Research advances in Risaralda. An overview of 8 experiences

Universidad Tecnológica de Pereira

Editorial UTP

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CONTENT

Introduction

Esteemed readers,

I am honored to present to you this remarkable book, a testament to the invaluable research conducted in the fields of Health, Law, Engineering, and Administrative Sciences. Each chapter within these pages represents the culmination of extensive investigations carried out by dedicated scholars affiliated with the Red Universitaria de Risaralda (RUN), a network comprising 15 esteemed higher education institutions.

Risaralda has emerged as a thriving hub for higher education, bolstered by its strategic geographical location, high quality of life, rich biodiversity, and competitive development. Today, Pereira ranks third in the index of university cities, with a student enrollment rate exceeding 63%. Close to 50,000 students pursue academic programs within the department. Notably, three institutions have achieved accreditation for their excellence in education, positioning Risaralda among the most competitive regions in terms of accredited academic programs.

As we celebrate the 20th anniversary of the Red Universitaria de Risaralda in 2023, it is with great pride that we reflect on its pivotal role in fostering collaboration among public and private higher education institutions. Our mission has been twofold: attracting students to our region and supporting sustainable development and quality of life for our community. The mesa de investigación (research committee) has diligently coordinated the necessary actions to unite our researchers, facilitating an integrated approach to various disciplines and themes associated with the challenges faced in our region.

The objectives of this book are fourfold. Firstly, it serves as a platform to celebrate and commend the tireless efforts of our researchers, whose dedication and passion have contributed to the advancement of knowledge in their respective fields. Secondly, it is an opportunity to express our sincere gratitude to the mesa de investigación (research committee) for their invaluable contributions in curating and promoting this significant publication. Thirdly, we aim to communicate the essential role of the Red Universitaria de Risaralda in fostering institutional collaboration and generating impactful research outcomes. Lastly, through this compilation of research findings, we aspire to position the department of Risaralda as a premier destination for higher education.

The audience for this book encompasses the academic communities of the institutions within the Red Universitaria de Risaralda. It also extends to the business and professional sectors within the department, the public sector, and the general community. We believe that the knowledge shared within these pages will inspire further collaboration and innovation across various sectors, ultimately benefiting our society as a whole.

In conclusion, I invite you to delve into the depths of this thought-provoking compilation of research findings. May it ignite curiosity, spark conversations, and pave the way for future discoveries. Together, let us continue to cultivate a vibrant academic landscape and propel the department of Risaralda to even greater heights.

Warm regards,

Felipe Baena B
Rector areandina Seccional Pereira
President of Red Universitaria de Risaralda (RUN)

1 CHAPTER ONE

Tobacco Use and Social Skills in Children from Two Schools in Pereira, Colombia

Consumo de tabaco y habilidades sociales en escolares de dos Instituciones Educativas en Pereira, Colombia

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Ángela Liceth Pérez Rendón[3]

Abstract

Aim: To describe tobacco and Social Skills use in high school students from two public schools in Pereira. **Materials and methods:** Observational, descriptive, cross-sectional study with a quantitative approach. During the first half of 2019, we administered an anonymous survey based on the social skills scale and the cigarette consumer classification questionnaire. **Results:** The sample comprised 190 schoolchildren whose average age was 16 ± 1,2 years; 71,6 % reported never having smoked, 24,7 % had smoked at some point in their lives, and 4,7 % smoke at present.

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Moreover, twenty percent had tried cigarettes, and the rest used to smoke but quit. Respondents started to smoke at 14 ± 1,83 years old on average. We found that 6,4 % are dependent on nicotine, without significant differences between schools, gender, grade, or the people they live with ($p <$ 0,005). Regarding social skills, the variable best related to tobacco use is assertiveness to say no. **Conclusions:** It is necessary to devise action plans and public health strategies addressed to a population in need of quality care and support, thus reducing non-communicable diseases related to tobacco use in the region. Such strategies should also build social skills such as saying no (being assertive) and initiating social interactions.

Keywords: smoking, social skills, adolescent, non-communicable diseases, public health (source: DeCS, BIREME)

Resumen

Objetivo: Describir el consumo de tabaco y habilidades sociales en estudiantes de último grado de educación básica secundaria y educación media de dos colegios públicos de la ciudad de Pereira. **Materiales y métodos:** Investigación observacional, descriptiva, de corte trasversal con enfoque cuantitativo, aplicando durante el primer semestre de 2019, una encuesta anónima basada en la escala de habilidades sociales (EHS) y el cuestionario para la clasificación de consumidores de cigarrillo C4. **Resultados:** La muestra fueron 190 escolares con media de edad de 16 ± 1,2 años; el 71,6% declararon nunca haber fumado, el 24,7% ha fumado alguna vez en la vida; el 4,7% de todos los encuestados reportó fumar actualmente, el 20% ha probado el cigarrillo y el restante fumaba, pero dejó de hacerlo, con una edad promedio de inicio de consumo de 14±1,83 años. Se encontró que el 6,4% son dependientes a la nicotina, sin observar diferencias significativas entre las instituciones educativas, el género, grado escolar o con quien conviven con p < 0,005. Respecto

a las habilidades sociales, las variables mejor relacionadas con el consumo de tabaco se relacionan con la asertividad para rechazar el consumo. **Conclusiones:** Es necesario desarrollar planes de acción que induzcan a la generación de estrategias en salud pública que permitan intervenir una población necesitada de atención y acompañamiento de calidad y de esta manera, lograr reducir consecuentemente la posibilidad de desarrollo de enfermedades no transmisibles en la región relacionadas con el consumo tabaco, entre ellas habilidades sociales como decir que no (ser asertivo) e iniciar interacciones sociales.

Palabras clave: tabaquismo, habilidades sociales, adolescente, enfermedades no transmisibles, salud pública. (fuente: DeCS, BIREME)

Introduction

Tobacco use is a widespread public health problem around the world despite being a common risk factor for six of the eight top causes of death and the four primary non-communicable diseases: cardiovascular disease, chronic respiratory disease, cancer, and diabetes. Globally, these diseases account for 70 % of total annual deaths, of which 38 % occur prematurely, that is, between 30 and 70 years old. In the Americas, non-communicable diseases are responsible for 80 % of total annual deaths and 35 % of premature deaths ((OMS), n.d.; Organization, 2018). The Global Burden of Disease (GBD) study published in 1997 anticipated that tobacco-attributable mortality would increase from 3 million deaths in 1990 to 8,4 million deaths in 2020 (Murray & Lopez, 1997).

Alternative projections of mortality and disease by cause. 1990-2020: Global burden of disease study (Christopher, Murray & Lopez, 1997).

According to the World Health Organization (WHO), more than eight million people die each year from active and passive cigarette smoking, adversely affecting low- and middle-income countries. Smoking increases poverty since it involves a tremendous economic cost for healthcare services and produces human capital loss due to its morbidity and mortality (OMS, 2019). In Colombia, tobacco is considered a legal psychoactive substance for adults and, according to the country's laws, its use is prohibited and deemed illegal in individuals under 18 years old (Ley 124 de 1994 Prohibición Del Expendio de Bebidas Embriagantes a Menores de Edad, 1994)(Ley 1335 de 2009 Disposiciones Sobre La Venta de Productos de Tabaco a Menores de Edad, 2009).

The smoking rate has decreased globally from 23,5 % in 2007 to 20,7 % in 2015 among people aged +15 years, with a comparable trend in the Americas: 22,1 % in 2007 and 17,4 % in 2015 (Organization, 2018). According to the 2016 national study on psychoactive substance use in the Colombian school population, 24,1 % of the students surveyed stated having used tobacco at some point in their lives, with a prevalence of 8,1 % in the last month. The use of this substance increases considerably with the students' age, and the average age of the first experience is 12,9 years, very similar for men and women. Regarding the difference between urban and rural areas, cigarette consumption in the last month is slightly higher in urban areas (8,1 %) than in rural areas (7,4 %). Compared with the study on the school population in 2011, there was a decrease in cigarette smoking prevalence for the last month (10 %) (Ministerio de Justicia y del Derecho, 2013; Observatorio de Drogas de Colombia et al., 2016). Six and five percent of the Risaralda schoolchildren who participated in the 2016 national study reported having used tobacco in the last month, which places the department below the national average (Observatorio de Drogas de Colombia et al., 2016).

Therefore, tobacco use is an enormous problem that affects adolescents and is increasing, which will directly impact people's health in the upcoming years, as the number of diseases and their early onset will rise, with all the consequences that may ensue as mentioned above. It is crucial to identify the factors that may be influencing consumption in young people, particularly those that can be modified to reduce this risk.

A relationship between deficits in social skills and the use of tobacco and other psychoactive substances (Felicissimo et al., 2013; Morales et al., 2011; Rondina et al., 2015) and even an association between a deficit in social skills and substance dependence and abuse (Morales et al., 2011) have been suggested. It has been found that the ability to say no assertively is a protective factor against adolescents' intention to smoke in the future (Epstein et al., 2007). Similarly, tobacco abstinence is positively related to perceived social skills (Niaura et al., 2002), and social anxiety plays a vital role in maintaining tobacco use (Watson et al., 2012). Several studies show that the development of social skills is considered a protective factor against the use of psychoactive substances, including tobacco (Aleixandre & Mallorca, 2004; Barkin et al., 2002; López Larrosa et al. 2012; Varela, 2010), although some others propose further research (Felicissimo et al., 2013).

This study aims to identify the possible relationships between tobacco use and the social skills of ninth-, tenth- and eleventh-graders from a rural school and an urban school in Pereira through the cigarette consumer classification questionnaire (C4) and Gismero's social skills scale (EHS).

Materials and methods

This observational, descriptive, cross-sectional epidemiological study includes a population of ninth-, tenth, and eleventh-graders from two public schools in Pereira, one rural and one urban. At the beginning of the study, the total estimated population was 305 schoolchildren, including the total number of schoolchildren whose parents authorized participation (informed consent) or accepted participation (informed assent) and filled out the instrument online. The sample size was established with a confidence level of 95% and an error of 4,5%, which resulted in a sample of 190 students, of which 50 % were female, 49,5 % male, and 0,5 % other genders.

We employed the cigarette consumer classification questionnaire (C4) to assess the risk of addiction to nicotine, determining the smokers' consumption level from complex elements such as frequency, intensity, problems associated with tobacco use, and form of use (degree of inhalation). The questionnaire allows classifying addiction as mild, moderate, and severe. The maximum possible score is 50, meaning that the person is highly dependent on nicotine, and the minimum score is 0 when the person does not smoke or had never tried a cigarette. The classification scale is divided into four consumption levels: low (1-5 points), moderate (6-17 points), high with signs of the onset of dependence (18-29 points), and dependent (30-50) (Londo, Rodriguez, Gantiva, 2011; Londoño et al., 2018). The Cronbach's alpha reliability test was applied to the questionnaire for the Classification of Cigarette Consumers (C4), and a value of 0.71 was obtained.

The social skills scale (Gismero, 2010) used to assess social skills comprises 33 items, 28 of them written to detect a lack of assertion or deficit in social skills and 5 of them as positive statements, with four alternatives response. Its response format is an ordinal Likert-type scale with four items, as follows: A: I do not relate at all; it rarely happens or would happen to me; B: it has nothing to do with me, even if it happens to me sometimes; C: it roughly describes me, even though

I do not always act or feel that way; D: I strongly agree, and I would feel or act that way in most cases. The evaluation scales are (a) self-expressing in social situations; (b) defending consumer rights; (c) expressing anger or disagreement; (d) saying no and cutting off interactions; (e) requesting something from the opposite sex, and (f) initiating positive interactions with the opposite sex. Participants were classified according to the social skill (EHS) level as high, medium, or low. Using the percentile reached, we obtained a first global index of the student's EHS level or assertion; if the percentile was 25th or below, the subject's level was rated as low. Values at the 75th percentile or over were considered high, and those with a percentile between the 26th and 74th as medium. A Cronbach's alpha reliability test was applied to the social skills scale, obtaining a value of 0.78.

Inclusion Criteria

Students enrolled in the educational institution in the last grade of elementary secondary and middle school, students with informed consent signed by parents or guardians, and students with signed informed consent.

Exclusion criteria

Students who do not attend the day of application of the instrument, instruments that are not at least 70% filled out, and students who have mental limitations and/or neurodevelopmental problems.

The study was carried out under the Declaration of Helsinki (Editorial, 2008), the Singapore Declaration (Declaración de Singapur Sobre La Intregridad En La Investigación, 2010), and Colombian Resolution 008430 of 1993 (Resolución Numero 8430 De 1993 Normas Científicas, Técnicas y Administrativas Para La Investigación En Salud., 1993), according to which it must

have the collaborators' approval. All participants received detailed information about the study and provided their written informed consent to participate in it before inclusion. The Research Committee of the Faculty of Health, Fundación Universitaria del Área Andina, Pereira, approved the research.

The data were tabulated and processed using the statistical package SPSS version 24. We carried out a descriptive analysis of the qualitative and quantitative variables. For the bivariate analysis, the chi-square test was used to determine the degree of relationship between the sociodemographic variables, social skill dimensions, and the risk of nicotine. Subsequently, we performed a Pearson correlation analysis for the quantitative variables and a Spearman correlation analysis for the categorical variables. Finally, after performing the bivariate correlation analysis, the high-correlation items were eliminated to avoid multicollinearity. We removed two variables from the social skills group and four from the nicotine consumption group. With the refined variables, the optimal scaling was completed to calculate the canonical dimensions and check whether social skills influence the participating students' tobacco use.

Results

The sample consisted of 190 schoolchildren aged 16 ± 1,2 years old on average, with 31,1 % of ninth-graders, 34,7 % of tenth-graders, and 34,2 % of eleventh-graders. Forty-six and eight percent of students belonged to a rural school and 53,2 % to an urban one. Forty-six and three percent of the participants reported living with both parents, 42,1 % with their mother, 2,6 % with their father, and 8,9 % with people different from their parents.

Tobacco use

Seventy-one and six percent of the students stated never having smoked, and 24,7 % had smoked at some point in their lives. Of them, 54,5 % are male and 45,5 % female; 4,7 % of all respondents smoke at present. Twenty percent have tried cigarettes, and the rest used to smoke but quit. The average age of the first try is 14 ± 1,83 years.

Of the 47 schoolchildren who claimed having smoked at some point in their lives, 51,1 % belong to the urban school and the remaining to the rural one. Thirty-eight and three percent are in ninth grade, 34 % in tenth grade, and 27,7 % in eleventh grade, without significant differences in schools or school grades ($p > 0,05$). When inquiring about what type of substance they have used, we identified that the most used are cigarettes, followed by vape pens and marijuana. It should be noted that some of them consume several of the substances evaluated.

Ninety-three and six percent smoke ten or fewer cigarettes; 44,7 % take ten minutes or less to smoke after waking up, 8,5 % take between ten minutes and an hour, and the others take more than an hour. We also observed that 23,4 % of smokers find it difficult to stop smoking where prohibited, 78,7 % would like to quit smoking, and 83 % have tried without being able to do so, even though relatives or health professionals have advised them to quit and it has led to health problems. When asking active smokers which cigarette they would most hate to give up, they answered the last of the night (38,3 %), followed by the one accompanying a drink (23,4 %), and the first in the morning (19,1 %), as shown in Table 1.

Table 1

Substance-consuming students from two schools (Pereira, 2019).

	N	%
Type of substance used		
Cigarette	20	42,6
Vape pen	14	29,8
Cigarette, electronic cigarette, vape pen	5	10,6
Marijuana	3	6,4
Cigarette, vape pen	3	6,4
Marijuana and basuco (cocaine paste)	1	2,1
Cigarette, marijuana	1	2,1
How long ago did you start smoking?		
Less than a year	10	21,3
One year	2	4,3
More than one year	16	34
3-5 years	7	14,9
More than five years	9	19,1
More than ten years	3	6,4
How do you smoke cigarettes?		
Keeping the smoke in the mouth	25	53,2
Inhaling the smoke	22	46,8
How many cigarettes do you smoke per day?		
Ten or fewer cigarettes	44	93,6
11-20 cigarettes	2	4,3
31 or more cigarettes	1	2,1
How soon do you smoke after waking up?		

More than one hour	22	46,8
31 minutes-1 hour	4	8,5
6-10 minutes	6	12,8
Less than 5 minutes	15	31,9
The cigarette I would hate to give up the most		
The one before an exam	4	8,5
The one after lunch	5	10,6
The first in the morning	9	19,1
The one accompanying a drink	11	23,4
The last of the night	18	38,3
Would you like to quit smoking?		
Yes	37	78,7
No	10	21,3
Have you tried to quit smoking?		
Yes	39	83
No	8	17

Source: Own elaboration.

When performing the Spearman correlation analysis between the variables of the C4, there was no significantly high correlation between any of the questions. We found a moderate correlation between how they smoke cigarettes and gender ($r = 0,487$; $p = 0,001$), indicating that male students are more likely to inhale the smoke deeply, and an inversely low correlation with the school ($r = -$

0,321; p = 0,028). Urban school students are more likely to inhale the smoke than rural school students, who keep it in their mouths.

From the results obtained, we established the level of risk of nicotine dependence among schoolchildren who have smoked at some point in their lives: 2,1 % have moderate risk, 91,5 % high risk, and the remaining 6,4 % are dependent on nicotine. There were no significant differences between schools, genders, school grades, or the people they live with (p > 0,05).

Social skills

When determining the dimensions of the study population's social skills, we noted that they were low: 33,6 % in self-expressing in social situations; 35,3 % in defending consumer rights; 25,8 % in expressing anger or disagreement; 30,5 % in saying no and cutting off interactions; 30 % in requesting something from the opposite sex, and 28,9 % in initiating positive interactions with the opposite sex. In analyzing each social skill dimension concerning gender, we found statistically significant differences (p < 0,001) in self-expressing, showing that of the participants with low self-expressing, 21,6 % were women. Of those with a low level of defending consumer rights, 19,5 % live only with their mother (p = 0,023). Of those with a low level of saying no, 11,6 % are in the ninth or tenth grade (p = 0,018). No statistically significant differences were found in requesting something, initiating interaction, or expressing anger regarding sociodemographic variables, as shown in Table 2.

Table 2

Comparison between social skills dimensions and sociodemographic variables.

		Woman	Men	Other	*P*-value
Self-expressing in social situations vs. Gender	Low level	21,6 %	11,1 %	0,0 %	0,011
	Medium level	22,1 %	24,7 %	0,5 %	
	High level	6,3 %	13,7 %	0,0 %	
		Ninth	**Tenth**	**Eleventh**	***P*-value**
Saying no vs. Grade	Low level	11,6 %	11,6 %	7,4 %	0,018
	Medium level	10,0 %	18,9 %	18,4 %	
	High level	9,5 %	4,2 %	8,4 %	
		Both parents	**Mother**	**Dad or other relatives**	***P*-value**
Defending consumer rights vs. People they live with	Low level	13,7 %	19,5 %	2,1 %	0,023
	Medium level	29,5 %	17,4 %	7,4 %	
	High level	3,2 %	5,3 %	2,1 %	

Source: Own elaboration.

When performing the Pearson correlation analysis on the social skill dimensions, we found that self-expressing has a moderate positive relationship with the saying no dimension ($r = 0,489$; $p < 0,001$), followed by requesting something ($r = 0,454$; $p < 0,001$) and initiating interactions ($r = 0,364$; $p < 0,001$). This result indicates that the higher the student's social skill of self-expressing, the higher the other skills mentioned, as presented in Table 3.

Table 3

Correlational analysis between the social skill dimensions.

	Self-expressing	**Defending consumer rights**	**Expressing anger**	**Saying no**	**Requesting something**
Self-expressing	1	-0,022	0,359**	0,489**	0,454**
Defending consumer rights	-0,022	1	-0,015	-0,017	-0,128
Expressing anger	0,359**	-0,015	1	0,391**	0,259**
Saying no	0,489**	-0,017	0,391**	1	0,454**
Requesting something	0,454**	-0,128	0,259**	0,454**	1
Initiating interaction	0,364**	0,065	0,220**	0,370**	0,208**

Correlation is significant (p<0.01). *Correlation is significant (p<0.05).

Note: prepared by the authors using the spss statistics package.

Source: Own elaboration.

In the general scale of social skills, we identified that 23,7 % of the 190 participants exhibited a high level, 25,8 % a low level, and the rest a medium level, with statistically significant differences between social skills and gender (p = 0,021). We noted a higher level of social skills in the male gender (14,7 %) and, of the percentage who had a low level of skills, 17,9 % were women, without influencing the grade, age, the people they live with, or school (p > 0,005).

In the Spearman correlational analysis between the global score of social skills and their relevant components, we identified a good correlation between self-expressing (r = 0,642; p <

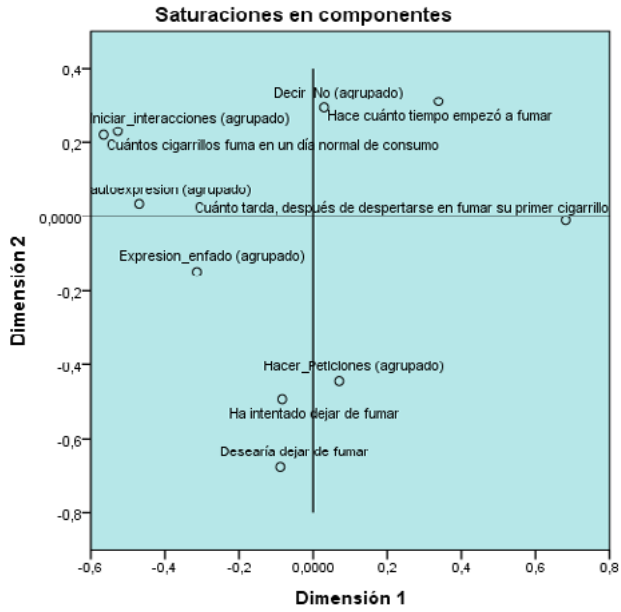
0,001) and saying no (r = 0,619; p < 0,001); a moderate correlation with expressing anger (r = 0,448; p < 0,001), requesting something (r = 0,493; p < 0,001), and initiating interactions (r = 0,529; p < 0,001); and a low correlation with gender (r = 0,224; p < 0,001).

Finally, after the bivariate correlation analysis within the group of the social skill dimensions and the risk variables for nicotine addiction, the optimal scaling was performed to calculate the canonical variables and check whether there is some significant correlation between the two dimensions and whether social skills affect the risk of nicotine consumption and the grade of the study population. The adjustment between the two sets of variables is 1,603, suggesting that the loss of information is 0,397, where the first dimension contributes 82,1 % and the second dimension 78,2 %.

The variable that contributes the most to the study in the first dimension is saying no (49,9 %), followed by initiating interactions (45,6 %). Concerning the risk of nicotine dependence, the variable that contributes the most is how soon they smoke their first cigarette after waking up (46 %). In the second dimension, the variable that contributes the most is requesting something (80,5 %), followed by saying no (78,3 %), as shown in Figure 1.

Figure 1

Main components of social skills vs. risk of nicotine addiction.



Source: Own elaboration.

Below are the resulting canonical equations for each study pair and their relevant adjustment:

Social skills vs. Nicotine consumption

$$U_{11} = 0{,}449X_{1i} + 0{,}082X_{2i} + 0{,}499X_{3i} + 0{,}026X_{4i} + 0{,}46X_{5i} \quad (1)$$

$$V_{11} = 0{,}244Y_{1j} + 0{,}46Y_{2k} + 0{,}028Y_{3l} + 0{,}029Y_{4m} + 0{,}025Y_{5n} \quad (2)$$

Where:

X: Transformed variables that make up the components of the social skills scale. X1: self-expressing; X2: expressing anger; X3: saying no; X4: requesting something; X5: initiating interactions. i: the severity scale (low, medium, or high).

Y: Transformed variables that make up the risk of nicotine addiction. Y1: How long ago did you start smoking? Y2: How many cigarettes do you smoke on a typical day? Y3: How soon do you smoke the first cigarette after waking up? Y4: Would you like to quit smoking? Y5: Have you tried to quit smoking? j, k, l, m, n: the rating scale for each question in the C4 (see Table 1).

Discussion

About the research problem question raised, whose purpose was to identify the relationships between tobacco use and the social skills of high school students from two public schools, one rural and one urban, in Pereira, Risaralda, we observed that 24,7 % of the participants had been smokers at some point in their lives and 4,7 % currently smoke. Meanwhile, the figures provided by the 2016 national study on psychoactive substance use show consumption in 24,1 % of the students surveyed, who claimed having used tobacco at some point in their lives with a prevalence of 8,1 % for the last month (Observatorio de Drogas de Colombia et al., 2016). These data are consistent with the results presented in this research, from which we deduce the importance of devising strategies to decrease consumption, aligned with the goal of the Ten-Year Public Health Plan in its

Non-communicable Diseases dimension of reducing the figures of smoking or otherwise increasing the age of onset over 12 years of age (Ministerio de Salud y Protección Social, 2012).

Another significant contribution of the present research is the analysis of the risk of nicotine dependence. We inferred that 6,4 % of the study population was classified within this category, which requires that different agents, both public and private, actively participate in formulating action plans to counteract this problem. It should be considered that the responsibility for a region's economic development falls on the youth and, if this population continues to form these habits, they will unavoidably trigger high-cost diseases for a bankrupt health system like the Colombian one.

Another relevant finding related to measuring the feeling of quitting smoking is that 6,4 % of the participants reported anger, irritability, impatience, stress, and anxiety. This result is worrisome considering that the epidemiological newsletter on attempted suicide delivered by the Risaralda Governor's Office in September 2017 reported 409 cases of attempted suicide, of which 67,2 % (275 cases) were women and 32,8 % men (134 cases). We construed that the behavior of suicide in Risaralda positions it in fifth place nationally, with an increasing tendency. It affects mainly minors and women, with significant relapse rates (Ceballos et al., 2017).

As mentioned above, various studies have shown a relationship between tobacco use and social skills (Epstein et al., 2007; Felicissimo et al., 2013; Morales et al., 2011; Rondina et al., 2015). Social skills can be understood as either risk or protective factors, particularly for the onset of tobacco and other substance use. Two social skills can be critical in the risk of use: on the one hand, initiating interactions that would allow establishing social relationships in multiple contexts, not only in risky ones, and on the other, saying no, which would enable the adolescent to turn down

a cigarette under peer pressure. This study shows that these two skills are best related to the risk of nicotine addiction, along with requesting something.

Conclusions

The researchers' objectives revealed tobacco use among the young population of Risaralda, showing data and facts that are closely related to those presented in other national studies. This alarming situation proves the need to develop action plans and public health strategies addressed to a population in need of quality care and support, thus reducing non-communicable diseases in the region.

Research that includes a young population becomes a reflection of a region's future behavior, shedding light on the potential development of physical and mental diseases in the future. With a more holistic view, they allow predicting how there may not be a sufficiently productive workforce in the long term to promote the region's economic and social development.

According to the WHO's data, tobacco use kills more than 7 million people each year around the world. Nearly 80 % of the more than one billion smokers on the planet live in low- and middle-income countries, where the burden of tobacco-related morbidity and mortality is heavy. Tobacco users who die prematurely deprive their families of income, increase healthcare costs and hinder economic development (OMS, 2019). Therefore, it is a priority to form partnerships between different public health agents to promote high-impact strategies that provide social value to the population and generate indicators associated with this problem.

The WHO makes it clear that the burden of disease attributable to smoking causes 26,460 deaths a year and the healthcare system invests 4,7 trillion Colombian pesos annually to care for people with diseases caused by smoking or exposure to tobacco (Valderrama & Sandoval, 2017). These figures support the prevailing need to adopt the researchers' suggestions.

Considering that adolescents can be susceptible to social pressure, particularly peer pressure, incorporating social skills training programs in schools could become a protective factor against the risk of consumption. If smokers are found in the reference groups, it can be easier for adolescents to start using tobacco and, depending on the group's practices, continue to smoke regularly; a social skills intervention can be a promising strategy to promote healthy lifestyles.

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The present study was carried out by a multidisciplinary team that spent a year joining forces to achieve its objectives. Today, this scientific article has materialized to provide accurate information on a current social phenomenon and help develop intervention proposals that impact and minimize smoking rates.

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Conflicts of interest

The authors declare no conflict of interest.

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2 CHAPTER TWO

Lesbian visibility: between control and family silence

Visibilidad lésbica: entre controles y silencios familiares

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Abstract

Sexual diversities have been the subject of great and vast developments in the social sciences, however, one of the contributions of the research from which this article derives is in understanding lesbian experience around their struggles, contradictions, and exclusions, from a biographical-narrative perspective. To carry it out, in-depth semi-structured interviews were carried out, which allowed us to identify three categories that correspond to 1. the invisibility and rejection by families, 2. the controls imposed by the beliefs of compulsory heterosexuality, and finally 3. the discourses of violence and exclusion. The results showed that the violence to which these women are exposed constitutes an obstacle in the process of recognizing themselves as lesbians, opting for different paths such as keeping their sexual orientation secret even when this may be contrary to their well-being and emotional tranquility.

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Keywords: sexual diversity, heteronormativity, family, violence, gender.

