The COVID-19 pandemic impact on citizen life satisfaction in a southern Brazilian City

Marcelo Benetti Correa da Silva, Marina Giacometti Valente, Ana Cristina Fachinelli, Gessica Giacomin Soares, Vinicius De Tomasi Ribeiro

Abstract
This study aimed to analyze the effects of the COVID-19 pandemic on the significant attributes and dimensions by the citizens' perceptions to understand how the social isolation affected the city life satisfaction. A survey was conducted in a southern Brazilian city applying the CityLifeSAT validated scale seeking to confirm the theory in a different environment in two moments: one before and one during the COVID-19 pandemic. Therefore, there was performed Confirmatory Factor Analysis (CFA) applying Convergent Validity and Discriminant Validity to measure how well the theoretical factors correspond with the reality, and Student's T-Test in order to compare the means pre and during-COVID-19. The results demonstrate that, from the 10 initial dimensions, six converged, confirming the scale in a different environment and demonstrating that the factors Health/Well-Being, Mobility Services, Recreation, Walkability, Social Integration and Safety are relevant by the citizens' judgment. Moreover, our findings identified significant increases in the citizens' satisfaction regarding to the sidewalks, walking routes, distances between bus stops, sense of security, and an enhanced immigrant inclusion. The satisfaction with the cultural options of the city was the only attribute that showed a decrease.

Keywords: Sustainability; City life Satisfaction; COVID-19 impact; Confirmatory Factor Analysis
Paper type - Academic Research Paper

The COVID-19 pandemic impact on citizen life satisfaction in a southern Brazilian City

Introduction

In recent years there has been a growing concern and discussion about sustainability in cities. In September 2015, United Nations (UN) adopted the seventeen "Sustainable Development Goals (SDG's)" (UN Statistical Comission, 2017), one of the targets presented being SDG 11 which refers to the sustainability of cities and communities. Current studies have demonstrated that, to achieve the SDG's, the residents' commitment is fundamental (Barrett et al., 2020). Particularly, the citizens' satisfaction is determinant to generate commitment and positive reflections (Zenker & Rütter, 2014). The monitoring tool CITYLIFESAT scale (Silva, Bebber, Fachinelli, Moschen, & Perini, 2019) enables researchers to evaluate the satisfaction perception of the residents related to the cities according to the SDG's (UN Statistical Comission, 2017), ISO 37120 (International Organization for Standardization, 2017), in association with the European Barometer (Rabier, 2003) and American Barometer (Latin American Public Opinion Project, 2012). Appling the CITYLIFESAT scale (Silva et al., 2019), it is possible to monitor the progress of these objectives and relate the impacts of the Coronavirus Disease 19 (COVID-19) pandemic on citizen perception in a post-pandemic scenario. Gathering the opinion and the judgement of the residents regarding to the products and services that the city offers to them is a way to translate, evaluate and promote the inhabitant viewpoint to identify weaknesses and strengths to contribute to the sustainability in the cities.

In 2020, the world has experienced a global devastation caused by the rapid spread of a virus with long periods of asymptomatic incubation, evidencing the fragility and vulnerability of the human social structure (Donthu & Gustafsson, 2020; Ntounis, Mumford, Loroño-Leturiondo, Parker, & Still, 2020). The COVID-19 pandemic generated an intense concern in all society sectors, including industrial, service and social areas (Bove & Benoit, 2020), resulting in serious economic consequences all over the world. This fact modified the companies' attitudes and the customers' behavior (Anastasiadou, Chrissos Anestis, Karantza, & Vlachakis, 2020). In Brazil, at the end of March 2020, people from all the States were required to comply with social isolation rules, which forced people to stay in their homes. The panic caused by the COVID-19 outbreak made several citizens to empty the supermarkets' shelves to store products at home (Anastasiadou et al., 2020), fearing for their health even when interacting with service providers (Bove & Benoit, 2020).

