. A high correlation that points out to innovation as a main characteristic of Born Global companies. Jakobsson et al.

(2020) indicate, for Born Global companies in Sweden, that these present special skills in topics such as market, strategy, creation of clusters, logistics and marketing. In the same way, they affirm that the managerial skills are not used to the same extent but are necessary for the successful performance of this type of entrepreneurships.

However, their study concludes that the lack of experience in internationalization or the lack of financial resources force these companies to prioritize and promote the development of this type of skills. Lezana et al. (2020) achieve that Born Global companies can have higher levels of success when they satisfy the main foundation of internationalization: nothing more than satisfying the need to eliminate physical distance and allowing psychological distance to generate demand in global markets.

5. CONCLUSIONS

- At the beginning of the concept, there is a need to continue researching on this topic or "phenomenon", starting from the facts in history that favored its appearance in the global market.
- In the 2000s period, there is an evolution of the definition of Born Global Companies. At the same time, there are case studies of this type of companies, mostly software companies. These companies are in constant evolution and allow a real application of the term.
- Finally, in the last decade, three perspectives are presented. The first one is the Change of Approach, dedicated to analyzing successful models, or changing the paradigm of analysis of the definition in this type of entrepreneurship. The second is Distinctive Characteristics, oriented towards the relevance of the training and skills in managers, market knowledge, logistics preparation, economic approach and importance of government institutions. The third and last is Living Practice, where the focus is to satisfy the need that originated internationalization. For the last one, one must consider first the distinctive characteristics approach, considered the most efficient path to success. In this sense, Born Global has allowed start-up companies to maintain a boom in terms of innovation, value creation and even to present themselves as an entrepreneurial opportunity. This evolution makes it possible to distinguish clear characteristics of the process and the way in which a company can be born into the global market from its origins.

REFERENCES

Andersson, S., Awuah, G., … U. A.-I. M., & 2020, U. (2020). *How do mature born globals create customer value to achieve international growth?* https://www.emerald.com/insight/content/doi/10.1108/IMR-11-2018-0340/full/html

Bell, J., McNaughton, R., & Young, S. (2001). "Born-again global" firms: An extension to the "born global" phenomenon. *Journal of International Management, 7*(3), 173–189. https://doi.org/10.1016/S1075-4253(01)00043-6

Campbell-hunt, C. (2004). A Strategic Approach to Internationalization: A Traditional Versus a "Born-Global". *Approach. 12*(1), 57–81.

Cavusgil, S. T., & Knight, G. (2015). The born global firm: An entrepreneurial and capabilities perspective on early and rapid internationalization. *Journal of International Business Studies, 46*(1), 3–16. https://doi.org/10.1057/jibs.2014.62

Chhotray, S., Sivertsson, O., Tell, J., Fong, C., Ocampo, L., Oktaviani.J, Ughetto, E., Ferguson, S., Henrekson, M., Johannesson, L., Estado, E. L., Arte, D. E. L., Empresas, D. E. L. A. S., Globales, N., García-Canal, E., Valdés-Llaneza, A., Oktaviani.J, Bell, J., McNaughton, R., … L Rose, E. (2018). The Roles of Leadership, Vision, and Empowerment in Born Global Companies. *Journal of International Entrepreneurship, 16*(1), 38–57. https://doi.org/10.1007/s10843-017-0201-8

Etemad, H. (2017). Towards an emerging evolutionary life-cycle theory of internationalized entrepreneurial firms: from born globals to borderless firms? *Journal of International Entrepreneurship, 15*(2), 111–120. https://doi.org/10.1007/s10843-017-0204-5

Evers, N., Gliga, G., & Rialp-Criado, A. (2019). Strategic orientation pathways in international new ventures and born global firms—Towards a research agenda. *Journal of International Entrepreneurship, 17*(3), 287–304. https://doi.org/10.1007/s10843-019-00259-y

Ferguson, S., Henrekson, M., & Johannesson, L. (2019). *Getting the facts right on born globals. Small Business Economics*. https://doi.org/10.1007/s11187-019-00216-y

Fong, C., & Ocampo, L. (2020). La PyME en México, modelos de creación de empresas exitosas: el caso de las nacidas globales, las gacelas y las spin-off. *Red Internacional de Investigadores en Competitividad, 1*(1), 1069–1088.

Fong, C., Ocampo, L., Oktaviani.J, Ughetto, E., Ferguson, S., Henrekson, M., Johannesson, L., Estado, E. L., Arte, D. E. L., Empresas, D. E. L. A. S., Globales, N., García-Canal, E., Valdés-Llaneza, A., Oktaviani.J, Bell, J., McNaughton, R., Young, S., Cavusgil, S. T., Knight, G., … L Rose, E. (2017). The Roles of Ladership, Vision, and Empowerment in Born Global Companies. *Journal of International Entrepreneurship, 51*(1), 51. https://doi.org/10.1057/jibs.2014.60

García-Cabrera, A. M., García-Soto, M. G., & Suárez-Ortega, S. M. (2017). Macro-level spillovers and micro-level capabilities as antecedents of young SMEs' propensity to export and to become a born global. *International Entrepreneurship and Management Journal, 13*(4), 1199–1220. https://doi.org/10.1007/s11365-017-0451-x

García-Lillo, F., Claver-Cortés, E., Úbeda-García, M., & Marco-Lajara, B. (2017). Exploring the intellectual structure of research on 'born globals' and INVs: A literature review using bibliometric methods. *Journal of International Entrepreneurship*, 1–29. https://doi.org/10.1007/s10843-017-0213-4

Harveston, P., Kedia, B., & Davis, P. (2000). Internationalization of Born Global and Gradual Globalizing Firms: The Impact of the Manager. *Journal of Competitiveness Studies, 8*(1), 92.

Hashai, N., & Almor, T. (2004). Gradually internationalizing "born global" firms: An oxymoron? *International Business Review, 13*(4), 465–483. https://doi.org/10.1016/j.ibusrev.2004.04.004

Hodgkinson, A. (2000). *The Internationalisation Process of Asian Small and Medium Firms*. January, 1–13.

Hull, C. E., Tang, Z., Tang, J., & Yang, J. (2019). Information diversity and innovation for born-globals. *Asia Pacific Journal of Management*, 1039–1060. https://doi.org/10.1007/s10490-019-09651-7

Jakobsson, J., Fri, H., & Gillholm, L. (2020). *The Utilisation of Capabilities in Born Globals' Internationalisation Process A Multiple Case Study of Swedish Born Globals*. https://gupea.ub.gu.se/handle/2077/65247

Knight, G. A., & Cavusgil, S. T. (2005). A taxonomy of born-global firms A Taxonomy of Born-global. *Management International Review, 45*(January 2005), 15–35.

Kudina, A., Yip, G. S., & Barkema, H. G. (2008). Born global. *Business Strategy Review, 19*(4), 38–44. https://doi.org/10.1111/j.1467-8616.2008.00562.x

Lezana Zúñiga, B., Cancino, C., Castillo, D., Guede Vicencio, B., & Carlos Salazar-Elena, J. (2020). *Distancias Psicológicas y el Éxito Exportador de las Born Globals*. remef.org.mx. https://doi.org/10.21919/remef.v15i0.541

Lin, S., Mercier-Suissa, C., & Salloum, C. (2016). The Chinese born globals of the Zhejiang Province: A study on the key factors for their rapid internationalization. *Journal of International Entrepreneurship, 14*(1), 75–95. https://doi.org/10.1007/s10843-016-0174-z

Lopez, B. (2017). *Identificación de los antecedentes de las Born Globals*.

Lopez, L. E., Kundu, S. K., & Ciravegna, L. (2009). Born global or born regional Evidence from an exploratory study in the Costa Rican software industry. *Journal of International Business Studies, 40*(7), 1228–1238. https://doi.org/10.1057/jibs.2008.69

Madsen, T. K., & Servais, P. (1997). The internationalization of born globals: An evolutionary process? *International Business Review, 6*(6), 561–583. https://doi.org/10.1016/s0969-5931(97)00032-2

McCormick, M., & Somaya, D. (2020). Born globals from emerging economies: Reconciling early exporting with theories of internationalization. *Global Strategy Journal, 10*(2), 251–281. https://doi.org/10.1002/gsj.1368

Méndez Lazarte, C. (2015). Análisis del comportamiento de internacionalización de pequeñas y medianas empresas exportadoras. El caso de empresas exitosas de la industria del software en Lima. *Sotavento M.B.A., 25*, 18. https://doi.org/10.18601/01233734.n25.03

Nguyen, Q. A., & Mort, G. S. (2020). Conceptualising organisational-level and microfoundational capabilities: an integrated view of born-globals' internationalisation. *International Entrepreneurship and Management Journal*. https://doi.org/10.1007/s11365-020-00662-1

Ohmae, K. (1991). *El mundo sin fronteras*. Mac Graw Hill.