Resumen

Las diversidades sexuales han sido tema de grandes y vastos desarrollos en las ciencias sociales, sin embargo, uno de los aportes de la investigación de la cual deriva este artículo, está en comprender la experiencia de mujeres lesbianas alrededor de las luchas, contradicciones y exclusiones, desde una perspectiva biográfico – narrativa. Para su realización, se hicieron entrevistas semi-estructuradas a profundidad que permitieron identificar tres categorías que corresponden a: 1. la invisibilización y el rechazo por parte de las familias, 2. los controles ejercidos desde las creencias de la heterosexualidad obligatoria y, finalmente, 3. los discursos de violencia y exclusión. Los resultados mostraron que, las violencias a las que se ven expuestas estas mujeres, constituyen un obstáculo en el proceso de reconocerse como lesbianas, optando por diferentes caminos como mantener en secreto su orientación sexual aun cuando esto pueda contrariar su bienestar y tranquilidad emocional.

Palabras Clave: diversidad sexual, heteronormatividad, familia, violencias, género.

Introduction

Throughout modern history, women have experienced the hierarchies of power that fall on them and have lived the marginality that comes with loving people of the same sex and disregarding the mandates of compulsory heterosexuality, that is, being a lesbian is a direct threat to what it means to be a woman in Latin American culture (Bolivar and Pacheco, 2014). This represents a latent scenario of silence and concealment that manages to reflect on a small scale what happens with the social construction of the lesbian category, which denotes a

different experience from the one that heterosexual women and homosexual men go through.

In view of this, some authors (Esguerra, 2002; Yang and Iñiguez-Rueda 2020) mention that the definition of the lesbian category has not been a concern throughout the studies carried out in the 19th century, which is largely due to the hegemony of the masculine that once again contributes to the invisibility of this female group; thus, the imperceptibility of lesbian is historical and is a product of the lack of knowledge that has always prevailed about female sexuality. Evidently, this situation is encouraged by a social, political, and patriarchal system that has privileged the masculine, giving order and control to the world based on this imaginary; consequently, women and lesbians appear here as subsidiaries of men (Guillaumin, 2005).

This is affirmed after tracing the visibility of homoerotic practices from the Greeks to the discourses of the Germans Ulrichs, Kertbeny, and Hirschfeld, who constructed the category of the word homosexual and, in turn, defined heterosexuality, but did not incorporate the existence of lesbianism (Zubiaur, 2007). Thus, the concepts of lesbianism and homosexuality are determined by the configurations imposed by compulsory heterosexuality. Rich (1999) and Wittig (2006) point out that the characteristics of heterosexuality function as a matrix that orders life and thought; it is considered a cultural mandate that dictates a single way of being and being in the world.

Likewise, Rich (1999) reiterates that heterosexuality is a political system in which the obligatory nature of directing desire and orienting sexually affective practices towards the opposite sex support the social order and the deepest structures that sustain current societies. Therefore, a number of relations of domination and violence towards women who are in situations of male subordination continue to be visualized, showing that collectively, women still lack power, no matter to whom their desires and affections are directed (Rich, 1999 and Martín, 2006).

Similarly, Wittig (2006), agrees in stating that this heterosexual thinking produces social relations of domination and permeates the entire understanding of social reality, giving rise to totalizing interpretations in which lesbians manage to escape the usual relationship of power and control between men and women.

However, despite the constant marginalization that this collective has experienced, sexual experiences and love between women have always existed. Esguerra (2002) states that lesbians first appear in literature with the poems of Sappho, passing through the pen of Sor Juana Inés de la Cruz, Radclife Hall, and Virginia Woolf, among many others. That is, they begin to come to life from literature, a tool through which the expression of the affections of homoeroticism between women began, this was the only way out in which they could evade the censorship of society.

Hence, a history of more than two millennia of invisibility is identified, which escaped through the interstices of literary fiction and, as long as they remained sheltered there, would not have a major impact on the heteronormative order (Sequeira 2021). In this regard, Hinojosa (2001) states that in the face of the themes of love between women, physical and sexual attraction, a "confessional culture was installed, whose tacit pact was that, if things were handled "under the table", without directly confronting the dominant norms, homosexuality could happen, as an inevitable and socially tolerated fact" (Hinojosa, 2001, p. 178).

The starting point is then a construction in which the identity of lesbians is perceived as more fragile than that of gay men, and it is precisely for this reason that it is often less convenient for them to bind themselves to a single sexual orientation. Therefore, it is observed that when investigating the relationships that women have, they have more bisexual experiences, even Gimeno (2002) found that it was common for women over 35 and 40 years of age to have had primary relationships with men while having female lovers. In regard to

this, Osborne (2008) points out that bisexuality could be a way of facing the consequences of defining themselves as lesbians and escaping from a society that excludes and punishes them physically and psychologically by considering it socially as an identity conflict (Ballester, et. al. 2020). This situation is described in the words of Gimeno (2002) when she pointed out the following: "our discrimination (being lesbians) has more to do with gender than with sexual orientation" (p. 45).

However, by the twentieth century, even much earlier, they were occupying the streets. This happened hand in hand with the feminist movements and, in the second half of the same century, with homosexual liberation. Even so, this path happened in the midst of a feminist movement that "had to assure the world that they were NOT lesbians" (Hinojosa, 2001, p.182) and of a gay movement that concentrated, for 50 years, on contributing to the struggles for the vindication of homosexuality, overshadowing the participation of trans women and lesbians.

One of the aspects that contributed to these vindicatory processes was the contribution of several scientists who, in the second half of the last century, carried out large-scale research that allowed them to affirm a condition of sexual diversity that unfolds in a hetero-homosexual continuum in which all human beings are placed at some point. Alfred Kinsey in the 1950s, for example, interviewed 5,300 male and 5,940 female subjects proposing the existence of women and men in a hetero-homosexual continuum (Kinsey, Pomeroy, and Martin, 1948). In this research, they found that 4% of those interviewed had been exclusively homosexual from puberty onwards, 10% were predominantly homosexual for 3 years between 16 and 55 years of age and 37% had at least one homosexual activity directed at orgasms after puberty; with respect to women, homosexuality was present in only 50% in relation to that of men. Later in the 80's with Helí Alzate (1987), this line is continued by presenting a perspective of sexual diversity that is not categorical and radical in a single possibility, thus remaining in the line of

the continuum, raised decades ago; this author states that homosexuality accounts for "a sexual desire that is directed preferentially towards individuals of the same sex ... but not fish, has a heterotypic sexual behavior" (Alzate, 1987, p. 123).

All these contributions, constitute today the provocation for great discussions that take greater prominence in the debate on sexual diversities, an example of this is the approach of Garcia (2017), who shows that: "the theory of the sexual continuum proposes to understand sexuality as a complex variety of sexual identities, corporealities and ways of living sexuality that exceed the complexity of the dichotomous male-female thinking" (p. 261). Thus, it is clear that both categories are constructed, so that the dualistic approach of sex/gender as nature/culture is reductive and simplistic, and serves to keep free of questioning ideas about sex, which thanks to their consideration as "natural", seem essential, necessary and ahistorical, for example, the dichotomous male-female binarism and normative heterosexuality (Butler, & Soley-Beltrán, 2006).

Thanks to these contributions, the struggles of the lesbian movement and the theoretical thinking that underpinned feminism determined that women's experiences were and are differentiated according to conditions of race, social class, and sexual orientation, among many other categories that generate oppression on people (Inaba & Miguel 2021). Specifically, for women who love other women, it became necessary to question the heterosexual ideas and practices that were imposed as a natural and universal order, for which all women had to be at the mercy and those who did not were covered by an imperceptible layer (Llamas, 1998).

From this perspective, the purpose of this research is to understand the experiences, struggles, and contradictions experienced by homosexual women within their families. As specific elements of deployment, it is proposed to deepen three emerging categories in its results: invisibility, control by sexuality, and the discourses of violence and exclusion. These

become a point of reference for the understanding of the struggles for vindication that remain to be developed on the part of sexual diversity groups and movements, the training processes that are necessary at the micro and meso-systems level, and the responsibility that also corresponds to educational institutions in this challenge.

Materials and Method

The research was developed from a qualitative methodology with a narrative biographical design that made it possible to know the stories and interpretations of the experiences of homosexuality of six women; with this design, it was possible to enter into the understanding of the particular meanings of their own stories, in a singular and particular look as it collects the subjectivity of the people who narrate their lives, which is not a reference of generalization (Landín & Sánchez, 2019).

The narrative biographical perspective favored recognizing different nuances in the classification of lesbianism; such as the case of women who have homoerotic and affective relationships with women or those self-described as “Tomboy”[3]. Each experience represents a key piece to analyze the strict gender norms that fall on women's bodies and lives, mandates that sometimes prevent them from loving and being coherent with their feelings. In this sense, the method allowed a different way of building knowledge, since the researcher becomes merely the connection between the field, the research, and the community to ensure that these voices are heard (Moriña, 2017).

[3] In the words of the participant, this adjective refers to "girls who look like boys [...] there are some who act like boys, there are others who are versatile, they act like a girl and a boy, there are others who are complete girls but physically look like boys" (Daniela, personal communication, November 20, 2017).

Participants: The following table shows the socio-demographic description of the six women who participated in the research, nominated with pseudonyms to safeguard their anonymity.

Table 1.

Participant	**Age (years)**	**Sexual Orientation**	**Disclosure to family members**	**Marital status**
Marcela	21	Lesbian	Yes	Single
Daniela	19	Lesbian	Yes	Couple (woman)
Andrea	18	Lesbian	No	Couple (woman)
Ana	23	Bisexual	Yes	Single
Cristal	23	Bisexual	No	Couple (woman)
Valentina	21	Lesbian	Yes	Couple (woman)

Source: own elaboration (2021)

The participation of the young women was voluntary and they were fully informed about all the details of the research scope, the inclusion criteria were homo or bisexual sexual orientation and the decision to participate in the study on a voluntary basis.

Instruments: The collection of information was developed through semi-structured in-depth interviews, with an instrument of 32 questions in the following categories: 1. Meaning of the experience of sexual diversity. These questions were considered related to Emotional, bodily experience, and couple relationships. 2. Family dynamics: interactions, control, authority, limits, 3. Exclusions and discrimination: displayed in the daily interaction environments of young women.

The instrument was adjusted in a pilot exercise that allowed for feedback, according to the research categories set out in the research objectives.

Procedure: The women participating in the research were openly recruited from the entire university population and informed in detail about the objectives and methodology of the research. Likewise, they were also provided with details about the confidential handling of the information and the ethical framework for the development of the research under the regulatory framework for Colombia: Law 1090 of 2006 (deontological and bioethical manual of psychology) and Law 1581 of 2012 (protection of personal data). Therefore, the informed consent was socialized and signed by all parties involved, then the ethics committee of the sponsoring universities approved it.

The in-depth interviews were conducted according to the preference of the participants, in some cases at the university itself, and in others at the young women's places of residence. These interviews were carried out in two weekly sessions in which it was possible to go into detail about the questions posed in the instrument.

Processing and analysis: This section was carried out based on the recognition of women's voices. It was an ethical commitment to ensure that the categorical analyses did not stray from the women's perspectives, as Schewe and Vain (2021) propose. Thus, the interpretative process of the biographical narratives was carried out in two logics of analysis: a singular one that recognized the particularities of each story, supported by a genogram and contextual description of each case study type participant. In a second moment, the transversal analysis of the material was developed, oriented to the understanding of the plots of meaning according to the research categories. Thus, the analyses of each one were interpretatively rearticulated, recreating the characteristics of the subjectivities emerging in these accounts.

With the previously mentioned material, the purification of the units of meaning was carried out, according to a categorical matrix, using the technical and technological tool of Atlas ti, in order to support the organization, analysis, and interpretation of information. In this way, it was possible to differentiate, understand and relate the information obtained, in a wide variety of nuances. Consequently, it was possible to make the most of the information and to present the results.

Results and Discussion

The research from which the article is derived, is intended to enter into the singular experience of six lesbians and, from there, understand their experiences, struggles, and contradictions from invisibility in the family. It is shown that, despite being the system that is socially called to watch over the emotional well-being of the members, this group does not always fulfill its functions. Therefore, when speaking of invisibility in the family, reference is made to all those situations and interactions in which a clear rejection is manifested due to the contradiction that it implies to the system of beliefs as they do not identify with a gender and sexual orientation according to the one expected by society.

Another aspect that unfolds in the findings is the experience of sexuality under the surveillance and control exercised by their family through the economy, in order to regulate the movements outside the home. This situation is manifested in the fact that parents restrict the money they give their daughters for their personal expenses, even in some cases denying it completely. It is also the opportunity to mention that although it is complicated to talk about sex for the parents of the heterosexual population, there is even more reserve when it is necessary to talk about sexual practices in homosexuality. Therefore, the conversations in relation to the sexual and reproductive health of lesbians are almost non-existent . The last

category presents the discourses of violence and exclusion, generated by public, and private institutions, health services and public spaces.

These results are shown below, according to the three categories that emerged in the biographical analyses. Each of them was nominated in the light of some of the most representative phrases of the participants.

Invisibility in the family: *"Everything in my life has to do with sexual orientation!"*

To begin with, it is considered relevant to point out that, for the women interviewed, the experience of declaring themselves lesbians has been difficult because of the barriers they encounter in their environment, it is observed in their stories how surprising it is for them to witness the levels of rejection that other people feel because of their sexual orientation. For this reason, the first stories with which this discussion opens refer to the difficulties that they repeatedly expressed.

> "...one has the bad fortune of finding a circle of friends who do not support him/her and in a couple, it is also going badly, so who do I turn to, if they do not accept me at home either?" (Interview with Marcela, February 2020).

> "at home, my brothers told me that I would see who I wanted to get involved with, that it was my problem..., but obviously I know that they don't like it, especially not my father" (Interview with Andrea, February 2020).

Sometimes, the burden of having to act differently from who they are becomes such a strong experience that they even prefer to run away from their lives, abandon their families to avoid social stigma, and start from scratch in places where they feel they no longer have to pretend what they don't want to be. In this sense, for some of the participants, the best option is to give

up their lives. In view of this, Pantoja, Martínez, Jaramillo, and Restrepo (2020), state that:

> Both stigma and prejudice become informal mechanisms of social control of gender constructions and sexual orientations that deviate from the heteronormative; in this sense, they become predisposed to acts of discrimination, exclusion, and violence, which we refer to here as the continuum of homophobia; they also have an impact on the invisibility of families and their consequent social isolation (p. 4).

Therefore, the act of communicating to their families about their sexual orientation, far from representing what would seem to represent the cessation of the anguish of remaining hidden, means exposing themselves to continued violence and discrimination by their families. Such a conversation does not guarantee recognition and peace of mind, but on the contrary, exacerbates the emotions of sadness and guilt associated basically with having to confront themselves for being different from what their families and society expect.

> "The first question my dad asked me was: are you a lesbian? and I said no! and he said: I don't understand, if you like a woman you are a lesbian, then he told me that was not right" (Interview with Valentina, May 2020).

In these interactions, fears begin to materialize after the revelation of sexual diversity due to the attitudes of rejection they receive from their environment and especially due to the lack of support they receive from their families. This happens because there is an implicit belief that disapproval leads to punishment and therefore to behavioral change, that is, it seems that they believe that through these attitudes they can achieve a change in the sexual orientation of their daughters (Butler, 2004). Therefore, while they are going through the process of recognizing themselves as sexually diverse, society begins to demand that they behave in a "straight" or

"not so lesbian" manner in order to classify them in the categories that are based on the myths of heteronormativity and thus reduce the impact of accepting them (Butler, 2002).

In this sense, society's solution has always been aimed at ensuring that sexually diverse people are the ones to make the changes that ensure adaptation without generating major traumas. However, the work should not consist in modifying the members of the LGBT community but in updating the understanding related to the subject. As pointed out by Castellanos (2011) it is possible that at the beginning sexual diversity may be rejected even by the person himself and the surrounding context, but if after a while, the person has accepted his identity and this continues to be a social problem, it is not the person who must change but his environment.

Therefore, social pressure and society's eagerness to get them to adapt and mimic heteronormative standards begin to permeate their ways of assuming themselves as diverse. In the case of Ana, it is observed that since she began to realize that she was a lesbian, she devised a plan that consisted of never exposing or confronting her family about her feelings so as not to violate cultural teachings, even if this meant keeping her way of loving as a secret:

> "Obviously my parents were going to find out and I didn't want them to find out, I preferred to die. When I was little, I thought that if someday I was going to be with a woman I would think about leaving the country or the city far away from my family, I saw my future far away from my family so I could be what I wanted, my plan was to never tell them" (Interview with Ana, May 2020).

Apparently, it is this experience that makes them be and live in ways different from the realities of heterosexual people. However, the patriarchal scenario in which they are immersed as a society begins to threaten the freedom to choose a partner even in heterosexual women, i.e. This means that control mechanisms not only work for sexually diverse women but also for

families with heterosexual daughters who must also confront the patriarchal structures and generalized teachings that culturally guarantee peace and tranquility at home. Therefore, they should not alter the heterosexual thinking that grants a totalizing vision of their role and function in the family system (Olivera, 2015; Riensenfeld, 2006; Witting, 2006).

> "That was the other issue, because of my dad I couldn't go out with anyone, I couldn't do anything. Everything was about going from the university back home and to take care of my brother" (Interview Valentina, March 2020).

In regard to the above mentioned it is important to highlight that even when they prefer to risk their own peace of mind in order to comply with the social mandate that precedes them in their role as exemplary women and caregivers, in the moments when they talk about their genuine interactions with their classmates in the university context, there are expressions of pleasure and security, expressions of pleasure and security are evidenced. This calls into question those revelations in which they assure that the best thing to do is to remain hidden from their relatives, which generates a permanent contrast in their lives. It seems that they live two alternate realities, a constant incongruence in which they cannot live their true feelings (Auad, 2021).

Likewise, it is essential to point out that even though for many of them it may seem unnecessary to have the conversation with their relatives, it is evident that they are living in a way that is incongruent with what they want and want to be. As Quesada (2004) says "a rupture between the individual self and the social self, the object of demands and expectations, immersed in power relations" (p. 142). In this sense, the resource they use to confront their environment is not healthy, because it is not simply a matter of hiding information but of the way they feel in relation to it. So, if they hypothetically had the possibility of telling their sexual

orientation without having to live with the consequences of their revelation, would they still be hidden? This, in some ways, may shed light on how difficult it can be to constantly try to convince oneself that things are okay, even when they are not. Authors such as White and Epston (1993) argue that even the decision to remain silent is a clear and forceful way of communicating, i.e., that the innocent omission of information is revealing clues as to how they feel.

In addition, there are other reasons why secrets are kept and it is because of the social places of economic dependence that have historically locked women in the private sphere, which has allowed them to come out little by little, but under strict control (Sancho, 2005). Although these lines reflect the experience of young women students, it is clear that the concealment of sexual orientation in their families guarantees survival (Colombia Diversa, 2005). This is the case of Andrea, an 18-year-old student who, when asked about the power that her father has in her decisions, responds:

> "I depend completely on him (dad) that is, to go out he is the one who gives me money, if I go to the university he gives me the transportation, he gives me food, well, practically everything, and in my house, he is very macho, very controlling, if I went out to the corner he would not let me, if I talked to friends, he would not let me... if he puts the money he does whatever he wants, and he says that the person who does not follow his rules leaves, that is, he practically would throw me out" (Interview Andrea, November 2020).

These words identify male power and the need for women to build autonomy. In the words of Lagarde (1999) "Women need sexual independence but also economic independence and wealth" (p. 108). Therefore, it is said that these two elements are not isolated and are interdependent.

On the other hand, Andrea's testimony recognizes the strength of the idea of the traditional family and gender roles in the life experiences of the participants. However, it is necessary to emphasize that although all the families described by the participants refer to this patriarchal model, other ways of living together in the system are also observed that involve broad support networks, care represented by aunts, grandmothers, cousins that do not necessarily pass through the criteria of consanguinity and co-residency (Ferro, 1991; Lagarde, 1999; 2008).

Thus, it can be evidenced that the historical invisibility experienced by lesbians is based on family dynamics that have ignored women's power and decision-making over their own lives. The following section characterizes the place of families (mainly mothers and fathers) in the students' experiences of sexual diversity. Despite not having the versions of their families, they share a representation of the family associated with control and order regarding sexuality.

Sexuality and control: "My mom always told me, you'd better become a whore than a lesbian; but it was the other way around".

The narrative with which this category opens belongs to Ana, and in these short words, the enormous transgression of being a lesbian in the XXI century is presented. Heterosexuality is so much privileged that it is imposed even leaving aside the mandate of monogamy and other restrictions imposed on women's sexuality through marriage (Rubin, 1989), including privileging the call to work as sex workers. After all, a patriarchal society ensures that a large group of women continue to engage in this. Thus, in the homophobic context, it is preferable for a woman to work selling her body than to decide to have a relationship with another woman. That is, prostitution is validated over any decision that involves a woman contradicting the heteronormative role she is obliged to fulfill.

In this story, the mother's voice plays the role of guardian of the deepest foundations of

the social order: patriarchy. In most of the interviews, the relationships of the participants with their family networks are complex and sometimes it can be observed that it is the same women who surround them who are in charge of calling their nieces, daughters, and granddaughters to order through physical and discursive control devices. On many occasions, under the belief that, by regulating them, they are doing them a favor, that is, that such domination has the objective of protecting them in their difference (Jiménez, Borrero and Nazario, 2011).

Hence, one of the most outstanding aspects of lesbian existence has to do with the extensive control exercised over their lives by family members. This surveillance is such that it reaches the point of restricting the economic support, mobility, study possibilities, and friendship and support networks of their daughters when it is suspected that they are attracted to people of the same sex or that they already have lesbian relationships (Eiven, Sardá and Villalba, 2007 and Pineda, 2013).

> "When my mother realized that it was worse (she lives in Aruba), she came to Colombia. When she found out, she told me she was going to take away my last name, she literally told me that if I didn't change she was going to come here, and if possible she would even take me out of the country; it was a constant fight" (Marcela interview, February 2020).

In this sense, Castellanos (2011) argues that lesbians have always been treated with indifference, and by escaping male domination, they are condemned to receive treatment that demonstrates male power through social stigmatization. In response, participant Marcela recalls that when she dared to tell her aunt and cousin that she was in a relationship with another woman, her life changed:

> "When they realized, they took away my cell phone, no one could visit me, I did not

> receive calls... they told me that I had to stop that, and then once I ran away from school and they told my grandmother and it was total chaos, that time was very hard because I practically lasted a year locked up (Marcela interview, February 2020).

These control strategies have been sustained from primitive to contemporary societies, in rigid prohibitions focused on the denial of their own sexuality, to the point of locking them up to prevent them from making decisions regarding themselves. This situation is exemplified in both Marcela's and Ana's stories:

> "My mother wouldn't let me go out with anyone, I couldn't stay at anyone's house, if I knocked on the door, where would she go? If she goes to the store, she doesn't delay me, she kept me locked up. I can't go to my grandmother's because she thinks I'm going to lock myself in the room to do something with her or something like that and for them, it's like disrespecting their house (Interview Ana, May 2020).

On women fall sophisticated surveillance and control devices exercised by men and some women who begin to present themselves under the name of representatives and perpetrators of a system that gradually manages to consolidate and naturalize patriarchal hegemony. A dynamic that guarantees dominance while invisibilizing women's decisions (Olea, 2018).

Another mechanism of control exercised over women consists of silence about sexuality: sex was not discussed in most of the participants' families and little information was received about relationships that had reproductive purposes, or that involved a man (Cruz, 2007). When Marcela was asked about sex education, she warns that:

> "In my house, everything was geared towards men: that you take care of a disease, of a pregnancy, that there are contraceptive methods, but everything was male-female and in school they also did that and they were always male-female" (Interview Marcela, February 2020).

Thus, most of the learning required by the families was aimed at reinforcing compulsory heterosexuality in their daughters (Del Mastro, 2019). To the point that Valentina's father told her:

> "I would have preferred a thousand times that you would have gotten pregnant than that you were with a woman" (Valentina interview, February 2020).

Presenting oneself to society as a lesbian appears as the most undesirable scenario, so much so that sex workers and mothers at an early age are preferred, as shown in the above narrative. All this in is a context where there is a growing awareness of the immense difficulties for women to assume a life project related to pregnancy at an early age (Limón, 2007). These teachings operate as controls and reiterations of the social place and functions of being a woman. Thus, the family prefers that their daughters procreate under precarious circumstances rather than witnessing them choose to love other women (Cuba, 2018 and Gómez-Sotelo; Gutiérrez-Malaver and Izzedin-Bouquet, 2012).

Discourses of violence and exclusion: *"they saw us with morbid curiosity and started to say horrible things to us".*

The construction of identity takes place in a permanent tension between the "should be" imposed by the heterosexual order, through culture and socialization, and between personal searches for fulfillment and personal meaning. These power mechanisms were not only evidenced in the family discourses of the participants but also in the role played by the Catholic Church; in Marcela's process, it is revealed that this important institution is in charge of perpetuating aggressions.

> "The few times I went, I had the misfortune of talking to a priest. And when I went to confession, he almost put me on my knees with pebbles and asked for forgiveness. And I told him that I have no reason to ask anyone for forgiveness and that this was not normal. And he gave me the longest sermon in the world. I got up and never went back to church" (Interview with Marcela, February 2020).

From this context of rupture and anguish, she chooses to love, the power to love differently, and in this process she is not interested in labels but, on the contrary, in resisting the violent discourses that make her sick and annul her possibilities of being close to her family (Maffia, 2006).

In addition to the aforementioned exclusionary discourses, there is another form of control in which male power is leveraged (Serrano, 2004). In the words of Rich (1999), this social order attempts to "stifle women's creativity" and "marginalize them from large areas of knowledge and the cultural achievements of society" (p. 174). In the following narrative, it can be glimpsed that, for some parents, restricting professional training becomes a strategy of subjugation.

> "My dad told me: it's either your studies or her. Clearly [he] knew where it was going to hurt because studying is the most important thing for me and I wouldn't give it up for absolutely nothing, he knew that ..." (Interview with Valentina, in February 2020).

Rich (1999) explains that there are ways of identifying male power that are obvious to identify, however, there are some that are buried in the discourses of domination that take special violence against lesbians. This situation can be seen in the different contexts in which these women live, as can be seen in the following testimony:

> "Once we were at a MÍO bus station and some old men looked at us lasciviously and

> started to say horrible things to us. I didn't agree with that and I told them to show more respect. I have never liked to go along with people who make those horrible obscene comments and nobody does anything" (Interview Andrea, November 2020).

Feeling attacked by the context and feeling alone in relation to the support they receive from the people around them, is also a disconcerting situation to which they must definitely get used to since society continues to maintain the myths and established orders in which any difference must be punished, almost as if implying that the blame falls on the shoulders of those who have decided to live their sexual diversity publicly.

Perhaps for these reasons, fears of family and social reactions are often paralyzing, they fear for their safety because they know they are targets of criticism to the point that invisibility is a strategy to lead a quiet life (Bourdieu, 2003). They try to go unnoticed by assuming a role that is alien to their personal experience but that responds to the dynamics of a context that is in charge of constantly executing them (Barrientos and Cárdenas, 2013).

Finally, it is considered important to close this discussion with a series of questions that try to make the reader reflect on these life experiences: how do lesbian women escape from this political system (masculinist society)? Are lesbians not traversed by the gender constructions that are culturally given to a woman's body? What makes the lesbian experience different that subtracts it from the political system? What relationship, based on the heterosexual regime, do women and lesbians share?

Conclusions

In the narratives of the young participants, experiences can be evidenced through the differentiated learning and responsibilities that society has taught and demands from women and men. These realities take shape from the narratives of lesbian students who still keep their

sexual orientation hidden from their families; also from the stories of physical and discursive control that families exert on the erotic and affective choice of their daughters, granddaughters, and nieces.

On the other hand, it also shows how institutions guarantee the heteronormative order when using discursive and practical strategies, they insist that lesbian women direct their desire towards men. Finally, the reflection integrates exclusionary discourses that show that the struggles for identity and the full recognition of each human being take place in the midst of a dispute over ideas of the world that even indicate whom to love and how to love. Therefore, lesbian visibility is a hotly debated issue and in view of this, the challenge of contributing to the construction of spaces in which these realities of life can be understood and recognized is recognized.

Additionally, it is necessary to continue with the development of research that investigates the experiences of lesbian women who are immersed in a culture that is still ordered by heteronormative principles, in order to continue making visible the needs and voices of those who are living their process of recognition in sexual diversity.

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3 CHAPTER THREE

New centralities in the city of Pereira, 1990-2019

Las nuevas centralidades en la ciudad de Pereira 1990-2019

Cesar Augusto Castaño Galvis [1]

Abstract

The objective of this article is to analyze the reconfiguration of the urban space of the city of Pereira because of a new form of management of the urban space that gave rise to new centralities. The methodology is supported by the analysis of public documents and photographs that record these transformations between 1990 and 2019. As a result, it is found that the urban management model of the city of Pereira, in the studied period, is associated, among others, with the implementation of Law 388 of 1997 and public-private partnerships that express a new way of organizing the territory. It is concluded that the new model of the urban management of the city, framed in the planning instruments that gave rise to new centralities, is due to the change in the world economic model based on neoliberal policies. What Harvey (1989) calls urban entrepreneurship, which turns the territory into a commercial.

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Keywords: urban management model, urban renewal, new centralities, neoliberalism, urban entrepreneurship.

