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PRESENTATION

Revista de Negócios is located in Blumenau, state of Santa Catarina, Brazil, in the campus of Uni-versidade Regional de Blumenau—FURB, post-graduate programme in Business Administration. Revista de Negócios is published quarterly in January, April, July and October on the website furb.br/rn.

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MISSION

Revista de Negócios advances the knowledge and practice of management learning and education. It does it by publishing theoretical models and re-views, mainly quantitative research, critique, exchanges and retrospectives on any substantive topic that is conceived with studies on emerging countries. Revista de Negócios is an interdisciplinary journal that broadly defines its constituents to include different methodological perspectives and innovative approach on how to understand the role of organizations from emerging countries in a globalized market.

SCOPE AND FOCUS

Revista de Negócios aims to create an intellectual and academic platform, under the perspective of Strategic Management Organization, to promote studies on Emerging Countries. The Journal looks and reviews for contributions to the debate about researches on two specific topics: innovation and competitiveness and strategic organization in emerging countries. The topic of innovation and competitiveness covers all studies and researches related to how organizations can sustain their competitiveness, particularly focusing on innovations, entrepreneurship and performance. The second topic covers studies and researches on strategic management of organizations, more specifically on how companies can or should act at strategic level looking mainly but not only to external context, supply chain, competitive strategies in international market, and marketing approach. The editorial policy is based on promoting articles with critical perspectives seeking for the understanding of the differences and similarities among emerging countries and in comparison with experiences and theories on strategic management in developed countries. It intends to promote specific contributions of how theoretical and empirical studies on emerging economies may contribute to the advance of theories related to innovations and competitiveness and strategic management of organizations. It is welcome scholars particularly working on such topics to submit theoretical essays, empirical studies, and case studies. The Revista de Negócios is open to different methodological perspectives and innovative approaches on how to understand the role of organizations from emerging countries.

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Estimating the underestimation profile of health service need s through telephone counseling centers

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KEYWORDS

Underestimation, Health demand, Health system, Logistic regression, Statistics.

ABSTRACT

The public and private health systems around the world face an expansion of services in parallel with the demand for improved quality and cost savings. Quality and efficiency of such systems are affected by the underestimation of the needs for patient care, compromising the clinical condition of the patient and system costs. The objective of this study is to identify the factors that determine the underestimation of the need for health services in Brazil. The survey used data collected from medical advice call center reports, totaling 19.690 observations; 2.166 of these have involved underestimation of needs, wherein the complexity of the intention of the patient is smaller than the recommendation proposed by the physician, which is divided into very or less critical. Through a logistic regression model, it was possible to estimate the critical factors in determining the underestimation in very and less critical needs for health services in Brazil. The closeness to the weekend increases the probability of a very critical underestimation. Daytime hours feature a very critical underestimation tendency. In terms of age groups, we can see a probability of very critical underestimation in younger individuals. This study showed that the user profile that was most likely to have very critical underestimation of the demand for health care was that of the underage individual who calls on weekends and in the early hours of the day.

PALAVRAS-CHAVE

Subestimação; Demanda de saúde, Regressão logística, Estatísticas.

RESUMO

Os sistemas de saúde público e privado em todo o mundo enfrentam uma expansão dos serviços em paralelo com a demanda por melhor qualidade e redução de custos. A qualidade e eficiência de tais sistemas são afetadas pela subestimação das necessidades de atendimento ao paciente, comprometendo a condição clínica do paciente e os custos do sistema. O objetivo deste estudo é identificar os fatores que determinam a subestimação da necessidade de serviços de saúde no Brasil. A pesquisa utilizou dados coletados em relatórios de call-center de aconselhamento médico, totalizando 19.690 observações; 2.166 destes envolveram subestimação das necessidades, em que a complexidade da intenção do paciente é menor do que a recomendação proposta pelo médico, que se divide em muito ou menos crítica. Por meio de um modelo de regressão logística, foi possível estimar os fatores críticos na determinação da subestimação nas necessidades muito e menos críticas de serviços de saúde no Brasil. A proximidade do fim de semana aumenta a probabilidade de uma subestimação muito crítica. O horário diurno apresenta uma tendência de subestimação muito crítica. Em termos de faixas etárias, podemos ver uma probabilidade de subestimação muito crítica nos indivíduos mais jovens. Este estudo mostrou que o perfil do usuário com maior probabilidade de subestimação muito crítica da demanda por assistência à saúde foi o do menor que liga nos finais de semana e nas primeiras horas do dia.

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1 Introduction

The Brazilian health system is formed by public and private systems. The private system is represented by health insurance plans and self-employed professionals, whereas the public system is represented by the Unified Health System (SUS - Sistema Único de Saúde). The latter safeguards all Brazilians universal access to health care. However, such a configuration of the Brazilian health system does not ensure user satisfaction with the services provided. According to the Federal Council of Medicine (2014), 93% of Brazilian respondents consider the public and private health systems in Brazil to be poor or very poor.

An increasingly used resource in this segment to improve the service level is the adoption of Information and Communication Technologies (ICT), which enable health care providers to offer patients health care (Westbrook et al., 2009; Niv et al., 2018). The main stakeholders of the e-healthcare industry are employers, patients, providers and health insurance plans (Mukherjee and McGinnis, 2007; Kim et al., 2019). Mobile health or m-health is a subset of e-healthcare, comprising several health services that may be provided by the mobile phone and other communication devices (Weinstein et al., 2013; Castillo et al., 2017).

The scope of e-health studies has expanded in recent years. Some research initiatives are: the impact of medical advice phone centers on reducing costs of the system (Guimarães et al., 2015; McFarland et al., 2017) highlights the main uses of m-health on smartphones and tablets, through developing numerous applications (Handel, 2011) and presents a system that evaluates the priority of a call to a nursing station based on the patient's context and information, including the recommendation for the most appropriate care (Ongenae et al., 2014) and another group of researchers evaluated the quality, as perceived by users, and with service efficiency (Mechael, 2009; Akter et al., 2010; Babich et al., 2016).

The increased use of phones, especially the more recent use of mobile phones and smartphones, has introduced an important frontier for e-health, which is the possibility of doctor-patient interaction by distance communication (Albritton et al., 2018). According to Mukherjee and McGinnis (2007) and Njeru et al. (2017) the potential of e-health technologies to educate patients and promote management improvements is unlimited. Health system operators can make use of certain information and counselling practices to reduce the flow of patients, redirecting them to real demand. Patients intending to enter emergency care can be redirected to general practitioners' offices for less complex procedures or can make an appointment through medical advice systems via call centers.

Given that the potential demand of the health system is not usually the adequate demand of the real needs of the patient, the medical advice platform enables the user to obtain information that provides him or her with an appropriate use of the available health service. For instance, the user can contact this service both in non-emergency and emergency situations by dialing a few digits and, thus, receiving medical information, consultation, treatment, screening, diagnosis, forwarding and advice by registered doctors (Ivatury, 2009; Lv et al., 2016).

Turner et al. (2002) present a study on the implementation of medical advice centers in Australia and shows that the advice proposed by the center diverged from the original intention of the patient. The advice center recommended patients to seek an appointment instead of hospital emergency units; the percentage was 54% for adults and 78% for children. In a study on the inadequate use of emergency services in England, McHale et al. (2013) show that a higher percentage of inadequate care occurs with children in early childhood. In Brazil, Carret et al. (2009) and Guimarães et al. (2015) presented similar results, wherein the proportion of inadequate demand for health services in young people and children is significantly higher.

With respect to gender, (Guimarães et al., 2015; McHale et al., 2013) note that males are more likely to use health services inappropriately; however, previous studies emphasize otherwise (Sarver et al., 2002; Carret et al., 2007). Another factor considered in the literature that can interfere with the patient's initial demand is the time of day in which the service is demanded. Oktay et al. (2003), Bianco et al. (2003), Carret et al. (2007), McHale et al. (2013) and Guimarães et al. (2015) found that incorrect service occurred with lower intensity in the early daytime hours.

Improved health education equips patients

with the ability to take better preventive measures that will save patients money as well as decrease health system costs (Mukherjee and McGinnis, 2007; Bunik et al., 2007; Babich et al., 2016) identified the cost saving potential in making use of medical advice centers. Kile et al. (2008) recognizes that the use of a phone can potentially reduce emergency care services by diverting unnecessary emergency visits, leading to a potential reduction in service costs, health system costs and overcrowding of hospital emergency rooms.

However, when the patient underestimates his actual health condition, whereby, the patient stays home or seeks an appointment at a clinic instead of going to the hospital, the consequences can be more serious. Jat et al. (2015) found that the underestimation of the severity of health conditions in pregnant patients led to a delay in seeking proper assistance and contributed to maternal deaths. One of the reasons for possible underestimation is that the advice offered by the call center is not always accurately interpreted by the patient (Leclerc et al., 2003; Njeru et al., 2017; Morony et al., 2018). This quality of service was studied by Mayo (1999) and corroborated by Chang et al. (2002). One of the points raised was the importance of the time spent in the conversation with the patient in improving the understanding, and nursing advice performed well in interventions with patients.

The underestimation of service priorities was inserted as a performance indicator to detect life risk situations by the emergency medical dispatchers in the study by Lindström et al. (2011). On the other hand, Laugsand et al. (2010) in their study on the underestimation by the health care provider with patients who have symptoms of cancer, show that this action causes undertreatment of the symptoms and had less favorable results.

Guise et al. (2014) and Keijser et al. (2016) note that the patient's safety risks associated with telephone assistance, including the underestimation of the knowledge required to use the technology (Hopp et al., 2006) demonstrates that hiding emotions at work is linked to human health, while Seok et al. (2014) studied the relationship between emotion at work and the use of medical services (consultations, hospitals and pharmaceutical drugs) in Korea. They concluded that those who underestimate their emotions, or who hide them, are more inclined to use the medical services, which may be more harmful in women than in men.

In this context, the objective of this article is to identify factors that determine the underestimation of the need for health services from data from calls to a medical advice call center. The impact that underestimation may have on the patient's health and on the health system costs is also highlighted. The use of telephone counseling centers can help minimize underestimation of needs. Articles about underestimation are rarely found. This study may contribute important information for patients and public and private health system managers.

2 Theoretical Framework

In this section, the topics will be presented: Information technology in the health service and Previous studies about E-healthcare.

2.1 Information technology in the health service

The use of information technology in the area of health services has been progressing considerably in recent years and helping to create digital solutions that help improve people's quality of life and even save lives (Mesko and Győrffy, 2019). Due to this digital advance, in the 2000s the concept of E-healthcare appeared in the world (Wu et al., 2006; Sharma et al., 2019). According to the Healthcare Information and Management Systems Society (HIMSS, 2019) E-healthcare can be conceptualized as a healthcare service system that uses information and communication technologies to provide healthcare services to its users.

The provision of the service through this type of health service system ranges from the communication between partners of the same network of hospitals to the care of patients in the most diverse and remote locations.

In this sense, health information technology is advancing rapidly, bringing improvements to professionals, patients and hospital organizations (Gams et al., 2019). Transforming power tools such as Artificial Intelligence, Internet of Things (IoT), robotics, Big Data, etc., are already part of the daily routine of health professionals and directly impact the patient's life (Xiang et al., 2020).

Thus, among the main benefits of using information technology in the health area, we highlight: 1- Automation of medicine, 2- Improvement in patient care, 3- More accurate

diagnoses through high-definition exams and telemedicine, 4- Safety and accuracy in surgical procedures, 5- Reduction of diagnostic errors and surgical procedures and 6- Use of decision support systems for assertive management (Hamza et al., 2019; Majumdar et al., 2020).

In view of the characteristics and tools used in E-healthcare, in the next section some previous Studies on E-Healthcare will be presented.

2.2 Previous studies about E-healthcare

Due to the importance of the problematic of E-healthcare system, many authors have been studying this theme.

Sarabdeen and Moonesar (2018), although considering that E-healthcare is a system that lowers health costs and improves the quality of service provision, affirms that among the problems of this type of system, the protection of data privacy of patients may be a barrier to the non-materialization of provision of service. In this way, the authors sought to investigate the privacy protection laws of available E-healthcare data and the perception of people who use E-healthcare services. Thus, the authors used descriptive statistics and correlational analysis in a sample of 46 health professionals and 187 health service users in Dubai. As a conclusion, the authors found that the available health data protection laws are limited in scope and that users felt they could rely on E-healthcare service systems.

Giansanti and Maccioni (2019) proposed a new model of respiratory rehabilitation in the field of Telemedicine and e-Health, in order to reduce the impact of respiratory disease on the quality of life of the patients. As it was an initial research, the practical results of the integrated model of Telemedicine and e-Health were not evidenced. The proposed model was built in an environment for domiciliary rehabilitation based on lung incentive gamified devices integrated into the e-Healthcare system.

Marino et al. (2019), sought to evaluate the implementation of screening programs and early detection in the prevention of breast cancer and cardiovascular diseases with the establishment of a remote diagnosis through Telemedicine in a sample composed of 321 women submitted to breast cancer screening and 109 individuals undergoing cardiovascular screening, such study was developed in southern Italy. For the sample studied, the authors concluded that the use of telemedicine significantly reduces the costs of breast cancer tracking and major cardiovascular diseases. Therefore, the use of telemedicine has proven to be a promising approach to provide various health services, especially for patients who are in the most remote and difficult to reach places.

Calvillo-Arbizu et al. (2019), developed an e-Health system for renal patients, adopting design practices focused on the user, usability and accessibility standards. As a result of this process, a multifaceted system was created and meeting the needs of each user. Thus, the improvement of the proposed system is directly linked to the use by different types of users.

García et al. (2019) developed a cell phone application for cerebrovascular accident detection that uses the cloud to store and analyze data, in order to provide statistics for public institutions. To validate the applicability of the application, 90 tests were performed checking the three most important symptoms of strokes: smile detection, voice recognition to determine if a sentence is correctly repeated and whether arms can be lifted. The research results showed that the application developed, through the test, determines whether or not users have symptoms of cerebrovascular accident.

Gams et al. (2019) presented a vision of the progress of environmental intelligence and artificial intelligence to aid medical diagnosis. In line with the studies by Gams et al. (2019), Xiang et al. (2020) sought to investigate the perceptions, receptivity and demands related to the implementation of artificial intelligence in the medical field. For this purpose, an online questionnaire was applied to 2780 participants and then the linear regression model was used. Among the results, the authors found a high level of receptivity (approximately 100%), a high level of demands (approximately 80%) and a high level of expectations (100%) regarding the implementation of artificial intelligence in the medical field.

It is observed a sequence of current research which prove the importance of the study of information technology and communication in the service sector, as well as the dissemination of the concept and practice of E-healthcare. Despite the fact that the topic is quite discussed in the literature, few studies are aimed at identifying the factors that determine the underestimation of the need for health services. Thus, this work aims to study this

theme.

3 Methodology

The data used in the survey are gathered from information contained in service reports from medical advice centers. The reports have the following information: the patient's age, sex, original intention in seeking care, recommendation by the medical advice center, and day and time of service. The information was collected continuously over a period of two months. Service users are customers of health plans or the public health system of municipalities contracting the service. It should be noted that, in the case of under 18-year-old users, the advice service was conducted by a responsible adult. This information was supplied by a medical advice center based in Recife, Brazil. This company provides medical advice service by telephone to users from different states and regions of Brazil.

The telemedicine service in Brazil is incipient, but it has been growing considerably. According to Globo (2020), one of the largest online appointment scheduling platforms, it scored an average of 1,200 appointments per day. Thus, taking into account the growing demand for online consultations, the pandemic by COVID-19 and some characteristic aspects such as safety in the movement of patients and doctors, agility and optimization of time, availability of access, the search for humanization in care and the rapid and effective diagnosis of these online consultations, the theme becomes highly relevant and therefore should be studied.

The variables extracted from this set of data are as follows: Age (continuous), Gender (1 = female, 2 = male), The patient's original intent for health care (1 = home care, 2 = visit to the clinic, and 3 = hospital visit), The medical advice (1= home care, 2 = visit to the clinic, and 3 = hospital visit), The part of the day (00:01 - 06:00; 06:01 - 12:00; 12:01 - 18:00; and 18:01 - 24:00), and Day (Monday, Tuesday, Wednesday, Thursday, Friday, Saturday, and Sunday) of the phone call.

From the variables highlighted above, the six hypotheses were developed to identify factors that determine the underestimation of the need for health services from data from calls to a medical advice call center.

H1: Age affect the probability of underestimating of the need for health services.

H2: Gender affect the probability of underestimating of the need for health services.

H3: The patient's original intent for health care affect the probability of underestimating of the need for health services.

H4: The medical advice affect the probability of underestimating of the need for health services.

H5: The Part of the day affect the probability of underestimating of the need for health services.

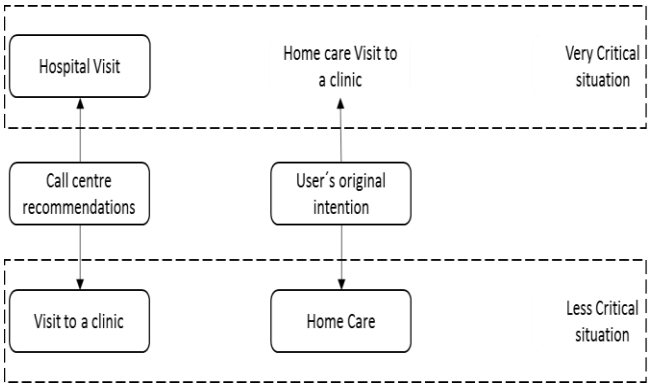
H6: Day affect the probability of underestimating of the need for health services.

The data used in the survey comprise all incoming calls in the period of two months, totaling 19.690 observations; 2.166 are situations of underestimation of needs wherein the complexity of the patient's intention is smaller than the recommendation proposed by the physician.