Oktaviani.J. (2018). ¿Pymes manufactureras globales? Bojorquez, Hernando; *Bojorque, 51*(1), 51.

Oviatt, B. M., & McDougall, P. P. (1994). Toward a Theory of International New ventures. *Journal of International Business Studies, 36*(1), 29–41. https://doi.org/10.1057/palgrave.jibs.8490193

Øyna, S., & Alon, I. (2018). A Review of Born globals. *International Studies of Management and Organization, 48*(2), 157–180. https://doi.org/10.1080/00208825.2018.1443737

Pettersen, I. B., & Tobiassen, A. E. (2012). Are born globals really born globals? The case of academic spin-offs with long development periods. *Journal of International Entrepreneurship, 10*(2), 117–141. https://doi.org/10.1007/s10843-012-0086-5

Rasmussen, E., & Madsen, T. (2002). The born global concept. Paper for the *EIBA conference*, December, 27. http://www.sam.sdu.dk/~era/EIBA Rasmussen 2002.pdf

Romanello, R., Karami, Gerschewski, Stephan, Evers, Natasha, & Xiao. (2020). International Opportunity Discovery of Born Globals: The Role of Institutions. *Academy of Management*. http://kar.kent.ac.uk/contact.html

Saucedo-Espinosa, Francisco, Vázquez-Zacarías, Manuel Alexis, & López, Lira-Arjona, A. (2016). *El estado del arte de las empresas nacidas globales mexicanas*. 2535–2555.

Servantie, V. (2015). *La Pyme que nace global: Internacionalización precoz y veloz*.

Tanev, S. (2012). Global from the Start: The Characteristics of Born-Global Firms in the Technology Sector. *Technology Innovation Management Review, 2*(3), 5–8. https://doi.org/10.22215/timreview532

Ughetto, E. (2016). Growth of born globals: the role of the entrepreneur's personal factors and venture capital. *International Entrepreneurship and Management Journal, 12*(3), 839–857. https://doi.org/10.1007/s11365-015-0368-1

Uner, M. M., Kocak, A., Cavusgil, E., & Cavusgil, S. T. (2013). Do barriers to export vary for born globals and across stages of internationalization? An empirical inquiry in the emerging market of Turkey. *International Business Review, 22*(5), 800–813. https://doi.org/10.1016/j.ibusrev.2012.12.005

Vargas, S. (2017). *La nueva tendencia en la internacionalización de una pyme – Fenómeno de Born Global*. 1–64.

Wadeson, N. (2020). Internationalisation theory and Born Globals. *Multinational Business Review*. https://doi.org/10.1108/MBR-10-2019-0123

Weerawardena, J., Salunke, S., Knight, G., Mort, G. S., & Liesch, P. W. (2020). The learning subsystem interplay in service innovation in born global service firm internationalization. *Industrial Marketing Management, 89*(May), 181–195. https://doi.org/10.1016/j.indmarman.2019.05.012

Zahra, S. G. G. (2002). Absorptive capacity: A review, reconceptualization, and extension. *AIAA Journal, 27*(2), 185–2013. https://doi.org/10.2514/1.J054260

Zander, I., McDougall-Covin, P., & L Rose, E. (2015). Born globals and international business: Evolution of a field of research. *Journal of International Business Studies, 46*(1), 27–35. https://doi.org/10.1057/jibs.2014.60

BMT21
3rd International Conference
Business Meets Technology.
Valencia, 23rd & 24th September 2021

FINANCIAL INCLUSION OF SMALL FIRMS: INFORMALITY, FINTECH SOLUTIONS, AND VOIDS

De-Miguel-Molina, Blanca [a]; Cadrazco-Suárez, Maryi [b1]; Juliao-Rossi, Jorge [b2] and Rincón-Díaz, Carlos [b3]

[a] *Universitat Politècnica de València, Spain. (bdemigu@omp.upv.es)*
[b] *Universidad de La Salle, Colombia. ([b1] mcadrazco@unisalle.edu.co, [b2] jjuliao@unisalle.edu.co, [b3] carincon@unisalle.edu.co)*

ABSTRACT: This paper analyses the relationship between institutional voids, the informality of small firms, and their financial inclusion in Colombia. Data for the analysis were obtained from a dataset available at DANE, which includes a sample of 86,969 small firms in Colombia and 2,467 in the Bogotá region. Descriptive analyses and a tree decision classification were conducted to obtain segments of entrepreneurs in the financial market, predict the formality of small firms, and analyse voids related to digital skills that might limit the solutions based on fintech. Results indicated that entrepreneurs less willing to demand credits represent the current largest segment, that formality and financial inclusion of small firms go hand in hand, and that digital skills might be a limitation for the extension of solutions based on fintech. The analyses allowed for identifying problems and solutions before conducting qualitative analyses with entrepreneurs.

KEY WORDS: *Financial inclusion; Informality; Colombia; Digitisation; C5.0 Decision tree.*

1. INTRODUCTION

Financial inclusion refers to the access to formal financial instruments by individuals and organisations in a country (Sarma & Pais, 2011). Improving the financial inclusion of small and mid-size enterprises (SMEs) has become a priority for governments (Granda et al., 2019) as part of the United Nations 2030 Agenda; Target 9.3 of the Sustainable Development Goals (https://sdgs.un.org/goals/goal9) concerns SMEs' financial inclusion. However, COVID-19 impacted the revenue stream of small firms severely and, in countries like Colombia, the high percentage of small firms engaged in informal activities reduced their access to government aids (OIT & CEPAL, 2020).

International organisations have promoted different solutions during the last decade. One of these solutions was microcredits, promoted to fight against usury and as a solution based on trust and social capital (Gatto, 2018). More recent solutions have included crowdfunding and crowdlending, which tend to be based on a platform business model.

How to cite: De-Miguel-Molina, B., Cadrazco-Suárez, M., Juliao-Rossi, J., and Rincón-Díaz, C. 2021. Financial inclusion of small firms: informality, fintech solutions, and voids. In Proc.: *3rd International Conference Business Meets Technology*. Valencia, 23rd & 24th September 2021. 177-185. https://doi.org/10.4995/BMT2021.2021.13654

However, asymmetric information and adverse selection have been identified among their drawbacks and might explain lower success than expected (Andrikopoulos, 2020). From a platform business model, the success of these platforms based on fintech would entail strong network effects (Cusumano et al., 2019), requiring several lenders and borrowers to ensure the economic sustainability of the platform. In emerging countries, institutional voids might also explain the failure of some solutions, as companies from developed nations tend to assume customers behave similarly as in their countries (Khanna et al., 2005).

Availability of data related to the financial inclusion of small firms is recent, reducing the literature and studies available that offer knowledge about this theme (Martinez et al., 2020). This paucity of research extends to both in developed and emerging countries, with scant longitudinal data presenting an additional challenge. Therefore, this chapter will focus on analysing some of the ideas raised in previous paragraphs for a specific country, Colombia, to answer the following three research questions:

- RQ1. What customer and non-customer tiers could be detected through funding data?
- RQ2. Can institutional voids related to informality explain the lower financial inclusion of small firms?
- RQ3. Can institutional voids related to digitalisation explain lower use of solutions such as crowdfunding?

The structure of this chapter is as follows. After this introduction, a short literature review is included. Next, the methodology section explains the data used in the analyses, while the results section presents the analyses carried out to answer the research questions. Finally, the conclusions section summarises the main ideas obtained from the analyses.

2. FINANCIAL INCLUSION OF SMEs

Studies about the financial inclusion of SMEs have concluded that access to bank credits remains a constraint for small firms, although those studies proved the stability of the system as banks lend a minor amount of money to many small firms reducing credit risk (Brei et al., 2020). The literature provides examples of authors who tried to measure the financial exclusion of firms, stating the need to understand the impact on the firm and the economy. Kling (2021) indicated that when a small firm has no access to credits, its growth is limited due to its low capacity to finance new investments. Therefore, when exclusion is common in a country, the final impact on the economy may explain why governments are concerned about this target.