Resumen

El objetivo de este artículo es analizar la reconfiguración del espacio urbano de la ciudad de Pereira, producto de una nueva forma de gestión del espacio urbano que dio origen a nuevas centralidades. La metodología se soporta en el análisis de documentos públicos y fotografías que registran estas transformaciones entre los años 1990 y 2019. Como resultado se encuentra que el modelo de gestión urbana de la ciudad de Pereira, en el periodo de estudio, es efecto, entre otros, de las alianzas público-privadas. Estas fueron contempladas y propiciadas por Ley 388 de 1997 que expresan una nueva forma de ordenar el territorio. Se concluye que el nuevo modelo de gestión urbana de la ciudad, enmarcado en los instrumentos de planificación que dieron origen a nuevas centralidades, obedece al cambio de política económica mundial basada en las políticas neoliberales. Lo que Harvey (1989) denomina empresarialismo urbano, que convierte el territorio en un producto comercial.

Palabras claves: Modelo de gestión urbano, renovación urbana, nuevas centralidades, Neoliberalismo, empresarialismo urbano

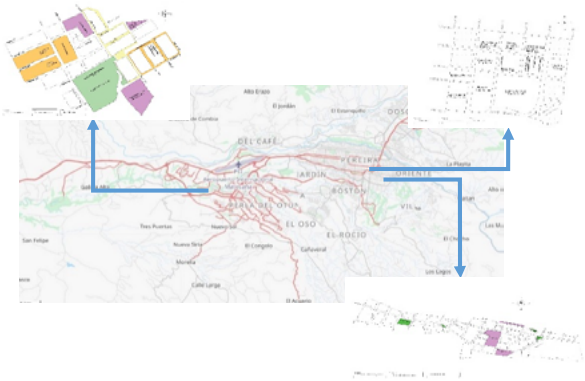
Introduction

The city of Pereira has experienced a series of transformations in the urban space since the 1990s, promoted by the city's administration in alliance with the private sector. The agreement searched to give the city a new productive dynamic and an image of a metropolis centered on commerce, according to the dominant free market economic proposals on a global scale. The transformations

began in the 1990s with the renovation of Bolivar Park, which became Bolivar Square. It occurred in 2001 with the urban renewal of the old market square, a sector known as La Galería, which was part of the traditional center of the city. The transformation of this last space impulses the consolidation of the neighboring sector of the Circunvalar into a new centrality. Subsequently, the Guadalupe Zapata Park is located in the Cuba neighborhood to the southwest. It was transformed to accommodate the substation of the Megabus transportation system, based on the Subcentro Cuba partial plan. With this fact, associated with an urban renewal at the service of the transportation system, a new centrality was created in the city (figure 1).

Figure 1

New centralities



Source: own elaboration

They are understood as an urban form characterized by the concentration of an offer of services that polarizes a more or less extended area of influence and competes directly with the traditional center

by attracting activities and flows that are restructured on a metropolitan scale (Beuf, 2011, p. 148). This phenomenon has been occurring since the 1990s, in almost all of Latin America and elsewhere in the world, as shown by the works of Pastene (2016), Vecslir (2011), Vega (2007), and Harvey (2005). All these expressions of the neoliberal model have impacted urban management in Colombia in recent decades. In the city of Pereira, their emergence makes it possible to evidence a new form of urban space management, as a product of the change of productive bet from the industrial city to the business city in accordance with the neoliberal model.

The objective of this article is to analyze the reconfiguration of the urban space of the city of Pereira through new centralities, as a product of this new model of urban space management. It focuses on examining the public-private alliances that made possible the transformations of the city through the implementation of Law 388 of 1997. To this goal, first, the methodology implemented is shown. Second, we describe how the city's urban space was managed before the 1990s. Third, the context of neoliberalism and the concept of urban entrepreneurialism proposed by Harvey (1989) are presented to explain the new form of urban space management. Finally, it is shown that the emergence of the new centralities in the city of Pereira is the product of the spatialization of this new model of urban management based on neoliberal postulates and urban entrepreneurialism.

1. Methodological notes

The research is framed in a historical hermeneutic paradigm. The method focuses on documentary analysis, in particular: a) documentary analysis of urban management from the territorial perspective, following Harvey's approach (1989); b) analysis of secondary sources (city research in graduate studies and local history) that accounts for the forms of territorialization of the city of Pereira; c) analysis of primary sources: city maps, photographic archives, and official sources: development plans and land use plans:

The selected time frame is located between 1990 and 2019, it includes the beginning of the change of productive commitment from an industrial city to a commercial city, until the completion of the city's infrastructure works that contributed to consolidate the new centralities. In the defined period, processes were presented such as the implementation of a new global free market economic model, the consolidation of the modernization of the Colombian State through the 1991 Constitution, the implementation of a new urban management model stipulated in Law 388 of 1997 and the transformations of the urban space through urban operations called partial plans.

To explain the forms of urban management that have transformed the space of the city of Pereira, the analytical-methodological perspective of David Harvey (1989) will be followed, which explains the implementation of a new urban management model called urban entrepreneurship. The author supports this model in three aspects: public-private alliances, the business activity of these alliances, and the policies of the place and not of the territory. This article focuses on examining the former.

2. The urban configuration of the city of Pereira, 1920-1990.

The city of Pereira was founded in 1863, with the name of Villa de Pereira, on what was once known as Cartago Viejo on the banks of the Otún River. In its beginnings and until 1914 the Villa de Pereira was characterized by agricultural production and the market fairs of the surplus of this production, which were held every 6 months in the central square, currently known as Plaza de Bolívar, for the transit of Caucanos and Antioqueños, turning Pereira into a crossroads and, therefore, a place of exchange (Uribe, 2002, p. 4). After this period, the city began a process of growth that consolidated Pereira as one of the most important cities in the region between 1950 and 1986 due to its industrial and commercial activity and its urban growth.

This process of urban growth of the city of Pereira is framed in two important periods for the configuration of the urban space. The first corresponds to the large city project undertaken by the elite of Pereira in the early 1930s, based on the coffee economy and alliances between the elite and the city's inhabitants to configure the urban space. The second refers to the process of industrialization of the city that was accentuated after 1950. In this process, the city's administration formed alliances with the inhabitants for the construction of housing and new urban sectors linked to the development and needs of the emerging industry.

2.1 The big city project and the coffee economy, 1920 – 1950.

The city of Pereira is part of the coffee-growing region of Colombia: Therefore, the coffee economy. By the year 1910, according to Álzate and Sandoval (2008) and Ospina (1974), this product had represented more than half of the value of the country's exports, reaching 70% and 80% of these exports in the 1920s, and was interrupted at the end of 1929 due to the world and national economic crisis. Despite this, this economy impulsed the development of Colombian industry, especially in Antioquia and Pereira.

In the case of Pereira, the first industries related to the processing of coffee beans were generated, such as coffee threshing machines, pulping machines, and agricultural inputs. Gradually other industries different from coffee production began to emerge, such as the Pereira glassworks, textiles, the Pereira tramway, and the Continental Brewery, among others, and with them the first concentrations of workers and the emergence of the first neighborhoods such as the Primero de Mayo.

In this context of the coffee economy and the emergence of the industry, the elite of Pereira, the owners of large extensions of land, the large coffee producers, and the owners of the industry

gathered in the Rialto Club, and then in 1925, they gave birth to the Sociedad de Mejoras Públicas (Public Improvement Society). This civic organization began to promote the project of making Pereira a great city, generating an alliance with the inhabitants of the city, a humble population of peasant origin that had arrived in these lands in search of better opportunities. To this end, the elite used the discourse of civility as a value of social cohesion (Correa, 2015), placed at the service of urban development, as occurred in several cities in the country, before centralized urban management systems were defined.

Under the great city project and the discourse of civism, a form of urban space management was generated in the city, characterized by the alliance of the elite with the city's inhabitants and the processes of self-construction, the latter allowing the construction of key infrastructure works such as the Matecaña Airport (1945-1947), the 30 de Agosto Avenue and the Olympic Village (1982), which - added to other factors of the city's development such as the telephone plant and the generation capacity of the power plants - made Pereira an attractive space for the production of capital and the settlement of new industries, as happened in the years of 1941 and 1941: The Libare 1931 and Belmonte in 1941, which were at the forefront of the time - made Pereira an attractive space for the production of capital and the settlement of new industries as it happened in the 1950s.

2.2 The process of industrialization and urban expansion, 1950-1990

The industrial growth and urban expansion experienced by the city of Pereira since the 1950s are framed in two global contexts that played an important role in the urban space management model. The first of these is related to the idea of development and progress, which appeared in the 1950s after Harry Truman's inaugural speech as president of the United States in 1945 and which quickly received the support of the United Nations, becoming the dominant discourse and the paradigm to

follow, especially among Third World countries that aspired to reach the levels of development of the First World (Escobar, 1999). Under the Marshall Plan, the United States government generated a series of programs to provide technical and economic aid to underdeveloped countries as part of its global projection strategy (Sanohuja, 1999), which sought to bring Third World countries closer to development and keep them away from the temptations of socialism. In Latin America, it was known between 1961 and 1970 as the Alliance for Progress, a product of this alliance arose in Pereira in 1963 in the Kennedy neighborhood, together with the migratory processes of the 60 and 70s,[2] reinforced the idea of strenuously seeking development and progress (Castaño, 2014).

The second context that frames the process of industrialization and urban expansion corresponds to the model of import substitution through national production of the Economic Commission for Latin America and the Caribbean (ECLAC). It sought to encourage the generation of local industries to produce the goods that were acquired through imports. At the same time, it generated the development of the local economy.

Under these two global contexts, the city of Pereira began a process of industrialization leveraged on the coffee economy and the arrival of foreign capital, partly because the city had achieved around the big city project in the 30s to provide the city with an infrastructure such as the Airport, the 30 de Agosto Avenue, the power plants, among others, which made the territory attractive in the 50s for the investment of foreign capital in the generation of industries as shown in Table 1.

[2] According to the IOM migration profile for Colombia (2010), in the 1960s and 1970s, a migratory process began for Colombians abroad, the United States, Venezuela, Ecuador and England, where between 4,000 and 10,000 women migrated. This process generated the entry of important remittances into the country, and the shipment of technology-based goods that became sites for that idea of development and progress.

Table 1

Industrialization with foreign investment.

Nombre	**Año**	**%Capital ext.**	**Origen**	**No. Empleados**
Tejido Paños Omnes	1950	21%	Francés, norteamericano y panameño	467
Industrias La Rosa	1950	100%	Suizo	700
Hilos Cadena	1952		la multinacional inglesa J. P Coats	817
Papeles Nacionales	1960		multinacional canadiense Kol. Inc.	600
Colpapel S. A	1962	50%	empresa norteamericana Kimberly Clak Corporation	400
Industrias Valher	1969	51%	multinacional norteamericana Sara Int.	400
T.P.L Transformadores	1970	42%	Westinghouse Electric Corporation	205
Industrias Nicole		80%	multinacional norteamericana Sara Int.	800
Inpal	1979	27%	capital ecuatoriano	38
Suzuki	1982	85%	capital japonés	311

Source: Industrialización con Inversión extranjera. (Herrera & otras, 1986)

This process of industrialization of the city represented an accelerated population growth, as described by Muñoz (1983), and as indicated by DANE data, in 1951 Pereira had a population of 115,342 inhabitants, of which 66% were located in the urban area. By 1985, it had 303,843

inhabitants, 82% of whom were located in the urban area. That is, in less than 30 years the population had tripled, as had the urban population.

Based on the above, the city of Pereira generated an urban space management model, which revolved around the needs arising from the emerging industry, that is, higher education 1961 with the Technological University of Pereira (UTP) and the National Learning Service (SENA) and the construction of new neighborhoods and housing in the city to house the inhabitants who came to the city attracted by the job offer.

The construction of housing and new neighborhoods in the city was generated from a form of alliance between the city administration (State) and the inhabitants. To urbanize the city, consisting of the delivery of plots of land with services through the Institute of Territorial Development accompanied by materials, technical support, and credit. The inhabitants built their homes and, in some cases, the infrastructure works such as streets, sidewalks, and sewerage. However, these programs did not meet the need for housing and the inhabitants took over other areas of the city with the complicity of the city administration, which then generated processes of legalization of the land, technical, and financial support for the consolidation of these areas. These practices were added to the industrial and population growth, and the city presented an important urban development since between 1950 and 1990 it incorporated into its urban areas large sectors such as Ciudadela Cuba in the 70s, Villasantana in the 80s, and the Industrial Park sector at the end of the 80s and beginning of the 90s, among other sectors.

2.3 Neoliberalism and the urban space management model of Pereira 1990-2019.

The transformation of the economic model in Colombia in the 1990s generated a new way of conceiving, managing, and intervening in urban space. This was a consequence of the

implementation of a series of neoliberal policies in urban planning as happened in many Western countries since the late 1970s (Theodore, Peck, & Neil, 2009).

The set of neoliberal measures known as the Washington Consensus included ten reforms concerning fiscal discipline, public spending priorities, tax reform, interest rates, exchange rates, trade policy, foreign direct investment, privatization, deregulation and, finally, property rights. This economic policy decalogue was based on three aspects: the role of the State in this new economic model, the advantages of economic globalization, and the distribution of wealth (Llistar, 2003). The first aspect is that the State should reduce its size and leading role, leaving the management of the economy and the provision of basic services in the hands of the private sector. The new role of the State would be limited to being an occasional regulator of market excesses and a guarantor of social stability.

The second aspect, which is related to the advantages of globalization, refers to the fact that the opening of economies would allow a higher level of exports and facilitate the arrival of new capital to the countries, as well as imports that would lower the cost of living. Its promoters hoped that companies would settle in the national territory, which would translate into a financial and production capitalization of the country, as well as a transfer of science and technology. However, in countries such as Colombia, the effect was that the incipient industrialization processes of intermediate cities such as Pereira, with industries such as textiles or the food production sector, were interrupted by massive imports of goods with zero or low tariffs.

The third aspect, regarding the distribution of wealth, suggests that the strengthening of the private sector, through the arrival of foreign capital, and the establishment of new companies, would generate a "wealth cascade" effect that would benefit the less favored classes (Llistar, 2003). In intermediate Colombian cities such as Pereira, there was no evidence of the arrival of capital that

would encourage the growth of the productive sector and generate employment. The effect was an outsourcing of the economy, in a context of flexibilization and in many cases labor precariousness.

This is evidenced in the DANE records on the evolution of the urban labor market: Pereira. In the last 15 years, according to the criterion of affiliation to social security, in 2007 informality was 56.4%; in 2010 58.5% in 2015 53.8% and in 2019 51.2%. In other words, more than half of the population is in the informal sector.

This new political and economic context reveals the role assumed by the State and the private economic sectors in the management of public affairs and the territory. Urban entrepreneurialism as this new form of public management of cities, states, and large social conglomerates implies economic growth and wealth distribution. However, as Harvey (1989) has already stated, city governance can be considered a social process in which many actors with different objectives and interests interact and manifest themselves in spatial practices. Even though, under the neoliberal model, the dominant spatial practices are related to the interests of the circulation and reproduction of capital.

The implementation of a new form of urban management can be understood through Harvey's (1989) concept of urban entrepreneurialism based on three general features: the first is entrepreneurship, with the notion of a public-private partnership as the centerpiece. The second corresponds to the activity of these public-private partnerships that are entrepreneurial. The third refers to the fact that entrepreneurship focuses much more on the political economy of place than on that of territory (Harvey, 1989, p. 7). That is, the policies and transformation of space are oriented towards improving the conditions for the production and/or circulation of capital, rather than improving the living conditions of those who inhabit it.

The studies by Salinas (2014) in Mexico and Medina (2013) in Spain verify, in the same sense as Harvey (1989) and Moloch (1976), that the private sector has an increasingly preponderant

role, not only in the construction of public policies but also in the configuration of new urban spaces and the reconfiguration of existing ones. This does not imply that the State disappears, but rather that it is reconfigured as proposed by Sassen (2000), that is, a new private institutional order is generated, articulated by the global economy. In this sense, the bet of the private sector tends to improve the conditions for the reproduction and circulation of capital, without prioritizing the living conditions of citizens. This is what Sassen (200) and Harvey (1989) call policies of place and not of territory. Public-private alliances focus on economic development with the speculative construction of place and not on the improvement of conditions within a particular territory.

Consequently, the ideals of democracy and participation, under which the neoliberal model is promoted as a guarantor of freedoms and human dignity (Harvey, 2007) are a control trick that generates a sense of autonomy and sovereignty that the States no longer possess. At the same time, the sensation of strong citizen participation in the design and execution of public policies is created. In practice, this clashes with the limited capacity of ordinary people and the political structures that represent them, embodied in the States, to produce their territory. The particularities of these territories do not only obey the needs, interests, and imaginaries of their citizens but are, to a large extent, defined by economic elites that co-opt and execute some representations of the State to reproduce the interests of global capital.

Within this framework of transformations in the economic and policy model, Colombia transformed from the Welfare State or Fordist-Keynesian model, in which the State played a leading role in protecting the interests of the nation and its citizens, to the neoliberal model based on economic openness, free markets, and free competition, in which the private sector takes on this leading role. Thus, the State becomes the guarantor of the rights of global capital and generates conditions that facilitate its arrival, allowing private investment in public affairs and services that were previously under the jurisdiction of the State. In other words, the privatization of what was

previously public and the denationalization of resources and public policy programs are promoted, as shown in the studies of Salinas (2014).

The new urban management model proposed by neoliberalism framed in market logic and the leading role of the private sector is evidenced in a series of rules contained in the Colombian legal system, such as Law 9 of 1989, which establishes rules on municipal development plans, purchase and sale and expropriation of property, and other provisions. Subsequently, Law 388 of 1997, known as the Land Management Law, amends Law 9 of 1989 and Law 3 of 1991 and establishes other provisions. These laws obliged all territorial entities, mayors' and governors' offices to formulate their respective development plans and Land Management Plans (POT), Basic Land Management Plans (PBOT), or Land Management Schemes (EOT), depending on the number of inhabitants. But it also gave them the responsibility of managing the resources for their development (Prado, 2020).

In relation to Law 9 of 89, which searched to solve a series of problems that were not considered in the urban code and that generated a disorderly growth of cities. It was conceived as Restrepo (2019) puts it "under the influence of the great national and international political, economic, legal and social scenarios, such as political-administrative decentralization and the adoption of neoliberalism in its market sphere" (p. 667).

With the implementation of Law 388 of 1997, a new territorial planning and management model was generated, as shown by the analyses of Maldonado (2008) and Carrión (2008). This law sought to strengthen the processes of decentralization and modernization of the State by handing over planning and management competencies to local entities:

Article 5 concept. municipal and district land use planning comprises a set of concerted political-administrative and physical planning actions undertaken by the municipalities or districts and metropolitan areas in the exercise of their public function, within the limits established by the Constitution and the laws, in order to have efficient instruments to guide the development of the territory under their jurisdiction...

The implementation of the space management model implied processes of participation, coordination, and linking of different actors and social, economic, and urban interests, in addition to a series of planning instruments that would allow the achievement of the necessary resources for this purpose, as well as the analyzed by Maldonado (2008) allowed the mobilization of capital gains or socially created land prices to produce urban land that would improve the material conditions of life and socio-spatial integration (p. 46).

Similarly, Law 388 of 1997, in Article 8, Section 9, and Article 18, incorporates the participation of private actors in the management and execution of infrastructure works for transportation, home public services, and public facilities; of equal in article 19 literal 6 grants the possibility to him to the deprived one to present partial plans.

> In the cases provided in the general urban regulations, the partial plans might be proposed to the municipal or district planning authorities for their approval, by private persons or entities interested in their development. In no case, will be allowed to modify the determinations of the zoning plans or their structural regulations.

The insertion of private actors in the pacification and execution of land use plans, contemplated in Law 388 as planning units and partial plans, is in line with the first aspect of the urban management model proposed by Harvey (1989) of entrepreneurship urban, that is, public-private partnerships. And the first characteristic raised by Llistar (2003) of the neoliberal model, in relation to the diminution of the State and the leading role of the private sector in the management of the economy and therefore of the urban space, as shown by Lefebvre's studies, (2013), Harvey, (1989) and Restrepo (2019).

3. The reconfiguration of the urban space of the city of Pereira and new centralities

Under this regulatory context, the city of Pereira formulated its first land use plan in 2000, through Agreement 18 of the year 2000, and its implementation began in 2001 with the partial plans and public-private partnerships that gave rise to the reconfiguration of urban spaces in the city into new centralities, the traditional center, the Circunvalar Avenue and the Guadalupe Zapata Park.

The spaces reconfigured as new centralities are part of dynamics that correspond to the activity of these public-private partnerships, consistent with the second characteristic of the urban entrepreneurial model proposed by Harvey (1989). Thus, these urban spaces that had been historically consolidated as territories inhabited, controlled, practiced, and symbolized by their inhabitants, users, and passers-by, are affected and transformed. This is because, despite invoking citizen participation in the formulation of initiatives that would result in new centralities, these territorialities are not considered, probably because they do not obey the logic of economic interests that usually inspire many urban transformations.

3.1 Pereira's traditional downtown.

The traditional downtown is understood as the place where the processes of commercial exchange of agricultural and industrial production begin. In Pereira, this downtown began to consolidate as a space of mercantile and economic power with the opening of the marketplace on August 30, 1923, as reported by historian Hugo Angel Jaramillo (1983):

> Up until then, the market was held in awnings in the Plaza de la Victoria, today Plaza de Bolívar. This initiative was promoted by Alfonso Jaramillo Gutiérrez, who was assigned the block between Carreras 9ª and 10ª and 16th and 17th Streets [place it occupied until 2001]; the Meat Pavilion was also built in the adjacent block to the east on 16th Street with Carreras 9ª and 10ª (page 290).

Around the marketplace and the meat pavilion, the commercial and service sector of the city developed. This with the opening of wholesale stores, restaurants, and lodgings that provided services to the peasant population and merchants who came to the place to carry out the activities of the commercial exchange, and gradually consolidated as the traditional downtown that covered 21 blocks located between Carrera 9 and Railroad Avenue between 14th and 18th Streets.

However, the concentration of activities in this part of the city center led to environmental, social, and physical deterioration (EDUP 1984, Muñoz 1983, Orozco 1982). This deterioration justified the urban renewal of the center of the city of Pereira known as the Ciudad Victoria Partial Plan (Figure 2). This became the most important project of the first Land Use Plan (POT) of the city of Pereira, implemented during the 2001-2003 administration. It made use of the planning instruments and strategies contemplated in Law 388 of 1997, such as urban planning units, partial plans, and public-private alliances in urban development.

Figure 2

Map of the Ciudad Victoria Urban Renewal Plan.

Source: The authors. Drawing by Byron Julián Parra Gómez

The city administration, on its own initiative, decided to intervene in the traditional center of the city through Decree 1301 of October 17, 2002, called the "Ciudad Victoria" partial plan, making use of the planning instruments contemplated in Law 388, specifically in Article 19, which defines partial plans as "instruments through which the dissipations of the ordinance plans are developed and complemented for specific areas of urban land...". In the same article, it contemplates the incentives and participation of private actors in urban development, among other provisions. This decree establishes economic criteria, as well as facilites public-private investment processes; or grants incentives to investors such as tax exemptions for up to two years. This article evidences the importance of the private sector in urban development, in line with the idea of urban entrepreneurialism proposed by Harvey (1989).

As a result of the partial plan "Ciudad Victoria", a sector of the traditional city downtown

was transformed with the intention of changing its vocation and orienting it towards the search for competitiveness, as described in the 2002 city administration management report.

> The Ciudad Victoria Renovation Plan went from being one of the many plans formulated since the 1980s to becoming a reality, which will recover the traditional center, the commercial vocation and, therefore, the employment and economic development of Pereira. Victoria City and the second stage of Belalcázar Avenue will transform the urban structure and improve the city's competitiveness (Alcaldía de Pereira, 2003).

3.2 Circunvalar Sector

In the 1990s, this sector was inhabited by the city's elite. The architecture referred to large houses with wide spaces and little residential use. After the urban renewal process of the old market square in 2001 and the construction of the pedestrian bridge in mid-2005, in La Plaza Cívica Ciudad Victoria, the transformation of this sector began in the late 1990s with the construction of the first shopping center, La Terraza, specializing in the food served at the table, located on 3rd Street and Circunvalar Avenue (see figure 3). This center, built before the urban renewal process, marked the beginning of this transformation because it was the first to break the residential dynamics of the sector and to bet on a type of shopping center commerce, towards which the urban management of Ciudad Victoria and the economic bet of the city would be oriented.

In the process of revising and updating the POT established by the Agreement 23 of 2006, it was determined, among other provisions, to divide the city into planning units, and the definition of centralities was introduced in the Article 152. However, this revision and update did not establish

modifications to the residential use of this sector. This modification was carried out through Decree 717 of 2007, which establishes the provisions of planning unit 3 (UP3).

In Title 1 "Policies, Objectives and Strategies", Article 3. The General Policy of the UP3, takes up the concept of centrality established in Agreement 23 of 2006 and incorporates it in this planning unit. In article 4 objectives, it establishes in the fourth objective the function of centrality:

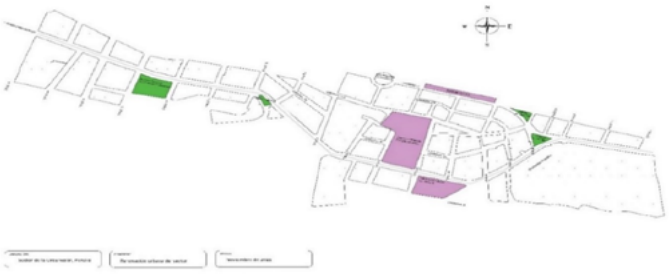
Consolidate the two centralities of the UP through the determination of main and compatible uses and the solution of their mobility conflicts and provide collective facilities to the lower sectors of the planning unit with the greatest lack of local coverage facilities, such as the Jardin, La Churria Travesuras, Mejia Robledo, Popular Modelo, and El Bosque neighborhoods.

Referring to the residential use the Circunvalar sector has had, objective 6 of the same article establishes the residential function: "To preserve the residential vocation in the UP3, stimulating the development of the urban voids that still need to be consolidated, complementing it with a good urban endowment and with commercial activities and specialized services as part of its economic sustainability".

The urban void referred to in UP3 corresponds to the current Parque Arboleda Shopping Center (the largest purple polygon in Figure 3). The change in land use and the establishment of this sector as a central location facilitates the legal conditions for the development of this shopping center through private investment.

Figure 3

Map of the Circunvalar Avenue Sector.



Source: The authors. Drawing by Byron Julián Parra Gómez

However, UP3 does not contemplate large-scale urban projects, such as partial plans; on the contrary, the intervention of the city administration focused on complementary works to facilitate mobility and beautification of the urban space (green polygons in Graph 3). The above potentiated the private investment processes that transformed the Circunvalar Avenue sector from being the residential sector of Pereira's elite to become a new city center.

3.3 Guadalupe Zapata Park

The Guadalupe Zapata Park is in the center of Ciudadela Cuba in the southwest of the city of Pereira. This citadel is composed of five communes (districts) and more than 100 neighborhoods. In the

early 2000s, the park was the obligatory passage for the different neighborhoods that made up the citadel; all public transportation circulated around it. The characteristics of the park corresponded to green areas, with concrete paths that communicated with a meeting point in the center of the park.

The urban renewal process of the Guadalupe Zapata Park, carried out between 2007 -2009 through the Subcentro de Cuba partial plan, is approved in decree 223 of April 2007, to make room for the subway interchange of the mass transit system of the city la ciudad (Megabus) delimiting the intervention zone (Figure 4). It goes from being a neighborhood park to become the Guadalupe Zapata Plaza, changing the dynamics of its area of influence.

Figure 4

Partial plan delimitation Subcentro de Cuba.

Source: Gómez (2011). Proyectando una ciudad

In relation to the Subcentro de Cuba, Decree 223 de 2007 in articles 36 y 37 Establishes the contributions, burdens, and benefits assumed by the public and private sectors, the regulation evidences the public-private alliances in the function of the transformation of the urban space of the city of Pereira.

Subsequently, Decree 794 of 2007 modifies Article 35 of Decree 223, to provide greater facilities for the arrival of private investors: "This decree is issued, which, among others, will greatly benefit the arrival of hypermarkets or large shopping centers to this unit" (Municipality of Pereira, 2007). This will facilitate the arrival of the Éxito department store chain in the Cuba sector, specifically in the influence of this partial plan.

Around these new structures, the plaza, the subway (Megabus) interchange station, and the Éxito store, other activities of the tertiary sector of the economy began to be located, such as financial institutions, funeral services, shoe and clothing stores, notary services, among others, which ended up turning the sector into a new center of the city of Pereira. Currently, it has extended along Carrera 25 to approximately 67 bis Street, as shown in Figure 5.

Figure 5

Mapa Subcentro de Cuba.

Source: The authors. Drawing by Byron Julián Parra Gómez

4. Urban management models in the city of Pereira

The dynamics of configuring and reconfiguring the urban space of the city of Pereira have been linked to the socio-historical, economic, and productive conditions of the city, as occurred in the cases in all processes of space production (Lefebvre, 2013; Harvey, 1989 and Restrepo, 2019). However, it can be shown that the crazy dynamics are affected by the socio-historical dynamics, policies, and economies of national and global scale, thus influencing the models of managing urban space.

As mentioned before, Pereira has implemented three models for managing urban space. The first one emerged in the 1930s with the Great City project of the Pereiran elite and ideals of

civility, this was followed by the model proposed by ECLAC and the state planning of the years 1950-1990s. During the studied period, the neoliberal model started in the 1990s with state modernization and decentralization processes, which generated a management model framed in urban entrepreneurship. The implementation of the neoliberal model globally led to a series of political economic and social transformations.