Bogdan et al. (2004) and Guimarães et al. (2015) assumed that the recommendation provided by a medical advice center is divided into the following three categories: home care (low intensity of care); visit to the clinic (intermediate intensity, not including emergency actions, such as visiting a general practitioner and scheduling an appointment); and hospital visit (high intensity of care, including emergency actions and going to hospitals).

The underestimation of the need for health care is divided into very critical underestimation when the patient should go to a hospital emergency, but prefers to stay at home (home care) or schedule an appointment (visit to a clinic) that then severely compromises the user's health due to failure to provide the adequate level of service, and less critical underestimation when the user should schedule an appointment (visit to a clinic), but prefers to stay at home (home care), compromising the individual’s health because of the delay in diagnosing and treating an illness. The latter may be considered less serious than the former. Figure 1 illustrates this situation.

Figure 1. Flow chart of representation of very critical and less critical situation



Source: The authors (2020)

All statistical analyses were performed using XLSTAT software (Addinsoft, 2016). First, an analysis was performed using chi-squared testing in both underestimation groups. Next, a binary logistic regression model was used in which the underestimated level was assumed as the dependent variable and the other requests were explanatory variables. In the regression model (Equation 1), the Stepwise Forward method was used. At each iteration, this inserts the significant variables of the model. In the end, the only parameters that remained were those that have a consistent relationship with the dependent variable.

The study was submitted to the Committee of Ethics in Research of the University of the State of Mato Grosso. The information used in the survey was obtained from a secondary dataset provided by the medical advice center, which has a service protocol that originates data without identifying the user (patient). The rapport of the Committee of Ethics is contained in Letter No. 008/2014-REC/UNEMAT.

4 Results and Discussion

In recent years, Brazil has faced a recessionary economic environment that is associated with high inflation. This combination has reduced the purchasing power of households and, consequently, the income available for health expenses, as evidenced by the number of Brazilians who have quit the private health system. In 2015, 766,000 Brazilians abandoned their health insurance plans, a decrease of 1.5% over the previous year, according to the Institute of Supplementary Health Studies (IESS, 2016), while there has been a drop in the tax collection, compromising the transfer of funds to the public health system. Therefore, it is fundamental for managers of public and private health systems to minimize costs and increase their efficiency. The literature shows that providing information to the patient reduces costs (Bunik et al., 2007; Kile et al., 2008; Guimarães et al., 2015).

In this way, nineteen thousand observations were collected and 2.166 showed situations of underestimation. Table 1 shows information from the sample, demographic characteristics and circumstances of the service of 2.166 telephone calls that were collected by a medical advice system when the patient initially underestimated the need for health services. It also shows the distribution of the very critical and less critical requests according to the aforementioned characteristics. Overall, 63.7% (n = 1.380) of the calls were considered very critical and 36.3% (n = 786) were considered less critical requests. Medical advice call center users are predominantly women (64.6%), and the predominant age group is those patients above 59 years of age (28.9%), which is followed by those between zero and fifteen years of age (19.6%). In the latter case, the requests for health care are made by the parents or guardians. Regarding the most frequent time for using the service, the period from 6:00 a.m. to 6:00 p.m., accounting for 69.7%, is the busiest. For the day of the week, patients called more often on Tuesdays (17.5%), Wednesdays (16.9%) and Fridays (16.1%).

According to Table 1, with respect to gender, an equal proportionality of data for both very critical underestimation and for less critical underestimation (χ 2 = 0.137; p-value = 0.711) can be observed. However, with respect to age, we see a significantly higher proportion of patients with a very critical underestimation attitude in the group from zero to fifteen years old (χ 2 = 25.527; p-value <0.001) and a higher proportion of patients with a less critical underestimation attitude in the group from 25 to 34 (χ 2 = 7.807; p-value = 0.005). The other groups (16-24 with χ 2 = 2.669 and p-value = 0.102; 35-44 with χ2 = 0.618 and p-value = 0.432; 45-59 with χ2 = 3.058 and p-value = 0.080; and over 60 years old with χ2 = 0.706 and p-value = 0401) do not present statistically significant differences in their proportions. In relation to the time that patients call, those with a very critical

underestimation attitude have a higher proportion in the 00:01 - 06:00 time slot (χ 2 = 28.208; p-value <0.001) and in the 06:01 – 12:00 time slot (χ 2 = 6.507; p-value = 0.011). However, we see a higher proportion of patients who have a less critical underestimation attitude in the 12:01 - 18:00 time slot (χ 2 = 17.484; p-value <0.001).

Table 1. Sample profile and demographic distribution of very critical and less critical requests according to explanatory variables.

Demographic distribution	Frequency (%)			χ^2	p-value
	General (n=2.166)	Less critical (n=786)	Very critical (n=1,380)		
Gender					
Females	64.6	65.1a	64.3a	0.137	0.711
Males	35.4	34.9a	35.7a	0.137	0.711
Age					
0-18	19.6	13.9a	22.8b	25.527	<0.001
18-24	9.1	10.4a	8.3a	2.669	0.102
25-34	17.8	20.9b	16.1a	7.807	0.005
35-44	10.8	11.5a	10.4a	0.618	0.432
45-59	13.8	15.5a	12.8a	3.058	0.080
60 plus	28.9	27.9a	29.6a	0.706	0.401
The part of the day					
00:01 - 06:00	4.0	1.0a	5.7b	28.208	<0.001
06:01 - 12:00	36.1	32.6a	38.0b	6.507	0.011
12:01 - 18:00	33.6	39.2b	30.4a	17.484	<0.001
18:01 - 00:00	26.4	27.2a	25.9a	0.425	0.514
Weekday					
Monday	10.1	7.5a	11.6b	9.207	0.002
Tuesday	17.5	20.2b	15.9a	6.006	0.010
Wednesday	16.9	17.9a	16.4a	0.868	0.351
Thursday	13.5	15.9b	12.1a	6.206	0.013
Friday	16.1	19.1b	14.4a	8.058	0.005
Saturday	14.1	11.3a	15.7b	7.997	0.005
Sunday	11.8	8.0a	13.9b	16.770	<0.001

Values with different letters within the same row are significantly different (p≤0.05) according to the chi-square test to K proportions with Marascuilo procedure and multiple comparisons.

Source: The authors (2020)

With respect to the distribution of weekdays, there is a higher frequency of patients with a very critical underestimation attitude on Mondays (χ 2 = 9.207; p-value = 0.002), Saturdays (χ 2 = 7.997; p-value = 0.005) and Sundays (χ 2 = 16.770; p-value <0.001). On Tuesdays, Thursdays and Fridays, there was a higher proportion of patients with a less critical underestimation attitude (χ 2 = 6.006, p-value = 0.010; χ 2 = 6.206, p-value = 0.013; and χ 2 = 8.058 and p-value = 0.005, respectively).

Binary logistic regression models are used in the literature when the variable of interest has only two results and is influenced by independent variables. The choice of the binary logistic regression model in this study was based on similar work by McHale et al. (2013) and Guimarães et al. (2015). The proposed model is presented in Equation 1.

$$Logit\ i\ =\ ln\left(\frac{Odds\ Event}{1\ -\ Odds\ Event}\right) =$$

$$Y= \beta 0\ +\ \beta 1 X_{Day} + \beta 2\ X_{Part\ of\ day} + \beta 3\ X_{Age}$$

Onde:

$Logit\ i$ = Y = is the dependent variable related to probability of underestimating of the need for health services

$\beta 0$: is the intercept of regression

$\beta 1$: is the slope related to the independent variable X_{Day}

$\beta 2$: is the slope related to the independent variable $X_{Part\ of\ day}$

$\beta 3$: is the slope related to the independent variable X_{Age}

From the result of the binary logistic regression model, the relationship between the independent variables with the probability of the underestimated needs of the patient is obtained. As seen in Table 2, the critical variables that compose a very critical profile for the underestimation of needs for health services are, as follows: weekdays (OR: 1.058; 95% CI: 1009-1108), part of the day (OR: 0.803; 95% CI: .725 - 0.890), and age (OR: 0.947; 95% CI: 0.904 - 0.993).

Table 2 – Regression model

Variables	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I. for EXP(B)	
							Lower	Upper
Day	0.056	.024	5.538	1	.019	1.058	1.009	1.108
Part of the day	-0.21	.052	17.568	1	.000	.803	0.725	0.890
Age	-0.05	.024	5.104	1	.024	.947	0.904	0.993
Constant	1.172	.186	39.534	1	.000	3.228		

Source: The authors (2020)

From Table 2, it is possible to see that Equation 2 of the regression model occurred by:

$$Y= 3.228\ +\ 1.058\ X_{Day} + 0.803\ X_{Part\ of\ day} + 0.947$$

X_{Age}

As seen in Table 2, the closeness to the last days of the week increases the probability of very critical estimation by 5.8% per day; as a result, on weekends, the probability of underestimating very critical situations is higher and may more severely compromise the patient's health. There is a higher probability of very critical underestimation in the early hours of the day, which decreases as the hours advance, and each period of the day has a 19.7% reduction in the probability of very critical underestimation. Underage individuals tend to be more likely to very critically underestimate considering that, for each additional year, the probability of very critical underestimation is reduced by 5.3%.

Hence, it can be inferred that the user's profile and service circumstances with higher probability of very critical underestimation of the demand for health services are, as follows: underage individuals on weekends and in the early hours of the day. The proposed model is statistically significant because it rejects the null hypothesis (β0, β1, β2 and β3 = 0) in the likelihood ratio test, according to Equation 2. Therefore, the estimated parameters are significant, which is endorsed by the low p-value.

The Wald test corroborates to confirm the significance of the proposed logistic regression model. As shown in Table 2. Each estimated parameter is significantly different from zero. That is, the relationship between the dependent variable and Day (H6), Part of the day (H5) and Age (H1) is confirmed.

In line with the results found in this research, the authors McHale et al. (2013) Carret et al. (2009) and Guimarães et al. (2015) showed that age is a determining factor in the inadequate demand for health services such that the lower the age, the higher the probability of inadequate demands. This study also showed that age also affects the severity of the decision and that within such underestimation there are different levels of health risk, because as age increases, the probability of very critical underestimation decreases, decreasing by 5.3% for each additional year.

Another important finding is that most calls come from women, which is consistent with the results of Oktay et al. (2003), Carret et al. (2007) e Guimarães et al. (2015). However, this study showed no statistically significant difference in the underestimation attitude between genders.

In this study, the highest incidence of calls occurs in the early hours of the day, wherein the time slot from 06:01 to 12:00 (36.1%) is the one with highest incidence, unlike what authors such as Bianco et al. (2003), Carret et al. (2007) e Guimarães et al. (2015) have written in their papers, including that the quantity of mistaken calls was lower in the early hours of the day. It is important to note that from 00:01 to 12:00, very critical underestimation is more frequent. It is also important to highlight that the regression model reinforces this idea, showing that from the first hours of the day, for each increase of 6 hours in the slot, there is a reduction in the probability of a very critical underestimation by approximately 19.7%.

The closeness to the last days of the week increases the probability of very critical estimation by 5.8% per day; as a result, on weekends, the probability of underestimating very critical situations is higher and may more severely compromise the patient's health. There is a higher probability of very critical underestimation in the early hours of the day, which decreases as the hours advance, and each period of the day has a 19.7% reduction in the probability of very critical underestimation. Underage individuals tend to be more likely to very critically underestimate considering that, for each additional year, the probability of very critical underestimation is reduced by 5.3%.

Several authors, such as Bianco et al. (2003), Afilalo et al. (2004) and McHale et al. (2013) demonstrated that patients have an inadequate demand attitude for health services, especially on the weekend. This survey shows that very critical underestimation occurs on Saturdays, Sundays and Mondays. In this sense, this study explores something deeper than the inadequate demand and its relationship with age, the time of day or day of the week, which also indicates the severity of the inadequate underestimation and its possible effects on patient lives.

The role of underestimation of the need for commitment to the individual's health has been studied by Kile et al. (2008) in his article on the contribution of underestimation for maternal death, as well as by Laugsand et al. (2010) who show that results are not as beneficial regarding cancer treatment in their study on underestimation by the health care provider. The severity of human health can also be associated with underestimation of

emotions at work according to Hopp et al. (2006) and Seok et al. (2014). As a result, identifying this patient's profile requires increasing the probability of saving lives.

With such a purpose, a more thorough study was conducted by performing a more detailed identification of the patient who underestimates the need to care for his own health by analysing the gender, age, day of the week and time of his call to the medical advice call center. Sixty-four percent of the patients who underestimate the doctor's advice were identified to correspond to the very critical underestimation group, increasing the potential harm to the patient's health.

Another factor presented in the literature that compromises the clinical condition of patients is the fact that the user may or may not follow the guidance provided by the service provider. Bogdan et al. (2004) demonstrated that 68% of patients disagreed with the actions originally recommended by the nurses and 46% chose an action in which the health care was lower than what had been suggested. A different result was reported by Kempe et al. (2006), who conducted a study of all pediatric patients whose families had contacted the call center after work, concluding that approximately 75% of those families followed their recommendations to stay home or go to the emergency. Another notable point is the quality of service, Chang et al. (2002) e Lindström et al. (2011) confirmed that the quality of service is an important factor for interventions to have a higher probability of success.

As a result, medical advice via call centers, besides enhancing cost reduction in assistance, can influence the well-being of the patient who underestimates his or her need for health services from the moment he or she follows the provided recommendations. However, the use of the technology by the user must be studied as part of profile identification. Guise et al. (2014) and Keijser et al. (2016) note that the risks of underestimation are related to the knowledge required to use the technology. Tate et al. (2013) state that the use of mobile phone messages or specific applications on the smartphone can help minimize underestimation. Shahrokni et al. (2015) propose that the internet, through mobile devices for people over 65 years of age, could be used for interventions related to health.

5 Conclusion

This study explores beyond the inadequate demand, which has been, up to now, not previously presented in the literature; it explores the possibility of deterioration in the patient's health, either by a wrong initial decision or because patients do not follow the recommendations from medical advice call centers.

This survey shows that, based on the identification of the patient's profile and circumstances of the service that underestimate his need for health services (very critical and less critical), there is a need for the health system to readjust its strategy with respect to monitoring the patient after the call, through educational and promotional campaigns, and information policies through contact channels with the health system (m-health). These actions aim to increase the patient's life expectancy, making it necessary to assess the ability of the attendant to use the active call center (calling the patient) and understand the effort and time involved in such calls when determining whether the instructions were followed. Furthermore, the delay in providing assistance can be more expensive for the health system.

Hence, in this context, the combination of informational efforts and monitoring can reduce the patients' underestimation and his or her needs, helping cover the gap between the patients' thought about his or her health and real conditions, avoiding health complications from wrong decisions as well as reducing costs in the healthcare system.

6 Implications and Further Research

The research can make a link between the object of study, underestimation of health care needs and practical application for the benefit of society. The understanding that weekends, in the early hours of the day, and in groups of underage individuals, constitute the risk group for underestimation of needs, provides information that can support the development of health service management policies that provide information for publics more likely to underestimation. The adoption of information policies oriented by the results of the research tend to increase the right decision making in the demand for health services, bringing social contributions - preservation and quality of life from the adoption of health procedures, with the correct specification and at the

right time, as well as economic - reducing health care costs, late adoption of a treatment can aggravate the clinical condition of the patient, a fact that causes a more burdensome treatment.

For Paese and Aguiar (2012), the formulation of strategic policies in the health sector is composed of a set of stages, in which the formulating agent decides which parameters will directly impact on the organizational management. According to Campelo, Santos and Oliveira (2017) in this process of policy formulation, the organizational manager must take into account all the essential factors related to the decision process, as well as the profile to whom these policies are addressed.

Therefore, among the possible practical implications of this study for health service policy-makers through telephone counseling centers, it is highlighted that the identification of the factors that determine the underestimation of the need for health services can contribute to the organizational context, since it guides the organizational policy-makers in the health service scenario, establishing a set of relevant factors for the elaboration and implementation of these policies.

From this perspective, the results of this research, besides contributing as a managerial tool, contribute to the social area, since the manager will take into account the factors that determine the underestimation of the need for health services in the process of formulating organizational policies, linking the participation of civil society and other actors involved, instigating and questioning the elaboration of some management policies, thus providing an improvement in the service rendering process, since this will be integrated with the factors identified by the user of the service.

Although this study contributes to relevant information, as it helps to identify patients with the potential to seriously underestimate their need for health services, investigating the factors related to their profiles and care circumstances that contribute to such underestimation, limitations should be recognized.

The first limitation identified in this research refers to the delimitation of data collection in a single medical counseling center based in Recife, Brazil, which provides medical telephone counseling services to users of public health systems and to users of health plans. Another limitation is that the demographic variable district/region was not included in this study, which could be useful to analyze its effect along with the other variables (days of the week, gender and age). And finally, the causes of underestimation have also not been researched and identified in this study.

Thus, for future work it is recommended to expand data collection in more than one medical counseling center in various locations including the district/region demographic variable. Another recommendation with regard to future studies refers to the evaluation of the causes that lead women to make most of the calls since the study did not show a statistically significant difference in the attitude of underestimation between the genders. Furthermore, the current format of the study does not consider what happened to the patient after the underestimation and neither the reason why proximity to the weekend increases the probability of a very critical underestimation, this being another recommendation. At last, it is recommended to replicate this study in other countries to identify differences and similarities in the behavior of people using the m-health service.

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Studies on emerging countries

Factors that Determine the Purchase of Portable Electronic Devices

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KEYWORDS

Consumer purchasing,
Industrialization,
Ornamental Stone Sector.

ABSTRACT

This study establishes whether the link to a specific sector of activity influences consumer purchasing behavior, and the factors that determine that lead them to purchase a portable electronic device. The ornamental stone industrialization sector was selected. A statistical descriptive study was carried out with a sample of 145 consumers involved in processing in the ornamental rock sector. Descriptive statistics, correlation and multiple linear regression analysis were applied for data analysis. The results demonstrate that consumers take into account interconnected factors, such as brand, design and utility, when purchasing a portable electronic device, and they look for a simultaneous application in their professional activities, with little emphasis on new features. Thus, it is concluded that consumers are interested in products with a proven multifunctional application. Future studies could analyze consumer behavior in other economic sectors, as well as proceed with an comparative analysis of the results achieved, which could contribute to improvements in organizational management for micro and small companies in different economic segments.