International organisations have tried to encourage solutions to the challenge of exclusion for small firms. One of these solutions is microcredits, although critics point out that this financial instrument did not reach small firms in Latin American countries. For example, Durango-Gutierrez et al. (2021) tried to predict the default of customers

in Colombia and concluded that the main factors impacting defaults include the amount of money lent and the gender of borrowers. They also indicated that the institutional environment introduces additional costs in lending money, like guarantees, which might also influence default.

With the advances in fintech, new solutions based on platforms were developed, such as crowdfunding and crowdlending. In crowdfunding platforms, entrepreneurs seek funding through the platform, which organises operations related to funding (Moysidou & Hausberg, 2020), while in crowdlending platforms, customers finance firms directly through the platform (Maier, 2016). Some platforms that specialise in funding startups, while others focus on funding SMEs. The latter became an essential support for small firms, which are considered vital engines in countries' economies. In both cases, those authors indicated that trust needs to be ensured by the platform organisers, as they are the intermediaries between lenders and funders, and investors place greater trust in platforms with which they are familiar (Moysidou & Hausberg, 2020). However, the economic sustainability of the platform also depends on achieving a strong network effect: the increase in the number of lenders attracts more borrowers and vice versa (Cusumano et al., 2019).

The term "institutional voids" refers to the difficulties firms might encounter when they try to replicate their business models in emerging markets (Khanna et al., 2005). These voids might strain relationships between buyers and sellers (Khanna, 2015). Voids will reflect, for example, the use of digital payment by firms and customers, which might hinder the connection between buyers and sellers.

3. METHODOLOGY

Data for the analyses were obtained from the survey elaborated by DANE Colombia called "Encuesta de Micronegocios 2019". This year was selected because it includes a module about financial inclusion. The sample used in this work involves 86,969 firms in Colombia (2,467 in the Bogotá region) with fewer than nine employees. Variables defined for analyses are presented in Table 1: factors related to the level of formality of the firm, financial resources obtained when the firm was founded, and digital skills of firms.

To answer RQ1 and RQ3, descriptive analysis was carried out, applying the variables in Table 1 to the entire database. Frequency of users were obtained for variables related to financial inclusion and digitisation. To answer RQ2, a decision tree with the algorithm C5.0 was created. The sub-sample of firms in Bogotá were selected in this analysis. The decision tree revealed rules that predict the willingness of future entrepreneurs to register their firms in the Chamber of Commerce. For this analysis, variables related to formality and funding were used (marked in Table 1). The R library "C50" by Max Kuhn, based on Quinlan tree models, was applied for the analysis. For training and test samples in the tree, the criteria were two-thirds and one-third of the database, respectively.

Table 1. Variables in the analyses for RQ1, RQ2, and RQ3.

Concepts	Variable	Meaning	Values
Output	ChamberCom*	Firm registered in the Chamber of Commerce	Yes (1), No (0)
Formality	RUT*	Register Unique for Taxes	Yes (1), No (0)
	AccReg*	Register for Accounts	Yes (1), No (0)
	ComName*	Commercial name	Yes (1), No (0)
Financial inclusion in startup phase	FundEntSv*	Funded the startup with own savings	Yes (1), No (0)
	FundFam*	Family credits	Yes (1), No (0)
	FundBk*	Banks credits	Yes (1), No (0)
	FundUsur*	Usury credits (pawnbroker)	Yes (1), No (0)
	SeedCap	Seed Capital	Yes (1), No (0)
Digitisation	Smartphone	Firm uses smartphones	Yes (1), No (0)
	OnlineBank	Firm uses online bank	Yes (1), No (0)
	Apps	Firm uses apps	Yes (1), No (0)
	NCashPay	The firm accepts: Online pay, Debit cars, credit card	Yes (1), No (0)
	PCandOther	Firm uses PCs and other devices	Yes (1), No (0)
Entrepreneur	OwnerGender*	Gender of the firm's owner	Man (1), Woman (2)
	OwnerAge*	Entrepreneur's generation	Silent (74-91), Boomers (55-73), Generation X (39-54), Millennials (23-38), Generation Z (<= 22)
Firm	FirmAge*	Years since the firm was set up	StartScale (≤ 5 years), Mature (>5 years)

(*) variables included in the model for tree decision (RQ2).

4. RESULTS

RQ1 aimed to find customer and non-customer tiers through funding data. Descriptive analysis of the database gave the percentage of entrepreneurs who had access to funding when setting up their new firm (left side in Figure 1). The figure also indicates whether entrepreneurs have access to funding sources nowadays (right side in Figure 1). The project for which the analysis was carried out aimed to design a solution based on crowdfunding; therefore, circles in the figure were included to indicate tiers of non-customers in the sense of Kim & Mauborgne (2017). From this view, entrepreneurs who think that credits are unnecessary and those who fear debts would be the most distant segments for a crowdfunding solution, although they remain important segments due to their size. Platforms able to demonstrate they are worthwhile and trustworthy might offer a solution for these segments. The figure percentages show that the use of credit by small firms in the country is low, implying a low level of financial inclusion for small firms. Low level of financial inclusion is evident in bank credits, which amount to 9-12% of

firms. Moreover, microcredit is not a successful solution; only 1% of entrepreneurs in the samples had access to this financial instrument.

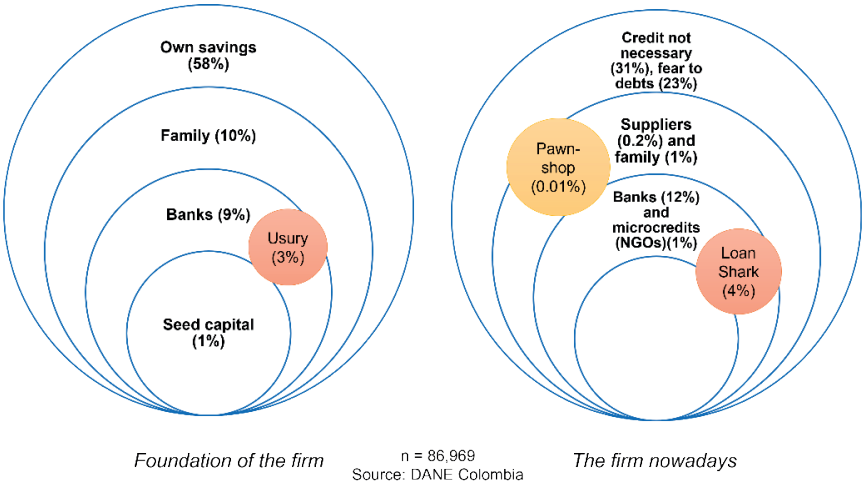


Figure 1. Financial inclusion of small firms in different phases. Sample of Colombia.

RQ2 intended to find any explanation for institutional voices related to the informality of small firms and its impact on the financial inclusion of these firms. As the output was the registration in the Chamber of Commerce, the sample consisted of the 2,467 small firms in the Bogotá area. Tree decision with C5.0 algorithm allowed for understanding the decisions of entrepreneurs considering the two concepts, informality and financial inclusion. Table 2 presents the rules that predicted whether the entrepreneurs would register in the Chamber of Commerce. Six rules were obtained, three indicating factors that would explain no registration in the Chamber, while the other three suggested registration. Rules revealed that the lack of formality would result in no registration in the Chamber. The rules also indicated that financial exclusion goes hand in hand with informality. Therefore, informality and lack of access to credit banks will result in no registration in the Chamber. The errors from the rules amounted to 10.8%, with 177 out of 1,644 cases in the training classified incorrectly. In the sample tested, there were 823 users, 725 correctly classified, 51 predicted as 'yes' but not registered, while 47 were predicted as 'no' but did register. The accuracy of the tree is, therefore, 88.09%.

Figure 2 shows the tree decision, with nodes representing visually how entrepreneurs' choices influence their final decision about registration in the Chamber of Commerce. The decision of registering a commercial name when setting up a new firm is an important node, with attribute usage when rules were generated of 97.45%. A Colombian unique taxpayer identification number, known as a Registro Único Tributario (RUT), is also a significant factor (58.09% of usage in rules) that encourages adhesion to the Chamber. The tree indicates that entrepreneurs who decided not to formalize the payment of taxes would not be willing to register in the Chamber. When entrepreneurs obtain a commercial

name resulting in higher formality (RUT and AccReg), the entrepreneur would be more willing to register in the Chamber, independent of access to bank credit or use of own savings to set up a new business. The tree also indicates that when there is financial inclusion and access to bank credit, the entrepreneur will be more likely to register in the Chamber.