In Colombia, the implementation of this model was reflected in the processes of modernization and decentralization of the State, which were consolidated with the 1991 political constitution and the implementation of the economic opening in the 90s, this social, political and economic global and national context had an impact on the change of productive focus of the industrial city resulting from the ECLAC model and the state planning of the 50s, to a commercial city in line with the neoliberal model of free markets, which led to a reconfiguration of the urban space of the city, or Pereira into new centralities. In the model, citizens and inhabitants have formally subordinate participation to that of the elites in the production or the city, however, they are alternative ways of participation through various processes or territorialization, from everyday life itself.

In conclusion

Based on the above, it is possible to conclude that with the entry into force of Law 388 of 1997 in Colombia, a new model of urban space management emerges. This model is implemented in Pereira with the approval of the POT. Being one of the first cities in Colombia to make use of the planning instruments contemplated in Law 388, such as partial plans and planning units, implemented through Decree 1301 of 2002, Decree 717 of 2007, and finally, Decree 223 of April 2007, are clearly oriented to the configuration of new centralities in the urban space of the city.

In the planning processes contemplated in the agreements, conditions were created for the private sector to play a preponderant role in the reconfiguration of the intervened space, and even in the plans where it was not initially contemplated, new decrees were created with the objective of facilitating its participation, such as decree 794 of 2007 for the Cuba sub-center.

In the urban space management model implemented in the city of Pereira, it is possible to identify the characteristics of the urban entrepreneurialism model proposed by Harvey (1989), based on public-private partnerships, these partnerships are presented in the three urban transformation processes. The city of Pereira transformed it's a productive bet from an industrial city to a commercial city through the activities of public-private partnerships framed in the outsourcing of the economy, presented in the logic of the new Centralities.

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4 CHAPTER FOUR

Bibliometric analysis of scientific publications on the effect of roots on slope stability

Analisis bibliométrico de las publicaciones científicas del efecto de las raíces en la estabilidad de taludes

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Abstract

The effect of roots on slope stability has been discussed and documented by many earth science and geotechnical researchers. It requires explicit knowledge of the soil-vegetation relationships and the incidence of water as a trigger for landslides. Historically it has been a controversial issue, but most researchers recognize and accept the role of vegetation cover in

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erosion control. By consulting scientific information in the Web of Science database, with the keyword EFFECT OF ROOTS ON SLOPE STABILITY, 425 documents were selected and evaluated using open-source tools. It was found that the most significant scientific production was concentrated between 2012 and 2020; the USA is the most cited country, despite having less scientific production than China and Italy. The most cited authors highlight the positive effect of vegetation on mechanical reinforcement, the reduction of pore pressure, and the increase in soils' shear resistance. However, they also recommend strengthening research processes to improve knowledge about the effect of the morphometry and density of the root system, the diameter, and resistance to traction of the roots and their spatial distribution, increasing slope stability. The researchers' main challenge is to incorporate the distribution of the roots, the stress-strain behavior of the reinforcement of the roots, and the resistance of the roots to compression into the slope stability models.

Keywords: erosion, shear resistance, soil bioengineering, slope stability, root density, root reinforcement

Resumen

El efecto de las raíces en la estabilidad de taludes ha sido tratado y documentado por muchos investigadores de las ciencias de la tierra y la geotecnia. Exige un conocimiento claro de las relaciones suelo-vegetación, además de la incidencia del agua como agente detonante de deslizamientos. Históricamente ha sido un tema controversial, pero la mayoría de investigadores reconoce y acepta el papel de la cobertura vegetal en el control de la erosión.

Mediante la consulta de información científica en la base de datos Web of Science, con la palabra clave *effect of roots on slope stability*, se seleccionaron y evaluaron 425 documentos, utilizando herramientas de código abierto. Se encontró que la mayor producción científica se concentró entre los años 2012-2020; que USA es el país más citado, no obstante tener una producción científica menor a China e Italia. Los autores más citados destacan el efecto positivo de la vegetación en el refuerzo mecánico, la reducción de la presión de poros y el incremento de la resistencia al cizallamiento de los suelos, aunque también recomiendan fortalecer los procesos investigativos tendientes a mejorar el conocimiento acerca del efecto de la morfometría y densidad del sistema radicular, el diámetro y resistencia a la tracción de las raíces y su distribución espacial, en el incremento de la condición de estabilidad de laderas. El principal reto de los investigadores está en incorporar a los modelos de estabilidad de taludes la distribución de las raíces, el comportamiento tensión-deformación del refuerzo de las raíces y la resistencia de las raíces a la compresión.

Palabras clave: bioingeniería de suelos, densidad radicular, erosión, estabilidad de taludes, resistencia al corte, refuerzo de raíces

Introduction

It is estimated that the vegetation increases the resistant forces and, in this way, reduces the failures of the terrain because the root system of the living vegetation forms a framework that increases the shear resistance and improves the stability conditions of the terrain (Istanbulluoglu & Bras, 2005). For Ekanayake et al. (1997), the greater or lesser contribution

that the roots provide to the soil's resistance depends on the chemical-physical composition of the soil, the resistance, and the morphology of the roots themselves. To verify the effect of living vegetation on the stability of the land, Gray & Sotir (1995) defined that the main reason for the loss of stability and increase in the occurrence of mass removal processes on slopes, after the felling of the forest, is the rotting of the roots and their subsequent loss of resistance, a fact that is directly associated. The purpose of this article is to evaluate state of the art in the scientific production of research on the effect of roots on slope stability, making use of open-source tools, such as Bibliometrix and VOSviewer (Aria & Cuccurullo, 2017; van Eck & Waltman, 2010)

Some theorists of soil mechanics (Braja M.Das, 2002; González de Vallejo et al., 2002; Juárez-Badillo & Rico-Rodríguez, 2014; Suárez Díaz, 1996) have established that the shear resistance of soils cannot be considered as a single and constant criterion, as it is conditioned by multiple variables. The starting point of the most accepted failure criterion is the one proposed by Coulomb, who relates the normal and tangential forces and establishes the shear strength through Equation 1:

Equation 1: Ecuación 1: $\tau = c' + (\sigma n - \mu) \tan \varphi'$

where

τ = shear strength in a failure plane

σn = normal stress in the failure plane

μ = pore pressure

c’ = effective cohesion

φ' = effective friction angle

From the classics of the theory of shear resistance, it is confirmed that a material fails due to the critical combination between regular forces and shear forces acting on the ground and that the parameters to consider are cohesion, angle friction, and everyday stress. However, based on previous research, and under the different effects that the presence of vegetation exerted on the stability of slopes, many researchers undertook the task of quantifying the effect of vegetation on the stability of slopes, incorporating traditional models for calculating the resistance to the cutting of soils, the effect exerted by the roots and in general the role of vegetation. In this sense, Greenwod et al. (2004) estimated that the parameters of interest contributed by the vegetation in the calculation of the safety factor in two case studies carried out in Greece and Italy, with fault surfaces less than one (1) meter depth were: additional effective cohesion, increased cutting weight, reinforcement of traction force by the roots, possible changes in the resistance of the undrained soil and changes in pore pressure. The increases in the safety factor in both cases were of the order of 9% to 25%, confirming the role that vegetation plays in slope stability.

From the same premise, Ji et al. (2012) and Tsige et al. (2020) determined the increase in the safety factor, through a finite element model applied on rectilinear slopes and terraces, from the evaluation of the effect of the increase of the additional cohesion provided by the roots, in the stability of inclined surfaces. Root density and its tensile strength, measured in the laboratory, were counted. The authors were able to determine that when the slope was reinforced with plant roots, the Factor of Safety (FoS) improved from 22–34%.

Some of the positive effects of vegetation, particularly of roots, on slope stability, are evidenced in the control of surface runoff, in the anchoring effect of deep roots, reducing excess water in the soil, and the mesh effect exerted on the surface part of the soil (Feng et al., 2020; Gao et al., 2020). Some authors recognize the positive role that vegetation (grasses, stubble, shrubs, and trees) plays in slope stability and erosion control, in addition to its incorporation into soil bioengineering practices (Gray & Barker, 2013; Gray & Sotir, 1995; Punetha et al., 2019; Rickli et al., 2019; Wang et al., 2020). Confirming the role that the roots play in the stability of slopes, Ni et al. (2019) maintain that the smaller the roots' diameter, the resistance increases, and smaller spacing between plant species improves the resistance condition of the soil. Veylon et al. (2015) ratify this appreciation when he states that "evenly distributed fibrous root systems are more effective in shallow soils, while main root systems are more effective in reinforcing deeper soils" (p. 9). At the same time, it highlights that a hillside with different plant species tends to be more stable than one where monocultures predominate due to the control of infiltration water exerted by different root systems.

Burylo et al. (2011) confirm the increase in the resistance of soils in the presence of thin roots due to the property they have to resist more significant stresses than thick roots. They also conclude that grasses and shrubs' vegetation provide more excellent resistance to soil shear in the surface layers than tree species in scarce development stages.

For Giadrossich et al. (2017) and Giadrossich et al. (2019), the resistance of the soil by the action of the roots is more efficient in cohesive soils than in frictional soils. However, it should be clarified that, in saturation conditions, the effect can be adverse. This is because, soil moisture content increases, cohesive forces are reduced, thereby diminishing the reinforcing effect exerted by the roots. The authors question the validity of the method used

by Wu et al. (1979) and Waldron & Dakessian (1981), since they argue that the increase in shear resistance due to the roots' effect is overestimated. They do coincide in the notorious decrease in shear resistance, when the soils, regardless of the predominant type of vegetation, have excess humidity and when, due to the indiscriminate felling of trees, the root systems decompose. Istanbulluoglu & Bras (2005), Fan & Su (2009) and, Fattet et al. (2011) maintain their position on the positive effect of roots on slope stability and argue that shear resistance increases as the number of roots in the soil increases. Giadrossich et al. (2019) confirm the reinforcement of the soils by the effect of the roots and warn that their functionality on short and steep slopes is not as expected, as occurs in river slopes or road cuts (Bordoloi & Ng, 2020).

Jotisankasa et al. (2015) in their particular study of the beneficial or adverse effects of the Vetiver System, which contemplated physical-mechanical parameterization and estimation of the hydraulic properties of the soil, found that the humidity of the soil Soil is a highly significant conditioner in the role that roots play in increasing their resistance to shear. They also estimated that the root system of Vetiver, once it reached 8 months of age, influenced the decrease in the permeability of high-plasticity clays and low-plasticity silts. Like other authors, they verified that the roots of Vetiver, either due to their advanced age or due to the invasion of other species, began to decompose, affecting the loss of resistance of the soils, which is why they recommended that surfaces covered with this species should undergo frequent maintenance.

In this same sense, Jotisankasa & Sirirattanachat (2017) showed that the biomass of Vetiver roots affects the hydraulic behavior of soils, and they differentiate said behavior in experiments carried out in Low plasticity Mud (ML) and Clay Sands (SC). They found that

the saturated permeability of the ML increases when the biomass of the roots per volume of soil is less than 6.0 Kg / m3; while when it is greater than 6.5 Kg / m3, the permeability is reduced, with a corresponding increase in the shear resistance of the soils.

Liu et al. (2018) warn about the importance of considering the changes induced by the roots and the strata or layers that make up the soil, in permeability, since it is important to know the factors that influence interstitial pressure, at different depths and their distribution along with the soil profile.

Danjon et al. (2008), from three-dimensional models that allowed the analysis of the spatial position of the roots, their typology, and geometric distribution, calculated the increase in the safety factor of the slope utilizing the equilibrium method limit. This model confirmed the increase in the safety factor, incorporating the additional cohesion provided by the roots of the vegetation as a soil reinforcement mechanism. meter from it, this effect is negligible. They further estimate that the soil reinforcement generated by the roots is a function of the tensile strength, the cross-sectional area of the root, the angle of the root relative to the fault plane, and the total length of the root. After the point of intersection with the slip surface. Bischetti et al. (2005) and Genet et al. (2005) estimate that the tensile strength increases as the root diameter decreases and, as defined by Cammeraat et al. (2005), the number of roots that cross the surface of Failure notably increases the stability of the slope, due to the increased resistance to shear generated by the root network.

For Chok & Kaggwa (2004), vegetation influences slope stability through two mechanisms: it regulates the hydrological cycle of soils and exerts significant mechanical effects on their resistance to shear. The authors refer to eliminating excess water through evapotranspiration processes and the reduction of soil pore pressure. In the same way, they

state that the resistance to traction provided by the roots increases the resistance to the cutting of the soils, which confirms the stabilizing effect of the vegetation, of course, is making clarity about its functionality shallow soils. The authors use the finite element method and incorporate apparent cohesion and root zone depth in the calculations.

Most of the authors, whose research has focused on the role that vegetation plays in the stability of slopes, have agreed and evaluated the mechanical effect that roots exert on the stability of the land and the increase of the shear resistance. This contribution is associated with the anchoring effect of the roots, forming an interweaving or network in the terrain's most superficial horizons. In the studies made by Ziemer (1981), Abe & Ziemer (1991), Gray & Sotir (1995), Wu & Sidle (1995), and Pineda et al. (2016), in addition to other authors, highlight the role of vegetation of two fundamental ways: increasing the cohesion by the effect of the roots and dosing the soil moisture by the effect of water consumption and evapotranspiration. Ziemer (1981) summarizes it masterfully by referring to vegetation's role in the slope's stability when it highlights the effect of anchoring and mechanical reinforcement of the roots, the distribution of moisture within the soil, and the decrease from neutral pressures or pore pressures.

In short, the role of roots in slope stability is an unquestionable fact (Filippo Giadrossich et al., 2019; Lan et al., 2020; Lotfalian et al., 2019). For Graf et al. (2009), the roots affect a slight increase in the internal friction angle and, consequently, the soil density value. For their part, Ji et al. (2012) state that, although the increase in apparent cohesion due to the effect of the roots is well documented in the scientific world, the role and influence of the spatial variation of the roots, the architecture of the root system, is still unknown (Reubens et al., 2007) and so the morphology of the land. Schmidt et al. (2001) establish significant

variations in slope stability, according to the type of vegetation, age of the roots, conformation, and distribution of the root system (Sanhueza & Villavicencio, 2012), and lateral distribution, as proposed by Schwarz et al. (2010). They raise the importance of the primary geometric and mechanical properties of root systems and their role in stabilizing the soil mass, including stress-strain relationships.

In contrast to the previous appraisals, which highlight the stabilizing function of the roots, Casadei & Dietrich (2003) estimate that the lateral distribution of the roots in moderately sloping terrain and relatively dry soils increases the susceptibility and magnitude of landslides, clarifying that these events are controlled by the strength of the roots and the relative saturation by local topographic effects. In turn, Ghestem et al. (2011) explain that the root system can alter the underground water flow, increasing the interstitial pressure and consequently triggering landslides. In this same sense, Greenwod et al. (2004), although they confirm the role of direct reinforcement of the roots in the stability of slopes, warn about the problems caused by vegetation in the stability of the foundations of buildings.

Methods and data collection

The consultation of scientific information regarding the effect of roots on slope stability was done through the Web of Science database, provided by Clarivate Analytics, using the search equation EFFECT OF ROOTS ON SLOPE STABILITY, by subject, and without additional filters. The consultation covered all the years of scientific production. The search yielded 425 articles, from which the scientometric and bibliometric analysis was developed, using the open-source tool Bibliometrix, through the import of bibliographic data from Clarivate

Analytics Web of Science (Aria & Cuccurullo, 2017). For the analysis of bibliometric network data and the visualization of scientific information structures, the VOSviewer software (van Eck & Waltman, 2010), developed at Leiden University, was used. Such action included co-authorship between countries, analysis of co-authorship between organizations, analysis of co-authoring by sources, and analysis of keyword co-occurrence.

The search for scientific information on the topic effect of roots on slope stability, the object of this bibliometric analysis, corresponded to January 24th, 2020, and covered all years.

Table 1 summarizes the totality, type, and percentage distribution of the articles corresponding to 1996-2020, finding that 77.4% correspond to research articles. This table suggests the enormous and growing interest that the topic has had in the scientific world, and that is both substantially and closely related to modern concerns about the effects and impacts that erosion has on anthropic activities. It is interesting to note that all the articles were published in 220 sources and that most of them were published by multiple authors, a fact that allows us to infer the existence of well-established scientific networks.

Table 1

Main information.

Description	Results
Documents	425
Sources (Journals, Books, etc.)	220
Keywords Plus (ID)	1082
Period	1991 - 2020

Authors	1281
Authors of single-authored documents	17
Authors of multi-authored documents	1264
Documents per Author	0,332

Sourceown elaboration

Data, analysis and results

Annual Scientific Production

The evolution over time and trends in annual scientific production, in terms of thematic scientific publications, are summarized in Figure 1 and Table 2. It should be noted that the first publication on the subject was registered in 1991, and since then, until the year 2004, its annual growth was relatively slow, denoting a stagnation or gap regarding scientific interest in this topic. Starting in 2005 and continuing until 2020, research on the effect of roots on slope stability contributed to the high development and emergence of soil bioengineering as a discipline of interest in the field of control of erosion. This growth is evident in the increased scientific production, with 381 articles published, accounting for 89.6% of the total scientific production. This production level had its highest peak during 2015-2020, with 253 articles, corresponding to 59.5% of the total publications. This production level had its highest peak during the years 2015-2020, with a total of 253 articles, corresponding to 59.5% of the total publications. Table 2 shows that the development and scientific interest of the subject has grown in recent years due to the negative impacts that erosion generates on human activities,

specifically on the built infrastructure (roads, buildings), agricultural areas, and urban environments.

Table 2

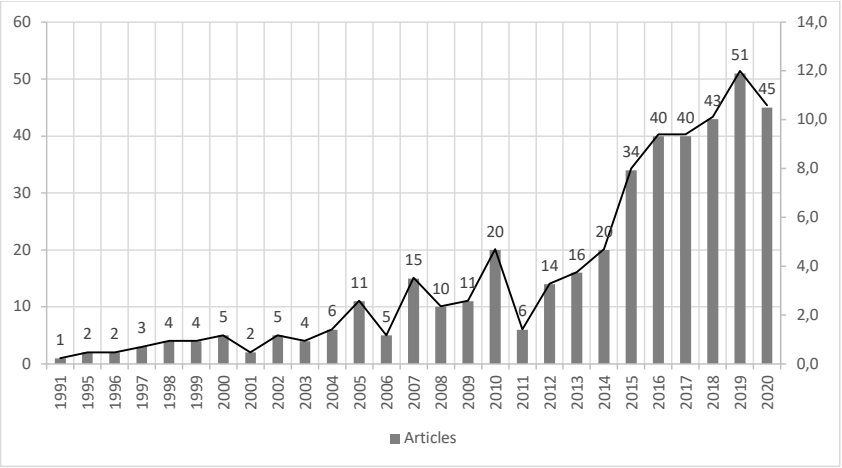
Annual Scientific Production.

Year	Articles	Distribution %	Year	Articles	Distribution %
1991	1	0,2	2008	10	2,4
1995	2	0,5	2009	11	2,6
1996	2	0,5	2010	20	4,7
1997	3	0,7	2011	6	1,4
1998	4	0,9	2012	14	3,3
1999	4	0,9	2013	16	3,8
2000	5	1,2	2014	20	4,7
2001	2	0,5	2015	34	8,0
2002	5	1,2	2016	40	9,4
2003	4	0,9	2017	40	9,4
2004	6	1,4	2018	43	10,1
2005	11	2,6	2019	51	12,0
2006	5	1,2	2020	45	10,6
2007	15	3,5			

Source: own elaboration

Figure 1

Annual Scientific Production.



Source: own elaboration

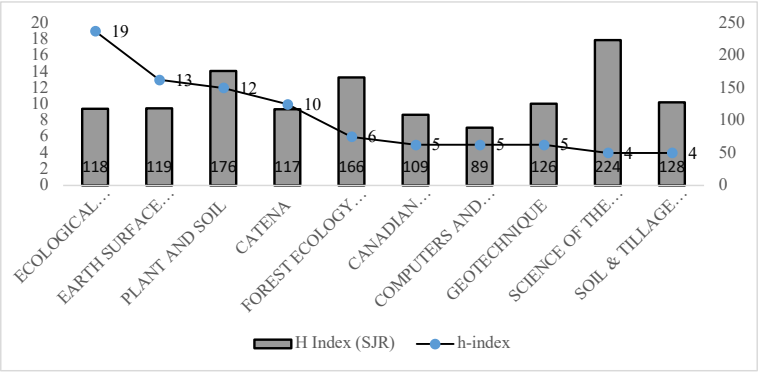
The 10 most productive sources

The Top 10 of the most relevant sources can be seen in Figure 2 and Table 3, which show the 15 most prominent publications that make up the sources with the highest scientific productivity on the subject under study. It is identified that the source *ECOLOGICAL ENGINEERING* is the one that has published the most significant number of articles (25), corresponding to 5.8% of the total distribution of publications. The Dutch publication has an impact factor of 3,406, and its subject areas of interest are environmental sciences, environmental engineering, management, monitoring, environmental policies, and the

conservation of nature and the landscape. Secondly, there is the publication *EARTH SURFACE PROCESSES AND LANDFORMS* with 21 articles. Interdisciplinary magazine from the United Kingdom, whose topics of interest are earth sciences and surface processes. It is well known that the sources Ecological Engineering, Earth Surface Processes and Landforms, Catena and Plant and Soil, three of them Dutch, accumulate 78 publications (18.3%) of the total, a fact that highlights the leading role of the Netherlands and the United Kingdom in scientific research in earth sciences. Considering that the publication of the 425 articles is concentrated in 220 sources, it is of significant interest to note that 1.8% (4) of the sources have published between 18 and 25 articles; 24.6% (54) have published between 2 and 9 articles and 73.6% (162) have only published one (1) article.

Figure 2

Top 10 Most Relevant Sources.



Source: own elaboration

Table 3

Top 15 Most Relevant Sources.

Source	h-index	TC	NP	Quartil (SJR)	H Index (SJR)
Ecological Engineering	19	1036	25	Q1	118
Earth Surface Processes and Landforms	13	1145	21	Q1	119
Plant and Soil	12	1211	14	Q1	176
Catena	10	394	18	Q1	117
Forest Ecology and Management	6	349	6	Q1	166
Canadian Geotechnical Journal	5	136	7	Q1	109
Computers and Geotechnics	5	85	7	Q1	89
Geotechnique	5	72	6	Q1	126
Science of the Total Environment	4	82	8	Q1	224
Soil & Tillage Research	4	160	6	Q1	128
Geomorphology	4	83	6	Q1	147
Earth-Science Reviews	4	158	4	Q1	179
Eco- and Ground Bio-Engineering: the use of Vegetation to improve Slope Stability (Book and conference proceedings)	3	27	9	NA	NA
Landslides	3	43	7	Q1	72
Hydrological Processes	3	548	5	Q1	151

Source: own elaboration

Top 10 productivity and author recognition

Jorge Hirsch, from the University of California, proposed the h-index in 2005 to measure real scientific productivity, its impact, and the recognition of researchers and institutions in the scientific world.

Table 4

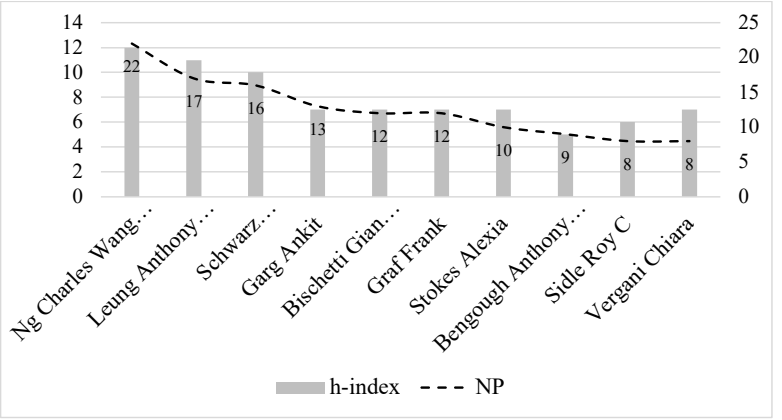
Author impact.

Author	h-index	g-index	TC	NP
Ng Charles Wang Wai	12	19	399	22
Leung Anthony Kwan	11	17	351	17
Schwarz Massimiliano	10	16	415	16
Garg Ankit	7	13	277	13
Bischetti Gian Battista	7	12	514	12
Graf Frank	7	12	209	12
Stokes Alexia	7	10	616	10
Bengough Anthony Glyn	5	9	184	9
Sidle Roy C	6	8	383	8
Vergani Chiara	7	8	192	8

Source: own elaboration

Figure 3

Author impact



Source: own elaboration

According to table 4 and figure 3, the h-index of researchers who have historically worked on the topic "the effect of roots on slope stability" denotes that in the case of Ng Charles Wang Wai, of his 22 publications, twelve (12) of them have reached a minimum level of 12 citations. The author, Ng Charles Wang Wai, has a Ph.D. in Civil Engineering (Geotechnics) and is a professor of sustainability at CLP Holdings, working in Civil and Environmental Engineering. Likewise, Leung Anthony Kwan presents an 11 h-index and 17 publications. Leung Anthony has a Ph.D. in Civil Engineering with experience in unsaturated soil mechanics, root biomechanics, and soil-vegetation-structure interaction and is also a professor of geotechnics.

Top 15 of the most cited countries and their scientific production

Table 5 and Figure 4 show the top 15 of the most cited countries, with their corresponding citation averages and a total number of articles. The United States ranks first with a total of 2,919 citations and an average number of citations per article of 71.2, in contrast to countries like China, which, with a more significant number of published articles (118), presents 803 citations and an average number of citations per article, of 6.8. Italy and the United Kingdom stand out in the same way, with a total of 43 and 34 articles published, respectively, and with very similar averages of citations. The role that Belgium plays in this top is highlighted, since on average, the number of citations per article is well above all the others (191.5), despite having only four published articles. The case of Greece is also very particular since, with only one published article, it presents an average of citations per article of 76.0, surpassed only by Belgium.

Table 5

Top 15 Most Cited Countries.

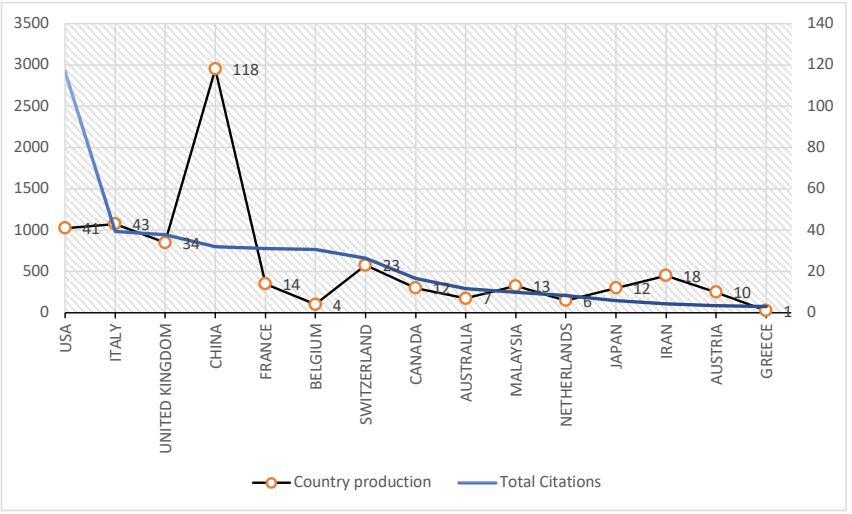
Country	Total Citations	Average Article Citations	Country production
USA	2919	71,2	41
Italy	982	22,8	43
United Kingdom	946	27,8	34
China	803	6,8	118
France	776	55,4	14
Belgium	766	191,5	4
Switzerland	660	28,7	23
Canada	417	34,8	12

Australia	295	42,1	7
Malaysia	250	19,2	13
Netherlands	211	35,2	6
Japan	148	12,3	12
Iran	106	5,9	18
Austria	86	8,6	10
Greece	76	76,0	1

Source: own elaboration

Figure 4

Top 15 Most Cited Countries.



Source: own elaboration

The 15 Most Global Cited Documents

Table 6 confirms that Richard M. Iverson's publication, entitled Landslide Triggering by Rain Infiltration, published in WATER RESOURCES RESEARCH, vol 36, N ° 7, pages 1897-1910 of July 2000, obtained the maximum of 875 citations with a citation count per year of 39.7. In his research, Iverson (2000) confirms the incidence of rains as a trigger for landslides. However, it warns about the usefulness of these empirical methods, as it suggests that they do not provide a theoretical framework to understand how hydrological processes influence the location, time, and rates of landslides or to predict the occurrence of landslides in the face of the effects of climate change and the dynamics of land uses. Similarly, Gyssels G. (co-authored with Poesen, Bochet Li), with his article Impact of Plant Roots on the Resistance of Soils to Erosion by Water, published in PROGRESS IN PHYSICAL GEOGRAPHY, 29 (2), 189 -217, has 480 citations and a rate of citations per year of 28.2. Gyssels et al. (2005) argue that soil erosion rates decrease significantly, in direct relation to the presence of vegetation, due to the stabilizing effects exerted by the roots and their role in controlling excess water in the soil. Table and Figure 10 illustrate the information on the top 15 of the most cited documents worldwide, with their corresponding authors and total citations.

Figure 5 allows better visualization of the importance of the authors, referred articles, and the collaboration networks built between them. Iverson, Gyssels, Simon, Dietrich, and De Baets are the most cited authors. In turn, De Baets, Bischetti, and Genet, due to the centrality of their nodes and the number of links, are the authors with the largest collaboration networks, despite not being the most cited.

Table 6

Top 15 Most Global Cited Documents.