PALAVRAS-CHAVE

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RESUMO

O estudo objetiva verificar se o vínculo a um setor de atividade específico influencia o comportamento de compra do consumidor e os fatores determinantes que o levam a adquirir um dispositivo eletrônico portátil. Foi escolhido o setor de industrialização de rochas ornamentais. Um Estudo Descritivo Estatístico foi realizado tendo como amostra 145 consumidores envolvidos com o beneficiamento do setor de rochas ornamentais. Para a análise dos dados aplicou-se a estatística descritiva, correlação e análise de regressão linear múltipla. Os resultados mostram que os consumidores no momento da compra do dispositivo eletrônico portátil levam em consideração fatores interconectados como marca, *design* e utilidade, e buscam uma aplicação simultânea entre a atividade profissional, com pouca ênfase no aspecto da novidade. Assim, conclui-se a existência de interesse por produtos que atestam sua multifuncionalidade. Estudos futuros poderiam analisar o comportamento do consumidor de outros setores econômicos, bem como proceder uma análise comparativa dos resultados, o que pode contribuir com melhorias na gestão organizacional para as micro e pequenas empresas de diversos segmentos

1 Introduction

To a large extent, unrelenting competition has been responsible for the increasing speed in changes that have taken place both within and outside of organizations (Guidi *et al.*,2018). In this setting, company behavior has demonstrated a significant transformation, which has resulted in these companies giving greater emphasis to individual values, collective competencies and structural reconfigurations, striving for flexibility and dynamism. These qualities require constant change and innovation, which are determinants in organizational performance (Guidi *et al.*, 2017a; Jia & Li, 2016; Tomei & Ferrari, 2010).

Thus, radical or incremental innovation is a means to temporarily achieve a competitive advantage, which is a condition relevant for company participation in current and potential markets. For the client, innovation also makes a difference, since it creates value for personal gain, through the supply of technologically more advanced products (Feldens, Maccari, & Garcez, 2012; Šandová & Grabowska, 2015). However, the high costs generated by the lack of useful information and absence of qualified labor have been, in Kuhl and Cunha's (2013) opinion, the most common obstacles that result in companies delaying their development processes for new products or services.

We highlight that the marketing process, as an innovative tool, greatly assists companies in implementing changes, product design or even with packaging, as well as their positioning, promotion and in establishing prices, with a view to providing a better response to client needs, as well as facilitating the opening of new businesses, or even repositioning a product in an existing market, in the eagerness to improve sales (Jia & Li, 2016; Organisation for Economic Co-operation and Development [OECD], 2005; Šondová & Grabowska, 2015).

Furthermore, programming innovations is a challenging procedure that requires study, time and resources, as well as determination by the managers who make decisions, with a view to overcoming the turmoil caused by these barriers. Among the obstacles, those which are most prominent are of economic, organizational, informational and technical (qualified staff and technical services) origin; however, the existence of other difficulties (cooperation, consumers, norms and regulations),of equal importance to the previous items (Kuhl & Cunha, 2013), cannot be ignored.

In fact, seeking to understand the importance of the process of presenting new products and services in this setting of accelerated technological development, so, the search problem could be defined as: would their purchasing decisions for these products be influenced by their professional performance?

The main objective of this study is to identify which requirements consumers consider when they decide to acquire gadgets. Seeking to discover the needs and reasons that lead them to obtain new, technologically developed products is justified by the fact that the development of newand/or replacement products is fundamental for a company's long-term success, guarantee Neves & Castro (2003) and Pantano & Priporas (2016). However, as the authors highlight, it is not a simple process, since "the capacity for innovation is the differentiating factor for consumers" (p. 41). Therefore, researching why a client acquires a gadget assists with an organizational vision and justifies obtaining the knowledge required to prospect for new portable electronic devices.

Therefore, this research is equally justified, to a large extent, by an individual's sense of satisfaction with life, and as Costa & Horn (2012) recommend, may be related not only to differences in the objective experience but also to what a person has and their expectations. This said, the reputation of products and the possibility of social interaction that gadgets provide, favor the intensification of their assimilation. Thus, for Crossland, Silva & Macedo (2014), electronic products, such as smartphones, tablets and e-book readers have achieved a marked increase in sales, with a rapid deference to the possibility of accessibility in recent years. In line with McHenry *et al.* (2017), the increase in assimilation is also due to developments in the provider's level of comfort and the possibility of an environment characterized by high levels of technology.

The relevance of this work is to verify the influence of consumer behavior, with regards to the growing search for technologically developed products. So, the search problem could be defined as: would their purchasing decisions for these products be influenced by their professional performance? Thus, paraphrasing Lauterborn (1990), Grönroos (1994, 1996), Gummesson

(2017), Payne & Frow (2017) and Rosenberg & Czepiel (1992), improvements in making the appropriate decisions is required to support this topic, which may provide an insight into what consumers are looking for, or need to attain.

Similarly, Pantano & Priporas (2016) and Eastman & Liu (2012) highlight the relevance of a study concentrating on improving knowledge of consumer behavior in this setting of an increase in portable electronic products, as a promising area that lacks investigation. Consequently, for Rodriguez-Torrico, Cabezudo & San-Martin (2017, p.465), portable electronic devices "are involved in almost 70% of purchasing processes." Thus, consumer influence in the purchasing decision-making process is highlighted and, according to Gensler, Verhoef & Bohm (2012), this is demonstrated by the possibility of greater interactivity in all stages of the process, such as: research, purchasing and post-sales.

Following this initial chapter, we present the theoretical foundations on the topic and, according to Knopf (2006), should be conclusive. To this end, we do not merely seek to describe a summarized list of what each researcher presents but, instead, focus on the body of work, seen as a whole; in other words, in the spirit of performing a literature review, to provide theoretical support. The methodology used is detailed in the third chapter and data analysis is presented in the fourth chapter. The debate is brought to a close in the fifth chapter, putting forward the final considerations.

2 Theoretical Framework

Modern consumer shave presented distinct behavioral characteristics, e.g., greater demands, individualism, involvement with the origins of products, independence in personal choices, information and quality of the goods acquired (Capon & Hulbert, 2000). However, despite being vital for the growth, profitability and longevity of Brazilian companies, the development and launch of portable electronic products has become a reality (Zeithaml, 1988).

According to Kratzer, Meissner &Roud (2017) and the OECD (2005), a company is characterized as groundbreaking when it presents an innovative program (*e.g.*, product, process, marketing and organization) during its market evaluation period and is achieved by anticipating tendencies.

Therefore, we highlight that an early understanding of market characteristics is part of the informational strategy with which an operational manager needs to operate, in order to guarantee a competitive advantage over direct and indirect competitors. With this in mind, the organization should aim to learn about the behavior of current and potential clients in advance, in order to adjust in time and, therefore, have better conditions for functionality, service, accessibility, image, deadlines, price, quality and respect for international norms (Grover & Kohli, 2012; Ravald & Grönroos, 1996; Zeithaml, 1988; Zeithaml & Zeithaml, 1984).

According to Costa & Horn (2012), in Brazil the dramatic growth of e-commerce reflects the expansive reality, and the search for gadgets for daily use is presented as a new frontier of consumerism (Guidi, Giuliani & Spers, 2017c). Examining perceived quality in a direct comparison with experience, Costa & Horn (2012) highlight four standards in their observations: a) the gap between what a person has and what this person wishes to have; b) the gap between what a person has and what s/he thinks similar people have; c) the gap between what a person has and what s/he owned in the past that was considered better and d) the difference between what a person has and their expectations.

Starting with competence, represented by the sum of individual know-how, a company can acquire new knowledge for their products, processes and applicability (Grönroos, 1994; Guidi, Spers, & Oliveira, 2017b; Payne & Frow, 2017). With regards to knowledge, this can take place in three ways: a) through social networks with users; b) by identifying perceived opportunities, and c) from other companies, through their capacity for design, and following-up competitor behavior through consumer behavior (Grönroos, 1994; Payne & Frow, 2017).

According to Paiva, *et al.* (2018) and Schumpeter (1961), an entrepreneur's search for new consumer markets leads him/her to cross new frontiers and promote conceptual innovations, with a view towards retaining intensive commercial transactions. These authors see the current technological growth as part of what they call "creative destruction"; in other words, a process that is required in order to prepare companies to replace their old products with new or technological more advanced ones, following the

target market trend.

Generally speaking, for Assis, Serralvo & Prado (2015), Gomes & Pereira (2015), Manfio & Lacerda (2016) and Rozenfeld *et al.* (2006), presenting products consists of a set of activities through which possibilities and possible technological restrictions are sought from the desire for consumption, to achieve ideal specifications. However, we highlight that the conceptualization of new products has basic differences but they all converge towards the definition established by the Oslo Manual, which considers products, based on three attributes: a) really new products; in other words those that do not yet exist in the market; b) products launched to meet client demands, and c) products created to replace existing ones and do not meet client demands (OECD, 2005).

For Peres, Muller & Mahajan (2010) and Saeidi, *et al.* (2015), the main factor for the growth of new products is the heterogeneity of consumers, and not interaction between them. According to their approach, the social system is heterogeneous in innovation, sensitivity and price requirements. Despite this, the market volume dynamic is determined by product distribution facing a fall in prices (Scuotto, Giudice & Carayannis, 2017).

In relation to the factors for success or failure of many companies' products, various definitions can be used, which may lead to different results (Guidi *et al.*, 2017b). For a wide range of organizations, the measure of success is the volume of sales achieved while, for others, it is the profit obtained. There are also those who consider success as a way of improving their market image. The determinants of the success or failure of the same product are different in each company (Cordova, Dolci, & Gianfrate, 2015; Crosetto & Regner, 2014; Mattar, 1982; Ramoglou & Tsang, 2016; Scuotto, Giudice & Carayannis, 2017).

Therefore, the market presents a positive tendency in relation to the search for something new, in terms of innovation, or even products with on-board technology systems[1], for the development of new products. The economic advantage generated by the success of a new product produces a significant relation, by altering characteristics of company behavior in relation to the consumer (Story, Boso, & Cadogan, 2015; Tukker, 2015; Urdan & Osaku, 2005; Scuotto, 2016; 2014; Scuotto, Giudice & Carayannis, 2017).

Strategies for product reputation and recommendations of association and content are perceived using the sequential analysis of actions. Along these lines, Henard& Szymanski (2001) present what they consider to be predictions of performance that would lead to success on the launch of a new product: a) marketing proficiency; b) a proficient launch; c) market orientation; d) proficiency in strategic planning activities for products; e) meeting consumer needs; f) marketing orientation; g) dedicated R&D resources; h) technological innovation of the product; i) technological proficiency: applied human resources, and j) market orientation: proficiency in strategic planning activities for products.

Thus, the observation that the importance of success factors usually declines over time and requires new theoretical approaches, in order to better capture the nature of new product development (NPD), is unmistakable. To this end, it may be inferred that the potential to create competitive advantages by understanding NPD factors of success is reduced when knowledge becomes more widespread among managers. On the other hand, consumer behavior has other variables; in other words, a search for a previously recognized problem and also purchasing actions have developed with individual impulses (Evanschitzky, *et al.*, 2012; Costa & Horn, 2012; Rodriguez-Torrico, Cabezudo & San-Martin, 2017).

3 Methodology

With the aim of achieving the goals proposed for this research, the methodological investigation strategy observed was a deductive, quantitative and positivist study, with a cross section, since the data had been collected in a single event and summarized statistically. Thus, we organized this article using hypothetic-deductive logic (Hair, *et al*., 2007; Levine, *et al*., 2008).

We highlight that an adapted, structured questionnaire was used, taking the foundations proposed by Gade (1998), Davenport & Prusak

[1]On-board technology systems are related to the use of hardware (electronic) and software (instructions), incorporated into a device with a pre-defined objective.

(1998), Santini, *et al*., (2019), Van Roy & Zaman (2019) and Cromwell *et al*., (2020) as the basis, which discuss the fact of motivation originating in the individual through instinct, impulses or needs; in other words, they seek to store the data on technology systems, located in various departments, which central information systems departments manage, to improve responses to requests for organizational marketing management .From another perspective, observing the foundations proposed by Lee, Kim & Choi (2019), Grewal, *et al*., (2019), Muhammad, Dey & Weerakkoky (2018), Ahmad, *et al*., (2019) and Camurça (2008), who highlight the presence of psychological factors, which are also determinants for the consumer in this process, identified in the following way: for pleasure, profit, self-esteem, social approval, and to avert loss or pain. Thus, among the internal and external factors, we established the questioned criteria for this research that led a consumer to acquire a specific product, thereby improving the understanding of the power of the need for satisfaction and the background to purchasing decisions.

When gathering the data, there was neither persuasion nor personal insistence, in relation to the respondents during application of the questionnaire. From the structured questionnaire a total of 185 respondents replied by the end of the established timeframe. From this total, at the end of the specified period, only 145 questionnaires were considered valid, therefore forming the final sample, henceforth called the "sample". This result demonstrates a very low number of non-valid responses.

We opted to use primary, instead of secondary data, to undertake this research. The target population was specifically made up of consumers who had acquired portable electronic devices in the last 24 months, on account of the considerable increase in sales in recent years. The above-mentioned sample was made up of employees at micro and small companies, who work in the ornamental stone processing sector in the southeast region of Brazil. Thus, the sample unit of this research is made up of "elements of the population who will be submitted to the sampling" (Malhotra, 2012, p.272); in other words, collaborators at micro and small companies who are involved in the ornamental stone processing sector in the southeast region of Brazil, since this region has the largest technological development in this area. Therefore, we define the classification of the sampling techniques as non- probabilistic and selected for convenience, since this technique uses random selection, the researcher`s criterion, and availability of the sample unit (Malhotra, 2012; Creswell, 2014).

Since the researchers were not present on application of the questionnaire, it was made up of closed questions, which are easy to apply and analyze, accompanied by clear and specific instructions (Creswell, 2014). Since the characteristics of the population were inferred from a sample, an error factor was introduced to the process, with regards to the real difference between the sample and the population (Hair *et al.*, 2007; Levine *et al.*, 1998; Levine *et al.*, 2008).The data was collected during the period between December 31, 2013 and June 10, 2014.

Before the instrument was applied, it was duly validated using Cronbach's Alpha, to discover if the construct scales correctly represented the respective concepts. We measured all the variables in Likert or semantic differential scales, with five, mutually exclusive, ordinal points.

We used the multiple regression analysis technique, which is made up of a combination of independent variables, in order to better understand the variable dependent, from an analysis of the results attained. We performed the premises of homoscedasticity (Breusch-Pagan), the absence of multicollinearity (FIV), serial autocorrelation (Durbin-Whatson), and normality of the residuals (Kolmogorov-Smirnov) (Hair *et al.*, 2007; Levine *et al.*, 1998; Levine *et al.*, 2008).

To continue, we adopted the multivariate approach, to analyze the structures in the internal relations between the variables, favoring use of the exploratory factor analysis (EFA) technique, which was proceeded by the principal component analysis method, use of Varimax orthogonal rotation and Kaiser normalization, in order to provide the variables, observed from the created factors. We also undertook the following procedures during this phase of analysis: analysis of internal consistency reliability by calculating the Cronbach's Alpha coefficient; Bartlett's test of sphericity, significant to the level of 5%, and the Kaiser-Meyer-Olkin – KMO test. Similarly, we also observed the cluster analysis and multidimensional scaling. The level of significance used in all the analyses was 5% (Creswell, 2010; Hair *et al.*, 2005; Levine, *et al.*, 2008; Stevenson,

1986).We performed all the statistical procedures using SPSS 22 software.

4 Analysis

With regards to sample characterization, it was made up of both male (63%) and female (37%) respondents, with an age variation of between 25 and 55. The vast majority of the respondents had an average income of between seven and ten minimum salaries per month. They were all identified as being regularly employed, as participants in a formal activity, and small business owners, operating in the ornamental stone processing sector in the state of Espírito Santo. Their main activities were not identifiable.

In relation to the descriptive statistics (Table 1), we noted that, on average, the consumers represented in the sample are indifferent to the importance of the New Features(X14) variable when purchasing their gadgets, since the average is very close to 3. The Professional Activity (X11) variable presents an average close to 4, indicating that, on average, the sampled individuals partially agreed with the importance of its application in their professional activity, with regards to purchase and use. Following the same line of interpretation, the Status (X10) variable average was 2.3103, and this demonstrates that the sampled individuals partially disagreed with the importance of status at the time of acquisition. For the Exclusivity (X13) variable, the average of 2.5586 indicates that the individuals in the sample position themselves between partially disagree and being indifferent, in relation to the importance of exclusivity.

Table 1: Descriptive Statistics

Variable	n	Mean	Std. Deviation
X1 = Brand Reliability	145	4.0966	1.0496
X2 = Product Design	145	3.9241	0.9866
X3 = On-Board Technology	145	4.4414	0.6548
X4 = Price	145	3.4621	1.1961
X5 = Practical Use	145	4.3034	0.8844
X6 = Advertising	145	2.7379	1.1181
X7 = Family/Friends	145	2.4621	1.2528
X8 = Self-Esteem	145	2.2276	1.2458
X9 = Cost-Benefit	145	3.8069	1.0158
X10 = Status	145	2.3103	1.2333
X11 = Professional Activity	145	3.8414	1.2838
X12 = Off-The-Shelf	145	2.9448	1.2178
X13 = Exclusivity	145	2.5586	1.1895
X14 = New Features	145	3.0069	1.2275

Note: Generated by the Statistical Package for Social Sciences (SPSS) statistical software.

Source: Prepared by the authors.