Table 2. Rules extracted from C5.0 algorithm.

Rules*	IF	THEN (Prediction class)	Accuracy
R1	RUT = No	Class ***No*** (No register in Chamber of Commerce)	98.4%
R2	[FundEntSv = No] AND [FundBk = No] AND [AccReg = No]	Class ***No*** (No register in Chamber of Commerce)	93.0%
R3	[FundBk = No] AND [ComName = No]	Class ***No*** (No register in Chamber of Commerce)	92.0%
R4	[FundBk = Yes] AND [ComName = Yes]	Class ***Yes*** (Register in Chamber of Commerce)	83.3%
R5	[FundBk = Yes] AND [RUT = Yes]	Class ***Yes*** (Register in Chamber of Commerce)	77.4%
R6	ComName = Yes	Class ***Yes*** (Register in Chamber of Commerce)	66.8%

*Default class in output: No.

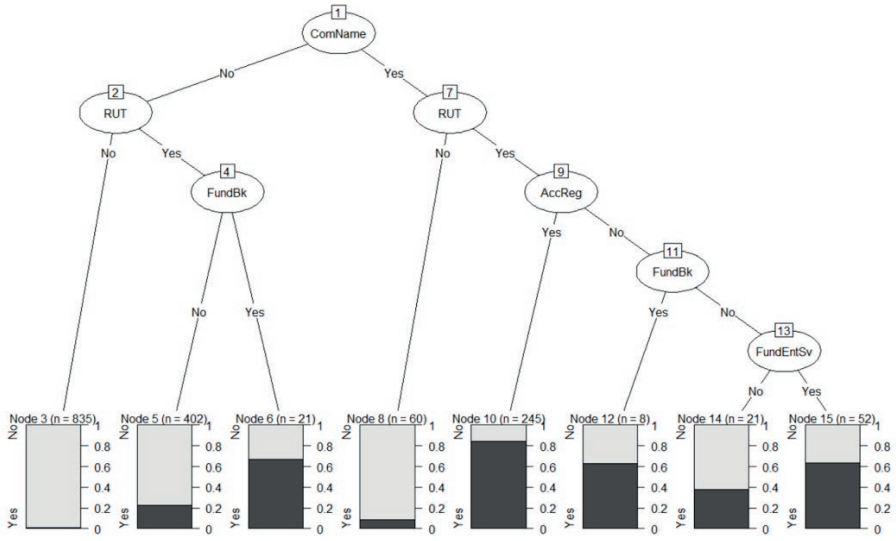


Figure 2. Tree decision obtained with C5.0 algorithm in R. Sample of Bogotá.

RQ3 aimed to identify whether the institutional voids related to digitalisation might encourage or discourage the use of platforms based on crowdfunding. These platforms are based on technology, which entails the the users' digital skills, such as using a smartphone,

being comfortable with online banks and making online payments. Figure 3 indicates that half of the firms in the database use smartphones, although there is low proportion of computer use. Moreover, few small firms perform online operations through a bank or accept payments by clients other than cash. Therefore, solutions based on fintech should consider a smartphone as the device more frequently used by small firms.

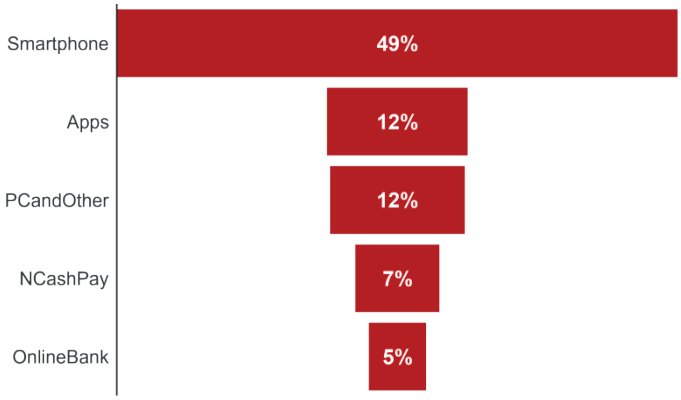


Figure 3. Percentage of firms. Sample of Colombia.

5. CONCLUSIONS

This chapter has presented analyses of financial inclusion and informality in Colombia. Through data available for a survey of small firms elaborated by DANE, three research questions were answered to derive three main conclusions. The first was the low level of financial inclusion among small firms in the country, implying that the government needs to progress toward this target to encourage the country's economic growth. The second conclusion was related to the need for reducing informality among small firms, as informality decreases their opportunity to obtain bank credit and, thus, diminishes the country's capacity to increase the financial inclusion of these firms. Moreover, less organised firms because they are not registered with the Chamber of Commerce, possess less capacity for negotiation with governments and credit institutions, as was evident during the pandemic-related lockdown. The third conclusion exposed the need to improve the digital skills of these firms and consider solutions for financial inclusion based on smartphones instead of other devices. Finally, the analyses also underscored the need for more research to offer new ideas that might be more successful than some solutions offered to date and to improve the design of current solutions.

ACKNOWLEDGMENTS

The research conducted in this chapter was funded by the Universitat Politècnica de València, Centtro de Cooperación al Desarrollo, ADSIDEO project AD2009, title 'Análisis

de necesidades para el diseño e implementación de una solución de crowdfunding que dé soporte a las empresas informales y micropymes en la zona centro de Bogotá' (coordinator: Blanca de-Miguel-Molina).

CONFLICT OF INTERESTS

There is no conflict of interest related to the project or the content in this chapter.

AUTHOR CONTRIBUTIONS

Maryi Cadrazco-Suarez particpated in the conceptualisation of the chapter, co-writing the introduction and the literature review, collecting data, elaborating the conclusions, and editing the final version. Blanca de-Miguel-Molina particpated in the conceptualisation of the chapter, co-writing the introduction and literature review, collecting and analysing data, and supervising the conclusions and the final version. Jorge Juliao-Rossi participated in the conceptualisation of the chapter, in the data preparation, in the supervision and validation of the analysis, and in the supervision of conclusions. Carlos Rincón-Díaz particpated in the conceptualisation of the chapter, in the supervision of the introduction and literature review, in the data acquisition, in the supervision and validation of the methodology, and in the supervision of conclusions.

REFERENCES

Andrikopoulos, A. (2020). Delineating social finance. *International Review of Financial Analysis, 70*, pp. 101519.

Brei, M.; Gadanecz, B.; Mehrotra, A. (2020). SME lending and banking system stability: some mechanisms at work. *Emerging Markets Review, 43*, pp. 100676.

Cusumano, M.A.; Gawer, A.; Yoffie, D.B. (2019). The business of platforms. Strategy in the age of digital competition, innovation, and power. HarperCollins Publishers, USA.

Durango-Gutiérrez, M.; Lara-Rubio, J.; Navarro-Galera, A. (2021). Analysis of default risk in microfinance institutions under the Basel III framework. *International Journal of Finance & Economics*, pp. 1–18.

Gatto, A. (2018). Historical roots of microcredit and usury: the role of Monte di Pietà in Italy and in the Kingdom of Naples in XV-XX centuries. *Journal of International Development, 30*, pp. 911–914.

Granda, C.; Hamann, F.; Tamayo, C.E. (2019). Credit and saving constraints in general equilibrium: A quantitative exploration. *Journal of Development Economics, 140*, pp. 302–319.

Khanna, T.; Palepu, K.G.; Sinha, J. (2005). Strategies that fit emerging markets. *Harvard Business Review, 83*(6), pp. 4–19.

Khanna, T. (2015). A Case for Contextual Intelligence. *Management International Review, 55*, pp. 181–190.

Kim, W.C.; Mauborgne, R. (2017). *Blue Ocean Shift*. Macmillan, London.

Kling, G. (2021). Measuring financial exclusion of firms. *Finance Research Letters, 39*, pp. 101568.

Maier, E. (2016). Supply and demand on crowdlending platforms: connecting small and medium-sized enterprise borrowers and consumer investors. *Journal of Retailing and Consumer Services, 33*, pp. 143–153.

Martinez, L.B.; Guercio, M.B.; Bariviera, A.F. (2020). A meta-analysis of SME literatura based on the survey on Access to finance of enterprises of the European central bank. *International Journal of Finance & Economics*, pp. 1–16.

Moysidou, K.; Hausberg, J.P. (2020). In crowdfunding we trust: A trust-building model in lending crowdfunding. *Journal of Small Business Management, 58*(3), pp. 511–543.