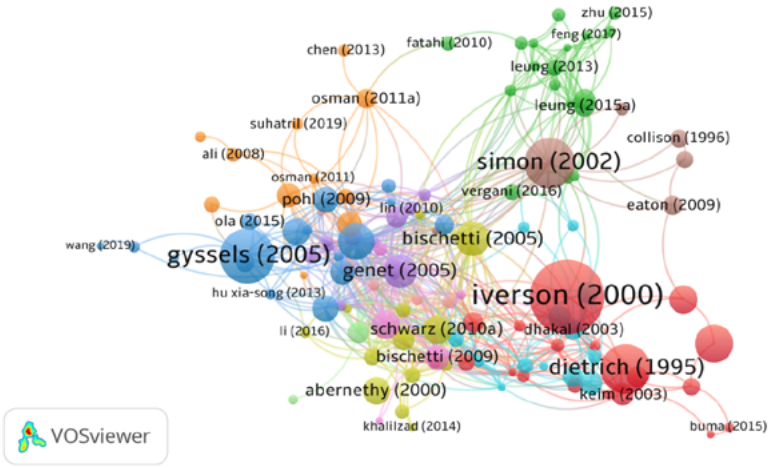
Paper	Authors	Total Citations	Links
Landslide triggering by rain infiltration	Iverson, R. M. (2000)	875	8
Impact of plant roots on the resistance of soils to erosion by water: a review	Gyssels, G., Poesen, J., Bochet, E., & Li, Y. (2005)	480	15
Quantifying the mechanical and hydrologic effects of riparian vegetation on streambank stability	Simon, A., & Collison, A. J. (2002)	411	27
A process-based model for colluvial soil depth and shallow landsliding using digital elevation data	Dietrich, W. E., Reiss, R., Hsu, M. L., & Montgomery, D. R. (1995)	392	4
The search for a topographic signature of life	Dietrich, W. E., & Perron, J. T. (2006)	236	2
Root tensile strength and root distribution of typical mediterranean plant species and their contribution to soil shear strength	De Baets, S., Poesen, J., Reubens, B., Wemans, K., De Baerdemaeker, J., & Muys, B. (2008)	216	37
Mississippi river delta: an overview	Coleman, J. M., Roberts, H. H., & Stone, G. W. (1998)	206	0
Biotechnical characteristics of root systems of typical mediterranean species	Bischetti, G. B., Mattia, C., & Gentile, F. (2005)	190	38

The influence of cellulose content on tensile strength in tree roots	Genet, M., Stokes, A., Salin, F., Mickovski, S. B., Fourcaud, T., Dumail, J. F., & Van Beek, R. (2005)	182	30
Quantifying the role of vegetation in slope stability: a case study in Tuscany (Italy)	Schwarz, M., Preti, F., Giadrossich, F., Lehmann, P., & Or, D. (2010	133	24
Vegetation-modulated landscape evolution: Effects of vegetation on landscape processes, drainage density, and topography	Istanbulluoglu, E., & Bras, R. L. (2005)	128	4
Root reinforcement in plantations of cryptomeria japonica d. don: effect of tree age and stand structure on slope stability	Genet, M., Kokutse, N., Stokes, A., Fourcaud, T., Cai, X., Ji, J., & Mickovski, S. (2008)	127	27
Effects of vegetation type on soil resistance to erosion: relationship between aggregate stability and shear strength	Fattet, M., Fu, Y., Ghestem, M., Ma, W., Foulonneau, M., Nespoulous, J., ... & Stokes, A. (2011)	126	8
The effect of riparian tree roots on the mass-stability of riverbanks	Abernethy, B., & Rutherfurd, I. D. (2000)	122	2
Biotechnical characteristics of root systems of typical mediterranean species	Mattia, C., Bischetti, G. B., & Gentile, F. (2005)	113	21

Source: own elaboration

Figure 5

Most cited authors and documents.



Source: taken and adapted from VOSviewer

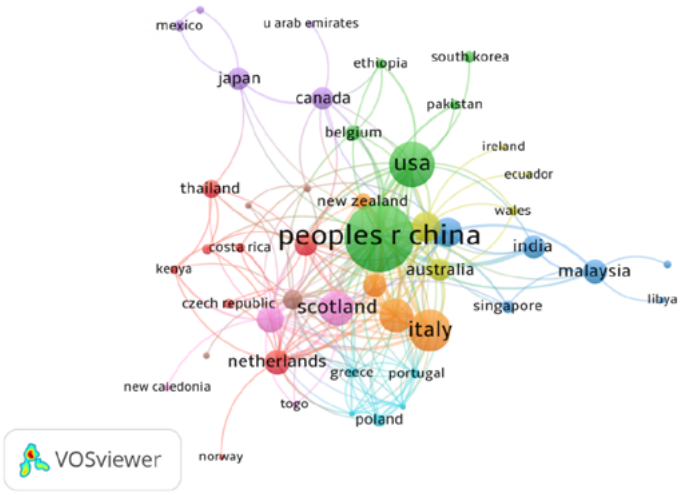
Analysis of co-authorship relationships between countries

The analysis was carried out with the VOSviewer software, with the following filters: a maximum of 5 countries per document, a minimum of 5 documents per country, and a minimum of 5 citations per country. Based on these criteria, it was possible to establish that only 20 countries meet them, defining 4 clusters and 74 links between the selected countries. The nodes in the figure represent the country, and their size shows its activity. Similarly, the curved lines define the collaboration relationship between countries, and their thickness determines the importance or degree of collaboration between them. Once the interpretation criteria have been mentioned, it can be stated according to Figure 7 that the People's Republic of China is the country with the most significant collaborative activity, as it has 13 links with a total of 101 shared documents. In the second instance, the collaboration of the USA is

recognized through 14 links of 49 documents. Figure 13 also shows that the countries with the highest validity and average publications are the People's Republic of China, Iran, Austria, and Switzerland. However, in the average number of citations, the USA, Belgium, Spain, and France are still the countries that lead their activity in international collaboration networks. Finally, it should be noted that based on the initially established criteria, Figure 7 allows visualizing the conformation of 4 clusters that group all the countries that meet the criteria, with 74 links and a total link strength of 145.

Figure 7

Analysis Citation Countries.



Source: taken and adapted from VOSviewer

Conclusions

Based on the consultation of scientific information in the Web of Science database, using the search equation by the topic *effect of roots on slope stability*, and once the bibliometric analysis and the visualization of relationships have been completed, the following are presented conclusions:

The first publication on the subject was registered in 1996, and since then, until 2004, its annual growth was relatively slow, denoting a stagnation or gap regarding the scientific interest in this subject. Starting in 2005 and after that until 2019, research on the effect of roots on slope stability had a relevant growth, expressed in more outstanding scientific production, since 286 articles were published, corresponding to 91.6% of total scientific production.

The most relevant source is Ecological Engineering, with 22 articles published, corresponding to 7.1% of the total distribution of publications. Secondly, there is the publication Earth Surface Processes and Landforms, with 20 articles. It is notable that the sources Ecological Engineering, Earth Surface Processes and Landforms, Catena and Plant and Soil, three of them Dutch, accumulate 71 publications (22.8%) of the total, a fact that highlights the leading role of the Netherlands and the United Kingdom in scientific research on the effect of roots on slope stability.

The author with the most extended validity in time is Roy C. Sidle since its publication record has been maintained between 1999-2016, highlighting that despite its minimal publications per year (1/year of validity), it reached a total of citations per year of 18.4 and 10.8, in the years 2006 and 2016 respectively.

The author's Ng Charles Wang Wai with nineteen (19) publications and an h-index of 11, and Leung AK, with fourteen (14) publications and an h-index of 10, are the most internationally recognized authors and those with the most significant scientific production.

Concerning he citations by country, the United States ranks first with 2,167 citations and an average of 74.72 citations per article in its 72 published articles. In contrast, with the highest number of published articles (196), China presents 478 citations and an average number of citations per article of 5.83.

The most relevant publications are those of Richard M. Iverson, entitled *Landslide Triggering by Rain Infiltration* published in Water Resources Research, with a maximum of 798 citations and a count of citations per year of 38 and that of Gyssels G. (co-authored with Poesen, Bochet LI, 2005), entitled *Impact of Plant Roots on the Resistance of Soils to Erosion by Water*, published in Progress in Physical Geography, 29 (2), with 419 citations and a rate of citations per year of 26.1875.

The researchers' main challenge is to incorporate the distribution of the roots, the stress-strain behavior of the reinforcement of the roots, and the resistance of the roots to compression into the slope stability models.

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5 CHAPTER FIVE

Sustainability of local agri-food systems in a municipality of the Eje Cafetero, Colombia

Sustentabilidad de los sistemas agroalimentarios en un municipio del Eje Cafetero, Colombia

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Orlando Ospina Salazar[2]

Julia Arredondo Botero[3]

Abstract

The local agri-food systems make an important contribution to the food security of rural territories. The analysis of its complexity facilitates the implementation of strategies to promote sustainable rural development. This study aimed to analyze 50 rural agri-food systems, using the MESMIS methodology (Framework for the Evaluation of Natural Resource Management Systems Incorporating Sustainability Indicators). A low level of schooling was found, mostly, a long history inhabiting the area, interest in the implementation of food security processes, but low interest in generational relief. The farm constitutes the basis for family maintenance, it is an important reservoir of genetic material and gender relations are equitable. Food crop management, which is

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one of the aspects that best defines the system, and which is largely based on agroecological practices, is a stable characteristic; in addition, another aspect to take advantage of is the willingness of producers to participate in strategies aimed at promoting food security. An aspect that puts sustainability at risk, is the lack of technical assistance. In general, strengthening these systems is economically possible through awareness raising and capacity building in resource management, socially, by taking advantage of the possibility of implementing organizational strategies and, environmentally, thanks to the interest in adopting agroecological practices.

Keywords: Agroecology, backyard, family farming; food security

Resumen

Los sistemas agroalimentarios locales realizan una contribución importante a la seguridad alimentaria de los territorios rurales. El análisis de su complejidad facilita la implementación de estrategias para promover el desarrollo rural sustentable. El objetivo de este estudio fue analizar 50 sistemas agroalimentarios rurales, usando la metodología MESMIS (Marco para la evaluación de sistemas de manejo de recursos naturales mediante indicadores de sustentabilidad). Fueron encontrados un bajo nivel de escolaridad, en su mayoría, amplia trayectoria habitando la zona, interés en la implementación de procesos de seguridad alimentaria, pero bajo relevo generacional. El sistema productivo es la base para el sostenimiento de la familia, es un reservorio importante de material genético y las relaciones de género son equitativas. El manejo de los cultivos alimenticios, el cual es uno de los aspectos que mejor define al sistema y que está ampliamente basado en prácticas agroecológicas, es una característica estable; adcionalmente, otro aspecto para tomar ventaja es la buena disposición de los productores a participar en estrategias encaminadas a la

promoción de la seguridad alimentaria. Un aspecto que pone la sustentabilidad en riesgo, es la falta de asistencia técnica. En general, el fortalecimeinto de estos sistemas es posible, económicamente, a partir sensibilización y el desarrollo de capacidades en la gestión de recursos, en lo social, aprovechando la posibilidad de implementación de estrategias de organización y, finalmente, en lo ambiental, gracias al interés en la adopción de prácticas agroecológicas, que ponen en evidencia una importante posibilidad de acompañamiento y sensibilización por parte del sector académico.

Palabras clave: Agricultura familiar, agroecología, seguridad alimentaria, traspatio.

Introduction

Food security, defined as the possibility of permanent access to an adequate amount of safe, nutritious, and culturally acceptable food for an active and healthy life (FAO 2012), is a global concern and is included in the Sustainable Development Goals. The concept of food security is contrary to malnutrition and poverty, some factors that put it at risk are poor health and basic sanitation conditions, environmental degradation, and inequity in access to services, among others (Linares 2019). Food and Agriculture Organization - FAO (2011) proposes four fundamental dimensions for food security fulfillment: sufficient food supply, the possibility offered by income to access adequate food, the use of energy and nutrients for a good nutritional condition, and stability in the periodic access to such food, despite external situations.

The concept of food security is closely linked to agriculture, particularly family farming. According to FAO (2014), family farming makes up for at least 84% of farms of less than two hectares and occupies only 12% of the agricultural area, an imbalance that could result in the majority of family producers being poor and exposed to food insecurity. This highlights the importance of recognizing the relevance of these types of systems for the sustainable development of rural areas and their impact on nations (Jaramillo et al 2017), since the effects of food insecurity

not only increase the risks of malnutrition and disease but also exacerbate conflicts and political instability, affecting the productivity and economy of the people, making it an important indicator of social inequity (FAO 2012, Pereira et al., 2017).

The study of family agro-food systems comprehending the recognition of their multifunctionality and multidimensionality, as well as their role in food production, the conservation of agrobiodiversity, and their potential contribution to the sustainability of territories (Bedoya et al 2016, Acevedo et al 2018) is fundamental to undertake strategies that promote sustainable rural development. This is conceived as the comprehensive improvement of the social welfare of the population and its economic activities, seeking the conservation of its natural resources and biodiversity (Pastor et al 2016), a starting point for undertaking actions aimed at guaranteeing food security in the region, with direct effects on the environmental, social, productive, financial and cultural conditions of their communities' lifestyles and a strategic element for the competitiveness of agricultural production systems (Acevedo et al 2018, Fonseca et al 2019).

In Colombia, the Eje Cafetero eco-region is located in the Andean region and is so named for being the largest coffee producer in the country. This has a high representativeness in several aspects and although it only covers 0.015% of the country's area, it constitutes a strategic region in terms of agriculture, ecotourism, and conservation, with cultural and territorial particularities that should be analyzed (Suaza et al 2015; Uribe 2009).

The eco-region is made up of the departments of Caldas, Risaralda, Quindío, northern Valle del Cauca, and northwestern Tolima, whose municipalities, in addition to a long tradition in the cultivation and commercialization of coffee and the development of agro-industry, promising production chains, and the provision of tourism services, present new perspectives for food security, while maintaining a close relationship with farmer economy (Arango 2008).

In the metropolitan area of Risaralda, east of the department, the municipality of Santa Rosa de Cabal is found. It is a mountainous territory located 10 kilometers northeast of the capital of Risaralda, at coordinates 4°52´ north latitude and 75°37´ west longitude and 1,750 meters above sea level. Thanks to its hydrology, it is one of the great regional water pantries and is a biodiverse municipality, with a great variety of ecosystems (Suaza et al 2015; Uribe 2009) and whose economy revolves around coffee, with a strong influence of the farmer economy, demonstrated by the fact that 80% of the farms correspond to plots with less than 5 hectares and in recent years, with a growing trend towards the tourism sector (Mintrabajo et al., 2013). This work was carried out to analyze the sustainability of agri-food systems in the Santa Rosa de Cabal municipality and their contribution to the food security of rural families in the area.

In general, it is considered that the strengthening of these systems is possible, economically, through awareness raising and capacity building in resource management, socially, by taking advantage of the possibility of implementing organizational strategies, and finally, environmentally, thanks to the interest in and adoption of agroecological practices. These highlight an important possibility of support and awareness raising by the academic sector in the absence of technical support by the State. Understanding the dynamics of these systems facilitates the identification of potentialities and weaknesses that should be intervened based on recognizing their complexity and value as a basis for food security not only for rural communities but also for the urban environment and the rest of the country.

Materials and Methods

The work was implemented according to the principles of participatory research and action. The productive systems were evaluated following the MESMIS methodology, a tool based on a cyclical, systematic, and multiscale approach (Silva et al 2017).

Fifty production systems in the municipality of Santa Rosa de Cabal were analyzed. The selection of the systems was based on criteria such as family habitation on the farm, availability of cultivated or arable land, and adequate disposition about the objective of the study.

The second stage consisted of identifying the strengths and weaknesses of each system or critical points. Subsequently, indicators were selected to evaluate the attributes of sustainability, corresponding to productivity (efficiency in the production of goods or services), equity (balance in the distribution of rights, duties, and responsibilities between men and women), stability (maintenance of production and productive performance in the face of externalities), resilience (capacity of the production system to protect and safeguard productivity in the face of uncertainty or disturbances), reliability (conservation of the resource base), adaptability (capacity to modify functioning in response to changes in the environment) and self-management (possibility of reducing dependence on inputs and making positive decisions in the community) (Albarracín et al 2019; Carreño et al 2019; Valdez et al 2017).

These attributes were analyzed using 42 indicators whose weighting is presented in Table 1. The collection of information for the measurement and monitoring of the indicators was carried out using an interview and the application of a structured survey. The information was complemented by direct observation and dialogues with the owner or person in charge and the participation of as many family members as possible.

Based on the evaluation of the degree of compliance with these indicators, the degree of sustainability of the evaluated systems was established, taking into account that a system can be classified as sustainable and with stable efficiency if it has a percentage of compliance with

indicators between 71 and 100%; the system is sensitive and moderately sustainable with values between 31 and 70%, and with values below 30% it is considered unsustainable and in danger (Fonseca et al 2020). Data were tabulated in Excel and results were analyzed using frequency distributions, represented graphically using "amoeba" or "radial" or radial diagrams. Multiple correspondence analysis was performed by using FactoMineR and FactoShiny packages in the R-Studio environment (ver. 1.1.453) (RStudio Team 2020).

Table 1
Measurement indicators to evaluate the sustainability attributes of the systems.

Attribute	**Indicator**	**Weighting by indicator**
Productivity	Number of crops or food species	5
	Food crops area	5
	Purpose of food crops	5
	Number of spice resources	2
	Area of the spice resources	2
	Purpose of spice resources	2
	Type of animals raised	3
	Total number of animals	3
	Purpose of livestock production	3
	Basis of household income	5
	Monthly/weekly household income	2,5
	Income/expense ratio	2,5

Return

Stability, reliability, and resilience	Number of medicinal crops	4
	Area of medicinal crops	3
	Purpose of medicinal crops	3
	Utilities on the farm	1
	Proof of water supply	1
	Drinking water quality	1
	Sanitary facilities on the farm	1
	Wastewater management	1
	Receipt of information or technical assistance in Food Safety	2,5
	Conservation of water sources	1
	Experience in agricultural production	1
	Perception of food security	2,5
Equity	Distribution of tasks by gender	5
	Quality of communication between family members	2
	Authority in the home	4
Adaptability	Labor in mainline items	3
	Labor invested in food and medicine production	3
	Manpower invested in animal husbandry	3
	Management of food crops	1
	Management of spice resources	1
	Management of medicinal crops	1
	External parasite control type	1
	Internal parasite control type	1

	Disease control type	1
	Use of organic fertilizers produced on the farm	1
	Number of people living and working on the farm	1
Self-management	Participation in organizations	1
	The conception of belonging to organizations and/or working in the community	2
	Advantages of working in a group or community	2
	Interest in participating in the elaboration of the Food Security Strategy	5

Source: own elaboration

Sustainability attributes were analyzed and represented by radial diagrams. The qualitative variables were analyzed by calculating frequencies, the categories were incorporated into the Multiple Correspondence Analysis (MCA), to produce new variables expressed in dimensions, corresponding to linear combinations of the categories to establish a numerical expression of these results.

Results and Discussion

General characteristics of the systems analyzed

92% of the farms are located more than one hour from the nearest urban center; at an altitude between 1600 and 1800 meters above sea level, in 62% of the cases, and between 1401 and 1600

in 38% of them. Fifty-eight percent of the farms were found to have less than 3 ha (20% less than 1 ha and 38% between 1 and 3), 26% have between 3.1 and 5 ha, 10% have between 5.1 and 10 ha and 6% have more than 10 ha.

Colombia, with a Gini coefficient of 0.89, is one of the most unequal countries in the world. In 2019, the percentage of owners of rural properties of less than one hectare was 43.26% and they occupied 0.5% of the country's rural land area, while 0.07% of land owners with more than 2000 ha occupied 54.7% of Colombia's rural land surface (Pachón 2022), additionally, according to the Informality Index of the Agricultural Rural Planning Unit (UPRA), 54.3% of the country's rural landholdings have informal land tenure, which leads to great vulnerability in socioeconomic terms (UPRA 2017).

Eighty percent of those interviewed are farm owners, 14% are administrators and the remaining 6% have another type of relationship with the property. Regarding the place of origin of the family group, in 54% of the cases, they come from the same or nearby villages, 36% from distant rural areas, and 10% have come from urban areas of other municipalities or departments. There is evidence of a strong attachment to the territory and it is an area that welcomes people from both rural and urban areas. Thirty-eight percent have lived on the property for more than 20 years, 24% between 6 and 20 years, 30% between 2 and 5 years, and only 8% have lived there for less than 2 years.

Regarding the size of the families, 94% of them have less than 5 members and only 6% have more than six. Concerning the educational level of the respondents, 76% have some primary schooling, 12% have some secondary schooling, and 6% have at least one of the spouses with a high school degree. Only 2% of the respondents have a university degree and 4% have no education at all.

Ninety percent of the farms have coffee as their main crop, while 10% are diversified and do not have a specific main crop. According to Pescio (2020), this type of system constitutes an important strategy for food security, given that they aim to supply fresh vegetables and animal protein to the domestic units in which they are developed, integrating a great diversity of birds, minor species, vegetables, fruits, medicinal and aromatic plants (Jaramillo et al 2017).

It is noteworthy that 12% of those surveyed expressed little interest in any of their children continue to work in the fields; the difficulties are evident when only 52% of them are exclusively engaged in agricultural activities and the remaining 48% have had to resort to other types of activities such as hairdressing, dressmaking, and trade to generate income to support the family. This situation reflects one of the most notorious problems of family farming, which is the lack of generational replacement. According to Bedoya et al (2016), in general, this trend is aggravated by the aging of the rural workforce, as the age of the heads of agricultural production units is around 50 years old. Additionally, the quality of health services according to the perception of 80% of the respondents, is poor, 18% think it is regular and only 2% consider it good.

An important indicator of food stability is the percentage of food that enters the farm (Lucantoni et al 2018). Colombia is one of the most vulnerable countries to access a basic food basket and, particularly in the rural sector, it is very complicated to access supplies in an equal manner, given the difficulty for these foods to manage to reach the communities (Aulestia et al 2020). Regarding this, all respondents buy at least 5 food products that could be grown on their land, so it is estimated that awareness raising and training could be intervention strategies with a high impact on food security.

Analysis of variables by attribute

Analysis of variables by attribute

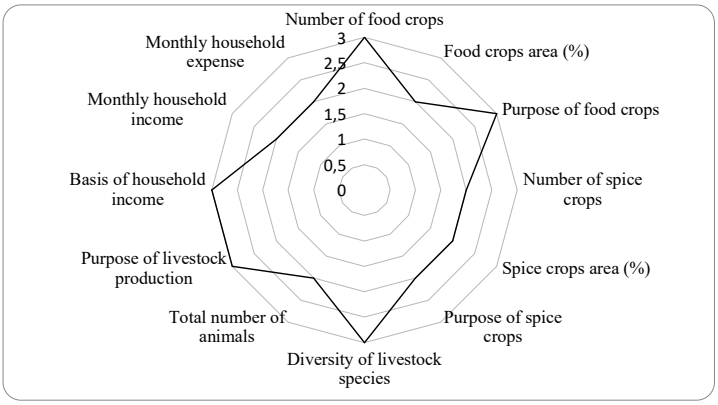
Productivity**:** *All productivity indicators were found to be stable or moderately sustainable (Figure 1). Such diversification of products is an important basis for food sovereignty since it provides families with a wide variety of nutrients, represented in vitamins, minerals, and proteins, which help to combat hidden hunger (Frison et al 2011).*

Both the crops and the production of livestock species are destined for self-consumption and sale, being the farm the basis of sustenance for the family and also a reservoir of genetic material, given the diversity of materials found. According to the variables categorized as sensitive, the density of animals per area, as well as the space allocated to food and condiment crops, are aspects that could be improved, seeking the optimization of production for sale, which would improve the monthly relationship between income and expenditure, another sensitive variable that can be addressed from the strategies of management and marketing of products.

According to Acevedo et al (2020) one of the main challenges facing agriculture is to increase productivity at all levels in the face of the imminent demand for food, which will eventually have to be duplicated by 2050 to cope with the growth of a population that will reach approximately nine billion inhabitants (FAO 2017). In this scenario, alternatives such as poultry production, frequent in this type of system, are important, since they provide supplementary incomes and are a source of high-quality protein for the diets of rural dwellers whose traditional diet is especially rich in carbohydrates (Islam et al 2020).

Figure 1

Radial diagram of sustainability indicators for the productivity attribute.



Source: own elaboration

Stability, reliability, and resilience: Regarding this attribute, aspects such as the trajectory in agriculture, the concept that producers have about the importance of food security, as well as the possibility of access to and quality of public and sanitary services are stable (Figure 2). Despite this, it is noteworthy that 88% of the families still use firewood for cooking, 78% of them combine it with another source, such as gas or fuel, 8% cook exclusively with gas, while only 18% have access to energy for cooking and combine it with other sources.

In addition to the secondary effects derived from the use of solid fuels, among which are health effects and the impact on productivity in rural areas given the collection and cooking time (Troncoso et al 2018), it is necessary to consider that species such as birds, kept under rustic conditions and without electricity, may be subjected to climate adversities, with the consequent impact on productivity, and even on aspects such as mortality and the occurrence of respiratory or gastrointestinal diseases (Cuca et al 2015).

The moderately sustainable variables for this attribute are the variety of species and the area used for medicinal crops, as well as the conservation status of water sources and the management of wastewater. In general, family farming systems conserve genetic resources and possess extensive knowledge about aspects of selection, use, and reproduction (Acevedo et al 2020). The cultivation of medicinal plants is of great importance because, in addition to representing an important cultural element, represented in the oral tradition of information transmitted from generation to generation, they are, in the case of rural communities, the main alternative for primary health care, given the restrictions on access to medical services and medicines as well as the difficulty and high cost of transportation (Gallegos 2016, Castellanos et al 2019).

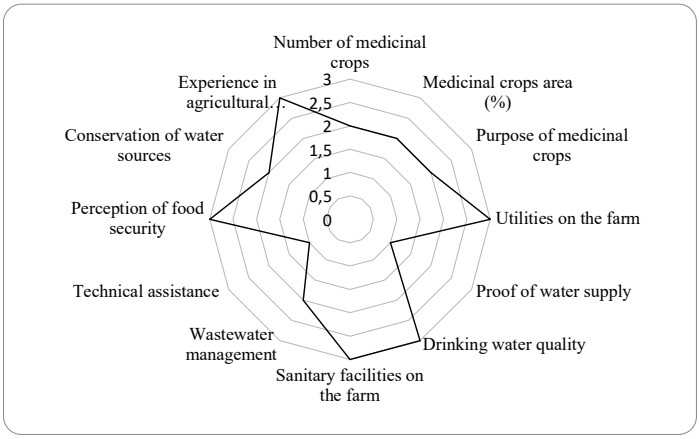
In addition to medicinal crops, water resource management is of vital importance, since sustainable development promotes the protection and sustainability of natural resources. In a scenario of global climate change, and given the ecological impact that some agricultural practices can generate, including excessive use of natural resources, evidenced in soil weathering and contamination of water sources (Albarracín 2019), it is essential to promote among producers, without intervening in their cultural dynamics, strategies such as the so-called sustainable behaviors, which are actions aimed at conserving natural resources (Barrera et al 2021). These include pro-ecological behaviors, focused on the conservation of the natural environment, frugal, which avoids the consumption of resources, altruistic, which seeks to increase the welfare of others, and equitable, equanimous, or balanced (Corral 2010, Heredia et al 2020).

Endangered or unsustainable aspects are the absence of technical assistance and the lack of consistency in water supply, aspects that depend on external entities to the system, and evidence of the lack of state provision in certain rural areas. According to FAO et al (2018), in some rural areas of the country, the food security of families has largely depended on their ability to maintain their own crops and the resilience they have acquired over time, particularly in response to neglect

by the State, reflected in the neglect of their needs, the lack of guarantee of their rights and the ignorance of their identity (Rivera 2018).

Figure 2

Radial diagram of the sustainability indicators for the Stability, reliability, and resilience attribute.



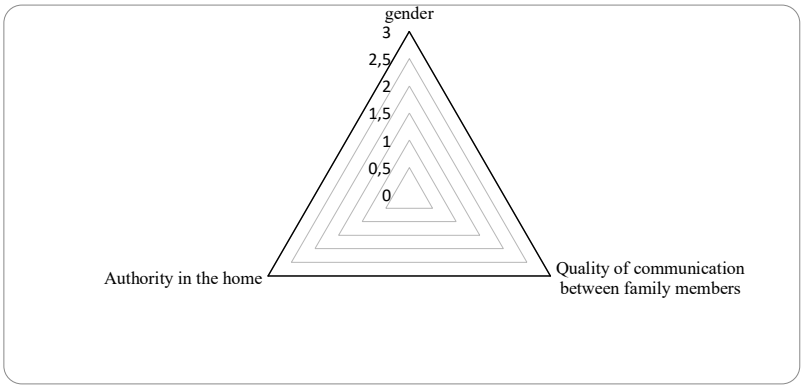
Source: own elaboration

Equity: The aspects evaluated in the equity attribute reflect sustainability and stable efficiency, determining that gender relations in the systems analyzed are adequate (Figure 3). The importance of this attribute goes beyond the territorial approach, as it guarantees a comprehensive, inclusive, and sustainable approach that generates equitable conditions and quality of life that result in the development of the territories and their inhabitants (Soares 2022).