The coefficient of variation (CV) presents a better sense of data dispersion. Therefore, it is a measure that associates the standard deviation with the average; in other words, it provides the variation of the data obtained in relation to the average. In this case, the higher this coefficient, the more heterogeneous the data obtained (Creswell, 2014; Hair *et al.*, 2007). Thus, data variability is better described through CV. With regards to the percentage of data variability analyzed, the Status (X10) variable has 53.38%, Professional Activity (X11) 33.42%, Exclusivity (X13) 46.49% and New Features (X14) 40.82%. Based on this data, the standard deviation for these variables has a relatively high value and indicates the dispersion of the sample data, i.e., how much they differ from the average(Hair *et al.*, 2007). It was also confirmed that the standard deviation of the sample presents high values. For the four variables analyzed above, the standard deviation varies between 1.19 and 1.29, with these values being relatively high, when compared with approximate averages of 2.60 and 3.80 respectively.

The positive correlations, as per Table 2, indicate that when one variable increases, the other also rises. In a negative correlation, the increase in the value of a variable is associated to a reduction in the value of another. This statistical analysis only evaluates linear associations, excluding any other format. They may vary between -1 and 1, with the closest to 1 in module, the stronger the correlation, and the closer to zero, the weaker the correlation, thereby indicating that a variable is not very linearly associated with the other (Creswell, 2014; Hair *et al.*, 2007).

The New Features(X14) variable only presents significant correlations with the Price (X4), Advertising (X6), Family/Friends (X7), Self-esteem (X8), Status (X10) and Off-The-Shelf (X12) variables, and application in Professional activity (X11). They are all positive and, between them, those that display a lower coefficient are Price (X4) and Off-The-Shelf (X12). Although the Professional Activity (X11) variable does not have a significant correlation with the New Features(X14) variable, as highlighted in Table 2.

Table 2: Correlation of variables matrix

	Correlation														
A	X1 = Brand reliability	1.0000													
B	X2 = Design	0.3089	1.0000												
C	X3 = On-Board Technology	0.3821	0.2457	1,0000											
D	X4 = Price	-0.1796	-0.0289	-0.0405	1.0000										
E	X5 = Practical Use	0.1103	0.0743	0.3547	0.0438	1,000									
F	X6 = Advertising	0.1164	0.2525	0.1591	0.0704	0.1933	1.0000								
G	X7 = Family/Friends	-0.0394	-0.0501	0.0713	0.2782	0.1546	0.4638	1.0000							
H	X8 = Self-Esteem	-0.1444	-0.1215	-0.0133	0.1526	0.1134	0.3821	0.5728	1.0000						
I	X9 = Cost-Benefit	0.0567	0.2139	0.0768	0.3540	0.2357	0.0652	0.0433	0.0295	1.0000					
J	X10 = Status	-0.0609	0.0024	0.0356	0.1092	0.0850	0.3565	0.4728	0.5548	-0.0405	1.0000				
K	X11 = Professional Activity	0.3206	0.0946	0.1582	0.0164	0.1895	0.1111	-0.0275	-0.0511	0.2479	-0.0652	1.0000			
L	X12 = Off-The-Shelf	0.0477	0.2161	0.0656	0.2894	0.1639	0.1984	0.2398	0.1411	0.3899	0.1502	0.3364	1.0000		
M	X13 = Exclusivity	0.0121	0.1488	0.0290	0.2029	0.1678	0.2936	0.3754	0.4432	0.0841	0.3165	0.0766	0.4433	1.0000	
N	X14 = New Features	-0.0868	0.0750	0.0048	0.1681	0.1580	0.1936	0.2688	0.3577	-0.0323	0.4022	-0.1623	0.1954	0.4206	1.0000

Note: Generated by the Statistical Package for Social Sciences (SPSS) statistical software.
Source: Prepared by the authors
.

Multiple linear regression, as per Table 3, explains the New Features(X14) variable through the Exclusivity (X13), Status(X10) and Professional Activity (X11) variables. Table 3 indicates that the R^2 for the model is 0.286. This means that the percentage of 28.6% variability of the New Features(X14) variable is explained by the Exclusivity (X13), Status (X10) and Professional Activity (X11) variables; or rather, it means that the 28.60% variation of the return (dependent variable) may be explained by three independent variables (Hair *et al.*, 2007).

From the ANOVA F-test, we observed that the model presented is significant (p=0.19). We highlight the inexistence of multicollinearity, since the Variance Inflation Factor (VIF) values were less than 5 (Hair *et al.*, 2007; Levine *et al.*, 2008). Through the Variance Inflation Factor (VIF) values presented, as per Table 3, the inexistence of multicollinearity (Wooldridge, 2007) can be assumed. The homoscedasticity test states that the homoscedasticity hypothesis can be accepted and the randomness test states that the randomness hypothesis can be accepted. The Kolmogorov-Smirnov adherence test states that the hypothesis of adherence to normal distribution can be accepted. There is an absence of serial autocorrelation, since the Durbin-Watson test value was 2.2 (Hair *et al.*, 2007; Levine *et al.*, 2008).

Observing the levels of significance, we noted that all of the model variables are significant, where, with each 1 point increase on the Status variable, there is an average increase in the New Features variable of 0.36 points. Therefore, we highlight that there is a positive correlation; in other words, the increase in the Status variable influences an increase in the New Features variable. Similarly, we noted that with each 1 point increase on the Professional Activity variable, there is an average increase in the New Features variable of 0.28 points, and with each 1 point increase in the Exclusivity variable, there is an average reduction in the New Features variable of 0.16 points. Therefore, the null hypothesis that there is no relation between the variables (Table 3) can be rejected.

Table 3: Association of the New Features variable with Status, Professional Activity and Exclusivity

Variable dependent – New Features	B	Standard error	t	p value*	95% confidence interval for B		VIF
					Lower limit	Upper limit	
Status	0.355	0.078	4.566	< 0.001	0.202	0.059	1.123
Professional Activity	0.281	0.075	3.744	< 0.001	0.133	0.429	1.121
Exclusivity	-0.163	0.069	-2.376	0.019	-0.298	-0.027	1.015
F = 5.645 p value (F) = 0.019 Durbin-Watson = 2.218 R^2 = 28.60%							

B - Coefficient; t – Test statistic; *. Multiple linear regression; VIF – Variance inflation factor; statistically significant if p<0.050.
Source: Prepared by the authors.

Exploratory factor analysis (EFA) is a multivariate technique (Table3) that approaches the problem of analyzing a structure of correlations between a high number of variables, reducing their dimension in to factors. To this end, the higher the factor loading, the higher correlation perceived (Hair *et al.*, 2007). The Product Design (X2) variable was disregarded during this process. Thus, 14 variables were reduced to 13 and then to only 4 factors. Therefore, from the 13 variables, with 145 observations, 4 factors were obtained with 145 observations. We observed data reduction, with a 39.282% loss in the total variance of the data observed in the model.

According to Aranha & Zambaldi (2008) and Bruin (2006), the initial eigenvalues are values obtained from the covariance or correlation matrixes, where the aim is to obtain a set of independent, uncorrelated vectors that explain maximum data variability. Thus, they indicate the total variance caused by each factor. Consequently, the sum of all the eigenvalues is equal to the number of variables: 13 in this case. The selection of 4 factors was achieved from an evaluation of the higher eigenvalues, or those close to 1, and their total variability. Therefore, the external influence factor had the highest value (eigenvalue =3.346); the second was the Delivery-Price factor (eigenvalue =2.036); the third was the Professional-Reliability factor (eigenvalue =1,528) and the fourth the Brand-Use factor (eigenvalue =0.993).

Proceeding, also in line with Aranha & Zambaldi (2008), a variance total of 60.718% was confirmed; in other words, the accumulated variance percentage explained by the factors was higher than 50%, which is the minimum accepted, according to Marôco (2010). The internal consistency of each factor was considered substantial; in other words, between 0.61 and 0.80.

For an analysis of the results and classification reliability, using the Cronbach's α co efficient calculation, according to the limits presented in order of importance, a value above 0.5 ($\alpha > 0.50$) is considered acceptable. Thus, we concluded that: a) component 1 has $\alpha = 0.796$, a value which is considered high; in other words, there are inter-correlations among its variables in the external influences component; b) component 2 has $\alpha = 0.605$, a value considered moderate and, therefore, it is also concluded that there are inter-correlations among the variables in the price/delivery component, and c) the other components, 3 and 4, as presented, also demonstrate an internal consistency.

We noted that the first factor, 'External influences', principally explains the Self-Esteem, Status, Family/Friends, Exclusivity, Advertising and New Features variables. The following factor, called 'Delivery-Price', principally explains the Cost-benefit, Price and Off-The-Shelf variables. Factor 3, 'Professional-Reliability', principally explains the Professional Activity and Brand Reliability variables. Factor 4, 'Brand/Use', principally explains the On-Board Technology and Practical Use variables. Thus, achieving the goal of identifying which requirements consumers consider when they decide to acquire gadgets, we identified, through EFA, that needs and external influences are relevant factors. Therefore, the

external influences factor was of greater relevance; it was also characterized by a higher number of variables and was responsible for 25.74% of the variance explained. Thus, it corresponds to a use requirement, connected to external aspects, and, therefore, self-esteem, status, the influence of friends and relatives, the possibility of exclusive use and the influence of advertising are elements that, together, are put forward as the strongest for decision-making on acquisition. Therefore, they are the most sensitive elements perceived by consumers.

Therefore, the Delivery-Price factor is responsible for 15.66% of the explained variance, and corresponds to the cost-benefit implicit in the product, and Off-The-Shelf, together with the desire to acquire. Thus, external influences and the product being Off-The-Shelf were the main elements explained by F1 and F2.

Proceeding, the professional reliability factor is responsible for 11.68% of the explained variance and corresponds to the possibility of use in professional activities, concomitant with the guarantees required with product quality. And, lastly, but no less importantly, the Brand-Use factor is responsible for 7.64% of the explained variance, and corresponds to the obligation perceived by consumers with use, linked to electronic elements and instructions incorporated into the product; in other words, with the intention of considering a predefined design.

Table 4: Factors, factor loading, Cronbach`s Alpha, Eigenvalue and % of Total Variance

Variables	Components				Cronbach's Alpha	Eigenvalue	% of variance
	Factor 1 (F1) External Influences	Factor 2 (F2) Off-The-Shelf	Factor 3 (F3) Professional - Reliability	Factor 4 (F4) Brand - Use			
Self-Esteem	0.798						
Status	0.759						
Family/Friends	0.755				0.796	3.346	25.739
Exclusivity	0.640						
Advertising	0.637						
New Features	0.562						
Cost-Benefit		0.764					
Price		0.709			0.605	2.036	15.661
Off-The-Shelf		0.669					
Professional Activity			0.770		***	1.518	11.676
Brand Reliability			0.683				
On-Board Technology				0.791	***	0.993	7.642
Practical Use				0.779			
Total	-	-	-	-	-	-	60.718

Extraction method: Principal component analysis.
Rotation method: Varimax with Kaiser normalization
Source: Prepared by the authors.

According to Aranha & Zambaldi (2008) and Hair *et al.* (2007), the X8, X10, X7, X13, X6 and X14 variables are correlated, since they have a high communality value, or rather, application of self-esteem, status, family/friends, exclusivity, advertising and new features are related to the evaluation the consumer makes of external influences (F1). Therefore, the X9, X4 and X12 variables, are equally correlated, since they present a high communality for these variables; in other words, the application of cost-benefit, price and off-the-shelf are related to the evaluation the consumer makes of price/delivery(F2) (Table 4).

In order to verify the presence of a significant correlation between the variables, we applied the Kaiser-Meyer-Olkin test and Bartlett's test of sphere city. The Kaiser-Meyer-Olkin (KMO) test provided the result of 0.722, considered satisfactory, since it is higher than the minimum value suggested of 0.6, as demonstrated in Table 5. Therefore, it is demonstrated that the multivariate analysis of the data is adequate. It is

also noted that the it is an adequate sample, or there is a partial correlation between the variables (Bruin, 2006).

From the result of Bartlett's test of sphere city, the null hypothesis should be rejected. The correlation matrix is an identity matrix, where the variable correlates exactly with it (r=1), but does not correlate with the other variables (r=0). The test provided the p value < 0.001. (Table 5). Therefore, the application of factor analysis is adequate and the factors explain the high proportion of data variability (Aranha & Zambaldi, 2008; Bruin, 2006).

Table 5: KMO and Bartlett's Test

Kaiser-Meyer-Olkin measure of sampling adequacy.		0.722
Bartlett's test of sphericity	Chi-square approximation	448.166
	gl	78
	P value	< **0.001**

Source: Prepared by the authors.

It is also perceived that the variables (X11) and (X1) have a high communality value; in other words, application of 'professional activity' and 'reliability of a known brand' is also strongly related to the evaluation the consumer makes of 'professional-reliability' (F3). Proceeding, it is confirmed that the On-Board technology (X3) and Practical Use (X5) variables have a high communality value and therefore are strongly related to the evaluation the consumer makes of 'brand/use' (F4). Thus, in almost all the variables, the communality value was higher than 0.5, and only X14 obtained a lower value but was still close, as presented in Table 6.

To summarize, the communalities represent the explanatory percentage that a variable obtained on the factor through factor analysis, where values under 0.50 should not be considered (Mâroco, 2010). The highest communalities were observed for the On-Board Technology (0.691), Professional Activity (0.684) and Practical Use (0.679) variables, and all of the remaining ones were higher than 0.50. This indicates a good explanatory power, with the exception of the New Features variable, which obtained the value of 0.469. However, this was not removed, since this variable is important for researchers.

Table 6: Communalities

Variable	Initial	Extraction
X1 = Brand Reliability	1.000	0.626
X3 = On-Board Technology	1.000	0.691
X4 = Price	1.000	0.594
X5 = Practical Use	1.000	0.679
X6 = Advertising	1.000	0.506
X7 = Family/Friends	1.000	0.588
X8 = Self-Esteem	1.000	0.652
X9 = Cost–Benefit	1.000	0.644
X10 = Status	1.000	0.588
X11 = Professional Activity	1.000	0.684
X12 = Off-The-Shelf	1.000	0.661
X13 = Exclusivity	1.000	0.512
X14 = New Features	1.000	0.469

Extraction Method: Principal Component Analysis.
Note: Generated using SPSS 22 statistical software.

Source: Prepared by the authors.

5 Conclusion

Thus, the relevance of marketing as a tool to sell the ideas that new product innovations require was also analyzed, in the theoretical foundation, which enables new studies to understand the value of this, as a way of learning, influencing and acting, in a hyper-competitive market

The statistical model provides an approximation and, therefore, the data, while not being completely true, may be close to reality. Thus, the model applied presents the relevance of the research, based on the sample attained, and considers the coverage of its results.

In response to the research problem; in other words, the requirements that consumers take into consideration when they decide to purchase portable electronic devices, it was noted that, *a priori*, the choices take place, striving for a simultaneous application between professional activity and other external activities, with moderate a tendency towards the new feature aspect. Consequently, based on the data obtained, we can confirm that these consumers essentially take into consideration a group of interconnected requirements at the time of the respective choice. To this end, we primarily highlight brand conceptualization, product design and their related applications to professional activity. We noted that the "professional activity" aspect was intrinsically connected to other activities related to the external

factors highlighted. We also observed the existence of a demand for products that have a proven, multifunctional application.

We highlight that the results indicate that the external environment exercises a strong influence on the organizational environment, requiring a proactive and innovative approach. Thus, we note that the need to implement and use online strategies to obtain organizational objectives, and improve the creation of value for consumers, allied to productivity, is implicit.

In addition, the following variables were highlighted: brand reliability, product design, on-board technology, price, practical use, advertising, family/friends, self-esteem and cost-benefit, as key elements in persuading clients to acquire a new product, with a technological profile, and practical use.

This result suggests standards of comparison in the correlation between these findings and those of Costa & Horn (2012), who researched the relationship of the perception of quality in portable electronic products. Therefore, we put forward their recommendations of product reputation, the possibility of individual or collective online interaction, and a better possibility for sequential analysis of behavioral actions as the main strategies observed.

Thus, the main correlated results in these findings suggest that the principal attributes of professional activity, which are coherent, are: brand reliability, product design, on-board technology and practical use.

6 Implications and Further Research

Therefore, we highlight the relevance of propagating innovative ideas. We suggest that the consumer profile for portable electronic device sin confirmed in expanded samples in future research. Future studies could then focus on the satisfaction of acquiring these products, in relation to what consumer shave, and what they wish to acquire, striving for constant innovation.

The limitations of this research focus on the lack of a probabilistic generalization. This technique could be used by future researchers for a comparison with this research data and statistical descriptive studies that confirm the consumer profile in expanded samples

Based on this research, future studies should analyze consumer behavior based on academic criteria, as well as an analysis of the results achieved, which may improve organizational management for micro and small companies in the segment analyzed. In an increasingly interconnected world, an improvement in speed of access to information for academics, as well as an analysis of the results achieved could improve organizational management for micro and small companies in this sector, since this improvement enhances management capacity and market communication.

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Studies on emerging countries

The interconnection between entrepreneurship and dynamic capabilities: a bibliometric analysis

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ABSTRACT

The aim of this study was to map the academic production addressing the themes entrepreneurship and dynamic capabilities. Through bibliometric analysis as a research method and using the WoS database we found 805 papers from which we present an examination of citations, co-citations, most prevailing journals, and the most productive authors displayed in form of maps produced with the assistance of VOSviewer software. Between the papers detected, it was possible to find 7 bibliometric analysis that treated the entrepreneurship and dynamic capabilities topics together. However, a deep exam on the seven papers demonstrated that most studies had the major focus on dynamic capabilities only addressing entrepreneurship related either to the entrepreneur itself or to its entrepreneurial orientation. Therefore, we conclude that entrepreneurship and dynamic capabilities are two fields of studies already consolidated by themselves but, in what concerns the research of the themes combined, they still need to have their relationships better explored. This work contributes theoretically by highlighting a relationship still underexplored at the literature, thus encouraging future studies on the theme. The practical contribution remains in offering information that may be useful to prepare managers to a most strategic and dynamic action.