OIT & CEPAL (2020). *La pandemia por COVID-19 podría incrementar el trabajo infantil en América Latina y el Caribe*. Nota técnica Nº 1 (www.ilo.org/americas/publicaciones/WCMS_747653/lang--es/index.htm).

Sarma, M.; Pais, J. (2011). Financial inclusión and development. *Journal of International Development, 23*, pp. 613–628.

BMT21
3rd International Conference
Business Meets Technology.
Valencia, 23rd & 24th September 2021

QUALITATIVE-COMPARATIVE ANALYSIS CASE STUDY: INTEGRATION OF WATER INTO THE BUSINESS STRATEGY

Diez Martinez, Inés [a1] and Peiró Signes, Ángel [a2]

[a] *Management Department, Universitat Politècnica de València, Camino de Vera, s/n, 46022 Valencia, Valencia. Spain. ([a1] indiemar@alumni.upv.es, [a2] anpeisig@omp.upv.es)*

ABSTRACT: Qualitative-comparative analysis (QCA) is a research based on Boolean algebra that integrates both qualitative and quantitative elements to perform the analysis of causal conditions for the production of an outcome. This study performs a use case of the QCA methodology, focused on whether water is integrated into the business strategy of companies. The purpose of this paper is to provide a case study for a "crisp" set, in which variables are dichotomous, where causal conditions and outcomes are either present or absent for each case. Within the case study, several causal conditions are explored as potential triggers to the integration of water into the business strategy of companies. The causal conditions explored are: whether companies have evaluated the effect of water in their potential growth, whether companies have experienced detrimental impacts linked to water, whether they require suppliers to report on water, and finally, whether companies have identified opportunities linked to water. Results show that the presence of both the conditions of "having evaluated the effects of water" and "identified opportunities linked to water" represent the majority of positive cases for water integration, thus, potentially being causal conditions that produce the outcome "water integration into business strategy". However, none of the potential causal conditions are identified as necessary conditions as there is record of companies integrating water even when none of the causal conditions are present.

KEY WORDS: *Qualitative-comparative analysis, Sustainability integration, Water management.*

1. INTRODUCTION

Qualitative-comparative analysis (QCA) is a research technique used for the analysis of causal conditions, "applying set-theoretic methods to cross-case evidence" (Ragin and Benoit, 2004). QCA is based on Boolean algebra, and it bridges between qualitative and quantitative elements for the study of cross-cased patterns (Ragin, 1987; Ragin n.d.).

This research applies the QCA methodology to investigate the trigger for the integration of water into the business strategy of companies. Water management may have different implications across industries, but it overall refers to "the control and movement of water resources to minimize damage to life and property and to maximize

How to cite: Diez Martínez, I., and Peiró Signes, Á. 2021. Qualitative-Comparative Analysis case study: Integration of water into the business strategy. In Proc.: *3rd International Conference Business Meets Technology*. Valencia, 23rd & 24th September 2021. 187-194. https://doi.org/10.4995/BMT2021.2021.13694

efficient beneficial use" (USDA, n.d.). Water management integration is important as water is a key resource for a wide range of industries, and it can be used to maximize the economic and social welfare without compromising the sustainability of ecosystems (Sun et al., 2011). Within the context of Spain, as described by Aldaya et al. (2010), water management is a key controversial topic. In Spain, despite of the increase of drought conditions in certain areas, the water crisis is more linked to water governance than to physical water scarcity.

In order to perform the study, the data used was sourced from the CDP, from a water management questionnaire (please refer to: Hammond, 2018). For the analysis, we focused on those companies in the questionnaire that were Spanish, looking into four potential triggers for the integration of water management**:** whether the company had evaluated how water could affect its growth strategy, had experienced detrimental impacts linked to water, requires suppliers to report on water matters and whether water presents opportunities for the company.

Purpose of the paper

The purpose of this paper is to provide a better understanding of the potential applications of QCA for the study of key sustainability topics such as companies' integration of water management. This paper could be used by future researchers as a reference for the study of companies with what regards finding a methodology that could be used to study the triggers for sustainability integration.

Research background

The qualitative-comparative methodology is a methodology widely used in social sciences, for example in comparative politics, business and economy or sociology (Roig-Tierno et al. 2017). Three types of QCA methodologies exist: csQCA, fsQCA, and mvQCA:

- csQCA: Represents cases where values are "crisp", dichotomous: An element would either "in" or "out" of a set, having either a value or "0" or a value of "1" (Grofman et al., 2009)
- fsQCA: In this case, the QCA technical is applied to a "fuzzy" set. A fuzzy set maintains the "out" as per "0" and the "in" for the 1, however, it also includes all intermediate values of memberhsip such as 0.1, 0.2, 0.3 etc., any value between 0 and 1 is acceptable (Ragin, n.d.; Skaaning, 2011)
- mvQCA: "mv" stands for "multi value". In contrast to csQCA, with a dichotomous logic, and fsQCA, which applies a fuzzy logic, mvQCA is based on multivalent logic. In the multivalent logic, both conditions and outcomes can assume multivalent structures (Thiem, 2015; Rihoux and Lobe, 2009).

As discussed by Roig-Tierno et al. (2017), currently mcQCA has a marginal use when compared to the usage of csQCA and fsQCA.

2. METHODOLOGY

This study is focused on the application of csQCA, as the selected questions of the questionnaire for the Spanish companies were answered with "Yes" (representing "1") and "No" (for "0"). The raw dataset used for analysis was retrieved from CDP and the software use for the application of QCA was fsQCA 3.0 (Ragin, and Davey, 2016).

- Dataset

The analysis is performed based on a CDP dataset named: "2014 – Company Water Dataset" (Hammond, 2019). CDP Worldwide is a Registered Charity no. 1122330, with a VAT registration no: 923257921 (website link: https://www.cdp.net). This dataset in particular is accessible in this link: https://data.cdp.net/Companies/2014-Company-Water-Dataset/5fe7-nx93, and the owner specified is Andrew Hammond

To be able to perform the QCA analysis, the answers to the questionnaire were processed to be made dichotomous (discarding those companies which had either "Don't know" or "Other" or no answer). Out of the full scope of the questionnaire, the study is focused on the 15 Spanish companies that had answered to the selected questions.

- Software tools

The software tool used for the preparation of the use cases analysed for this study was Microsoft Excel. Microsoft Excel was used to filter from the initial dataset the scope of Spanish companies and to transform those answers set to "Yes" as "1" and "No" as "0". For the QCA analysis, the software used was fsQCA 3.0 (Ragin, and Davey, 2016), Windows version. Software was used following the instructions specified in its user guide by Ragin (2016).

The main steps of the methodology are shown in Figure 1.

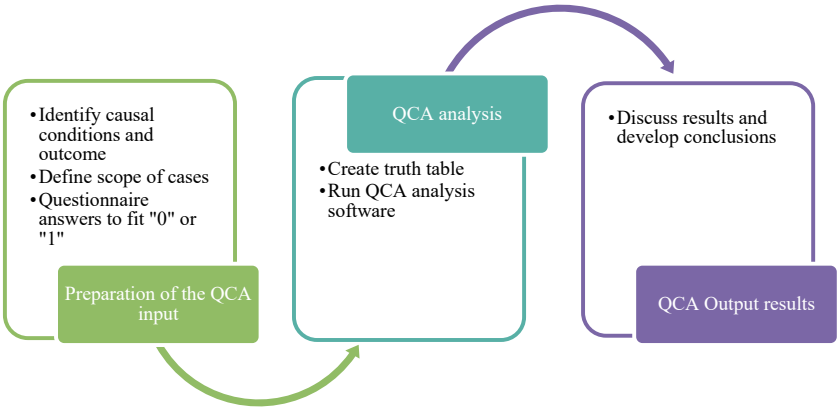


Figure 1. Research methodology steps.

3. RESULTS

QCA variables

The outcome and the causal conditions were defined as specified in Table 1. Other questions of the CDP dataset were excluded as they were deem as not relevant or there were not enough positive/negative answers to be included for the study.

Table 1. QCA Variables.

Variable name	Variable type	Question in CDP questionnaire
INTEGRATED	Set as outcome	"W6.2 Is water management integrated into your business strategy"
EVALUATEDEFFECT	Set as causal condition	"W1.2 Have you evaluated how water quality and water quantity affects / could affect the success (viability, constraints) of your organization's growth strategy"
DETRIMENTALIMPACTS	Set as causal condition	"W1.3 Has your organization experienced any detrimental impacts related to water in the reporting period?"
SUPPLIERREPORTS	Set as causal condition	"W2.5 Do you require your key suppliers to report on their water use, risks and management?"
OPPORTUNITIES	Set as causal condition	"W4.1 Does water present strategic, operational or market opportunities that substantively benefit/have the potential to benefit your organization?"