Quetzalli et al (2021), highlight the contribution that activities such as backyard poultry farming make to the empowerment of women in rural communities, who have gone beyond the simple intervention supporting men in the work and have acquired roles with greater autonomy and decision-making power in the production and generation of resources (Aristizábal et al 2019).

Figure 3

Radial diagram of the sustainability indicators for the Equity attribute.



Source: own elaboration

Adaptability: Concerning this attribute, only the management of food crops, which in general terms is carried out in accordance with the principles of agroecology and therefore environmentally sustainable, was stable (Figure 4); variables such as the management of medicinal crops, the origin of the labor force and the use of organic fertilizers produced on the farm, as well as sanitary control in general, are aspects with medium sustainability, susceptible to improvement, while the techniques used for the control of external parasites is deficient, since there are, in general, no practices associated with this aspect, despite being required.

Aspects such as the technical management of the system, the generation and use of appropriate technologies, and the optimization of available resources are key to its sustainability, but they are also susceptible to intervention and support from academia and the corresponding governmental entities.

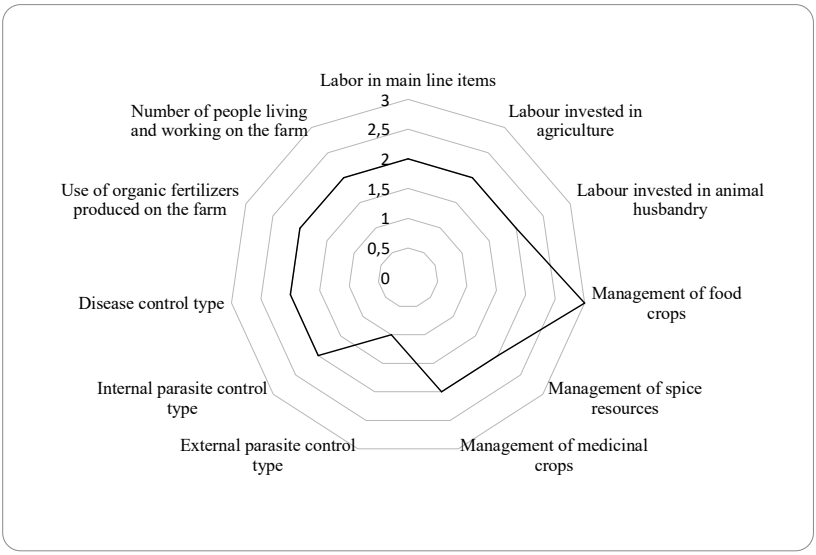
According to Martínez et al (2020), small producers, rural and farmer communities are a very vulnerable sector in the face of environmental changes, as they depend directly on natural resources for their economy and are therefore forced to modify their production strategies and even their way of life. Despite this, they generally have a wide range of practices, genetic material, knowledge, and adaptation mechanisms to face these challenges. Those systems that adopt the agroecology approach are based on sustainable agriculture and value cultural practices and traditional knowledge that strengthen food self-sufficiency and reduce dependence on external inputs, but there is a high interdependence between practices in agroecosystems with their biophysical conditions and the socio-economic situation of the rural family (Fonseca et al 2015).

In addition, these systems are "multifunctional", i.e., they fulfill ecosystem functions that go beyond the productive dimension of food, plant, and animal raw materials. These can offer other goods and services, some of them of a public nature (externalities) (Cañas et al 2015), due to the interaction of agricultural and livestock activities that contribute to functions such as the possibility of saving, exchange and generation of food and income, the recycling of material and energy, the use of family labor and the preservation of genetic materials and traditions (Jiménez et al 2019).

It should be noted that these types of systems are influenced by socioeconomic, political, and cultural aspects that are directly related to the particularities of the territory where they are located (García 2020).

Figure 4

Radial diagram of the sustainability indicators for the Adaptability attribute.



Source: own elaboration

Self-management: in general, producers are willing to participate in strategies to promote community food security, have a good concept of associativity, and are linked to organizations such as community action boards, local administrative boards, and cooperatives. However, one aspect to improve is their perception of the advantages of community work, as there are some constraints, such as the need for everyone involved to contribute (Figure 5).

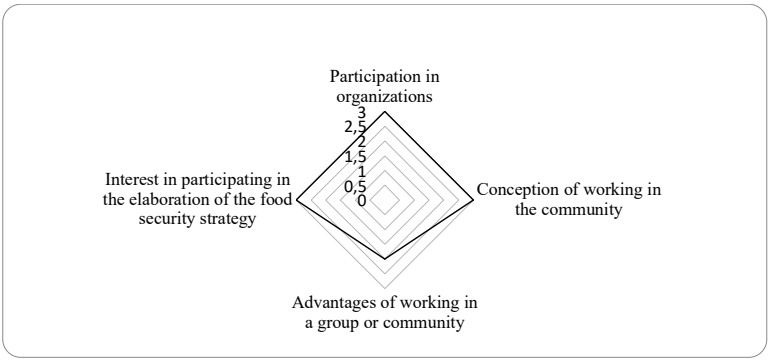
According to Acevedo et al (2020), small-scale systems can face the food and environmental crisis if they consider the promotion of agrobiodiversity, the democratization of access to land, organization, and collaborative work among territorial actors. This is because in order to face the growing dependence on inputs and technologies to achieve a minimum economic income, there have been changes in power relations in the agri-food system, with the consequent loss of heterogeneity of traditional systems and intensification leading to ecosystemic imbalance (Gallegos 2016).

To counteract the negative effects of globalization on these types of systems, one option is alternative economic networks or cooperativism, which gives prevalence to solidarity, and a sustainable economy, also focused on solving needs at the local level (Sánchez et al 2020).

On the economic side, the strengthening of these systems is possible through awareness raising and capacity building in resource management; on the social side, a great advantage is the willingness of producers to integrate organizational strategies; and finally, on the environmental side, thanks to the interest and adoption of agroecological practices, there is an important possibility of accompaniment and awareness raising by the academic sector in the absence of the State.

Figure 5

Radial diagram of the sustainability indicators for the Self-management attribute.



Source: own elaboration

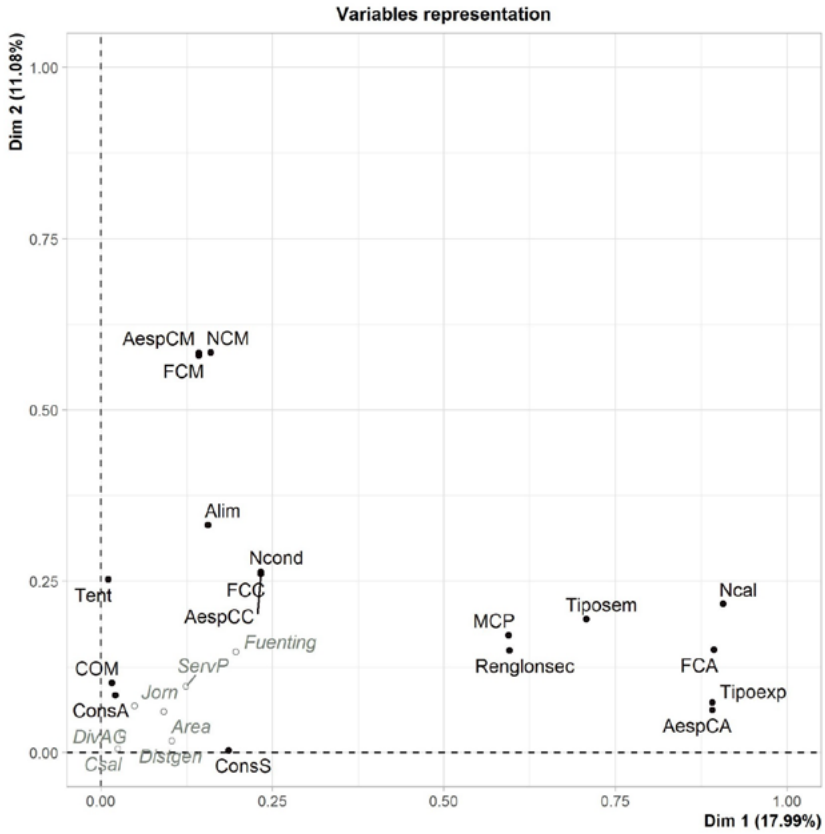
Multiple correspondence analysis

The first two dimensions explained 29.07% of the variance (Figure 6). The variables that most define the system, contributing to Dimension 1, are those related to the diversity, management, and organization of food crops, such as the number of food crops, their spatial arrangement (Associated, in monoculture, without spatial arrangement), their purpose (self-consumption, sale, both), the type of exploitation (agricultural, diversified without any main product); while the variables that contribute most to Dimension 2 are those related to the management, arrangement, and variety of medicinal crops (spatial arrangement, number, and purpose), which in addition to being a resource, could be an additional source of income for family sustenance.

The supplementary variables of the analysis were those associated with the socioeconomic aspect, such as public services, area of the farm, source of income, distribution of tasks by gender, and day labor on external farms. It can be observed that the above variables are related to social or environmental aspects, the type of crops is the aspect that most intervenes in the definition of this type of system.

Figure 6

Graphical representation of the first two dimensions of the multiple correspondence analysis.



Source: own elaboration

AespCM: Spatial distribution of medicinal crops; NCM: Number of medicinal crops; FCM: Purpose of medicinal crops; Alim: Animal feeding; Tent: Possession or tenure of land; FCC: Purpose of spice crop; AespCC: Spatial distribution of spice crops; Fuenting: Source of household income; ServP: Public services; Area: Farm area; Distgen: Distribution of tasks by gender; ConsS: Seed conservation; COM: Communication in the family; ConsA: Conservation of water sources; DivA: Animal diversity; Ccal: Number of food crop; MCP: Main crop management; Renglonsec: Secondary source of income; Tiposem: Type of seed; Ncal: Number of food crop; FCA: Purpose of food crop; Tipoexp: Type of farm; AespCA: Spatial distribution of food crops.

Conclusions

Local agri-food systems present dynamic interactions between many components and have an important role in the generation of food for the rural sector, the protection of natural resources, and the conservation of biodiversity. In the systems studied, it is necessary to regain confidence in community activities, producers require technical assistance and support to improve some processes, such as the health management of their animals and the planning of the farm to improve economic income since there is still a high dependence on non-farm sources of income.

There are strengths such as interest in the implementation of food security processes, the agroecological management of some crops, the diversity of species, rootedness in the territory, and equity in gender relations. The intervention of the academy must respect aspects of its tradition, seeking to improve internal capacities, its "multifunctionality" and its capacity for resilience in the face of external challenges, such as environmental restrictions and deficiencies derived from the absence of the state.

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6 CHAPTER SIX

Organizational strategies aimed at the Emberá Chamí unified indigenous reservation, Inamurcito community located in the municipality of Pueblo Rico, Risaralda

Estrategias organizacionales dirigidas al resguardo indígena unificado Emberá Chamí, comunidad Inamurcito ubicada en el municipio de Pueblo Rico, Risaralda.

Carla Johana Martínez García[1]

Yenny Marcela Vélez Herrera[2]

Abstract

This book chapter derives from institutional research which was aimed at the "Formulation of administrative, commercial and organizational strategies for the adoption of good agro-industrial practices in the production and marketing of products derived from sugar cane in the Inamurcito

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community" which began in 2020 and was extended until 2021 due to the mobility difficulties that arose due to the pandemic.

The fieldwork was carried out through visits to the community and conversations with the junior governor to establish an analysis of stands for Strengths, Weaknesses, Opportunities, and Threats (SWOT), through observation, open dialogue with the governor and with the community, the construction of a Vester matrix, also the causal methodology was worked under a tree of problems to establish real causes that affect the organizational processes in the community.

This research process has been aimed at establishing organizational strategies for the organizational strengthening of the community, to implement self-management processes that allow the generation of added value, thus placing their handicrafts and agricultural products in the regional market at better prices and allowing consumers access to organic food. The research team prepared a booklet as a communicative proposal, which was translated by the junior governor into the community's own language, edited and published by the Fundación Universitaria del Área Andina, and socialized to the community to generate an appropriation of the processes of good agricultural practices for the economic and social development of the community. The administrative guidelines have respected ancestral traditions, territorial, and cultural roots, guaranteeing recognition, respect, and protection of the autonomy and multiculturalism of the Indigenous community under study.

Keywords: organizational strategies, indigenous communities, ecology of knowledge, good agro-industrial practices.

Resumen:

El presente capítulo de libro deriva de una investigación institucional, que se enfocó en la "Formulación de estrategias administrativas, comerciales y organizacionales, para la adopción de buenas prácticas agroindustriales en la producción y comercialización, de los productos derivados de la caña de azúcar de la comunidad Inamurcito", el cual inició en el año 2020 y se extendió hasta el año 2021 debido a las dificultades de movilidad que se presentaron por la pandemia. El trabajo de campo se realizó mediante visitas a la comunidad y conversaciones con el gobernador menor con miras a establecer un análisis de debilidades, oportunidades, fortalezas y amenazas (DOFA), mediante la observación, dialogo abierto con el gobernador menor y con la comunidad, la construcción de una matriz de Vester, también se trabajó la metodología causal bajo un árbol de problemas para establecer causas reales que afectan los procesos organizacionales en la comunidad. Este proceso investigativo ha estado encaminado hacia establecer estrategias organizacionales para el fortalecimiento organizacional de la comunidad, para implantar procesos de autogestión que permitan la generación de valor agregado en los productos elaborados, ubicando así sus productos artesanales y agrícolas en el mercado regional a mejores precios y permitiendo a los consumidores el acceso a productos orgánicos. Se elaboró una cartilla como propuesta comunicativa por parte del equipo investigador, la cual fue traducida por el gobernador menor al lenguaje propio de la comunidad, editada y publicada por la Fundación Universitaria del Área Andina y socializada a la comunidad con el fin de generar una apropiación de los procesos de buenas prácticas agrícolas procurando el desarrollo económico y social de la comunidad. Las orientaciones administrativas dadas han respetado las tradiciones ancestrales, el arraigo territorial, y cultural garantizando reconocimiento, respeto y protección a la autonomía y pluriculturalidad de la comunidad indígena objeto de estudio.

Palabras Clave: estrategias organizacionales, comunidades Indígenas, ecología de saberes, buenas prácticas agroindustriales.

Introduction

In this section, we will present some results obtained during the research process, which also gave rise to the degree work of the Pereira Business Administration student Yenny Marcela Vélez Herrera, together with the researcher teacher Carla Johana Martínez García. The academic purposes of the researchers were aimed at the formulation of organizational strategies identified for the community self-management of the sugarcane mill project "Producing Hope" by the community of the Unified Indigenous Emberá Chami Resguardo, Inamurcito Community located in the municipality of Pueblo Rico Risaralda. The main purpose of this book chapter is to present the results obtained with the community through the application of the Vester matrix and the causal methodology of the problem tree and finally, the SWOT analysis obtained from the entire research process.

To dimension the importance of this research it should be kept in mind that the department of Risaralda has a large population of Emberá Chamí. According to the Organización Nacional Indígena de Colombia (ONIC, 2023), a large part of the Embera Chami population lives around the San Juan River and in the municipalities of Pueblo Rico and Mistrató, in the department of Risaralda, so considering the 2005 DANE Census, 29,094 people who self-identify as members of the Embera Chami people. 50.2% are men (14,609 people) and 49.8% are women (14,485 people). In the department of Risaralda, 55.1% of the population (16,023 people) live.

This population has been hit not only by the problem of internal displacement but also by all the technological backwardness to which they have been exposed. Thus, it is necessary for the

different social sectors to support the social, organizational, and political development of the communities in order to support the processes of good agro-industrial practices that guarantee the food stability of the communities and allow the conservation of the environment within the framework of respect for their own and traditional identities. It is also relevant to establish the challenges for social inclusion and strengthening the cultural identity of the Indigenous population by incorporating sustainable production systems within the framework of good practices under the guidelines proposed by FAO for these types of communities.

There is a commercial and technological gap for indigenous communities, among the variables that exacerbate this problem are difficulties in logistical organization (lack of training in project management), deficit in basic services, deficiencies in road access to the territories; climate change affecting the normal cycle of agricultural production; Limited Internet connectivity and mobile reception signal; in some parts of the territory there is no connectivity at all; risks of shortages due to landslides that occur in the area; generational change as young people migrate to the urban centers, exacerbating the technological gap; difficult access to education, and pressures from armed groups, which hinders the development of community projects. In addition to the above, there is a lack of consumer interest in the products of the Indigenous communities, preferring imported products, due to the lack of a culture for the valuation of the national product and strategies for the recognition of their products. All this has meant that the communities are relegated and do not feel productive even though they possess a lot of ancestral and cultural knowledge. This proposal has focused on the need for knowledge about the application of administrative tools and resources to access new forms of marketing such as social networks and digital platforms. This community has the knowledge to produce organic, environmentally sustainable agricultural products. They also produce beautiful handicrafts that reflect their

connections with nature, and a myriad of products from their diets that not only nourish but in many cases are useful for a healthy life.

On the other hand, it is pertinent to highlight that the community addressed is a community that has returned after a long process of displacement and that their empathy and desire to improve has allowed a dialogue of knowledge within the framework of respect for difference, which has led to a process of empathy and relationship under the respect of ancestral knowledge and the community's own worldview. Working with indigenous communities has been a challenge, especially when it comes to understanding their own realities and knowledge, for which we received support from an ethnic educator, in addition to the permanent accompaniment of the community's junior governor who was present accompanying the visits and the relationship with the community that is the subject of this study, to whom we are grateful for their voluntary participation.

Theoretical Framework

The theoretical approach to address the research problem focused on reviewing the literature on business administration, for which the concepts presented by Porter, M. (1999) on the value chain have been taken into account, contrasting with the theoretical proposal presented by Boaventura de Sousa Santos, who has worked with social projects and Latin American indigenous communities, integrating global aspects and management techniques to the production processes of indigenous communities in countries such as Brazil, Mexico, and others. For De Sousa Santos, B. (2012) "Alternative forms of knowledge are alternative sources of production" (p.5). Precisely what is sought is to start from the social realities of the territories and relate Indigenous communities with

governments and support organizations to seek help for the integration of their products, arts, and cultures that are better recognized in different global environments, respecting their culture and knowledge.

Porter is clear in establishing that for the generation of value in a company constructive collaboration is required in what he defines as three fundamental axes that we will talk about below. To begin with, it is important to be clear about the concept of "company" from the meaning given by the dictionary of the Royal Spanish Academy as "Organizational unit dedicated to industrial, commercial or service provision activities for profit". In this sense, for Porter the generic value chain is constituted first by the development of the product and its commercialization, that is, "the primary activities are those that have to do with the development of the product, its production, logistics and marketing and after-sales services". Secondly, according to Porter, there is the business infrastructure in which finance, accounting, quality management, public relations, legal advice, and general management that refers to the administrative and organizational process are contemplated. Third, there are the activities of support to the primary activities are composed of the administration of human resources, purchases of goods and services, technological development, telecommunications, automation, development, and process engineering, research that is, business infrastructure (As cited in Quintero, 2006). Considering the theory proposed by Porter and analyzing the object of study which in this case is the community project, it can be inferred that it is necessary to work on these three aspects to achieve added value to the products made by the community.

In addition to Porter's theoretical postulate, the experiences of Boaventura and some of his theses raised in the book "De las dualidades a las ecologías" are added, particularly in the section "Conclusions: nine theses on production alternatives", the author was taken from which the

following theses are taken: "The success of production alternatives depends on their insertion in networks of collaboration and mutual support" (De Sousa Santos, B., 2012).

Applying these theses, we sought to integrate the Indigenous community in the construction of answers to their problems from their ancestral knowledge and arts, in such a way that this construction allows them to integrate into a community organization with new learning for the development of their products and commercialization to participate voraciously with quality products and beneficial to the communities.

Methodology

To achieve the purpose of the research, the research methodology focused on carrying out an organizational analysis to elucidate the current situation of the community. The qualitative approach was aimed at the construction of the SWOT analysis and the quantitative approach focused on the problems, for which a data collection instrument was used as a data collection sheet and subsequent data analysis by means of the Vester matrix. The target population was the Emberá Chami Indigenous community of the Inamurcito village. The communication technique of the communicative strategy was done using playful booklets, training in the process of construction of the problems, and logistical organization for the collection of the required data. It should be noted that the community actively participated in the participatory process and in the socialization of the booklet.

Participants

The community project is made up of thirty-four families who have actively participated in the research process and in the socialization of the booklets as a strategy for disseminating good agro-industrial practices. It should be noted that the collection process was structured in this way considering the characteristics of the community in which the family groups act jointly, and their participation is defined by counting the families as the target population.

Results

Social context

The Indigenous communities located in the departments of Choco and Risaralda have been continuously victims of the forced displacement that has been experienced in the country because of the internal conflict. In the Thesis presented by Oriana Cortés Muñoz Cortés Muñoz (2013) to opt for the master's degree in social Anthropology at the National University of Colombia called *Interpretaciones de la migración y el desplazamiento embera, el caso de familias embera katío en Bogotá. Departamento de Antropología.* Cortéz presents a quote in which she exposes: The indigenous people who were in Bogotá by 2007 coming from several hamlets among them aguasal, cascajero, ocotumbo and pescadito, returned to the area of origin in 2007, lived in Andágueda for two years and traveled to Bogotá again claiming for a project that never arrived. The people interviewed recall that construction materials and tools were left abandoned on the roads on the way to the hamlets. In other words, the government project did not reach the territory. In the memories of this period, the lands are infertile, there are no animals, no food, and there are no memories of daily activities, which indicates to me that the

territory is empty of meaning, it is no longer remembered. This quote reflects the situation of the members of the Emberá Chami Unified Indigenous Reservation, and specifically of the Indigenous Community located in the village of Inamurcito who have not been oblivious to this scourge, forced displacement led them to abandon their lands and travel to Bogotá while the order was established in their territory to return again to a forgotten territory. This phenomenon of displacement and subsequent reincorporation into their territory has generated a problem of social organization, dismantling the system of community organization that is required for a collective enterprise, because for years their only objective as a community was to survive forced displacement in Bogotá.

In 2008 a grassroots community initiative arose, promoted by the junior governor of the Inamurcito village, who proposed to his community of 30 families of the Inamurcito village, the need to organize in order to improve their food sustainability, family employment, and community work to generate roots not only for its current members but also for future generations, based on life plans and indigenous mandates raised in the various assemblies of struggle and resistance of indigenous people. It began with the initiative of planting sugarcane considering the agricultural vocation of the community, in 2018 the idea of the construction of the sugarcane mill "Building Hope" proposal was well received by the community, with a first approach to Sena Pereira to learn technically about the planting and care of sugarcane cultivation through a training course in which the whole community participated and also received and planted the sugarcane seeds in their territory. A total of 10 hectares of sugarcane crops were planted, of which 9 hectares were planted on the land of the 30 members, with each family responsible for planting half a hectare (4 tons of sugarcane seed), and a hectare of leased land was used for planting according to information provided by the governor of the Inamurcito village. The Government donated the seeds, and the entire community attended the training and

committed to planting. A new challenge is how to manage the resources for the construction of the mill. Initially, the community presented a proposal to the Ministry of the Interior which was sent to the Rural Development Agency (ADR) where they were asked for technical information that they could not build considering that its members did not have training in the formulation of projects of this type. Thus, in a first approach with the University Foundation of the Andean Area through the IDEAS seedbed, the accompaniment of this community began in the first semester of 2019 to present a proposal for financial leverage to the Rural Development Agency, which was later submitted to the Governor's Office of Risaralda. The question then arose as to how to ensure that this community initiative does not fail and becomes a successful case, considering that other communities have received economic leverage from different Indigenous communities in the region, which has not been adequately addressed.

Figure 1

Photos of the community provided by the junior governor of the Inamurcito community.

Source: Oscar Arce Nariquiaza (2021)

Vester Analysis

To apply Vester's analysis, the Emberá Chamí community met at the home of Professor Pedro, who is the teacher assigned to the community school. The meeting began at 7:00 am on October 31, 2021, first socialize the dynamics of the methodology with the help of an ethnic educator, the junior governor, and the teacher assigned to the community school for the teaching processes, asking each of the participants what are the problems present in the community, and place the information on a whiteboard.

Figure 2

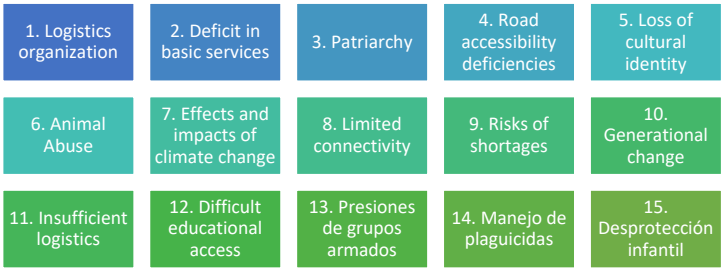
Photos taken during the activity with the community.

Source: Oscar Arce Nariquiaza (2021)

The following list of variables was obtained from this dynamic:

Figure 3

Variables obtained in the problem brainstorming.



Source: Martínez y Vélez (2021). Formulación de estrategias administrativas, comerciales y organizacionales para la adopción de buenas prácticas agroindustriales en la producción y comercialización de los productos derivados de la caña de azúcar, dirigidas al resguardo indígena unificado Emberá Chami, comunidad Inamurcito ubicada en el municipio de Pueblo Rico Risaralda fase 1.2.

With the above inventory of variables that delimit the organizational system addressed in this research work, we proceeded to qualify the causality and effect relationships between them, on a scale of 0 to 3 where 0 = no causality, 1 = low causality, 2 = medium causality, 3 = high causality. Consequently, it was explained in a very playful way to the community how they could participate and what the dynamics and purpose of the process were. The community participated, with the presence of the members that are part of the project “Producing Hope.”

Once the information built with the participation of the community was available. We proceeded to establish the cross-impact matrix, correlating the identified variables of the community's problems to establish a causal relationship. The variables were compared as

shown in figure 3, comparing them with each other and giving them the rating. Finally, the rows are added up to plot and identify which variables are the most important.

Figure 4

Image of the tabulation of the information in Excel according to the criteria established by the community, the Junior Governor, supported by the research team for the elaboration of the Vester matrix.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
1		1	1	1	2	0	0	2	1	2	2	2	1	1	1	17
2	0		1	1	1	0	1	1	1	0	1	1	1	1	0	10
3	0	0		0	1	1	0	1	0	2	0	3	1	0	1	9
4	1	1	0		0	1	3	1	0	1	2	0	1	0	0	10
5	0	1	1	1		0	1	1	1	1	0	2	1	0	1	11
6	0	0	1	2	1		1	1	0	1	2	3	0	0	0	12
7	1	1	0	1	0	4		2	0	1	1	1	0	3	0	11
8	1	2	0	1	0	1	2		1	1	1	0	1	0	0	11
9	1	0	1	2	3	0	3	2		2	2	1	1	0	0	19
10	0	0	1	3	3	1	0	1	1		0	1	1	0	3	16
11	3	1	1	1	1	1	0	3	3	2		1	2	1	2	23
12	0	2	1	3	1	1	3	3	1	1	2		1	0	2	20
13	0	1	1	1	2	1	1	1	1	1	1	2		1	2	16
14	3	1	0	0	1	0	1	2	0	1	1	3	0		0	14
15	3	2	2	0	1	0	0	1	0	1	0	2	2	0		14
	13	15	11	17	16	8	16	22	10	17	17	22	13	7	12	

Source: Martínez y Vélez. (2021). Formulación de estrategias administrativas, comerciales y organizacionales para la adopción de buenas prácticas agroindustriales en la producción y comercialización de los productos derivados de la caña de azúcar, dirigidas al resguardo indígena unificado Emberá Chami, comunidad Inamurcito ubicada en el municipio de Pueblo Rico Risaralda fase 1.2.

The next step is to take the Critical or double-linked: they operate in double functionality, being both causal and resultant at the same time.

The variables are selected:

- Active or driving those generating other variables. Causal processes.

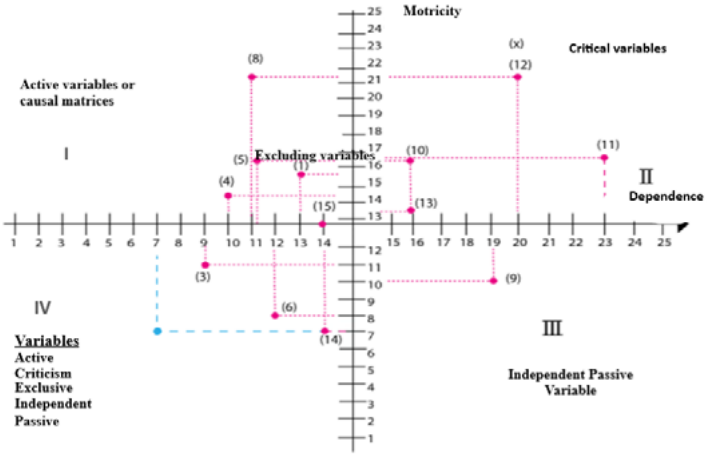
- Exclusive: they should not be considered for the intervention proposal for variables of very low intensity and very low dependence.

- Independent: correspond to those variables of low motor and dependence.

- Passive or dependent: represent those variables of very low dependence and very low causality.

Figure 5

Cartesian plane called motor and dependence graph and according to how the variable points.