PALAVRAS-CHAVE

Empreendedorismo, Capacidades dinâmicas, Bibliometria.

RESUMO

O objetivo deste estudo foi mapear a produção acadêmica abordando os temas empreendedorismo e capacidades dinâmicas. Por meio da análise bibliométrica como método de pesquisa e usando o banco de dados WoS, encontramos 805 artigos a partir dos quais apresentamos um exame de citações, cocitações, periódicos mais prevalentes e os autores mais produtivos exibidos na forma de mapas produzidos com o auxílio do software VOSviewer Entre os artigos detectados, foi possível encontrar 7 análises bibliométricas que trataram os temas empreendedorismo e capacidades dinâmicas em conjunto. No entanto, um exame aprofundado dos sete artigos demonstrou que a maioria dos estudos teve como foco principal as capacidades dinâmicas, abordando apenas o empreendedorismo relacionado ao próprio empreendedor ou à sua orientação empreendedora. Concluímos, portanto, que empreendedorismo e capacidades dinâmicas são dois campos de estudos já consolidados por si próprios, mas, no que diz respeito à pesquisa dos temas combinados, ainda precisam ter suas relações mais bem exploradas. Este trabalho contribui teoricamente ao evidenciar uma relação ainda pouco explorada na literatura, incentivando estudos futuros sobre o tema. A contribuição prática reside em oferecer informações que possam ser úteis para preparar gestores para uma ação mais estratégica e dinâmica.

1 Introduction

Entrepreneurship as a research field has been gaining prominence over the past years since its introduction over the 80's decade. It started to gain more focus over the year of 2000, precisely when the works of Shane and Venkataraman (2000) and Sarasvathy (2001) were published at the Academy of Management Review. While the former proposed an integrating framework for the entrepreneurship field, the last assumed that entrepreneurship is a process that involves not just the individual characteristics of the entrepreneur, but the environmental characteristics that will also affect the outcomes of an entrepreneurial opportunity.

At the same time another theoretical approach was also gaining prominence at the academy over the past years, which was the concept of dynamic capabilities, that emerged from the work of Teece, Pisano and Shuen (1997). The authors define the dynamic capabilities as being "The ability that the company has to integrate, built and reconfigure internal and external competences in order to address rapidly changing markets." (Teece, Pisano and Shuen, 1997:516). The authors point out that dynamic capabilities are considered processes, which are shaped by the organization positions and its history.

The emergence of studies in dynamic capabilities is related to the efforts of researchers aiming to understand why some firms possess and sustain competitive advantage, especially in markets of unpredictable and rapid changes (Peteraf, Di Stefano and Verona, 2013). In this sense, seminal authors like Teece, Pisano and Shuen (1997) stated that the rational action of the managers had a fundamental role in innovating, which is the key challenge for organizational change.

However, it was only in 2006 that the study of Zahra, Sapienza and Davidsson (2006) proposed to join the ideas of entrepreneurship and dynamic capabilities. Their article suggests that entrepreneurs have an important role as agents of change, but that change should also be embedded in organizational routines in order to achieve a reconfiguration of the firm's resources. This study achieved such importance that according to Mota *et al*. (2017) the article is listed as one of the most cited references at the dynamic capabilities stream.

In this sense, dynamic capabilities is a theoretical approach that interconnects with the field of entrepreneurship, mainly to the fact that dynamic capabilities and the exploitation of entrepreneurial approach are considered processes that involve not just the entrepreneur but the environment as well (Teece, 2016). For this reason, studying the interconnection of the two concepts are vital to understand an enlarge the view of how the creation and use of dynamic capabilities can help organizations to better perceive entrepreneurial opportunities, exploit them, and also undertake changes to implement new reconfigurations (Zahra, Sapienza and Davidsson, 2006; Gomes et al., 2019).

Despite of the importance of the two themes and the high number of bibliometric studies addressing the two concepts separately, the two subjects are rarely explored together as it will be demonstrated by the present study.

Aiming to map the present scenario of the scientific production based on entrepreneurship and the dynamic capabilities this bibliometric study presents an analysis of the existent literature, listing the main journals that published the themes together, the most productive authors, and the most cited references related to both matters. Afterwards clusters of keywords related to entrepreneurship and dynamic capabilities are also examined as well as other bibliometric studies that concerned the matter.

This paper contributes theoretically by addressing a relationship between two important themes and their interconnection as well as provides practical contribution, once the discussion about the relationship between dynamic capabilities and entrepreneurship can be useful to prepare managers to a most strategic and dynamic action.

Apart from this introduction, this paper is structured as follows: Section two encompasses a review of the literature that focused on the field of entrepreneurship as well as the field of dynamic capabilities. Section three details the methodological procedures of our study, followed by section four, where we discuss the results of the research. On section five we present the final considerations and on section six future research directions are provided.

2 Literature Review

2.1 An Overview of Previous Bibliometric Studies on the Fields Separately

According to McBurney and Novak, (2002) bibliometrics is an approach to evaluate and monitor the progress of a discipline field. As the approach relies on statistical quantification of data to have the analysis performed, such approach can only be used when a stream of research already has some sustainable literature that would provide a sample of statistical representation to perform the study (Diodato, 1994). In this sense, both entrepreneurship and dynamic capabilities considered separately, are research streams that already demonstrated such a sustainable amount of literature which resulted in a number of bibliometric papers published (Suominen, Seppanen, and Dedehayir, 2019; Apriliyanti and Alon, 2017; Dan and Goia, 2018; Santos, Marques and Ferreira, 2018).

Most studies concerning dynamic capabilities focus on the strategic management aspects like Ferrreira et al. (2017) and Vogel and Guettel (2013), demonstrating that dynamic capabilities is a research stream with different emerging perspectives such as strategic learning and organizational change. In general, it can be stated that bibliometric studies that addressed the dynamic capabilities vary within their objective, but most of them focus on addressing aspects of dynamic capabilities itself (the processes related to these capabilities).

Considering the field of entrepreneurship, the studies range from different aspects of entrepreneurship. The most recent ones focused on aspects such as regional development (Dan and Goia, 2018), female entrepreneurship (Santos, Marques and Ferreira, 2018), social entrepreneurship (Dionisio, 2019), organizational failure and decline (Kucher and Feldbauer-Durstmueller, 2018), as well as ethical aspects (Vallaster et al., 2019) and internationalization (Baier-Fuentes et al., 2019).

2.2 Bibliometric Studies on Dynamic Capabilities and Entrepreneurship Combined

Some authors addressed the topics of dynamic capabilities and entrepreneurship as a joined issue and did conducted bibliometric studies (Gomes et al., 2019; García-Lillo et al., 2017; Mota et al., 2017; Ferreira, Fernandes and Ratten, 2016; Vogel and Guettel, 2013; Benavides-Velasco, Quintana-García and Guzmán-Parra, 2013; Stefano, Gambardella and Verona, 2012). In the most recent study published, Gomes et al., (2019) it is possible to find an analysis related to the innovation ecosystem, in which, according to the authors, there is a research stream that draws from the previous business ecosystem literature. In this sense, although the study focusses neither on dynamic capabilities nor on entrepreneurship as its main line of inquiry it contains the concept of dynamic capabilities related to the business ecosystem literature. The concept of entrepreneurship is also mentioned and considered as on pf the the keywords of the paper.

The study of García-Líllo et al. (2017) focus on the ‘born global firms’, also known as ‘international new ventures’. In this sense, entrepreneurship is pointed as a field of study in which this type of organization is often explored, usually with studies addressing international entrepreneurship. Dynamic capabilities, on the other hand, are simply pointed as being used as a theoretical framework in some of the studies that the authors reviewed.

The study published by Mota et al. (2017) focus specifically on the dynamic capabilities stream, aiming to map the scientific landscape from 1990 to 2015. In this sense, the authors point to an increase on the number of publications over the past few years, considering the areas of business, economics and engineering the most important. The authors highlight that the resource-based view and the neo-Schumpeterian approaches were their main theoretical roots.

In contrast Ferreira, Fernandes and Ratten (2016) focus on the broad area of strategic management which also includes the dynamic capabilities. They conclude that there is a division between strategic entrepreneurship and corporate entrepreneurship, but they do not aim to establish a relation between dynamic capabilities and entrepreneurship.

Vogel and Güttel (2013) also investigated the field of strategic management, but the authors focuses specifically at the dynamic capabilities at the strategic management field, analyzing the literature between 1994 and 2011. They highlight that the dynamic capabilities is related to learning and change capabilities, which also concerns firm performance, aspects of organization theory, and the strategic management of the organizations.

Entrepreneurship, on the other hand, is only slighted mentioned as the entrepreneurial behavior, which, according to the authors, is a cluster that shares a common overlap with other clusters (such as sensing opportunities, and absorbing knowledge) more specifically when it comes to ambidexterity between exploration and exploitation.

The sixth study, published by Benavides-Velasco, Quintana-García and Guzmán-Parra (2013), deals with the research field of family business, with a review of literature that ranges from 1961 to 2008. In this sense, dynamic capabilities are identified in some studies of their sample. The authors consider it as being a suitable theoretical perspective that can provide advances on the studies related to the family firms. Entrepreneurship, on the other hand, appears with more emphasis on their study since it directly connects with the scenario of family business. In this sense, the authors provide a list of journals that published more than 5 papers related to family business, in which a number of entrepreneurship journals can be identified. Examples of them are: Entrepreneurship and Regional Development (5 papers); Journal of Business Venturing (25 papers); and Entrepreneurship Theory and Practice (55 papers). Although the study does not establish a direct relationship between dynamic capabilities and entrepreneurship the high number of papers resulted in the identification of a topic named Entrepreneurship/innovation, which encompasses studies that address entrepreneurship aspects within the family business organizations.

Last but not least, the seventh study, published by Stefano, Gambardella and Verona (2012) focus on the sources of innovation for organizations. The authors address specially technology and market demands. The dynamic capability is mentioned since the authors identified they are central to their literature review. In this paper, the study of Teece, Pisano and Shuen (1997) is identified as being the most central reference to the sample collected. The authors also mention that entrepreneurship plays a central role, even though some literature addresses innovation and entrepreneurship in isolation. Nevertheless dynamic capabilities and entrepreneurship are, again, explores in isolation from each other.

3 Methodology

For the present study, a bibliometric research method was chosen to map the academic production addressing the themes entrepreneurship and dynamic capabilities. The approach of the study is based on statistical techniques that allows a clear visualization of the scientific field as well as produce bibliometric maps (Zupic; Čater, 2015).

Bibliometric is known as an academic stream that seeks to evaluate the research developed by a scientific community in a specific research field (Gutiérrez-Salcedo et al., 2018). In line with that, the cited authors point that bibliometric technics are methods that aim to measure the research studies using scientific publications from bibliographic databases. In this sense, the availability of data enhances the aggregate data analysis, which provides the possibility of idea creation for the researchers.

Other authors like Osareh (1996) defends that bibliometric methods seek the improvement of scientific documentation, information and communication through the quantitative analysis of the academic work collections. The cited author explains that bibliometric studies contributes to a better understanding of the scientific research field, analyzing it as set of social activities with the use of scientometrics techniques.

Table 1. Summary of bibliometric research stages

Step	Activities
Research Design	Definition of research question; Choice of the most suitable bibliographic method according to the research question; Definition of keywords.
Compilation of bibliometric data	Search on database; Elaboration and compilation of files obtained; Filtering and exportation of bibliographic data using the Bibliometrix package for the statistics software R.
Analysis	Data cleaning; Results generation in the Bibliometrix package (R); Data and graphics selection.
Visualization	Tables and graphs development with the resulting data from Bibliometrix (R); Choice of the most suitable software for the bibliometrics maps visualization. Generation of bibliometric maps in the VOSviewer;
Interpretation	Analysis of results considering the theoretical background and the previous steps of research

Source: Adapted from Zupic and Čater (2015).

The citation traceability and the collaboration among researchers allow the consolidation of the bibliographic data exploration from the scientific research, as well as the orientation of these researches according to the most crucial study topics (Zupic; Čater, 2015). The authors also state that bibliometric studies are a complement, and not a substitute, of the traditional academic review methods, since it can provide analysis of academic fields by its structure, categorizing them by countries, universities, and journals. In this sense, while traditional methods focus on analyzing the subjects in a more detailed way, the bibliometric techniques can cope with a large number of studies and generate different results representations, thus encompassing a broader level of analysis. In order to reach that, this study followed some steps regarding its reliability. Table 1 summarizes the steps considered for this study.

In this sense, the present study was based on Zupic and Čater (2015) five step model. The first step initiates with the following research question: **What is the present scenario of the scientific production based on entrepreneurship and the dynamic capabilities theoretical approach?**

The second step consisted of defining the keywords related to the areas to be explored. For this study the keywords dynamic capabilities and entrepreneurship were chosen. Then a search was conducted on WOS and Scopus database in August 2020.

The strings "dynamic capabilit*" AND "entrepreneur*" were used at the title, abstract, keywords and keywords-plus of the papers. The types of the documents selected were "article" and "review". As a result of the search we identified 289 papers at the Scopus database, and 805 papers at WOS database. Considering the statements of Vieira and Gomes (2009), in which the authors conclude that about 2/3 of published papers are available to be found in both databases, and also considering that the use of VOSviewer software is only possible applying one database (Van Eck; Waltman, 2010), we selected WoS for this study regarding the major number of researches provided.

In the third step information such as title, author, keywords, journal, year, abstract and references from the studies were gathered to analyze the bibliographical coupling network and the impact measurement of the articles. After that, the analysis was conducted by using the statistical software R and the bibliometrix package. At this stage, the researchers eliminated the inconsistencies of the databases, such as blank fields, and invalid data.

In the visualization step, two stages were accomplished. In the first stage we generated and compiled the statistical data from the databases using the bibliometrix package (R software), were we also created tables with the most cited papers, collaboration indicators between authors, and indications of countries and research centers affiliations. On the second stage, we generatde a bibliometric map using the VOSviewer software. This software was created by Van Eck & Waltman (2010) and enables the data graphic visualization based on labels, density, cluster mappings, and also dispersion levels. Furthermore, VOSviewer is useful once it considers the items distances from a multidimensional scaling. In this sense, the more the items are quoted together, the stronger is their relationship. Thus, the closer will be their position on the map. It also allows one to demonstrate graphically how many citations the items received individually (Van Eck; Waltman, 2010).

Finally, in the fifth step the analysis of the results was conducted and will be presented in the following chapter.

4 Analysis and Discussion

The first analysis performed at the bibliometric approach was to verify the **concentration of articles by journals**. It was identified that 88 studies (10,4%) out of 805 documents from WoS database are from five different journals, as demonstrated at Table 1.

Table 1. Journals with most publications

Year	2016	2017	2018	2019	2020
International Business Review	1	2	3	3	2
Sustainability	0	1	7	8	6
Journal of Business Research	10	0	5	7	4
Industrial Marketing Management	1	3	7	6	2
Strategic Entrepreneurship Journal	3	4	2	1	0
Total	15	10	24	25	14

Source: the authors (2020)

Based on the results, it was also identified that the period between the 2017 and 2019 registered an increase in the number of publications. The journal that published the most was the Journal of Business Research, with 26 articles, followed by the journal Sustainability with 22 articles. The journal in third position (Industrial Marketing Management), published a special issue in October/2018 about capabilities in business relationships and networks, which resulted in the concentration of 7 publications at the year.

The second analysis performed was to identify **the most cited references**. The result demonstrate that the study of Teece, Pisano and Shuen (1997) prevailed and was cited in 545 documents. It was followed by the study of Eisenhardt and Martin (2000), cited in 386 documents. Table 2 displays the 20 most cited references.

Table 2. Most cited references

Cited References	Citations
TEECE DJ, 1997, STRATEGIC MANAGE J, V18, P509.	545
EISENHARDT KM, 2000, STRATEGIC MANAGE J, V21, P1105	386
TEECE DJ, 2007, STRATEG MANAGE J, V28, P1319.	355
BARNEY J, 1991, J MANAGE, V17, P99.	347
ZAHRA SA, 2006, J MANAGE STUD, V43, P917.	207
LUMPKIN GT, 1996, ACAD MANAGE REV, V21, P135.	189
ZOLLO M, 2002, ORGAN SCI, V13, P339.	185
COHEN WM, 1990, ADMIN SCI QUART, V35, P128	184
WINTER SG, 2003, STRATEGIC MANAGE J, V24, P99.	178
FORNELL C, 1981, J MARKETING RES, V18, P39.	171
PODSAKOFF PM, 2003, J APPL PSYCHOL, V88, P879.	159
PENROSE E, 1959, THEORY GROWTH FIRM.	150
WERNERFELT B, 1984, STRATEGIC MANAGE J, V5, P171.	150
HELFAT C.E., 2007, DYNAMIC CAPABILITIES.	141
MARCH JG, 1991, ORGAN SCI, V2, P71.	140
COVIN JG, 1989, STRATEGIC MANAGE J, V10, P75.	133
NELSON R. R., 1982, EVOLUTIONARY THEORY.	117
MILLER D, 1983, MANAGE SCI, V29, P770.	115
ARMSTRONG JS, 1977, J MARKETING RES, V14, P396.	110
ZAHRA SA, 2002, ACAD MANAGE REV, V27, P185.	107

Source: the authors (2020)

In order to identify the **most productive authors** of the sample we present fractional counting and full counting method. The difference between these two counts is that while the former splits the publication weight among the number (N) of authors with a fractional weight of 1/N (e.g. if a study has four authors, each one receives 1/4 of the publication, or 0.25 each), the latter assumes the value of 1 for all authors of the study (Perianes-Rodriguez; Waltman and Van Eck, 2016).