For the set of cases, variables are set with a "0" if "No" is specified, and "1" is "Yes" is specified. Further details were not taking into a account for this study. For example, for the question "Evaluated how water could affect growth strategy?" answers "Yes, evaluated over the next 1 year", "Yes, evaluated over the next 5 years" and "Yes, evaluated over the next 10 years" were considered as "1" and "Not evaluated" as "No".

Please note, for the setup of the analysis for the intermediate answer, it was put that "SUPPLIERREPORTS" = 1 was linked to the presence of the outcome as it is unlikely that the company requires suppliers to report (i.e., collects data from suppliers) without any integration of water into the business strategy. Also, the presence of opportunities could be linked to companies integrating water considerations into their business strategy. For the other two causal conditions, evaluated the effect of water does not necessary trigger water integration as the effect evaluated could have been that water had no effect in growth or that it was negligible. For the case of detrimental impacts, it could have been detrimental impacts out of the control of the company that cannot be directly tackled through water integration.

The truth table was created through the fsQCA software based on the 15 Spanish companies in scope of the questionnaire, the name of the companies has been anonymized.

They represent a variety of sectors such as banking, energy, manufacturing, retail, agriculture and others.

QCA was applied both investigating results for "INTEGRATED" set as "Present", and for "INTEGRATED" set as "Absent" investigating both the conditions that led to water integration into the business strategy and the no integration of water into the business strategy.

QCA analysis results for the presence of integration

Out of the three potential solutions available in the software: complex, parsimonious and intermediate solution. The intermediate solution was chosen because, as stated by Ragin (n.d.), it is the one that would use only those remainders that survive the counterfactual analysis with knowledge inputs.

Model: INTEGRATED = f(EVALUATEDEFFECT, DETRIMENTALIMPACTS, SUPPLIEREPORTS, OPPORTUNITIES)

Algorithm: Quine-McCluskey

frequency cutoff: 1, consistency cutoff: 1

Assumptions: SUPPLIEREPORTS (present), OPPORTUNITIES (present) For these assumptions, please note, whether they are set as present or present or absent, QCA solution does not change.

Table 2. Results for Integrated = 1.

#	function	raw coverage	unique coverage	consistency
1	EVALUATEDEFFECT*OPPORTUNITIES	0.727273	0.272727	1
2	DETRIMENTALIMPACTS*OPPORTUNITIES	0.545455	0.0909091	1

solution coverage: 0.818182; solution consistency: 1.

There are 8 cases with greater than 0.5 membership for the combination of causal conditions: EVALUATEDEFFECT*OPPORTUNITIES.

There are 6 cases with greater than 0.5 membership in for the combination of causal conditions: DETRIMENTALIMPACTS*OPPORTUNITIES.

There are 5 cases with membership in both combinations (EVALUATEDEFFECT*OPPORTUNITIES and DETRIMENTALIMPACTS*OPPORTUNITIES).

QCA analysis results for the absence of integration

Model: ~INTEGRATED = f(EVALUATEDEFFECT, DETRIMENTALIMPACTS, SUPPLIEREPORTS, OPPORTUNITIES)

Algorithm: Quine-McCluskey

frequency cutoff: 1, consistency cutoff: 1

Assumptions: SUPPLIEREPORTS (present), OPPORTUNITIES (present)

Table 3. Results for Integrated = 0.

#	function	raw coverage	unique coverage	consistency
3	EVALUATEDEFFECT*~DETRIMENTALIMPACTS *~OPPORTUNITIES	0.25	0.25	1

solution coverage: 0.25, solution consistency: 1.

There is only 1 case with greater than 0.5 membership for the combination of causal conditions: EVALUATEDEFFECT*~DETRIMENTALIMPACTS*~OPPORTUNITIES.

Please note: the "~" indicates the condition is negated.

Finally, Table 4 shows the percentage of positive cases.

Table 4. Descriptive analytics for each causal condition.

Variable	Percentage of positive cases
EVALUATEDEFFECT	60.0%
DETRIMENTALIMPACTS	40.0%
SUPPLIEREPORTS	26.7%
OPPORTUNITIES	60.0%
INTEGRATED	73.3%

4. DISCUSSION AND CONCLUSIONS

The results obtained from the QCA analysis in terms of "raw coverage", which represent the highest empirical evidence, show that evaluating the effects on the growth strategy and the identification of opportunities have the highest relevance for the production of the outcome, as the combination of these two represents 72.7% of positive cases with a consistency of 1 (every time this combination is in place, the water is integrated).

The second solution for the integration of water is also relevant as the combination of having experienced detrimental impacts and the identification of opportunities is present in 55% of positive cases, also with a consistency of 1.5 cases out of the total of 11 that integrate water are present in both solutions #1 and #2, showing that it is also common to find simultaneously having evaluated the effect of water, having experienced detrimental

impacts and being able to identify opportunities linked to water. However, the report of suppliers seems to be a less relevant variable, not a decisive causal condition for companies that evidence water management integration as the other conditions. Results also show that the integration of water management is not linked to any of the causal conditions or one of their combinations as a necessary condition.

Regarding the negative solution of the outcome, when "INTEGRATED" is set as negated, results do not show either a combination of casual conditions that could justify this absence of integration. Only solution #3 is found, and it is limited to the representation of 25% of negative cases, only involving one company, and thus, could be considered a marginal solution that cannot be extrapolated. The absence of any of the causal conditions is also not linked to the absence of integration.

Results suggest that the causal conditions studied may be need to be extended and that there are also other conditions linked to companies that may trigger not only the outcome, but also the causal conditions, such as, for example the industry. Energy or textile companies naturally integrate water, are more likely to identify opportunities linked to it etc., as the success of their business is inherent a high dependency on water. On the other hand, there are other industries that are less dependent on water, thus being less likely to have in place systems to identify opportunities, or for example, evaluated the effect of water.

Overall, this reached the objective of promoting a better understanding of QCA and further the develop the causal conditions related to companies' decision to integrate water into the business strategy. However, there are certain limitations as discussed in the next section.

5. LIMITATIONS AND FUTURE RESEARCH

One of the limitations of this study is linked to the scope of companies responding the questionnaire and its reference period, knowing that it is possible that in the past few years companies may have adopted a different position towards water integration. It would be useful to repeat this study once the CDP publishes a updated questionnaire with more contemporary data.

Another current limitation of the present study as it only considered the four potential variables defined. Future research direction can be linked to further study the implications of the specific company or sector characteristics for the integration of water into the business strategy. For example, water may have a different degree of relevance for an energy company than for a textile or a metallurgical company. In a similar manner, other elements such as the size of the company may influence the capabilities that the company has to create a detailed business strategy to include elements such as resource management policies.

REFERENCES

Aldaya, M. M.; Garrido, A.; Llamas, M. R.; Varela-Ortega, C.; Novo, P.; Casado, R. R. (2010). Water footprint and virtual water trade in Spain. *Water policy in Spain*, Chapter 6 (Water footprint and virtual water trade in Spain), 49–59.

Grofman, B.; Schneider, C.Q. (2009). An Introduction to Crisp Set QCA, with a Comparison to Binary Logistic Regression. *Political Research Quarterly, 62*(4), pp. 662–672. doi:10.1177/1065912909338464

Hammond A. (2018). 2014 - Company Water Dataset. CDP dataset. https://data.cdp.net/Companies/2014-Company-Water-Dataset/5fe7-nx93.

Ragin, C.; Benoit, R. (2004). Qualitative comparative analysis (CQA): State of the art and prospects. *Qualitative & Multi-Method Research, 2* pp. 3–13. https://doi.org/10.5281/zenodo.998222

Ragin, C. C. (1987). *The Comparative Method. Moving Beyond Qualitative and Quantitative Strategies*. Berkeley, Los Angeles and London: University of California Press.

Ragin C.C. (n.d.). *What is Qualitative Comparative Analysis (QCA)?*. http://eprints.ncrm.ac.uk/250/1/What_is_QCA.pdf

Ragin, C. C.; Davey. S (2016). *Fuzzy-Set/Qualitative Comparative Analysis 3.0*. Irvine, California: Department of Sociology, University of California.

Ragin, C. C. (2018). *User's Guide to Fuzzy-Set/Qualitative Comparative Analysis 3.0*. Irvine, California: Department of Sociology, University of California.