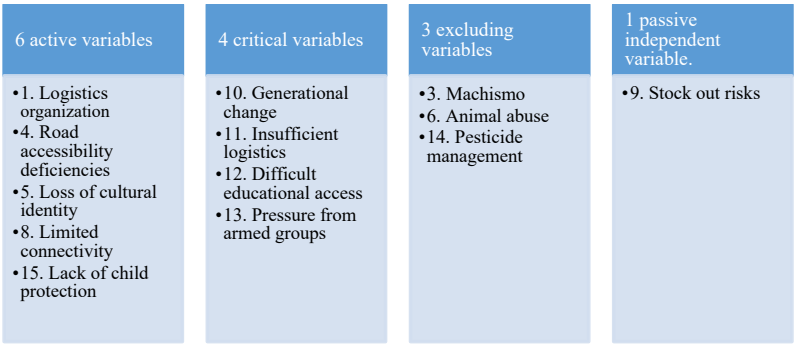


Source**:** Martínez y Vélez. (2021). Formulación de estrategias administrativas, comerciales y organizacionales para la adopción de buenas prácticas agroindustriales en la

producción y comercialización de los productos derivados de la caña de azúcar, dirigidas al resguardo indígena unificado Emberá Chami, comunidad Inamurcito ubicada en el municipio de Pueblo Rico Risaralda fase 1.2.

Figure 6

Analysis of the variables.



Source: Own elaboration

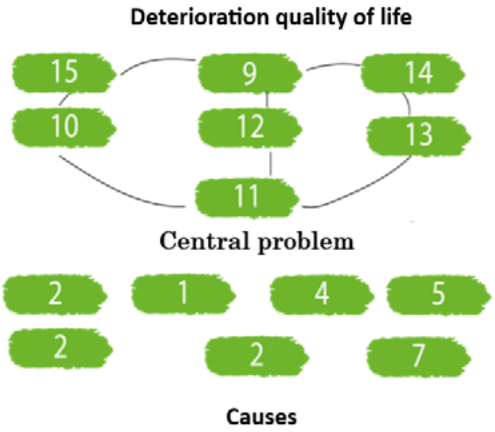
It should be noted that with the use of the Vester structural analysis, it was possible to classify the causes and effects of the problem in a better way.

Problem tree

The problem tree is a technique of the logical framework system, which makes it possible to identify and visualize the deepest causes and fundamental roots of the so-called central problem, which acts as the trunk of the tree. The consequences of the problem are seen as the leaves resulting from both the central problem and the structural and circumstantial causes.

Figure 7

Analysis of the problem tree.



Source: Martínez y Vélez (2022). Formulación de estrategias administrativas, comerciales y organizacionales para la adopción de buenas prácticas agroindustriales en la producción y comercialización de los productos derivados de la caña de azúcar, dirigidas al resguardo indígena unificado Emberá Chami, comunidad Inamurcito ubicada en el municipio de Pueblo Rico Risaralda fase 1.2.

Socialization of the Communication Strategy to the Community

The communication strategy arose as a proposal for a pedagogical approach for the community in its own language. It is a guide that made it possible to socialize key elements of Good Agro-industrial Practices (GAP) to the community. With the implementation of GAP, it is possible to benefit the Emberá Chamí community and the community project by reducing production costs, increasing productivity, and adding value to their products. An in-depth investigation of production

needs was conducted to prepare the booklet. It is an input that will allow for ongoing training for community members on good GAP. Below is a figure that shows the booklet prepared by the research team, which was delivered and socialized to the community on October 31, 2021.

Figure 8

The Pedagogical strategy of communication in Good Agroindustrial Practices.

Source: Martínez y Vélez (2021). Formulación de estrategias administrativas, comerciales y organizacionales para la adopción de buenas prácticas agroindustriales en la producción y comercialización de los productos derivados de la caña de azúcar, dirigidas al resguardo indígena unificado Emberá Chami, comunidad Inamurcito ubicada en el municipio de Pueblo Rico Risaralda fase 1.2.

Table 1

Analysis of Weaknesses, Opportunities, Community Trapiche "Producing Hope" Components: Organizational of the project.

WEAKNESSES	OPPORTUNITIES
Technical (cultivation and processing) Lack of organization according to the demand for raw material (sugarcane). There is a lack of response capacity on the part of the producers because they are destroying the sugarcane crop. The level of organization of the harvesters or growers is minimal and should be indispensable to achieve a constant and sufficient supply.	Organizational (Administrative) To be recognized as an efficient model of community organization. There are governmental and nongovernmental organizations that support community projects. Organizational proposals can be publicized by seeking alliances with other mills to cover markets.
Organizational ✓ There is no defined organizational structure. ✓ Lack of organization of community activities to motivate the association's personnel. ✓ Lack of commitment of the leaders' children to continue with the leader's functions. ✓ Lack of organization of community strategies to create alliances with other mills to cover the demand for the product (panela). ✓ Lack of organization of strategies to elaborate and manage	Marketing (Marketing channels) ✓ Commercial agreements could be structured to support prices during the year.

projects for the community association. ✓ Lack of motivation among community members due to existing problems in the organizational process. ✓ There are no procedure or function manuals. ✓ There is no ongoing training program. ✓ Marketing (commercialization channels) ✓ There are no payment methods that include payment guarantees. ✓ Lack of organization in the implementation of commercial agreements or contracts for the product (panela). ✓ General aspects of cultivation and harvesting practices are not known in detail.	

Source: Martínez y Vélez (2021). Formulación de estrategias administrativas, comerciales y organizacionales para la adopción de buenas prácticas agroindustriales en la producción y comercialización de los productos derivados de la caña de azúcar, dirigidas al resguardo indígena unificado Emberá Chami, comunidad Inamurcito ubicada en el municipio de Pueblo Rico Risaralda fase 1.2.

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Table 2

Analysis of Strengths, Threats, Community Trapiche "producing hope" Components: Organizational of the project.

STRENGTHS	THREATS
Technical (Cultivation and transformation) ✓ Knowledge of the members of the productive project in the elaboration of Panela. Organizational ✓ There is still a community work initiative. ✓ Support from the municipality in the proper organization of the project. ✓ Marketing (Marketing channels) ✓ Currently there are informal commitments to purchase panela from Indigenous marketers. ✓ Cooperation from community	Technical (Cultivation and transformation) ✓ Lack of knowledge of the technical structure of the pests present in the crops. ✓ Lack of knowledge of the production schedule, generating losses. ✓ Lack of knowledge of the strategic emergency plan. ✓ Organizational ✓ Opportunities for intervention by governmental and non-governmental projects may be lost. ✓ Low level of regional and national growth. ✓ Incorrect management of resources can generate economic and raw material losses. ✓ Desertion of members of the organization due to lack of support.

members, the governor, and the person in charge. ✓ governor and the person in charge.	✓ Opportunities for intervention in governmental and non-governmental projects may be lost.

Source: Martínez y Vélez (2021). Formulación de estrategias administrativas, comerciales y organizacionales para la adopción de buenas prácticas agroindustriales en la producción y comercialización de los productos derivados de la caña de azúcar, dirigidas al resguardo indígena unificado Emberá Chami, comunidad Inamurcito ubicada en el municipio de Pueblo Rico Risaralda fase 1.2.

Table 3

Identification of Organizational Strategies, Community Trapiche "producing hope" Components: Organizational of the project.

LIST OF OPPORTUNITIES	STRATEGIES (SO)	STRATEGIES (WO)
Organizational (Administrative) ✓ To be recognized as an efficient model of community organization. ✓ There are governmental and non-governmental organizations that support community projects. ✓ Organizational proposals can be publicized by seeking alliances with other mills to cover markets. Marketing (Marketing Channels)	Technical (Cultivation and transformation) ✓ Elaboration of didactic guides implementing good manufacturing practices. ✓ Improve and take advantage of the installed capacity of the panela processing plant. ✓ Develop value propositions where the community is organized in such a way that everyone participates in the project. Organizational (Administrative) ✓ Implement a work plan by scheduling meetings to sensitize partners to the	Technical (Cultivation and transformation) ✓ Increase sugarcane crops in a diversified manner on the lands of thirty-four families of the Emberá Chamí indigenous reservation. ✓ Implement work schedules with rotating shifts so that everyone works and has compensatory days. Organizational (Administrative) ✓ Motivate young people, children, and adults who make up the association, through2 awareness

✓ Trade agreements could be structured to support prices during the year.	importance of community organization. ✓ Make alliances with neighboring mills to meet product demands. ✓ Harnessing and strengthening farmers' skills and knowledge through partnerships with learning institutes. Marketing (Marketing Channels) ✓ Formalize agreements or commercial contracts with community marketers that require the product (organic panela) with the help of the governor.	meetings. ✓ Be supported by governmental and non-governmental organizations that support community projects. ✓ Elaborate to implement the strategic plan. ✓ Constantly train the project person and conduct quality monitoring.

THREATS (A)	STRATEGIAS (FA)	STRATEGIAS (DA)
Technical (Cultivation and transformation) ✓ Not knowing the technical structure of the pests present in the crops. ✓ Not knowing the production schedule, generates losses. ✓ Not knowing the strategic emergency plan. Organizational ✓ Opportunities for governmental and non-governmental project intervention may be lost. ✓ Low level of regional and national growth.	Organizacional (Administrative) ✓ Know the processes and technical sheets to minimize pests. ✓ Prepare a risk map of the processing plant and have a first aid kit. ✓ Ensure operators with occupational risk insurance. Organizacional (Administrative) ✓ To be recognized and supported by governmental and non-governmental organizations. ✓ To be recognized as an efficient model of community organization.	Technical (Cultivation and transformation) ✓ Motivate the youth, children, and adults that make up the association, through two awareness meetings. ✓ Seek support from governmental and non-governmental organizations that promote community projects.

Return

✓ Incorrect management of resources can generate economic losses and raw materials. ✓ Desertion of members of the organization due to lack of support. ✓ Opportunities for intervention in governmental and non-governmental projects may be lost.	✓ Marketing (Comercialización channels) ✓ Hold a meeting with project participants to socialize with them. ✓ The new community organization and it is essential to have their support.	

Source: Martínez y Vélez (2021). Formulación de estrategias administrativas, comerciales y organizacionales para la adopción de buenas prácticas agroindustriales en la producción y comercialización de los productos derivados de la caña de azúcar, dirigidas al resguardo indígena unificado Emberá Chami, comunidad Inamurcito ubicada en el municipio de Pueblo Rico Risaralda fase 1.2.

Analysis and discussion

The first major finding identified by the research group formed by Jean Pierre López, Daniel Ruiz, and Yenni Marcela Vélez Herrera, as research assistants and the teacher Carla Johana Martinez as principal researcher, was that the Emberá Chamí community of the Inamurcito Village has a process of artisanal sugarcane production, but they do not have an organizational structure or knowledge and skills to manage the community project. The great interest on the part of the junior Governor Oscar Arce during the whole process of ideation of the community proposal, the identification of needs, the accompaniment in the elaboration of the primers, and finally the socialization of these and the identification of possible solutions within the community to present organizational strategies providing accompaniment and security to the research team, as well as a community willing to learn, to cooperate and to be part of a community project.

It became evident that the communities of the Emberá Chami unified indigenous reservation have not had a good logistical organization for the agro-industrial processes in the production of sugar cane for a long time, leading to low productivity. According to studies conducted by the SIIC Ministry of the Interior, in 50% of the Indigenous communities, there are no roads, which means that animal transportation must be used to move the cargo, which generates cost overruns in time and money. In this case, one must travel from Pueblo Rico to Inamurcito on foot or by mule riding on arduous journeys, over rough roads, with innumerable geographical features characteristic of the region (tropical rainforest). It takes from two or three hours to walk (in the closest communities) to twelve or fourteen hours (in

the most distant communities). This problem is especially important to consider when preparing a proposal to transport the sugarcane product for marketing.

The results of Vester's matrix show that it is a priority to start establishing appropriate logistic organization processes according to the community and environmental characteristics. A lot of commitment is required from the community, given that being a young project, it is necessary to adopt clear and appropriate organizational strategies, mainly due to the identified road accessibility deficiencies that make it difficult to move cargo and achieve the community's goals of selling their products to the potential market that currently exists. Regarding the loss of cultural identity, community, governmental and civil society actions are required. Community intervention processes must respect language and culture so that ancestral practices can endure, without neglecting the incorporation of knowledge that will allow them to evolve as a community. Group dynamics require defined leadership processes and Western learning that will allow them to consolidate their community project while generating an understanding of their realities and community purposes.

Undoubtedly, the limited connectivity is a cause of social and economic gaps due to the impacts that technology brings with it today in the development of business processes, however, this gap can be overcome to the extent that governmental management is achieved, and this will be possible with community empowerment processes for resource management.

It is cultivated in a rustic way, without the application of technology since these communities are used to do everything with their own effort. Normally, trade is done in Santa Cecilia or the Aguta hamlet, and occasionally in the town of Pueblo Rico. But it should be noted that the commercialization is minimal, due to the deficient communication routes in

the area for the transportation of products. They are not very aware of the value of money and on many occasions, they still do barters internally.

Finally, regarding the lack of child protection, it is important that the community promotes healthy spaces for children and adolescents, guaranteeing adequate food and academic spaces that allow them to incorporate community knowledge. Precisely, the strengthening of the community project should be aimed first at guaranteeing the food sustainability of its own people and thus reducing the impact of hunger on children.

Conclusions

The research shows little administrative and logistic organization in the Emberá Chamí communities, which is a great inconvenience for the population to be able to sustain the community project over time with a tendency towards growth. For this reason, it is important that the community members acquire knowledge about administrative, logistic, and production methods of sugar cane products through training.

An organizational structure should be established following the natural logic of the community, considering the strengths and competencies of the participants in the community project. Since it is a collectivist project, it is necessary to understand the organizational structure from the integration not only of knowledge but also of functions. The administrative functions must imply a positive direction under a respectful leadership scheme, it cannot imply imposed authority, to avoid conflict within the community.

Likewise, clear roles must be established for participation in the projects and in production, establishing functions considering the manufacturing process, such as "sugarcane handling, milling, clarification, evaporation, crystallization, separation, refining, drying and finally transportation to its destination. The cultivation processes are manual, there is no application of technology due to the characteristics of the territories and the economic difficulties to access technified agricultural processes. This is an opportunity to incorporate good agricultural practices since it is easier to incorporate environmentally friendly practices and integrate sustainable crops. It is especially important to encourage the participation of the entire community in the production and marketing of their products, generating a sense of belonging to the project through the assignment of tasks and continuous motivation, involving the families not only in the work but also in the decision-making processes on issues of community importance. Since 50% of the territories where the Indigenous communities are located have no roads, it is especially important to address this problem adequately and take it into account when preparing a proposal for moving the sugarcane product for marketing, especially when considering production and marketing costs.

It should also be a differentiating factor in the process of establishing the history of the product of origin so that consumers are aware of the realities that are woven around the Indigenous communities. In addition to the above, methods of entry and transportation of the sugarcane should be proposed so that the products arrive on time at their destination and can be marketed. Normally, trade takes place in Santa Cecilia, or the hamlet of Aguta, and occasionally in the town of Pueblo Rico. There are no marketing and sales strategies due to deficiencies in networks for communication as well as for the transport of products. Among

their negotiation practices, they continue with internal bartering between members of the community, which can be a reference element to promote self-consumption in families that are in these territories far from the urban area.

The organizational strategies proposed and implemented are based on dialogue with the community and its main actors, needs and problems were established from consensus and community discussion through the application of Vester's matrix and the problem tree, which revealed important realities that are undoubtedly relevant issues for the community to start building strategies. Thus, some organizational, administrative, and technical strategies were proposed so that the community can begin to understand and implement them. It should be noted that, although a technical language of business administration has been used for these academic scenarios, in the intervention with the community, we have tried to socialize the administrative knowledge from the community's own language and to use an appropriate language according to their worldviews in order to really incorporate the ecology of knowledge proposed by the theorist Boaventura de Sousa Santos.

Finally, it is necessary to thank the financial support of the Fundación Universitaria del Área Andina (University Foundation of the Andean Area). Thanks to this it was possible to design the booklet with the authorship of the IDEAS seedbed of the Business Administration program presenting a methodical form on "Good agricultural practices for the production of sugarcane panelera" which with the translation of the junior governor was published in the community's own language and was socialized with the community within the framework of the sensitization carried out by the research team.

After the visit to the Emberá Chamí indigenous community, we have sought to follow up on the work that the community has been developing with the implementation of the "Producing Hope" sugarcane mill in order to continue training them on issues related to integrated crop management, marketing methods, and teamwork, among other concepts that help strengthen the work team and in turn have more sources of income.

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7 CHAPTER SEVEN

Psychomotor profile of children between 4 and 5 years old in the city of Pereira, Colombia

Perfil psicomotor de niños entre 4 y 5 años en la ciudad de Pereira, Colombia

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Abstract

Introduction: Psychomotor development is a key element in the integral development of early childhood since it enables the interaction of the child's organism with the world that surrounds it. Objective: To determine the psychomotor profile of children between 4 and 5 years of age, beneficiaries of the From Zero to Forever strategy through the Child Development Centers modality. Methods: Descriptive cross-sectional study. The study population was made up of 205 children between the ages of 4 and 5, who represent 100% of the children who benefit in the city of Pereira through the national strategy From Zero to Forever in the institutional modality. Vitor

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Da Fonseca's psychomotor observation battery was defined as an instrument. Results: 63.4% of the population belongs to the female gender, 49.3% and 48, 8% were 4 and 5 years old respectively at the time of the evaluation, the distribution in the low-low and low strata presented figures equal to the distribution by age. The classification of the psychomotor profile was dyspraxic at 54.6% and normal at 43.4%. The Chi Square tests did not report significance between the psychomotor profile and the sociodemographic variables gender and socioeconomic status.

Keywords: psychomotor, early childhood, neurodevelopment

Resumen

Introducción: El desarrollo psicomotor es un elemento clave en el desarrollo integral de la primera infancia, ya que, posibilita la interacción del organismo del niño con el mundo que lo rodea. **Objetivo:** Determinar el perfil psicomotor de los niños entre 4 y 5 años de edad, beneficiarios de la estrategia De Cero a Siempre a través de la modalidad Centros de Desarrollo Infantil. **Métodos:** Estudio descriptivo de corte transversal. La población de estudio se conformó por 205 niños de entre 4 y 5 de edad, que representan el 100% de los niños que se benefician en la ciudad de Pereira a través de la estrategia nacional De Cero a Siempre en la modalidad institucional. Como instrumento se definió la batería de observación psicomotora de Vitor Da Fonseca. **Resultados:** 63,4% de la población pertenece al género femenino, 49,3% y 48,8% tenía 4 y 5 años respectivamente al momento de la evaluación, la distribución en los estratos bajo-bajo y bajo presentó cifras iguales a la distribución por edad. La clasificación del perfil psicomotor fue dispraxico 54,6% y normal 43,4%. Las pruebas de Chi Cuadrado no reportaron significancia entre el perfil psicomotor y las variables sociodemográficas género y estrato socioeconómico.

Palabras clave: psicomotor, primera infancia, neurodesarrollo

Introduction

The period between management and the first five years of life is fundamental for the structuring of the biological and psychological bases that will allow the proper development of children. Early childhood is the main stage of the development of each human being, it is because during this period the processes that determine the affective, emotional, cognitive, intellectual, relational, physical, and sensory capacities of boys and girls take place (Vargas, 2013). Although it is true that human beings share a series of common characteristics and processes that are characteristic of us as a species, it is also true that the universality of human development is nuanced by the interaction of each of the subjects with the particular characteristics of the individual surrounding environment(Alberto & Hernández, 2018; Davison & Birch, 2001; Fonseca, 1979; Restrepo, 2000; Salgado, 2007).

In this order of ideas, the sanction of the State policy called From Zero to Forever makes sense. “De Cero a Siempre” is the Colombian commitment to the comprehensive development of children between 6 months and 5 years of age. One of the strategies through which the State policy is present throughout the territory is the so-called Child Development Centers, which are institutions designed to promote comprehensive development in boys and girls between the ages of two and five and eleven months of age, through a pedagogical project, adequate infrastructure, and the guarantee of health and nutrition standards(Ministry of National Education (MEN), 2014).

Now, there is currently sufficient scientific evidence that relates the importance of movement with the development of the central and peripheral nervous system (Grenada, 2016).

For some authors, movement is a critical aspect of life. It is essential to our ability to walk, run and play; seek and eat the food that nourishes us, communicate, and earn a living(Shumway-Cook & Woollacott, 2017). That said, it is necessary that the other actors in society implement actions that show the degree of effectiveness of the Child Development Centers (CDI) in terms of the comprehensive development of children and that is where knowing the psychomotor profile becomes relevant to the children who benefit from this strategy.

The psychomotor profile in children is directly related to psychomotor development (Caleros Saa et al., 2016). The psychomotor profile makes it possible to show how the biological and cultural determinants of development have an impact on the child and therefore allows the formulation of necessary therapeutic, educational, or rehabilitation interventions (Fonseca, 1998).

The objective of the study was to determine the psychomotor profile of children between 4 and 5 years old who benefit from Cero a Siempre strategy in the Child Development Centers modality in the city of Pereira Colombia during the year 2018.

Methods

Cross-sectional observational study with an analytical scope. The study population was made up of 300 children between 4 and 5 years old which represent 100% of the children who benefit in the city of Pereira through the national strategy De a Siempre in the institutional modality.

To determine the psychomotor profile, the psychomotor observation battery developed by Vitor Da Fonseca was used, which brings together a set of tasks that are significant for the child's relationship with the environment, thus allowing the detection of functional deficits in psychomotor

terms through a qualitative analysis of psychomotor signals. This battery does not deal with reflexes, sensations, or simple movements. The battery is divided into seven factors (tonicity, balance, laterality, notion of the body, space-time structure, global praxia, and fine praxia) which in turn are divided into a total of 59 subfactors.

Each of the subfactors is rated on a scale of 1 to 4 points, considering that 1 point refers to the fact that the child is unable to carry out the task entrusted to him (weak), 2 points to a performance with the difficulty of control and diverted signals (satisfactory), 3 points when the execution is complete, adequate and controlled (good), and 4 points when it is carried out perfectly, precisely, economically and with control facilities (excellent).

The sum of all the subfactors allows us to establish the type of psychomotor profile of each child, considering that:

- Between 7 and 8 the type of profile is deficient with significant learning difficulties
- Between 9 and 13 the type of profile is dyspraxic with slight learning difficulties
- Between 14 and 21 the type of profile is normal
- Between 22 and 26 the type of profile is good
- Between 26 and 27 the type of profile is superior.

To begin with the data collection a group of 12 students, from the last semester of the Physiotherapy program of the Areandina University Foundation was trained, they were accompanied by two advisory teachers, and then they traveled to the CDIS of the city for the application of the instrument to children between 4 and 5 years old who met the inclusion criteria.

As inclusion factors, it was defined: to be between 4 and 5 years 11 months old at the time of the evaluation and to be attending the CDI on a regular basis (minimum 4 times per week) so far in 2018. As exclusion criteria, having a diagnosis of some type of disability and not presenting the informed consent of the child's parents or guardians.

The information was tabulated in the Microsoft Excel 2010 program and subsequently analyzed with descriptive statistics using frequencies and percentages for categorical variables and medians with interquartile ranges for numerical variables. Subsequently, univariate and bivariate analyzes were performed using the Chi Square, Mann Whitney U, and Kruskal Wallis statistics. A level of significance <0.005 was established.

Results

Initially, 300 children were identified, of which 2 were excluded because they had not been fully evaluated. Data from 298 children were collected. Table 1 shows their sociodemographic data.

Table 1

Sociodemographic characteristics.

		N	%	P
Gender	Male	83	27.9	<0.001
	Feminine	215	72.1	
Socioeconomic	Medium-Low	83	27.9	0.003
	Bass	127	42.6	
	Low-Low	88	29.5	

Source: Own elaboration

Performance in six of the seven factors did not present significant differences (Table 2), only fine practice was influenced by gender, with satisfactory performance being the most prevalent in both genders, as shown in Table 3.

Table 2

Performance in the factors according to gender.

	Statistics	**p**
Tonicity	8447	0.419
Balance	8602	0.279
Laterality	8818	0.850
The notion of body	8371	0.338
Space-time structure	8500	0.436
Global Praxia	7835	0.064
Fine Praxia	7671	0.020

Source: Own elaboration

Table 2

Performance in fine practice according to gender.

	Fine Praxia		
Gender	**Weak**	**Satisfying**	**Good**
Male	23	56	4
Feminine	39	151	25

Source: Own elaboration

As shown in Table 3, no statistically significant differences were found in performance in each of the seven motor development factors according to the children's socioeconomic status.

Table 3

Performance in the seven factors according to socioeconomic status.

	χ^2	p
Fine Praxia	0.492	0.782
Global Praxia	2,171	0.338
Space-time structure	0.424	0.809
Body notion	3,565	0.168
Laterality	1,253	0.534
Balance	0.493	0.782
	χ^2	p
Tonicity	1985	0.371

Source: Own elaboration

Regarding the psychomotor profile, only two normal and good ratings were obtained. Being the normal rating the most frequent

Table 4

Psychomotor Profile.

Level	N	%	P
Normal	278	0.9329	<0.001
Good	20	0.0671	

Source: Own elaboration

Gender did not prove to be significantly associated with the psychomotor profile

Table 5

Psychomotor profile according to gender.

	Psychomotor Profile		
Gender	**Normal**	**Good**	**P**
Male	79	4	0.417
Feminine	199	16	

Source: Own elaboration

On the other hand, the socioeconomic level proved to be associated with the psychomotor profile, with the frequency of low-income children with a normal profile being particularly high (Table 7).

Table 6

Psychomotor profile according to socioeconomic status.

	Psychomotor Profile		
Socioeconomic	**Normal**	**Good**	**P**
Medium-Low	73	10	
Bass	119	8	0.037
Low-Low	86	2	

Source: Own elaboration

Discussion

Programs for the care and comprehensive development of early childhood play an important role in the development of societies. Almost all countries have this type of program, however, as indicated by the Inter-American Development Bank, the quality of these programs is not adequate (Inter-American Development Bank, 2017).

One element that clearly needs to be incorporated into these programs is the promotion of physical activity among children. Well, in line with our results and as concluded by Trujillo et al., the children in the CDIS of the city of Pereira do not comply with the Canadian recommendations for physical activity for early childhood(2019).

Movement is a critical aspect of life. It is not possible to think of surviving without movement. Although activities such as running, walking, and manipulating objects become important aspects in the evolutionary development of the human species, the relationship between the development and control of the movement with the evolution of emotional and intellectual capacities should not be ignored (Schmidt et al., 2017).

The results of this study are the first of their kind, since until the time of writing the final report there was no knowledge of any other study focused on the psychomotor profile of the children who were beneficiaries of the Zero to Forever strategy in the CDI modality, a situation that calls attention if one takes into account that if a child presents difficulties in the execution of motor tasks, other aspects of his life can be affected, such as self-esteem, quality of life, school performance, etc., performance in daily activities and the structuring of their personality (Goulardins et al., 2011). During early childhood, it is necessary for children to reach sufficient levels of physical activity through which they develop their psychomotor profile and thus be able to establish quality relationships with the outside world (Costa et al., 2015).

Similar results were found in children with asthma in the city of Paranaguá, where 50% of the children evaluated had an average score of 22 points, thus achieving a normal psychomotor profile (Diaz, 2006). The results obtained in this study differ significantly from those found by Monroy and Peña, who in 2005 determined the psychomotor profile in children with attention deficit hyperactivity disorder in the northern area of the metropolitan region in Chile, in that study they found that 86% of the children were categorized with a normal profile and the remaining

13.2% as good (Monroy & Pena, 2005). For its part, the study carried out by Calero et al. in schoolchildren aged 6 to 10 years in the city of Pereira showed that only 4% of them presented a dyspraxic psychomotor profile, 90.2% were good, and 5.7% were superior (Caleros Saa et al., 2016). To continue with this line of results, the study developed in Popayán by Roldán and Paz, determined that "the psychomotor profile of the total population is good"(González & Ortega, 2013, p 26.). A study carried out in the municipality of Jaú, state of São Paulo, evaluated the psychomotor profile of preschool children, finding a prevalence of 60% of the dyspraxic profile in both children from public and private educational institutions (Simões et al., 2008).

Regarding the significance between the sociodemographic variables and the psychomotor profile, a study carried out in the city of Armenia, Colombia, reported an association between age and the type of profile (Bolivar-Gutierrez & Arias-Padilla, 2012). Rodríguez et al. found a statistically significant relationship between the psychomotor profile, gender, and age(Rodriguez et al., 2013). Results that are contrary to those obtained in the present study where the Chi Square test presented bilateral significances greater than 0.05 when crossing the psychomotor profile with gender and socioeconomic status.

The comparison of the results presents a horizon full of challenges in future terms. Given the weakness of the CDI to guarantee high levels of psychomotor development in children, it is not surprising because the Inter-American Development Bank considers that the quality of the services of the Colombian Institute of Family Welfare is inadequate (Berlinsky, 2015). Now, when thinking about early childhood, we must remember the conclusion of the studies carried out by James Heckman, "services for early childhood care are of good quality, society can get a return of up to 17 dollars per every dollar invested" (Aasen & Bachelet-Jeria, 2010, p 9.).

Conclusions

Although Child Development Centers aim to promote the comprehensive development of children during early childhood, our findings allow us to identify that the effect of these centers is not large enough to ensure that children's psychomotor development reaches its full potential, which would be reflected in an excellent rating.

The association found between low socioeconomic status and good psychomotor development makes it reasonable for research to focus on detailing the effect that this and other sociodemographic variables may have on children's potential development.