Table 3 summarizes the 10 most productive authors. For comparison purposes we decided to maintain the authors counting with both full counting and fractional counting.

Table 3. Most productive authors

Authors	Articles	Authors-Fract	Articles Fract
Teece DJ	13	Teece DJ	9.167
Zahra SA	8	Zahra SA	3.583
Mahoney JT	6	Anning Dorson T	3.000
Mcgrath H	6	Arend RJ	3.000
O toole T	6	Wang Y	2.667
Saarenketo S	6	Mcgrath H	2.417
Weerawardena J	6	O toole T	2.417
Wright M	6	Alonso AD	2.333
Agarwal R	5	Deakins D	2.250
Blesa A	5	Foss NJ	2.250

Source: the authors (2020)

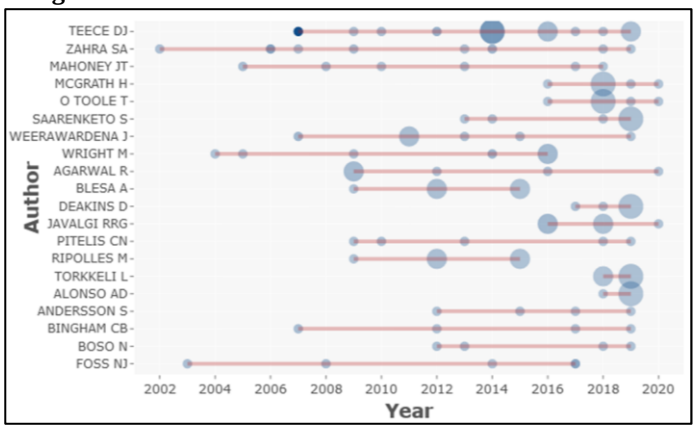
According to the results, Teece is the most productive author, on both fractional and full counting followed by Zahra. It is interesting to point that authors like Zahra, Wright and Argawal, had studies published at a phase that was called by Landström and Benner (2010) as the "Take-off phase" of entrepreneurship.

This phase started during the 90s and is known by the migration of scholars from different sciences fields to the field of entrepreneurship, on a movement called "transient researchers" (Landström and Benner, 2010).

Another analysis was conducted to verify **the most productive authors over time**, verifying if these 10 most productive authors were only "transient researches" or if they held a sustainable production over a longer period of time. Figure 1

summarizes the most productive authors with their respective year of publication, which demonstrates that most authors held a sustained production over a long period of time.

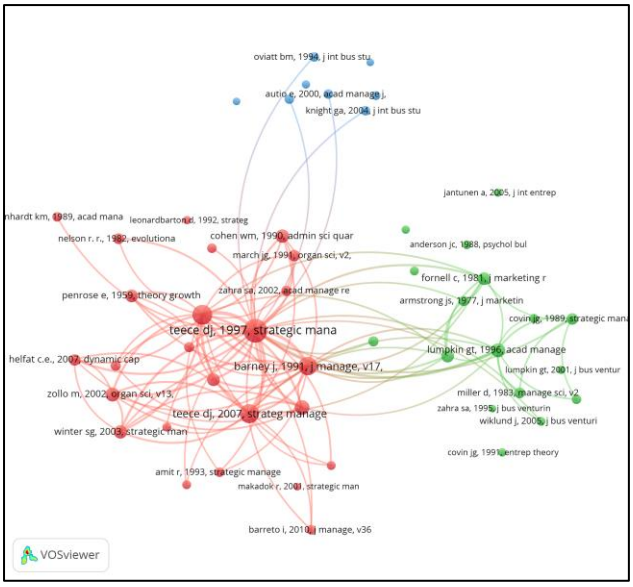
Figure 1. Authors contribution over time



Source: the authors (2020)

Subsequently a **co-citation analysis** was performed, in which the 50 most cited references of the sample were identified. Figure 2 presents this analysis, in which Teece's work appears as a central reference as well.

Figure 2. Bibliometric map of co-citations



Source: the authors (2020)

The co-citation analysis was categorized under three clusters with the assistance of the software VOSviewer which is based on the characteristics of the papers. The red cluster located at the left includes authors from a classical strategy research stream, such as Nelson (1982), Penrose (1959), and Barney (1991). Those authors represent a group of scholars that influenced the seminal works of the dynamic capability stream such as Teece, Pisano and Shuen (1997) and Teece (2007) which are two of the most expressive works of the sample. In this sense, this cluster is represented by a predominance of scholars related to the seminal works of dynamic capabilities, including scholars from the resource based theory, and other seminal works of the strategic management stream.

On the right side of the map, the green cluster displays papers related to the entrepreneurship field, such as Lumpkin and Dess (1996). Nevertheless, other authors with researches that do not directly relate to entrepreneurship can also be identified in the cluster, such as Fornell and Larcker (1991) and Covin and Slevin (1989). These authors are related to the strategy field. These cluster thus represents studies that are related to the dynamic capabilities studies.

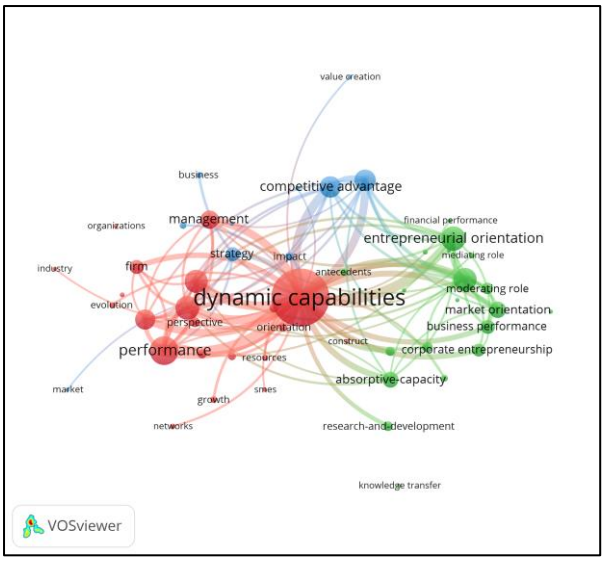
Finally, the third cluster is displayed in blue, located at the top of the map. This group of authors contains studies that deals with dynamic capabilities aspects, such as organizational capabilities, born-global firms, imitability, international growth, and new ventures. This cluster displays authors related to the aspects of international business research and is also related to the main cluster of dynamic capabilities.

The results displayed at figure 2 suggests that dynamic capabilities is a stream with a large amount of influence on the sample which can also be observed in the authors' contribution analysis.

Another analysis conducted was the **keyword relationship between the studies**. Thus, from the 805 studies of the sample, 1690 keywords were identified. Figure 3 summarizes the keywords that had 7 or more citations, which resulted in 50 keywords.

Figure 3 demonstrates three distinct clusters. The red cluster located on the right bottom left contains keywords more related to the field of dynamic capabilities once the keyword 'dynamic capabilities' is the central keyword. This cluster also contains keywords such as performance and firm and management. These subjects are often related to the organizational strategy aspects and are directly related to the dynamic capability and strategic management approaches.

Figure 3. Bibliometric map of the 50 most cited keywords



Source: the authors (2020)

In contrast, the green cluster, displayed on the right side of the map, contains keywords related to the entrepreneurship field, with the keyword entrepreneurial orientation being one of the most expressive one. In this cluster, other keywords like corporate entrepreneurship and market orientation also appear and are related to the entrepreneurship field.

Lastly, at the top of the map the blue cluster shows the keyword 'competitive advantage' as the most expressive evidence. It contains studies addressed mainly to international ventures literature.

In sum, the results demonstrate that the major part of the studies used in this sample are related directly to the dynamic capabilities stream. This is evidenced by the authors contribution analysis and also in the analysis of the maps of co-citation and keywords. The findings testify that dynamic capabilities were a central point for the studies analyzed.

Even considering the analysis of the keywords map, in which it was possible to notice a cluster that emphasizes the entrepreneurship field, most of the keywords are directly related to dynamic capabilities revealing the predominance of this field in comparison to the entrepreneurship one.

Furthermore, it is possible to extract from the map of co-citation that Teece as first author (1997; 2016) are the most preeminent, although, despite of the unquestionable importance of the author, his approach tends to limit the analysis of entrepreneurship, once it concentrates mainly on the person of the entrepreneur. Based on this evidence, we argue that such approach could lead to a constrained view of entrepreneurship.

On top of all, the analysis of the 7 bibliometric studies addressing dynamic capabilities within the entrepreneurship field evidenced that their content was explored in a way that isolated the fields from each another. In this sense we also argue that the two research fields could have their relationships better explored and articulated leaving space for deeper immersion. In addition, the creation of new theoretical models involving the issues related to dynamic capabilities and entrepreneurship could be also prospected.

5 Conclusion and Final Considerations

The results of the present study demonstrated that despite the great number of papers dealing with entrepreneurship and dynamic capabilities there is still a theoretical gap concerning researches that addresses the two of the field in an integrated way.

As evidenced in the findings there is some predominance of the dynamic capability over the entrepreneurship field that tends to treat the entrepreneurship only by its entrepreneur's feature, setting aside other perspectives of this field study.

As previously demonstrated, the few authors who intended to address both fields though bibliometric analysis did not accomplished that in an interrelated way. Thereby, given the complementary roles of dynamic capabilities and entrepreneurship, it is important to advance in the understandings of the topics together as well as the theoretical and empirical level.

Finally, this study has some contributions both to literature and to practicing. First by offering a unique bibliometric analysis that seek to interconnect both the entrepreneurship and the dynamic capabilities approach, as it was evidenced in the results, is rare to be found. Second, by pointing the gaps that still remain between these two important areas of knowledge. Third by encouraging future studies that could reach the underexplored gaps among dynamic capabilities and entrepreneurship. And finally, we expect that the information and the discussion contained in this study may provide managers with information that can lead to a most strategic and dynamic action.

6 Implications and Further Research

This research has limitations such as its quantitative method, which does not contemplate a deep analysis of content of all the 805 articles, but only on their main information. To reach a more profound analysis we suggest that future researchers conduct a qualitative review or even a meta-synthesis of the content.

Another limitation refers to the fact that only one database was used for the study. For this reason, relevant papers may have been missed. To overcome this limit, we suggest that future researches deal with a combination of different softwares that can enable the use of more than one database per analysis.

Finally, we argue that studies involving entrepreneurship and the dynamic capability theoretical approach is a fertile area for both theoretical and empirical studies. We are looking forward to future studies that can surpass our constraints and bring advances to this significant area of study.

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Studies on emerging countries

Cluster Life Cycle: A Study in the Vale dos Sinos Footwear Cluster

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Cluster, lifecycles, stages of development, decline and renewal of cluster.

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ABSTRACT

This paper aims at analyzing the stages of the lifecycle of clusters, based on four dimensions: diffusion of knowledge in the cluster, competitive advantage, structure of cluster and policies for clusters. For that, the Footwear Cluster of Vale dos Sinos-Paranhana in Rio Grande do Sul was chosen as a study object. The results point out that the cluster is little collaborative and little innovative. The cluster is still recognized as a great footwear producer, but the own identity of the people with the cluster is being lost. The local culture does not promote the diffusion of knowledge due the companies are closed. This research contributes with the comprehension of how the clusters develop, for this purpose, the flow of knowledge will have a central role in the renewal of the cluster. As a practical implication, the awareness of the difficulties and the necessary mechanisms to renovate a cluster are important so that it is possible to work on sectoral policies and of cluster. As theoretical contribution, the study reinforces that the lack of new knowledge influences the imprisonment, resulting from its dependent trajectory, leading it to the decline.

PALAVRAS-CHAVE

Cluster, ciclo de vida, estágios de desenvolvimento, declínio e renovação de cluster.

RESUMO

Esta pesquisa tem como objetivo analisar a relação entre fluxo de conhecimento, o lock-in e o estágio do ciclo de vida de um cluster. Para tanto, o Cluster Calçadista do Vale dos Sinos-Paranhana no Rio Grande do Sul foi escolhido como objeto de estudo. Os resultados apontam que o cluster é pouco colaborativo e inovativo. O cluster ainda é reconhecido como um grande produtor de calçados, mas a própria identidade das pessoas com o cluster está se perdendo. A cultura local não promove a difusão do conhecimento, uma vez que as empresas são fechadas. Esta pesquisa contribui com a compreensão de como os clusters se desenvolvem, para tanto, o fluxo de conhecimento terá um papel central na renovação do cluster. Como implicação prática, a consciência das dificuldades e dos mecanismos necessários para renovar um cluster são importantes para que seja possível trabalhar as políticas setoriais e de cluster. Como contribuição teórica, o estudo reforça que a falta de novos conhecimentos influencia o aprisionamento, o qual é decorrente da dependência de trajetória, levando-o ao declínio.

1Introduction

Despite globalization, many scholars argue that the location can explain the competitive advantage of firms and regions (Giuliani, 2005; Porter, 1998). Several studies show that the agglomeration of firms of the same sector strengthens the chances of survival and growth, besides increasing the potential of innovation of the firms (Baptista, 2000; Schmitz, 1999).

The cluster may be composed of several institutions, such as universities, research, and development centers and firms, creating a complex system of production and innovation, which holds several interconnections that influence themselves mutually (Menzel & Fornahl, 2010). In the past decades, the studies about the clusters were limited trying the explain the main characteristics of the clusters, their operation, and main advantages, giving little attention to issues related to their emergence, development and (Harris, 2020; Trippl, Grillitsch, & Isaksen, 2015).

The clusters are dynamic agents, having stages of development with their characteristics that changing over time (Crespo, 2011; Martin & Sunley, 2011; Menzel & Fornahl, 2010). It is crucial to determine the stage of the life cycle so that the decision-makers can manage the cluster according to the specific needs of each stage (Brenner and Schlump, 2011). It is also possible to investigate how knowledge flow and lock-in can influence the activity of innovation in clustered companies. This paper explores that gap in the literature of clusters concerning the relationship between the flow of knowledge and lock-in along the stages of development of clusters, especially in the context of the industries of low technological intensity in Latin America.

In this context, this paper aims at analyzing the stages of the life-cycle of clusters, based on four dimensions: diffusion of knowledge, competitive advantage, structure, and public policies. To do so, we conducted a case study of Footwear Cluster of Vale dos Sinos-Paranhana, it was one of the most important of the sector in the world and has passed through several transformations during its trajectory.

This paper is organized in six sections, besides this first introductory part, being them: the theoretical part will discuss the concepts of cluster and life cycle of cluster. The third section describes the methodological procedures. The fourth section will show the historical context of the footwear cluster and the data of this research. We will discuss the main findings in the fifth section. In the last, we present the final considerations, limitations, and further research.

2 Theoretical Framework

2.1 Clusters

According to Porter (1998), the clusters are geographical concentrations of interconnected companies and institutions of a particular field; the clusters embrace a grid of industries linked to the support institutions to improve the competitive performance of the firms. The primary purpose of the cluster is to offer resources for the companies, which they could not have access to acting in an isolated form (Schmitz, 1999). The superior development of the clustered firms arises from the reduction of transaction costs due to the presence of local suppliers, sharing of infrastructure, access to the labor, access to information, technologies, and institutions (Holm & Østergaard, 2015).

The clustered firms have a lower cost to identify, access, and change information (Presutti, Boari, & Majocchi, 2013), considering that diffusion of technological knowledge works better inside the geographical borders (Baptista, 2000). In this way, the location and the proximity are shown as key factors for the diffusion and exploration of knowledge (Vicente, 2018), making the clusters to prove themselves as environments favorable to innovation (Giuliani, 2005).

Although the evidence shows that the cluster increases the propensity and the diffusion of innovations, only the argument of geographical approximation does not apply the acquisition of new knowledge by the firms (Balland, Boschma, & Frenken, 2015; Presutti et al., 2013). The transference of knowledge among firms depends, among other factors, on the absorptive capacity of the firms (Cohen & Levinthal, 1990), and also, on the cluster strategies, corporative culture and actions of the firms (Isaksen, 2018).

Giuliani (2005) adopted the concept of absorptive capacity for the cluster level, showing that the absorptive capacity of the cluster is the capacity of the cluster to absorb, disseminate, and explore knowledge extra-cluster. The absorptive capacity impacts the capacity of the firm to acquire new knowledge and, consequently, to innovate,

which makes it a crucial factor for the growth and development of the clusters (Crespo, Suire, & Vicente, 2015). During the learning, the firms do not keep static; they combine the already existent knowledge and the knowledge of external sources, adjusting their technological bases (Menzel & Fornahl, 2010). Due to that movement, the localized learning changes the heterogeneity of the cluster, and the clustered firms tend to imitate the technological patterns of the well-succeeded firms, which generates behavior and technological pattern inside the cluster (Essletzbichler & Rigby, 2007). The common focus and the same technological patterns promote the learning of clustered firms (Martin & Sunley, 2006). However, the decrease of the heterogeneity inside the cluster may lead to a process of lock-in and the decline of the cluster (Grabher, 1993; Harris, 2020; Schmidt, Alex, Zen, Bittencourt, & Belussi, 2020). In this way, the dynamic of knowledge of cluster is related to the heterogeneity of knowledge and the cluster structure.

2.2 Path Dependence and lock-in effect

Path dependence is a historical process in which the results of a system are direct consequences of the own history of the system in question (Martin & Sunley, 2006). Some key events in the cluster's trajectory affect its constitution (Martin, 2010). These events also influence its historical path, routines, possibilities for action, and economic development (Grillitsch, Asheim, & Trippl, 2018; Scherrer & Vasconcellos, 2019; Vasconcellos, Calixto, Garrido, & De Souza, 2012) permanently. However, the emphasis on specific patterns can cause the trapped in its trajectory (Yang, Fu, & Li, 2017). The lock-in makes the developed technologies and the organizations to be driven to determined paths, even though there are more efficient alternatives possible (Martin & Sunley, 2006).