Roig-Tierno, N.; Gonzalez-Cruz, T.F.; Llopis-Martinez, J. (2017) "An overview of qualitative comparative analysis: A bibliometric analysis". *Journal of Innovation & Knowledge, 2*, i. 1, pp. 15–23. https://doi.org/10.1016/j.jik.2016.12.002

Skaaning, S-E (2011) Assessing the Robustness of Crisp-set and Fuzzy-set QCA Results. *Sociological Methods & Research, 40*(2), pp. 391–408. doi:10.1177/0049124111404818

Sun, F.; Chen, M.; Chen, J. (2011) *Integrated Management of Source Water Quantity and Quality for Human Health in a Changing World, Encyclopedia of Environmental Health*, Elsevier, pp. 254–265, ISBN 9780444522726, https://doi.org/10.1016/B978-0-444-52272-6.00286-5.

Rihoux, B.; Lobe, B. (2009) Chapter 12: *The case for Qualitative Comparative analysis (QCA): Adding leverage for thick cross case comparison of The SAGE Handbook of Case-Based Methods*, SAGE Publications Ltd, ISBN: 978-1-4129-3051-2

Thiem, A. (2015) Parameters of fit and intermediate solutions in multi-value Qualitative Comparative Analysis. *Qual Quant 49*, pp. 657–674. https://doi.org/10.1007/s11135-014-0015-x

USDA (United States Department of Agriculture) (n.d.) *Water Management, Natural Resources Conservation Service*. https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/water/manage/

BMT21
3rd International Conference
Business Meets Technology.
Valencia, 23rd & 24th September 2021

THE ROLE OF ARTIFICIAL INTELLIGENCE IN TRANSFORMING HRM FUNCTIONS. A LITERATURE REVIEW

Tuffaha, Mohand [a]; Perello-Marin, M. Rosario [b1] and Suarez-Ruz, Esperanza [b2]

[a] *PhD Candidate. Universitat Politècnica de València. Spain.(mohtuf@hotmail.com)*
[b] *Associate Professor. Universitat Politècnica de València. Dept. Organizacion de Empresas. Spain. ([b1] rperell@upvnet.upv.es, [b2] esuarezruz@omp.upv.es)*

ABSTRACT: Artificial intelligence (AI) has revolutionized the way employees and managers work. This paper investigates how literature analysis AI transforming in Human Resource Management (HRM) functions: Staffing, Learning & Development and, Motivation. Using recent advances in science mapping, this article analyses 30 journals and proceedings using three main keywords: "Artificial intelligence"; "Human Resource Management"; and "Transformation". All the consulted papers have been published in Scopus databases between 1998 to 2021 in order to explore and understand topic content and intellectual structure of how AI is transforming HRM functions. The results reveal a gap in literature to build a complete framework for the transforming role of AI in HRM functions. Particularly, Strategic HR Planning, Job Design and Compensation. This study gives insights and foundations for researchers to expand their study on the role of AI in HRM.

KEY WORDS: *Artificial intelligence (AI); Human Resource Management (HRM); Staffing; Learning & Development; Motivation.*

1. PURPOSE OF THE PAPER

AI offers advantages that may transform practices of HRM (Ore & Sposato, 2021) and the way people is managed (Xiong, Xia, & Wang, 2020). Despite, there are several studies on the applications of AI on HR, such as the use of AI in recruitment (Upadhyay & Khandelwal, 2018; Dennis, 2018) or how it is applied in performance management (Buck & Morrow, 2018; Zehir, Karaboğa, & Başar, 2020), there is still a perceptible gap in the in-depth comprehension of the transforming role of AI in the overall HRM functions. Taking this into account, the purpose of this piece of paper is to shed light on the understanding of how AI can be implemented in HRM functions adding value. The main goal is to help in improving attitudes and perspectives of

How to cite: Tuffaha, M., Perello-Marin, M. R., and Suarez-Ruz, E. 2021. The role of Artificial Intelligence in transforming HRM functions. A literature review. In Proc.: *3rd International Conference Business Meets Technology*. Valencia, 23rd & 24th September 2021. 195-200. https://doi.org/10.4995/BMT2021.2021.13696

both, HR practitioners and scholars on the evolution and successful implementation of AI within this context.

2. RELATED WORK

According to a digital HR Survey conducted in 2020 by PWC covering 608 executives and HR professionals, 55% of respondents believe HR's biggest contribution to digital transformation is digitalizing HR processes (PWC, 2020). Along similar line, Mercer's Global Talent Trends 2019 reported that 60% of companies plan to boost their use of workplace automation in 2020, including 59% in the United States and 55% in China (Mercer, 2019). This explain why organizations around the world are increasing their HR investments in AI and related technology trying to catch up with the transformational role made by AI on HRM functions.

Several scholars studied and proposed models that have linked the role of AI and HRM functions transformations. Pillai & Sivathanu (2020) investigate the transforming role of AI technology when adopted on talent acquisition. They provide vital insights to the HR managers to benchmark AI technology required for talent acquisition. Similarly, Merlin & Jayam (2018) addressing possibilities of how AI is transforming and supporting the HRM functions like recruitment, training, talent management and retention through analyzing secondary research data.

Likewise, Geetha & Reddy (2018) study how AI influences the recruitment process, through highlight the adoption techniques of AI in recruitment based on secondary sources of information. In the same way, Jain (2017) discusses how AI could be result of the entire digital transformation when the organization adopt this technology in diverse departments such as human resource, marketing, finance and manufacturing.

3. DESIGN/METHODOLOGY/APPROACH

The methodology used in this paper is a literature review (LR) to analysis topic content and intellectual structure between 1998 to 2021. LR employs a specific methodology of collecting and analyzing data from the existing literature (Mackenzie, et al., 2012) by associating data to conclusions in order to clarify what is known and unknown (Denyer & Tranfield, 2009). Data source was Scopus database, based on three keywords generated from VOSviewer software ("Artificial intelligence"; "Human Resources Management"; "Transformation"), (See Figure 1).

The keywords search has been selected without any filter such as "SU - Subject Terms" or period, in English language, from academic and scientific journals and materials presented at conferences.

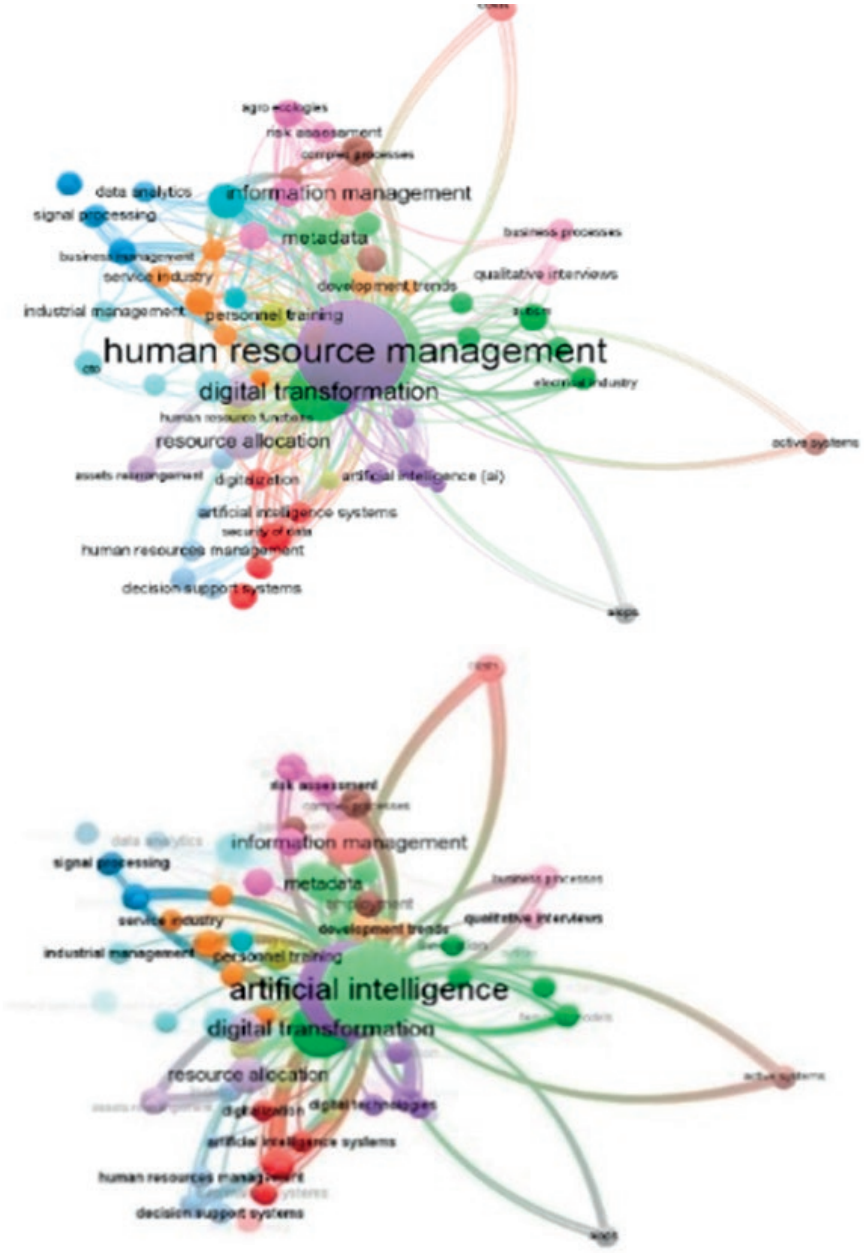


Figure 1. Images of the VOSviewer Network Visualization of the AI, HRM and Transformation Maps.