It is necessary for the national government of Colombia to promote a critical reflection on the guidelines for the operationalization of Cero a Siempre strategy, especially in the Child Development Center modality, in order to generate conditions that allow children to experience a process that responds more comprehensively to their needs while allowing the development of their psychomotor potential.

Although it is recognized that the Child Development Centers have made great progress in terms of early childhood care, it is important that professionals be linked within the interdisciplinary teams who can implement monitoring, evaluation, and intervention actions for the development of the movement in the human body of children.

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Conflict of interests

The authors declare that there was no conflict of interest during the conduct of this study.

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8 CHAPTER EIGHT

Analysis of assembly tasks without the use of vision: an opportunity for the design of support technologies in manufacturing environments

Análisis de tareas de ensamblaje sin el uso de la visión: oportunidad para el diseño de tecnologías de apoyo en ambientes manufactureros[1]

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Abstract

The inclusion of people with disabilities is a relevant action that companies seek to address, not only as a social responsibility strategy but as a commitment to the Sustainable Development Goals (SDGs), particularly in its economic dimensions (reduction of inequalities) and social (sustainable cities and communities). This research sought to identify the opportunities for inclusion offered by

1Result of the research entitled "Approximation to the sensory criteria of Universal Design based on inclusive technological experiences", registered with the Directorate of Research and Innovation of the Universidad Católica de Pereira, as a product of the research progress for the thesis of the doctoral candidate Gustavo Peña in the Doctorate in Design and Creation of the Universidad de Caldas.

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the assistive technologies designed to favor People with Visual Impairment (PwVI) in a productive environment, allowing them to contrast their aptitudes, abilities, and skills with respect to people with normal vision during the analysis of assembly tasks of a manufactured product in a local company in the municipality of Santa Rosa de Cabal in Risaralda / Colombia. The methodology addressed was Empirical Research through Design, which allowed the development of several prototypes that led to the identification of inclusion possibilities in that specific job position. After characterizing the activity of manual assembly in the company, tests were carried out with different people simulating the absence of blindfolded vision when assembling a chosen product. Later, the PwVI test was used to perform the same activity. After constructing preliminary design requirements, the test was conducted with this population, implementing two assistive technologies designed to reduce some shortcomings and difficulties identified in the previous tests. Finally, conclusions allow a broader understanding of the situation of PwVI in those environments and identify future opportunities for inclusion.

Keywords: Visual disability; Inclusion; Industrial Design; Manufacture; Assistive technologies.

Resumen

La inclusión de personas con discapacidad es una acción relevante que las empresas buscan abordar, no solo como estrategia de responsabilidad social, sino como un compromiso frente a los Objetivos del Desarrollo Sostenible (ODS), particularmente en sus dimensiones económicas (*reducción de desigualdades*) y sociales (*ciudades y comunidades sostenibles*). Esta investigación buscó identificar las oportunidades de inclusión ofrecidas por las Tecnologías de Apoyo (TA) diseñadas para favorecer a las Personas con Discapacidad Visual (PcDV) en un entorno productivo,

permitiendo contrastar sus capacidades, habilidades y destrezas con respecto a personas normovisuales durante el análisis de tareas de ensamblaje de un producto manufacturado en una empresa local del municipio de Santa Rosa de Cabal en Risaralda/Colombia. La metodología abordada fue la Investigación Empírica a Través del Diseño, la cual permitió el desarrollo de varios prototipos que dieron paso a la identificación de posibilidades de inclusión en ese puesto de trabajo específico. Después de caracterizar la actividad de ensamblaje manual en la empresa se realizaron pruebas con diversas personas simulando ausencia de visión con ojos vendados al ensamblar un producto elegido; posteriormente se dio paso a la prueba con PcDV al realizar la misma actividad. Después de construir unos requerimientos preliminares de diseño se realizó la prueba con esta población, implementando dos tecnologías de apoyo diseñadas para reducir algunas falencias y dificultades identificadas en las pruebas anteriores. Finalmente, se llegó a conclusiones que permiten ampliar la comprensión de la situación de las PcDV en esos entornos e identificar a futuro nuevas oportunidades de inclusión.

Palabras clave: Discapacidad visual; Inclusión; Diseño Industrial; Manufactura; Tecnologías de apoyo.

Introduction

In this paper, we describe the process carried out for the measurement of the skills of People with Visual Impairment (hereafter, PwVI) during the performance of a manual activity required in a work context, as well as the comparative measurement of the manufacturing skills they possess, in contrast to people that have normal vision.

The objective of this measurement is to obtain the requirements to identify possibilities of inclusion of visually impaired users in manufacturing environments for the productive development of companies, and also to understand how assistive technologies enable the inclusion of these users.

The research corresponds to a qualitative approach, in which the context of the company Diseñarte D&F, located in Santa Rosa de Cabal (Risaralda / Colombia), is analyzed. The process consisted of an exploratory study in which an assembly process of parts for the production of one of the main products marketed by the company is analyzed, corresponding to a scale model of a coffee pulping machine[5].

The data obtained from this exploratory study made it possible to objectively evaluate the possibilities of including these participants from a human, social, and responsible business perspective, according to other productivity scales focused on human resources and talents, beyond the traditional search for quantitative results, related to the reduction of time and movements, increased productivity, among others.

In order to justify the relevance of the study, various inclusion reports made by the National Disability Observatory (OND) as part of the National Disability System (SND) of the Colombian Ministry of Health and Social Protection (MinSalud) were consulted. Likewise, the management processes developed by the Development Secretariats of the municipalities to consolidate inclusion strategies in the productive scenarios of the regions were considered in order to describe the updated labor situation of the people registered in the Registry of Localization and Characterization of People with Disabilities (RLCPD). This allowed enlightening results for the beginning of a research process on this topic.

According to data provided by the National Administrative Department of Statistics in its latest report about persons with disabilities, in Risaralda, of the total of 3252 registered persons with visual impairment, 910 are working, 161 are looking for work, and 868 are performing household activities (DANE, 2019), which shows that almost half of the population with disabilities does not have their own income with which to meet their basic needs independently.

[5] Machine that is part of the Colombian coffee production process. This element is part of the regional identity of the Colombian coffee cultural landscape. The company Diseñarte D&F takes this product as a souvenir to commercialize it in different tourist scenarios of the region.

In Risaralda, out of every 100 Persons with Disabilities (PwD), 62 do not receive any type of income, leaving a portion of 38 who obtain their livelihood from some type of source of money. Of these 38 people who receive income, 23 of them receive less than 500,000 Colombian pesos (USD 147) per month as a result of formal or informal labor activity. This means that out of every 100 PwD, only 5 people receive more than 500,000 pesos per month, a figure below the minimum wage set by the Colombian government at COP 828,116 (approximately USD 250) for 2019, which makes evident the high economic vulnerability to which they are subjected. Of the total of the 38 people with income, some perform in labor areas as follows percentage-wise: Less than one (1) person would work in the service sector, two (2) people would work in the industry sector, six (6) people would work in the commerce sector (formal or informal), and four (4) people would work in the agricultural sector (DANE, 2019).

On the other hand, the unemployment crisis generated by Covid-19 profoundly affected the income and work possibilities for the population with disabilities (Saldarriaga Concha Foundation, 2021). The situation can become even worse when analyzing the labor differences for each type of disability. An example of this is the case of PwVI, who have greater labor restrictions in areas such as the industrial sector despite the fact that many of them have motor and cognitive skills that would allow them to perform successfully in these productive areas.

This situation can be understood by analyzing the reasons why an employer hires or does not hire a PwD, within which it is frequently argued that people with hearing impairment are included more frequently since they do not possess a critical disability for the required tasks. It is worth mentioning that PwVI does not awaken a particular or frequent interest in being hired by employers in industry or commerce due to the belief that in order to hire them they would have to make a series of adjustments that would affect the company economically.

According to the presidential advisor on disability issues Jairo Clopatofsky, "there are at least one million five hundred thousand (1,500. 000) PwD who are fit to work, but do not get jobs in the current conditions of the labor market in the country" (Caracol Radio, 2019) and in that sense, the employment situation of this population in the industry of Risaralda is precarious (8.7%), compared to those employed in commercial activities (21.81%), according to the registration of PwD in the Integrated Information System of Social Protection (OND-SISPRO, 2020), evidencing the exclusion of job opportunities and a great inequity on this matter in relation to other departments.

According to Uniminuto Radio, in statements made by the director of the National Institute for the Blind (INCI, Instituto Nacional para Ciegos) to the radio network RCN, "80% of the population with disabilities in the country is unemployed" (Vega Canasteros, 2019). This shows that the presence of disability conditions restricts labor access, regardless of whether the abilities of the PwVI allow them to perform within a specific product sector.

Thus, PwVI have been relegated to perform activities that, considering their potential and human talent, could be classified as minor tasks, of low complexity or without technical requirements, such as answering calls and telephone communication, or processes where only listening and speaking are required, avoiding manipulation or motor skills mediated by vision, among others. This affects the use of the necessary skills to perform manufacturing activities, underutilizing the capabilities that people could develop in a work environment to contribute to the productive development of the company.

In this sense, the research aims to highlight the possibilities that PwVI would have in a work environment, according to the alternatives offered by those senses that have not been affected by this condition, by providing new sensitive opportunities to perform their work, without affecting the productive conditions of a company.

The above shows the importance of taking advantage of the competencies and aptitudes of a PwVI, projecting their abilities to participate in manufacturing activities, through the reasonable adjustments required in spaces, tools, and instruments, as a necessary step towards the productive growth of companies and in parallel to the empowerment of this community from the dignity of work. In this regard, Shakespeare states that "it became illegal to treat disabled people differently from non-disabled people, and employers had to provide reasonable accommodations for disabled employees and remove access barriers" (Shakespeare, 2018, p. 17).

In Colombia, annual economic growth dynamics are relatively high compared to other countries in Latin America and the Organization for Economic Cooperation and Development (OECD), which would provide an opportunity for greater labor demand, which can be satisfied by taking advantage of the Colombian labor force of people with disabilities (Fundación ONCE (Spain), Fundación ONCE (Latin America), Organización Iberoamericana de Seguridad Social, & PricewaterhouseCoopers (PWC), 2019).

The improvement of the labor situation of PwD in Colombia is a pending task and requires more than a legal intervention by the State, which must involve technical and technological aspects to make inclusion viable, due to the complexity of the problem and the multiple actors and factors that are confronted in the search for solutions for this population.

For this particular case, the comparative performance of PwVI in the functions of assembly of parts within the company Diseñarte D&F is analyzed compared to the development of this same task by the currently hired operators having normal vision, in terms of some aspects that were identified as critical during the preliminary inquiries of the research and that were defined as follows: the (a) learning curve of the activity (time of apprehension of the ability to perform the tasks), (b) mistakes made (evaluation, recognition, and correction of failed procedures), (c) efficiency in the task performed (achievement of product assembly).

From this, the possibilities of inclusion in this work context can be investigated, using technological aids. It is worth highlighting that these aspects, seek to recognize the abilities possessed by PwVI in a humanistic and inclusive sense, addressing cross-cutting concepts such as usability evaluation (Barnum, 2011), activity-centered design (Bligård, Simonsen, & Berlin, 2016), low-cost assistive technologies (Bradley Camburn, 2018), and occupational inclusion.

Materials and methods

Procedure

This project has a qualitative approach, based on a strategic, transectional, exploratory, quasi-experimental research model (Tam Málaga, Vera, & Oliveros Ramos, 2008), therefore, it has an exploratory character, in which several instruments were additionally implemented to collect data such as: video recording, semi-structured interviews, open-ended surveys (Hernández Sampieri & Mendoza Torres, 2018), and usability analysis (Barnum, 2011), as part of user experience measurement (Tullis & Albert, 2013).

The analysis of the assembly task was carried out within the company Diseñarte D&F with the operator who currently performs this function, with whom the measurement of the movements, times, and biomechanics required to perform the assembly tasks was carried out. The analysis also addressed the conditions of the work environment in order to articulate the possibilities and characteristics of accessibility that the company can offer, in a hypothetical case of labor linkage to a PwVI. A strategy of non-participant observation was implemented, in order to subsequently propose an analogous scenario in which the comparative analysis of the assembly activities could be established.

Audiovisual information was collected through real-time video footage from 3 different points of view: top and side in the general shot, and hand focus in close-up, in order to understand the minimum skills required to perform the task of assembling the product.

This assembly activity was later replicated with the participation of six (6) people with normal vision in an experimental environment outside the company in which the necessary implements and inputs were available for the execution of the task, which would later facilitate the exploration of various technological artifacts and analyze their effectiveness based on the identified skills of the PwVI.

The main difficulties in the process of assembling parts without the use of vision were observed when testing by means of simulation of visual impairment with people who were asked to perform the assembly steps of the parts arranged on a work surface, in an intuitive way and blindfolded. This process was carried out with the aim of identifying the ability to recognize characteristics such as the shape and position of a piece.

This same procedure was performed with two (2) total non-congenital -or acquired- PwVI who executed the same tasks, which allowed comparing the data collected with the previously simulated PwVI. This observational analysis was performed using a limited and free version of the Kinovea software to recognize the movements of the user's hands during the activity.

Subsequently, the experiment was replicated in both groups with auditory guides to understand the positional relationships between parts of the assembly, and thus analyze the possibility of enhancing the sense of hearing as a complement in the absence of the sense of vision. These guides were guided by a person knowledgeable in the assembly of the product, who observed the procedure and offered support during the first tests. Subsequently, the need for the auditory guide was reduced, once the person acquired expertise.

To recognize the most relevant aspects of usability for these users, the times and movements to perform each operation in both experiences were analyzed and a semi-structured interview was conducted with each person involved to investigate the main criteria that should be considered to facilitate and reduce steps (Barnum, 2011, pp. 191-192), when manipulating the parts and with this information propose the preliminary design requirements with which to develop some technological artifacts as support devices when carrying out the assembly activity.

Then, several technological artifacts were developed and tested by PwVI with and without experience in the development of manual activities. Thus, it was possible to evaluate the failures and improvements that occur when performing the task of assembling parts, mediated by low-complexity technologies, and to establish the specific aspects of intervention for the improvement of efficiency and effectiveness parameters.

Finally, at the end of this experience, a survey with open answers was implemented to collect the pros and cons of the operation, usability, and usefulness of both devices for the purpose of making improvements or adjustments in subsequent iterations, in view of the suggestions made by these users. Through this analysis, it was possible to obtain some significant findings to be considered during the assembly process, so that the actions that were complex for the PwVI would be taken care of by the functions to be performed by the assistive technology.

With the development of the above processes, two conclusive activities are sought. On the one hand, the development of an assistive technology prototype for PwVI can serve as an interface for correct performance in the workplace during assembly, with productivity standards that are attractive to the company in terms of labor linkage. On the other hand, the establishment of conditions within which the inclusion of PwVI in work environments can be effective for both the company and the worker, in economic, productive**,** and labor dignity terms.

Participants

The population studied initially corresponds to the company's current operators having normal vision based on the work position to be compared, where a sample chosen by convenience was analyzed (Niño Rojas, 2011, p. 57) to perform the simulation of visual impairment with people with normal vision.

Subsequently, PwVI were observed to measure the effectiveness of the developed artifacts and raise the relevant variables of the system such as identification of product parts, polarity recognition (faces or facets) of the parts, identification of assembly points between parts, quality assessment in assemblies, error detection in assemblies, among others.

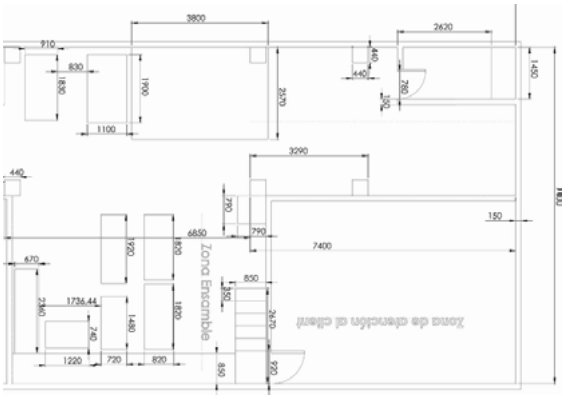
The sample selection criteria included PwVI of working age (18 to 62 years old), distributed in both genders; however, during the experiments**,** some variables were considered such as the origin of the visual disability (acquired or congenital), diversity of motor skills (fine and gross), socio-educational level and work experience related to the analyzed activity.

Setting

Once all the work areas were observed, we chose to select the assembly area, as shown in the company's plan view (see Figure 1), because this activity does not require the manipulation of machine tools or electrical machinery (saw, laser machine, CNC, etc.) that puts the PwVI at direct risk; it is also an area where repetitive tasks occur that favor learning.

Figure 1

Layout from the front zone of Diseñarte D&F.



Note. The plan shows a part of the layout or distribution of the production plant of the company Diseñarte D&F in 2019, showing the dimensions (in centimeters) and the distances to be covered by the operators in the assembly area. Source: Own elaboration.

The tasks performed in the assembly area are subordinated to the work area, which consists of a surface with an area for organizing materials, supplies, and tools, as well as minimal but sufficient lighting conditions for the activity; however, the volume of products accumulated in this space may limit some operations, as shown in Figure 2.

Figure 2

Note. The characteristics of the work area, the ergonomic conditions of the activity**,** and the type of furniture used by the operator in charge of the manual assembly process of the products analyzed for this research are shown. Source: Own elaboration.

Results and discussion

Phase I: Analysis of assembly activities by normovisual operator.

The test described below, as previously mentioned, was carried out using the assembly of the coffee pulper product, which offers the appropriate characteristics to allow a PwVI to be assembled as part of a workstation within the company.

This type of product consists of a series of pieces in MDF (Medium Density Fiber) made by laser cutting, which must be later assembled using protrusions and depressions that connect with each other to generate more complex volumes. The pulper has 41 pieces as shown in Figure 3, where its exploded view can be seen.

Figure 3

Coffee pulper exploded view.

Note: Different parts that make up the object to be assembled, are organized according to the sub-groups to which they belong. Source: Own elaboration.

During the assembly process, the assembly of the product by the operator was recorded, identifying the assembly sequence in sub-groups made up as follows: Hopper, Base, Card Holder, Cylinder, Uprights, Card Holder, and their corresponding parts as illustrated in Table 1:

Table 1

Product assembly step by step.

The process by Sub-Group	Parts and assembly steps
1. Cylinder assembly	a. Shaft with pinions
	b. Pinions with cylinder faces
	c. Cylinder faces with pinions
2. Uprights	a. Uprights with base
	b. Uprights with Cylinder

	c. Uprights with pinions
	d. Pinion shaft with sprockets and uprights.
	e. Auxiliary parts of uprights with uprights
3. Handle	a. Handle secured on each side
4. Blade	a. Blade mounted inside the hopper in contact with uprights.
5. Card holder	a. Joining of card holder faces to the base

Note: The processes required to assemble a 'coffee pulper' type product are shown, broken down by sub-groups and the parts that make up each one of them. Source: Own elaboration.

The fully assembled product can be visualized with its corresponding sub-groups in Figure 4, where the characteristics of the fit between parts and the difficulties it represents at a geometric and dimensional level for handling by the operator are highlighted.

Figure 4

Assembled pulper and the subgroups that make it up.

Note: The figure shows the fully assembled pulper and its subgroups. Source: Own elaboration.

From the assembly times, a series of records were obtained in which the times required to complete each fully assembled sub-group were established in a segmented manner, and they were integrated until the final assembled product was obtained. See the times in Table 2.

Table 2

Step by step product assembly time.

Assembly Process	Time in minutes and seconds
Cylinder	00:50
Uprights	01:31
Hopper	01:47
Card holder	00:41
Large pinions	01:26
Joints	00:51
Total	07:06

Note: The table specifies the average time for a normovisual person trained as an operator to integrate the sub-groups of the product. Source: Own elaboration.

This assembly time was obtained from the analysis of the normovisual operator to establish a classification of the skills necessary to perform the parts assembly task as follows:

1. Parts identification: this skill refers to the ability to differentiate the shape, size, position, and assembly indentations of each of the parts.

2. Identification of polarity of parts (location of sides of a part): This skill relates to the ability to identify the orientation they have in relation to their longitudinal and transverse axes so that the person can locate the groups of pieces by their corresponding sides for assembly.

3. Connecting the pieces: This skill allows the correct assembly of the pieces from the connection of the different assembly slots.

4. Generate a mental image of the model to be assembled: It is related to the possibility of recognizing the type of model being assembled and the sub-groups that compose it.

5. Evaluate errors made: It is related to identify a bad location between parts, or misalignments in the assemblies.

Phase II: Task analysis and assembly activities by simulated visually impaired persons.

In this activity, we analyzed the way in which blindfolded people perform the minimum necessary actions and skills for assembly that were previously identified during the analysis with the company's operator with normal vision (identification of parts, identification of polarity of parts, procedure for connecting parts, ability to generate a mental image of the model to be assembled, ability to evaluate errors made).

The test was carried out in a space that replicated the company's workplace. This simulation environment was organized according to conditions such as the operator's working position, similar space conditions, lighting, work supplies, and tools used. On the other hand, other aspects such as noise, temperature, architectural conditions, and plant layout were isolated in order to control the essential factors involved in the execution of parts assembly.

For this phase of the study, assembly tests were performed with a population of six (6) people who performed the process with the blindfold over their eyes, in order to identify differences between the performance of the task, using the sense of vision and without this sense. This was done to codify the variations present between PwVI and individuals with normal vision in the way they cope with tasks that require fine motor processes.

At first, the participant was asked to try to identify the object to be assembled by touch. For people who had had a visual experience and recognized a coffee pulper before, it was possible to recognize the object only from this sense.

From this it could be evidenced that the previous visual experience of a certain object, makes possible the generation of a mental model of it that allows its subsequent identification through touch, even when it does not possess a morphology or an exact scale to the initial image, as suggested by Campos & González (2017, p. 114).

This means that the existence of a mental image of a given object, constructed from the sense of sight, can be extrapolated to the tactile. This observation allows inferring that the origin of the visual impairment is a variable that conditions the possibility of recreating a mental model (Norman, 2001, p. 44), and produces differences in identification skills based on the sense of touch and therefore may affect assembly skills. These differences can generate inclusion criteria according to visual impairment profiles, in relation to the worker's previous visual experience.

Subsequently, we proceeded to analyze the ability to recreate mental images of a certain piece and its position and direction characteristics based on verbal indications from a guide and the perception of the message through the sense of hearing. The participants had to identify the type of piece, its polarity (direction and position related to the piece to be inserted), and the places of assembly by listening to the instructions of the moderator.

In performing this process, it was observed that learning assembly tasks from verbal-auditory cues provides contradictory information that requires more frequent checks by the simulated PwVI and therefore generates a greater number of errors.

From these first approximations, it became evident that factors such as the identification of pieces and the ability to generate mental models of the overall volume can be satisfied by the sense of touch, although with a greater amount of time required in the early stages of the learning curve.

Other factors, such as the identification of the polarity of the pieces, are more complex as they require longer contact with them to form a precise image of the morphological characteristics, which allows the identification of their connection points.

Finally, the error evaluation procedure is one of the main factors to be addressed in the search for improvements in the efficiency and effectiveness indicators for this task. The detection of accumulated errors without the sense of vision does not happen until the moment that the impossibility of continuing the task of assembling the other pieces is identified, which produces that the correction must be made by undoing multiple steps, affecting the confidence to continue the activity in a condition of visual impairment; in this regard, Gallego and Mejía (2017, p. 227) comment that improvements in attitudes and self-efficacy are related to the degree of exposure and acquired experience, as it decreases anxiety.

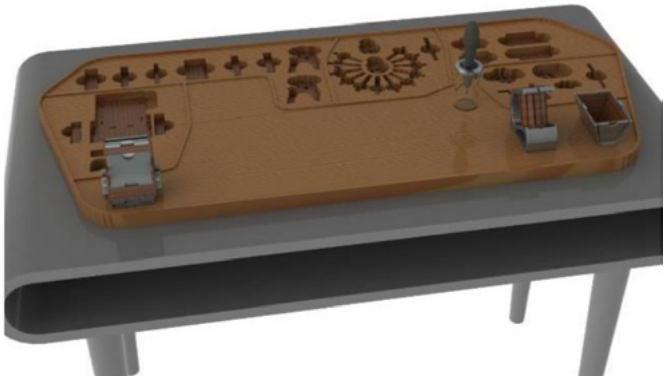
Phase III: Task analysis and assembly activities by the PwVI

In this case, the test was conducted with a PwVI, who was told that the activity was focused on assistive technology and not on the individual's skills during the task (Ribera, Termens, & García Martín, 2008, p. 104).

Two technical aids were used for the execution of assembly activities without the use of vision. These two artifacts consisted of a series of frames and assembly matrices in which the pieces could be placed, giving indications of the position and direction of each one of them, serving as a means of identification of the assembly points (see Figures 5, 6, 7, 8).

Figure 5

Technical support for the execution of assembly activities without the use of vision #1A.



Note: Own source: Semillero SeDisTec (Resident in Research Line Mateo Rodríguez).

Figure 6

Technical support for the execution of assembly activities without the use of vision #1B.

Note: Own source: Semillero SeDisTec (Resident in Research Line Mateo Rodríguez).

Figure 7

Technical assistance for the execution of assembly activities without the use of vision #2.

Note: Own source: Semillero SeDisTec (Resident in Research Line Julián Peña).

Figure 8

Technical support for the execution of assembly activities without the use of vision #2B.

Note: Own source: Semillero SeDisTec (Resident in Research Line Julián Peña).

The results evidenced during the 3 phases when performing the assembly tasks manually (without technical aids) to complete the product, showed that the learning curve is slow in both cases of visual impairment (simulated or real) **in comparison** with the normal visual operator. But that learning is improved by reducing the time in which the skills are acquired to execute the task and complete it in both conditions (without the vision) by up to 80% when using the designed assistive technologies.

It should be noted that the complementary activity of gluing with adhesives is still under study due to its complexity; however, it was considered in one of the designs in which the glue is supplied through a mechatronic device developed (see Figures 7 and 8) based on the complex technical considerations regarding this specific action. Even by including this last step, it was found that the efficiency increases by allowing the PwVI to conclude the assembly activity despite the extended time (average 17 to 25 minutes), and the efficiency also increases by gradually developing the skills with the assistance of assistive technology.

Conclusions

Differences in task execution between PwVI and people with normal vision were observed, according to emerging categories that allowed differentiating the types of users corresponding to the origin of disability, educational level, motor development, and previous work experience. These differences showed diverse levels of ability dependent on these categories and will serve as adjustment criteria for subsequent experiments when implementing artifacts designed for the inclusion of PwVI.

These observations made it possible to identify the characteristics necessary for the future implementation of some assistive technology in the work context, which will serve as a reasonable fit for including a PwVI according to the activity performed and its specific needs, which attends to the perspective of affordances, offers or new ways to take advantage of a device, which become visible to the user of technology (Norman, 2010, p.147) as possibilities of use and interaction.

Some of the findings that emerged from the interviews and surveys with the users who participated in the experiences exalt the haptic characteristics required in any device that accompanies an activity without the use of vision, in order to increase tactile stimulation through the fingers. In the same way, relevance was given to the sound and vibratory aspects that in a complementary way would be replacing any verbal order of a trainer (human or artificial), promoting the autonomy of the PcDV through the inclusion of auditory signals in the design of the technological device support.

The solutions preliminarily designed to execute the experiments during Phase III, favored the approximation of PwVI to the real conditions of a workplace which traditionally only normal-visual people could access, due to the conditions limited by the environment without intervention or reasonable adjustments. This approximation was represented by an increase in skills after the second and third tests with the population during the experiments. The need to use the other senses to carry out the activity allowed the PwVI to enhance new sensibilities that had not been explored as competencies for work, beyond their unconscious application in daily activities based on their condition of disability.

These experiments allowed the identification of new requirements for the design of assistive technologies that contemplate the factors mentioned above, related to the inclusion of technological elements (sensory and active), which increase tactile and auditory perceptions for the user in these types of activities.

Although the initial reason for the productivity of companies has been focused on the generation of financial wealth from the capabilities of their equipment, processes**,** and people, values are beginning to consolidate towards humanized companies, as proposed by the concept of **I**ndustries 5.0, which establishes new positions of the productive in favor of social and human aspects, beyond the considerations of time, quality, efficiency**,** and effectiveness.

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I am honored to present to you this remarkable book, a testament to the invaluable research conducted in the fields of Health, Law, Engineering, and Administrative Sciences. Each chapter within these pages represents the culmination of extensive investigations carried out by dedicated scholars affiliated with the Red Universitaria de Risaralda (RUN), a network comprising 15 esteemed higher education institutions.

Risaralda has emerged as a thriving hub for higher education, bolstered by its strategic geographical location, high quality of life, rich biodiversity, and competitive development. Today, Pereira ranks third in the index of university cities, with a student enrollment rate exceeding 63%. Close to 50,000 students pursue academic programs within the department. Notably, three institutions have achieved accreditation for their excellence in education, positioning Risaralda among the most competitive regions in terms of accredited academic programs.

As we celebrate the 20th anniversary of the Red Universitaria de Risaralda in 2023, it is with great pride that we reflect on its pivotal role in fostering collaboration among public and private higher education institutions. Our mission has been twofold: attracting students to our region and supporting sustainable development and quality of life for our community. The mesa de investigación (research committee) has diligently coordinated the necessary actions to unite our researchers, facilitating an integrated approach to various disciplines and themes associated with the challenges faced in our region.

Vicerrectoría de Investigaciones, Innovación y Extensión
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