Path dependence tends to be connected to regional institutions since the process of learning usually is local (Martin & Sunley, 2006). The importance of path dependence increases where there are conditions of growing returns due to the adoption of a pattern, which makes the incorporated technologies and products more attractive (Menzel & Fornahl, 2010). Despite the advantages of a dominant pattern (Crespo, 2011), in case the cluster cannot break this pattern, there will be a decrease of its heterogeneity and, consequently, reduction of innovations, leading the cluster to decline through the process of lock-in (Grillitsch et al., 2018; Isaksen, 2018; Menzel & Fornahl, 2010).

The effect of lock-in is the process resulting from path dependence (Grabher, 1993; Isaksen, 2018; Menzel & Fornahl, 2010; Schmidt et al., 2020). The lock-in is characterized by a state of balance, in which there is a low potential for endogenous change. Then, it's needed the action of some exogenous strength on the actors for the inertia to be broken (Martin & Sunley, 2006). In this context, the actors' cluster must seek new sources of knowledge outside its organization to absorb extra-cluster knowledge, not immersed inside the dependent trajectory (Giuliani, Pietrobelli, & Rabellotti, 2005; Harris, 2020; Trippl & Otto, 2009).

The lock-in must not be seen only as a negative influence; the growth of a regional economy derives from a positive lock-in (Martin, 2010; Martin & Sunley, 2006). The cluster is composed of several firms that, initially, present high levels of heterogeneity (Menzel & Fornahl, 2010). Due to that distance of knowledge, the companies have different economic performances (Balland et al., 2015). Thus, as far as some firms get high performance, other firms tend to copy the patterns that present better results (Maskell & Malmberg, 2007). That movement makes firms increase their gains of range and efficiency, which creates an effect of path dependence around the dominant model (Martin & Sunley, 2006). In this way, the lock-in may be understood not only as an effect responsible for the decline of the clusters (Cho & Hassink, 2009) but also, it explains the dynamics of the regional development. Yet, despite the strong appeal for the argument that clusters decline due to the inertia promoted by the lock-in effect, the concept also helps to explain the process of adaptation and transformation of clusters, since new trajectories emerge from the trajectories already existing (Grillitsch et al., 2018; Isaksen, 2018; Trippl & Otto, 2009).

Based on path dependence and lock-in effect, the performance of clustered' firms will be affected differently, according to the stage of development of the cluster (Bergman, 2008). Moreover, competitive advantages that guaranteed the strength of the cluster in the past may become

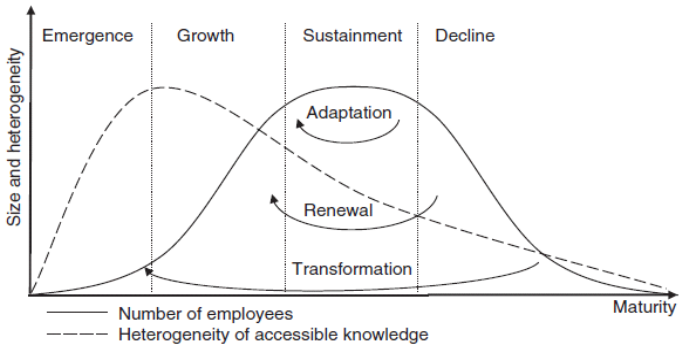
the main factors that lead it to the decline (Grabher, 1993; Martin & Sunley, 2006). This way, no economic advantage belonging to the cluster is permanent, which leads to treating the clusters as heterogeneous clusters and prone to changes (Harris, 2020; Martínez-Marín, Puello-Pereira, & Ovallos-Gazabon, 2020).

2.3 Life cycle of clusters

The approach of the life-cycle of cluster has been used to characterize the evolution of the clusters along the time (Bergman, 2008; Harris, 2020; Martin & Sunley, 2011). Most of the research about the life cycle of cluster involve three or five phases of development in which the cluster may be present (Ingstrup & Damgaard, 2013; Menzel & Fornahl, 2010; Presutti et al., 2013). The approaches about the life cycle highlight the importance of the heterogeneity of knowledge of the firms, the evolution of the value chain, and the path dependence of the industrial regions (Trippl et al., 2015). This new approach focuses on matters related to the actors, the networks, and the institutions. These dynamics are strongly different among the stages of the life cycle and affect the transmission from one stage to another (Fornahl, Hassink, & Menzel, 2015). The clusters aren't isolated actors, pre-defined, and pre-established, as guaranteed structures of success (Martin & Sunley, 2011).

The models of life cycle usually are characterized as an S-shaped curve, in which the cluster cross through periods of growth, stagnation, and decline (Bergman, 2008). Menzel and Fornahl (2010) developed a model that explains the dynamics and development of clusters. Besides that, they argue that the life cycle of clusters has a different pattern from the life cycle of industrial sectors (Menzel & Fornahl, 2010). This fact allows each cluster to have its trajectory that will impact on its performance (Martin & Sunley, 2006). The model of Menzel and Fornahl (2010) also brings the idea that key drivers through the stages of the life cycle are diversity and heterogeneity of knowledge. Then, the stages of the cluster will be defined based on quantitative and qualitative dimensions. Figure 1 presents the model of Menzel and Fornahl (2010).

Figure 1–Life cycle of the cluster



Source: Menzel and Fornahl (2010), p. 218.

Menzel and Fornahl (2010) show the relation of the development of the cluster and the absorptive capacity of the clustered firms. During the initial phases, the cluster shows itself disperse, with little possibilities of interaction, and the knowledge is diffuse. During the stage of growth, the firms start to interact more and absorb the knowledge from one another. In the sustainment phase, dense knowledge networks arise intra- and extra-cluster, the knowledge starts being widely widespread, emerging the possibility of a lock-in effect. In the decline phase, there is a weakening of networks due to the exit of many firms.

2.4 Development of the model of analysis of the cluster life cycle

The present article explores different dimensions of analysis to determine the stage of development of the cluster. This way, this section has the aim to present the main theoretical precepts that compose the model of analysis of the life cycle of the cluster, besides the *knowledge heterogeneity* (Menzel & Fornahl, 2010) and *the diffusion of knowledge* (Giuliani, 2005). Based on the literature review, we developed an analytical framework for presenting critical factors found next to the characteristics of each stage of the life cycle. The Table 1 shows four dimensions of analysis which involve: (i) diffusion of knowledge in the cluster; (ii) the competitive advantages; (iii) the structure of the cluster; (iv) the role of the support institutions and the development policies.

The idea that the firms in cluster have superior innovative activities (Baptista, 2000) gains more strength in moments where the tacit knowledge has greater relevance for the generation of innovative activities (Audretsch, Falck, &

Feldman, 2008). Audretsch and Feldman (1996) reviewed the influence of the life cycle in the industry on the propensity to innovative activities in clustered companies. They found out that the clustered companies presented a higher rate of innovations during the initial stages of the industrial sector and that firms outside the cluster presented higher rates of innovation after the growth of the sector. Thus, the authors conclude that the innovative activity happens especially during the initial stages of the life cycle of the industry, period where the tacit knowledge is more relevant (Presutti et al., 2013).

Van Klink and De Langen (2001) analyzed the dynamism of the *value chain* along the development of the cluster. During the initial stages, the networks of actors are established, and the value chain starts to be created with the strategic relations. During the phase of expansion of the cluster, the firms seek new opportunities to expand, the collective actions focus on refining the process of production and increasing the extent of the market. In the maturity phase, the cluster stabilizes the mix of products, the patterns of production, and sales. The final stage is achieved due to a change of market, and there is a big exit of firms which destabilized the value chain and may culminate with the end of the cluster (Van Klink & De Langen, 2001).

Wal and Boschma (2011) analyzed the *network's stability* of the cluster on the perspective of the theory of the life cycle. In the initial stages, knowledge and technologies are tacit, and they are fixed to the human capital factor. Thus, this regime results in instability and volatility in the cluster networks (Wal & Boschma, 2011). In the stage of growth of the cluster, a dominant technological design starts to emerge; the cluster begins to gain the market share, resulting in fast growth and increment of the cluster stability (Martin & Sunley, 2011). During the stage of maturity, we can see a decrease of market, the number of new inbound clients declines, and the innovative potential decreases. In this stage, the cluster faced a process of shakeout; that is, a significant number of firms exits the cluster because the industry becomes more and more competitive (Wal & Boschma, 2011). Thus, the final stages of the life cycle occur an increase of *rivalry and competition* to the detriment of *cooperation* (Malakauskaitė & Navickas, 2011). There is also a decrease in a variety of firms, and a disruption of networks (Wal & Boschma, 2011).

Malakauskaitė and Navickas (2011) related the life cycle of the cluster and the *degree of productivity*. During the emergence of the cluster, the productivity tends to be low, but with growth perspective. In the growth stage, the productivity of the cluster increases significantly. In the maturity phase, the emergence and adaptation of a dominant design make the productivity of the cluster to be high. In the decline stage, as the firms leave the cluster, productivity tends to decrease (Malakauskaitė & Navickas, 2011).

Staber and Sautter (2011) studied the relations between the *identity of the cluster* and its stage of the life cycle. The identity of the cluster is the shared understanding of the industrial, technological, social bases, and institutional characteristics of the cluster (Staber & Sautter, 2011). This identity considers cultural aspects and local conditions (Staber & Sautter, 2011). The authors conducted studies in two distinct clusters, revealing that the cluster can develop a closed identity or more flexible one driven to meet the new demands coming from new technologies and markets (Staber & Sautter, 2011).

According to Vahl (2009) and Menzel and Fornahl (2010), there is a relationship between the stage of the life-cycle of the cluster and the number of employees. During the initial stages, we will see a few companies and few employees in the cluster. However, as the cluster is developing, the number of employees and firms increases. During the maturity stage, the number of companies and employees is stable and starts to decline during the final stages of the life cycle.

The public agents also demonstrate an interest in the industrial clusters to promoting the development of a region (Ingstrup & Damgaard, 2013). In this way, the support institutions, as well as the cluster-oriented public policies and the facilitating agents, have great importance for the development of the cluster (Brenner & Schlump, 2011; Eraydin, 2016; Fornahl et al., 2015; Ingstrup & Damgaard, 2013). Brenner and Schlump (2011) argue that these public policies must consider the characteristics of each cluster and their current stage of life-cycle. Different stages of life require different strategies driven to the growth of the cluster (Brenner & Schlump, 2011; Ingstrup & Damgaard, 2013). Brenner and Schlump (2011) asked themselves if different types of measures should be used according to stages of the life cycle

of the cluster. Thus, the authors examined the effects of several policies driven to the development of the cluster and its effectiveness in the different stages of life cycle of the cluster, showing which policies have a positive effect in each stage of the life cycle and which do not.

Ingstrup and Damgaard (2013) showed that, in the initial stages of the cluster, the facilitators create networks focusing on developing and improving the local conditions, building safety loops, identifying new actors to join the cluster, and creating bonds among them (Ingstrup & Damgaard, 2013). Thus, the focus of the facilitators aims at creating critical mass and cohesion. In the second stage, the facilitators focus on the cooperation and the expansion of the trust (Ingstrup & Damgaard, 2013). Lastly, they will be integrators of the activities and seek new business opportunities.

Table 1 describes our framework and presents four dimensions to explain each stage: emergent, growth, sustainment, and decline. The low diffusion of external knowledge, the disruption of the networks, and the technological lock-in are signs of the decline of a cluster.

Table 1–Framework of analysis of the stage of life cycle of the cluster

Indicator		Stages of Life cycle of the cluster			
		Emergente	**Growth**	**Sustainment**	**Decline**
Diffusion of knowledge in the cluster	Diffusion of Knowledge	Few and weak knowledge networks	Increase of the connections, but there are still isolated firms	Dense networks of knowledge intra and extra cluster	Weakening of the networks
	Diversity of knowledge	Diffuse knowledge	Convergence for a dominant design of the cluster	Widespread – possibility of lock-in	Highly widespread – need of renewal
	Propensity to innovative activities in the firms	Low, but growing	High	High, but decreasing	Low
Competitive advantages	Strength of the networks in the firms of the cluster (networking)	Unstable	Growth of the stability	Peak of stability followed by the shake out	Disruption of the networks
	Level of Coopetition	Low	Firms cooperate more than compete, growth of trust	Firms compete more than cooperate, high trust	Low
Structure of cluster	Value Chain	Development of the value chain with different firms	Specialization of the firms in the chain	Stable roles of the firms in the chain	Reorientation of the roles of the firms in the chain
	Growth in the number of companies in the cluster	Low	Low, but growing	Stable	Great exit of the number of companies
	Growth in the number of employees in the cluster	Low	Low, but growing	Stable	Great exit of the number of employees
	Production of the firms	Low, but growing	Productivity higher or equals to the average of the industry	High	Productivity lower or equals to the average
	Technological heterogeneity of the firms	High and growing	High and decreasing	Moderate and decreasing	Low and decreasing
	Identity of the cluster	Heterogeneous identity	Development of a common identity	Homogeneous identity	Decrease of the homogeneity
	Qualification and specialized training	Non-existent	Low, but growing	High and growing	Decrease of the search for training centers
Policies for clusters	Role of the institutions	Development of networking	Development of the trade relations	Integration of the members of the cluster	Stimulate the diversification
	Focus of the institutions	Provide favorable conditions to the emergence of the cluster	Stimulate the cooperation	Creation of business activities	Search for new opportunities

3 Methodology

The methodological strategy adopted in this paper was a single case study. We chose the footwear cluster of Vale dos Sinos and Paranhana because its one of the most relevant in the Brazilian economy and having gone past different phases of growth and decline during its trajectory. Besides that, the footwear sector has great economic and social importance for the region.

The data collection happened in the years of 2016 and 2017, using three main sources:

interviews, databases of the government, and documental analysis. For the interviews, a semi structures script was created based on the proposed dimensions in Table 1. The interviews took place in person or by web. In total, fifteen interviews were conducted with different organizations that belong to the cluster. Table 2 presents information about the interviews. The duration of the interviews ranged from 40 minutes to 1 hour and 15 minutes.

Table 2 - Interview information

Type of organization	Interviewee's position	Number of pages transcribed
Footwear manufacturer	Entrepreneur	10
Footwear manufacturer	Supply manager	13
Footwear manufacturer	Exportation manager	13
Footwear manufacturer	Exportation manager	11
Footwear manufacturer	Marketing manager	13
Footwear manufacturer	Factory director	25
Footwear manufacturer	Entrepreneur	12
Footwear manufacturer	Director of Operations	8
Footwear manufacturer	Marketing and Communication Director	14
Tannery	Product development	10
Footwear components	CEO	15
Outsourcing service provider	Vice president	2
Design service provider	Entrepreneur	14
Supporting institution	Project Manager	15
Supporting institution	Director	9

Besides that, we used data bases of the government, such as RAIS – Annual Relation of Social Information, to collect information about the number of employees, firms, and production of the cluster. Lastly, the documental analysis explored sectoral reports, dissertations, and thesis about the cluster to analyze the historical context.

The data analysis of this research was performed based on the full transcripts of the interviews, the analyzed documents, and the observation. The analytical categories defined in this study were the cluster life cycle indicators identified in the literature. Thus, we used the strategy of triangulation of data to determine the consistency of data and validity of the results. The technique of data treatment was content analysis. We considered the Analytical Framework (Table 1) to conduct this analysis and compare data from different sources,

4 Analysis

The cluster Vale dos Sinos-Paranhana is one of the oldest industrial clusters in Brazil, which includes footwear manufacturers, leather goods, and institutional agents in the value chain (Calandro & Campos, 2016). The footwear industry in the Rio Grande do Sul is considered a very traditional industry, generating an impressive quantity of jobs. The shoes production in the region of Vale dos Sinos and Vale do Paranhana began through a leather-footwear tradition in which the German immigrants brought with them when they populated the region.

Brazil is the fourth biggest producer of shoes in the world (Abicalçados, 2018), having a footwear park constituted of 7.1 thousand companies and generates more than 279 thousand working places (Abicalçados, 2018) directly. Because it is an extensive industry concerning labor, the displacement of the footwear industry for regions that present lower costs of production is widespread, characteristic that makes the shoe manufacturing to be a "nomad" industry (Costa, 2009).

Despite being a very traditional industrial sector, the footwear cluster of Vale dos Sinhos-Paranhana has been going past difficulties (Abicalçados, 2018; Costa, 2009). According to Abicalçados (2018), from 2015 to 2017, the footwear sector presented a decline in all the performance indicators. The results emphasize the loss of more than 4,1 thousand of working places all over Brazil and a decline of 1271 establishments that manufacture footwear. The industry had also been reducing shoes production from 1.036 million pairs in 2013 to 908 million in 2017.

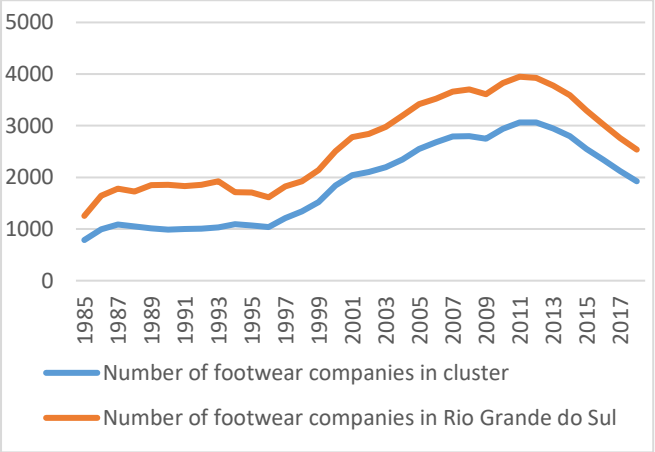
4.1 Stage of Development of the Cluster

The cluster of Vale dos Sinos-Paranhana has gone past several phases over the years. In each one of those phases, the cluster changed its technological orientations, going past renewal processes followed by new stability. We can identify the movement in a historical analysis of the number of firms and employees that belong to the cluster. The data withdrew from RAIS/TEM record

the formal relationships of the working places. The period 1985 to 2018 was used due to the availability of the data in RAIS.