4. FINDINGS

As a result of the research, 30 publications were found. Of the total, 8 of them (weight 26.7%) are articles and 22 conference papers (weight 73.3%). Noteworthy that most studies (95.3%) published between 2017 and 2021.

In detail, in 2020 there is a sudden increase in interest on the topic. This "Growth Period" is verified by the number of publications (15 out of 30), representing 50% of the total research. It is also important to understand how transforming and the advancement of AI has influenced this shift in the landscape of interest in HR research. Specifically, in this last 3 years (2019, 2020 and 2021), 77.4% of the research were specifically focused on recruitment & selection, onboarding and performance management. As an example, Malini & Srinivas (2020) describe the transformation role of AI on various HRM functions like recruitment, onboarding, learning and development, Performance management, social sharing and compensation and benefits. The rest of publications (represented 22.6%) are related to the advancement of AI in minimizing the administrative work of HR to take up with strategic role. Tewari & Review (2020) reinforce the understanding of how AI is enabling machines to make decisions more accurately than humans based on existing data sets and behavioral patterns. This transformation pushes machines to take over all work susceptible to be automatized leading HR professionals to take up more strategic and intellectual roles.

In terms of the area of knowledge where the papers are published, it is worth highlighting the fact that, Business, Management and Accounting subject area is covering only 12.7% from whole subject areas in Scopus database.

In this sample, the transforming role of AI in HRM functions is distributed with different objectives in the area of HR. In this period, AI is found that influences specifically in Work-related flexibility and autonomy, Creativity and innovation, AI-enabled HRM systems, Employee emotions wellbeing at AI-powered workplace, Recruiting and selecting the most suitable employees, the impact of the Internet of Things (IoT) and Machine learning (ML) on onboarding, learning & development, performance management, social sharing and compensation and benefits.

As a conclusion, it could be said that daily advances in AI constitutes a new approach in managing employees and enhancing firm performance, thus offering several opportunities for HRM but also considerable challenges at managerial and ethical level.

Finally, the literature fails to build a complete framework for the transforming role of AI in HRM functions. Particularly, strategic HR Planning &staffing, job design, motivation and compensation.

5. RESEARCH LIMITATIONS/IMPLICATIONS

The scope of databases is limited to Scopus. However, due to the scarcity of papers found, this analysis could be expanded to other databases to cover ISI, Emerald insight and Google Scholar.

Building on this piece of research, new lines for future research could be opened, such as building comprehensive framework based on qualitative or quantitative analysis covering staffing, motivation and learning & development in order to deep understanding the transforming role of AI in HRM functions.

6. PRACTICAL IMPLICATIONS

The papers and proceedings analyzed in the present study show variations in the interest in researching the theme, methods and vulnerability of AI on HRM functions. As far as academic implications concerns, this study highlights the need for empirically expanding the analysis of the role of AI in HRM.

Regarding practical implications this paper set the foundations for practitioners to efficiently plan the implementation of AI in HRM in order to get the most out of it.

ORIGINALITY/VALUE OF THE PAPER

This article advances in research on the transforming role of AI in the HRM functions through analyzing topics content and intellectual structure of business and management scholarship.

REFERENCES

Buck, B., & Morrow, J. (2018). AI, performance management and engagement: keeping your best their best. *Strategic HR Review*.

Dennis, M. (2018). Artificial intelligence and recruitment, admission, progression, and retention. *Enrollment Management Report, 22*(9), 1-3.

Denyer, D., & Tranfield, D. (2009). producing a systematic review. In A. B. David Buchanan, *The sage handbook of organizational research methods* (pp. 671–689). London: Sage Publications.

Geetha, & Reddy, B. (2018). Recruitment through artificial intelligence: a conceptual study. *International Journal of Mechanical Engineering and Technology (IJMET), 9*(7), 63–70.

Jain, S. (2017). Artificial intelligence-the engine driving the next wave of transformation in business. *Int. J. Adv. Res. Sci. Eng, 6*(1), 592-596.

Mackenzie, H., Dewey, A., Drahota, A., Kilburn, S., Kalra, P., Fogg, C., & Zachariah, D. (2012). Systematic reviews: what they are, why they are important, and how to get involved. *Basic Research for Clinicians*, 1-10.

Mercer. (2019, January 19). *Global Talent Trends*. Retrieved July 7, 2021, from Global Talent Trends: https://www.mercer.com/content/dam/mercer/attachments/private/global-talent-trends/2021/gl-2021-gtt-global-eng-mercer.pdf

Merlin.P, R., & Jayam.R. (2018). Artificial Intelligence in Human Resource Management. *International Journal Of Pure And Applied Mathematics, 119*(17), 1891-1895.

Ore, O., & Sposato, M. (2021). Opportunities and risks of artificial intelligence in recruitment and selection. *International Journal of Organizational Analysis*.

Pillai, R., & Sivathanu, B. (2020). Adoption of artificial intelligence (AI) for talent acquisition in IT/ITeS organizations. *Benchmarking: An International Journal, 27*(9), 2599-2629.

PWC. (2020, Augest 30). *How the new normal is shaping the future of HR*. Retrieved July 5, 2021, from PWC: https://www.pwc.com/m1/en/publications/new-normal-shaping-future-hr/how-the-new-normal-shaping-future-hr.pdf

Tewari, I., & Review, M. P. (2020). Artificial Intelligence Reshaping Human Resource. *International Conference on Advent Trends inMultidisciplinary Research and Innovation (ICATMRI)*, 1-4.

Upadhyay, A., & Khandelwal, K. (2018). Applying artificial intelligence: implications for recruitment. *Strategic Hr Review*.

Xiong, Y., Xia, S., & Wang, X. (2020). Artificial intelligence and business applications, an introduction. *Int. J. Technology Management, 84*.

Zehir, C., Karaboğa, T., & Başar, D. (2020). The Transformation of Human Resource Management and Its Impact on Overall Business Performance: Big Data Analytics and AI Technologies in Strategic HRM. In U. Hacioglu, *Digital Business Strategies in Blockchain Ecosystems* (pp. 265-279). Springer, Cham.

ISBN: 978-84-9048-417-3
9 788490 484173

Business Meets Technology
3rd International Conference

M Rosario Perello-Marín, Conrado Carrascosa López, Daniel Catalá Pérez (Eds.)

The **3rd International Conference "Business meets Technology"** took place on September 23rd and 24th 2021 in the **Business Organization Department** with the support of the Faculty of Business Administration and Management of the **Universitat Politècnica de València** (UPV), Spain.

The first and second edition of the Conference were held at the **University of Applied Sciences of Ansbach**, Germany, in 2018 and 2020, respectively.

The theme of the conference was «Business Meets Technology». By suggesting such a broad topic, we aimed to invite researchers with a variety of interests in theory and research in various areas of science, commerce and arts related to business and technology. By providing a general motto, we emphasized that contributions from all areas of science are welcome.

The objective of the event from its multidisciplinary approach was to allow generating and contributing valuable knowledge to face the great social challenges established as political priorities by the programs European science, research and innovation framework.

The international focus of the event, with the participation of leading experts from European universities, both in the scientific committee and in the scientific program as invited speakers, enriched the exchange of knowledge for all attendees.

edUPV
Universitat Politècnica de València