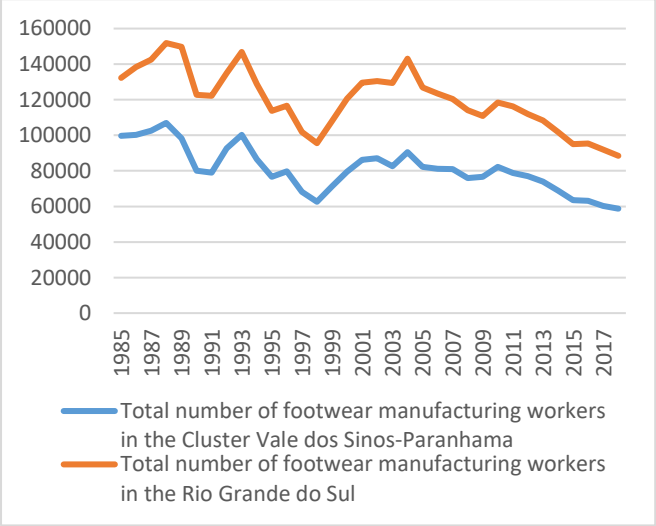
Figure 2 presents the evolution of the number of footwear manufacturers in the Cluster Vale dos Sinos-Paranhana and the State of Rio Grande do Sul. We also observed that the number of companies remained constant between the years of 1987 and 1995. After this period, the number starts to grow considerably until the years of 2011 and 2012, where it comes to its maximum number of 3063 companies. From 2012 on, the number of companies starts to decrease, coming to 1924 companies in 2018.

Figure 2–Footwear manufactorers in the Cluster of Vale do Sinos-Paranhana and in Rio Grande do Sul



Source: RAIS/MTE. 2018. Own elaboration.

Figure 3 – Evolution of the number of workers



Source: RAIS/MTE. 2018. Own elaboration

Concerning the labor, Figure 3 presents the evolution of the number of employees in the footwear manufacturing in the cities that are part of the cluster and in Rio Grande do Sul. The peak of workers in the cluster happened in 1988, coming to 106.947 workers. From 2004 on, the number of workers starts to decline, reaching 58.731 workers in 2018.

From the decade of 1960, the cluster received a high demand on the part of foreign companies that decided to outsourcing production the Brazilian companies. From the years 1990, Asian countries started to join the world scenario of production, practicing an intense competition due to its low costs, which forced the Brazilian companies to change their strategies, since they could not compete about price with the Asian companies. This way, the companies started to invest more and more in the creation, formation, and insertion of their own brand in the international market. Despite the changes oriented to the value-adding, the footwear sector is still going past difficulties, according to our data.

Concerning the **diffusion of knowledge** inside the cluster, the cluster is structuring its knowledge networks just now and that the local culture of closed companies still prevails. However, some initiatives have already been built to reunite groups and companies to discuss new technologies and tendencies. The production of shoes is an ancient activity, and the knowledge has passed through generations, coming to the point where the knowledge in the manufacturing was no longer tacit and could be expanded to other places, as it was the case of the migration of the industry to the Northeast.

In terms of **knowledge networks**, the interviewees pointed out that recently the cluster started to host events and workshops to connect the sector and disseminate knowledge. The interviewees also pointed out that there is a significant deficiency about researches and search for new technologies for materials, innovations in products, and services. Recently, Abicalçados started to promote programs, such as Moda Cor and Maratona Mude to increase the relations between the several links of the chain.

About the **innovation**, the cluster did not show itself innovative. Otherwise, few are the companies that indeed invest in research, and besides, the innovations are incremental and easily copied. In general, the industry stopped in the time, where there are very few changes in the industry blueprints in the last years. In the cluster, the closed culture of non-collaboration and copy still prevails.

The innovations are characterized by being incremental and derived specially from the material industry.

Concerning the **knowledge diversity**, the footwear cluster presents a low variety and for a long time there has been a dominant design in the cluster. The manner of production is very similar inside de companies, and the way that they try to distinguish themselves is through design or material, however, as the inspirations for new products are the same. There is a robust culture of copy, and the products end up being very similar.

Regarding **networking**, the cluster presents a very developed network and even stable. If, on the one hand, there is little cooperation among the producer industries; on the other hand, the networks created showed themselves better developed for the companies in the cluster. Moreover, the interviewees highlighted the role of the fairs as an important means to increase the networking and range of clients, as well as the incentive of meeting among entrepreneurs, suppliers, and clients, seeking the strengthening of the relations inside the cluster.

All of the interviewees pointed out that the companies present a low level of **cooperation**. They **compete** much more among them, due to the excess of products for an already saturated demand. The interviewees also pointed out that the attempts to create collective strategies even crash into the closed mindset of the entrepreneurs of the sector and that many companies are still managed by families, which do not seek partnerships. The interviewees also pointed out that, in the last years, the proximity between the support entities had improved.

Concerning the **value chain**, the footwear cluster of Vale dos Sinos-Paranhana presents a complete and very stable value chain. The interviewees argued that the gaucho cluster has a better value chain related to shoes in Brazil, being this an advantage in other producer regions. Another highlighting factor is a good logistic infrastructure, both for the intern market and exportation.

One of the changes in **heterogeneity** in the footwear sector occurred through the business model of the companies, reducing the production of **private label shoes**. The innovations also included design, the increment of new tendencies, and technologies in the shoe production. However, no great innovation has emerged in Brazil. The footwear industry waits to see what becomes a tendency in the European market and adapts to the Brazilian reality. The traditional model of footwear production and trade is ceasing to exist. Less and less, it is expected the companies to keep the model B2B, where the companies manufacture significant quantities of shoes and deliver them to distributing companies that are responsible for the sales in retail. The number of small companies selling directly to the consumer on the internet is increasing. This model does not count on stock and produces only on demand, and products with more added value characterize it.

The cluster is presenting difficulties in capturing and maintenance of its workforce. One of the causes of the scarcity is that the young people of the region do not realize the job inside a footwear factory as something positive, primarily because of the physical conditions and low salaries. Despite the lack of workforce, the interviewees highlighted that there are several training centers and organizations related to the footwear inside the territory of a cluster. Despite the existence of several graduation courses, Senai issued an alert to Abicalçados, showing that there were fewer people interested in a technical formation.

The footwear cluster presents a collective *identity* and a strong cultural identification of the society with the footwear. The manufacture of footwear is a family business and cross different generations over the years. In this sense, it is said that the footwear business is "inside the DNA" of the people. However, the interviewees also argued that the German culture also hinders the development of new innovations, since the people are very suspicious and closed, hindering the flow of information and knowledge.

Concerning the **support institutions**, the interviewees highlight that, recently, the institutions have been creating projects and helping the companies more and more. One of the main efforts made was the integration of the members of the cluster. To stimulate cooperation among the firms, Abicalçados has been developing projects, such as Future Group, Future of Footwear, and Brazilian Footwear. Abicalçados aims at stimulating the relations through fairs and market research, offering opportunities of business to the companies. About the *focus of the activities of the support institutions*, we noticed a search for increasing cooperation. Still, mainly, it is sought to create new business activities through the

promotion of Brazilian brands in the national and international markets.

4.2 Discussion of the Results

Based on the taxonomy of Giuliani (2005), the evidence indicates that the footwear cluster has absorptive capacity at the intermediate level since the companies have forms to generate internal knowledge. However, this knowledge is still adapted from the one existing, making radical innovations a rare event in the cluster. Moreover, there are few and weak knowledge networks. The cluster is in the early stages of its network of **knowledge diffusion**, because the region still has a very closed culture to share knowledge. Institutional and cultural aspects can be a significant limitation for the dissemination of knowledge diffusion since they define how the agents exchange knowledge (Holm & Østergaard, 2015; Isaksen, 2018; Staber & Sautter, 2011). In this sense, the culture of mistrust limits the knowledge to be recombined and transformed into innovations that encourage the renewal of the cluster (Grillitsch et al., 2018; Trippl & Otto, 2009).

About the **innovative capacity**, the cluster presents incremental innovations and easily copied. The literature about the life cycle of cluster shows that the clusters decline due to the cognitive isomorphism, which leads to a decrease of innovations (Martin & Sunley, 2011), a process that reinforce the lock-in effect (Harris, 2020; Schmidt et al., 2020). This way, the low innovative activity of the footwear cluster is a strong clue that the cluster is heading to a decline stage (Audretsch & Feldman, 1996; Martin & Sunley, 2011; Trippl et al., 2015).

Regarding **knowledge diversity**, the cluster presents a low level. The interviews identified a dominant design in the cluster, and the production model of footwear is very similar. According to Menzel and Fornahl (2010), the existence of a dominant model is characteristic of a mature cluster, and its continuity leads to a decrease of heterogeneity, being possible to cause a lock-in and, consequently the decline of the cluster (Grabher, 1993; Isaksen, 2018; Schmidt et al., 2020). The patterns that marked the success of the cluster become obsolete, and the existent model is going to face several difficulties, mainly due to the lack of competitiveness and innovations. This way, the footwear cluster is stuck in a dominant trajectory and needs increments on its heterogeneity to free itself from its current state (Trippl & Otto, 2009).

Wal and Boschma (2011) argued that networking develops with the capacities of the cluster along its life cycle. In this footwear cluster, we observed the existence of stable networking, but such stability may have led the cluster to a shakeout process. We can see the movement of the reduction of the number of companies based on secondary data (Figure 3). Moreover, the interviewees also mentioned the competitive worsening on the footwear prices. According to Wal and Boschma (2011), the process of shakeout and the worsening of competition for prices are characteristics of a mature network.

One of the main characteristics of a cluster is the relation of **competition, cooperation, and the trust relations** of the companies (Porter, 1998). The analysis showed that the companies of the cluster present a low level of cooperation, starting to compete much more among them. There is strong confidence among the clustered firms, in particular, in the context of the relationship between producers and suppliers. The lack of competition and trust and the little collaboration among the actors are characteristics of clusters in the final stage of the life cycle (Malakauskaitė & Navickas, 2011).

The low diversity of knowledge can also be one of the aspects responsible for the low cooperation activity and the high mistrust within the cluster. This aspect can be related to the distance between agents is very low (Boschma, 2005; Neffke, Henning, & Boschma, 2011; Nooteboom, 2000). In environments where cognitive distance is low, firms tend to have more homogeneous routines, making knowledge a redundant asset and unproductive cooperation activities (Boschma, 2005), since there are less gains through collaboration.

The cluster presented a complete and stable **value chain**. The cluster also has a dominant model in the patterns of production and sales, which indicates a value chain of a mature cluster (Van Klink & De Langen, 2001). Even after the exit of companies, the cluster is not yet undergoing a restructuring of the value chain. However, this may be the next stage of the cluster, in case it cannot reorient and renew itself.

Concerning the **number of manufacturers**

of footwear in the Cluster Vale dos Sinos-Paranhana, it was observed a strong decrease from the year of 2011. The same happened in the **number of employees** which has also been decreasing over the years. Another factor is the production of the number of shoes in the most recent years. The decrease in the number of companies, firms, and production are characteristics of a cluster in decline (Menzel & Fornahl, 2010; Vahl, 2009).

The model of Menzel & Fornahl (2010) points out that the strength that moves the cluster through the stages of life cycle is **diversity** and **heterogeneity**. No radical innovation happened in the last years, and all the companies follow the same model of production. The low heterogeneity is evidence of decline (Harris, 2020; Isaksen, 2018; Schmidt et al., 2020). However, producers are investing in new business models and different products, which may be an increase in heterogeneity. In that case, in case the cluster can increase its heterogeneity, it can go past a process of renewal (Grillitsch et al., 2018; Menzel & Fornahl, 2010; Trippl & Otto, 2009).

The footwear cluster presents a collective identity and cultural identification with society. The rooting and the cultural identification with the segment are characteristics of a mature cluster. Even with the existence of a strong collective identity, the clustered firms are finding difficulties in renewing their **workforce**. The lack of interest of new generations is a great challenge that the cluster will have to face in the future.

Staber & Sautter (2011) showed that a cluster has a central **identity**. The cultural characteristics of the region have developed the identity (Staber & Sautter, 2011). The identity of the cluster influences the trajectory of the cluster, possibly following two different paths: one of the paths leads the cluster to greater flexibility and the second path privileges a state of inertia and stability, that on the other hand, prevents the cluster from innovation and adapting, leading the cluster to the decline (Staber & Sautter, 2011).

Another factor to be analyzed is the **facilitation policies** of the cluster promoted by the support institutions (Eraydin, 2016). Policies driven to regional development have extreme importance for cluster development (Ingstrup & Damgaard, 2013). The interviewees highlight that, in the last years, institutions such as Abicalçados, Assintecal, and IBTEC have been creating new projects and helping the companies in several areas. For that matter, one of the main roles highlighted was the role of integrator agent of the members of the cluster, seeking to organize the companies to work more collectively.

Abicalçados aims at stimulating those relations through fairs and researches of target markets, offering the new companies' opportunities of business. Among the main tasks performed by the institutions, there are the actions of branding, meetings for idea sharing, funding in fairs, market research, and events of networking. Based on this, we noticed that the facilitator role of the footwear cluster is slightly dissonant from the current needs of the cluster. A facilitator that aims at the development of the relations is a characteristic of a mature cluster. However, the footwear cluster needs to increase its heterogeneity to renew itself (Menzel & Fornahl, 2010). This way, the actions of the institutions should be more driven to increase the diversity of the region through projects that aim at the innovation.

Based on the analysis framework of the life cycle of the cluster, Table 3 presents the application in the Footwear Cluster of Vale dos Sinos. It is observed that 9 of the 14 indications catalogued are found in the decline stage. The decline stage does not necessarily indicate the complete death, there are still a lot of renewal possibilities, as several authors (Bergman, 2008; Grillitsch et al., 2018; Martin & Sunley, 2011; Menzel & Fornahl, 2010; Trippl & Otto, 2009). However, to renew itself, a cluster needs a greater flow of external knowledge, fostering larger interactions with the extra-cluster agents and reducing the negative effect of the lock-in.

Table 3 –Stage of life cycle of the Footwear Cluster of Vale dos Sinos-Paranhana

Indicators		Stage of life cycle			
		Emergence	Growth	Sustainment	Decline
Diffusion of knowledge in the cluster	Diffusion of knowledge		Few networks of knowledge		
	Diversity of knowledge				Low diversity of knowledge
	Propensity to innovative activities in the firms				Low

Collective advantages	Strength of the firm networks of the cluster (networking)			Developed and stable networks	
	Levels of cooperation, trust and competition among the firms of the cluster				Low level of cooperation and high level of competition
	Value chain			Stable and complete	
Structure of the cluster	Evolution of the number of companies in the cluster				Decline of the number of companies
	Evolution of the number of employees in the cluster				Decline of the number of employees in the past years
	Production of the firms				Declining
	Technological heterogeneity				Low heterogeneity
	Identity of the cluster				Existence of a strong identity, but it is being lost
	Formation and especialized training				The cluster presents difficulties in renewing the workforce
Policies for cluster	Role of the institutions			Integrator agent of the members	
	Focus of the institutions			Goal to create new business activities	

5 Conclusions

The emergence and the evolution of clusters can be a research avenue to explain the difference of innovation capacity in the firm and cluster levels. The understanding of the specific needs that each stage of the life cycle demands is vital to keep the cluster competitive and innovative (Brenner & Schlump, 2011). Considering these needs, our paper aimed at analyzing the stages of the life-cycle of clusters, proposing an analytical framework.

As a theoretical contribution, we proposed a framework to analyze the stages of the life-cycle of the cluster, based on four dimensions: diffusion of knowledge, competitive advantage, the structure of the cluster, and policies for clusters. These dimensions are aligning with Fornahl et al. (2015) and Trippl et al. (2015).

The results point out that the footwear cluster of Vale dos Sinos-Paranhana presents a low level of cooperation and innovation. The cluster is still considering as the most significant producer of footwear, but new generations don't recognize this cultural and collective identity. The decline of the footwear cluster is related to the path dependence and the trapping effect that emerges from it (Schmidt et al., 2020; Vasconcellos, Garrido, Vieira, & Schneider, 2015). We identified the difficulty of renewing the technological basis of the cluster. This difficulty can be related to a lack of new knowledge (Menzel & Fornahl, 2010), inertia generated by outdated production models (Cho & Hassink, 2009) and local culture, which does not encourage knowledge diffusion (Staber & Sautter, 2011).

This context indicates that the footwear cluster needs to break with the current trajectory Vasconcellos et al., 2012). An alternative is to invest in the acquisition and diffusion of new knowledge and offer higher value-added products on the market (Trippl & Otto, 2009). In fact, since the 2000s, the cluster has invested in acquiring new knowledge, producing its own brand, and adding value (Vasconcellos et al., 2012; Vasconcellos et al., 2015) and, more recently, new sustainable business models have emerged in the cluster. However, these changes do not seem to have been sufficient to completely renew the cluster (Trippl & Otto, 2009).

The capacity of assimilation of superior practices makes the clustered firms to grow over the average of the sector. However, the superior practices end up disseminating and generating a dependent trajectory of a mental model, hindering new methods and innovations to happen. The lack of changes will impact competitiveness and start to compete for costs. In this way, the companies that did not have privileged positions in the value chain, or that were not so competitive, tend to disappear (Wal & Boschma, 2011).

6 Implications and Further Research

This research contributed to the understanding of the evolution of clusters, considering that the flow of knowledge will have a

central role in the renewal of the cluster. As a practical implication, the awareness of the difficulties and the necessary mechanisms to renew a cluster are essential to developing policies for clusters and the footwear industry in Brazil.

As a theoretical contribution, the study reinforces that the lack of new knowledge influences the negative lock-in, leading to the decline. Further research can validate the framework in empirical tests in the same cluster or different ones. Empirical studies will also clarify how the dissemination of patterns and the increasing heterogeneity in mature clusters.

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