Through information, consultation and active participation, public administrators can reduce the barriers in terms of understanding what the citizens recognize and comprehend (Gramberger, 2001). If the aim is to get feedback from the inhabitants about products and services that the city deliver to them (Bebber et al., 2021; Silva et al., 2019), using validated tools to query the citizens makes perfect sense. If the wanted effect is to engage residents in the development of new political options, active involvement tools are applicable (Gramberger, 2001; Nakamura & Managi, 2020; Silva et al., 2019; Zenker, Petersen, & Aholt, 2013). The citizens' civil commitment, collecting their opinion about their satisfaction with the attributes and the corresponding dimensions related to sustainability in cities, plays an essential role in civic participation (Kasser, 2017). People with low level of civil commitment try a lack of communication and social connection with other people of the society (Yeh, 2017). It is a matter of commit and search for a positive impact from the citizen's perception in their community. Therefore, comprehending how the significative attributes and dimensions of the city life satisfaction are perceived, as maintained by the SDG's and ISO 37120 (ISO, 2017; UN Statistical Comission, 2017), before and during the pandemic context, being able to identify the differences perceived by the people between these two moments is an issue approached in this study.

Theoretical Background

In the last years, the world has been experiencing a rapid and growing urbanization. As stated by the UN Department of Economic and Social Affairs (2018) only 30% of the global population lived in urban areas in 1950, reaching 55% in 2018, and the prospections show 68% of the world inhabitants living in urban zones until 2050 (UN Department of Public Information, 2018). Understanding that the world has increasingly been urbanized, it is essential the cities to have a more inclusive and sustainable growth. Sustainability can exist in social, economic, cultural and environmental aspects, and is defined as a characteristic or condition of a process or system that keeps it stable or constant in the long term, without leaving a shortage of resources for the next generations (Dantas, Sousa, & Melo, 2019).

The increasing concern about the quality of life at global level has generated a search for comprehension about individual, social and global well-being (Schnorr-Baecker, 2021). With the intention of establishing an action plan to the humanity and the planet to prosper, at the United Nations Conference on Sustainable Development Rio+20, the 2030 Agenda started to be written. The 2030 Agenda for Sustainable Development (United Nations, 2015)

incorporate the 17 Sustainable Development Goals (SDG's) which includes goals to transform financial, economic, and political systems, in order to guarantee human and social rights, as well as the world preservation. The Goal 11 "Make cities and human settlements inclusive, safe, resilient and sustainable" specifically approaches guidelines to cities and human settlements, offering an opportunity to monitor the urbanization phenomenon through the usage of the City Prospective index, composed by the dimensions: productivity, infrastructure development, quality of life, equity and social inclusion, environmental sustainability, urban governance, and legislation.

In Brazil, the translation and adaptation of the international standard ISO 37120 (International Organization for Standardization, 2017), allowed the access to metrics and indicators applicable in the Brazilian context. The first Brazilian standard about sustainability in cities is the NBR ISO 37120 (ISO, 2017) "Community Sustainable Development: indicators to municipal services and quality of life" which contains indexes that measure the performance of the public services and quality of life in the cities, capable of adjusting 100 indicators, divided into dimensions, including social, environmental and economic aspects (ISO, 2017).

Meanwhile, the COVID-19 pandemic has been changing our society in several angles, demonstrating that the parameters of sustainable development of the cities should be monitored since the quality of life's evaluations cannot be constant throughout the time. The frequency of the COVID-19 cases is mostly urban, revealing rates over 90%. For the cities to be prepared against next crisis, it is fundamental to progress the urban growth in a sustainably and inclusively way based on reliable and scientific data (United Nations, 2020). The pandemic crisis evidenced the huge importance of relevant and robust databases for the governances, organizations, public or private sector, and even the population in general, to have orientation and support in decision making, with coherent confrontation proposals. Data and statistics, at all levels, are indispensable to monitor the progress of the SDG's (Adams & Judd, 2016; United Nations, 2020).

This study is applying the CityLifeSAT scale (Silva et al., 2019), a metric to measure the perception and satisfaction of the citizens, using attributes adapted to Latin-American cities context, identifying what is perceived before and during the COVID-19 pandemic in a southern Brazilian city. The bibliometric analysis with global approach of articles related to this subject used the Scopus database and the keywords sustainability, SDG's, quality of life, and life satisfaction. As a result, 79 documents emerged. The first article linked to the theme was published in 2013, and an increase of publications appeared since 2019 (see Table I) indicating a growing tendency of studies in this area.

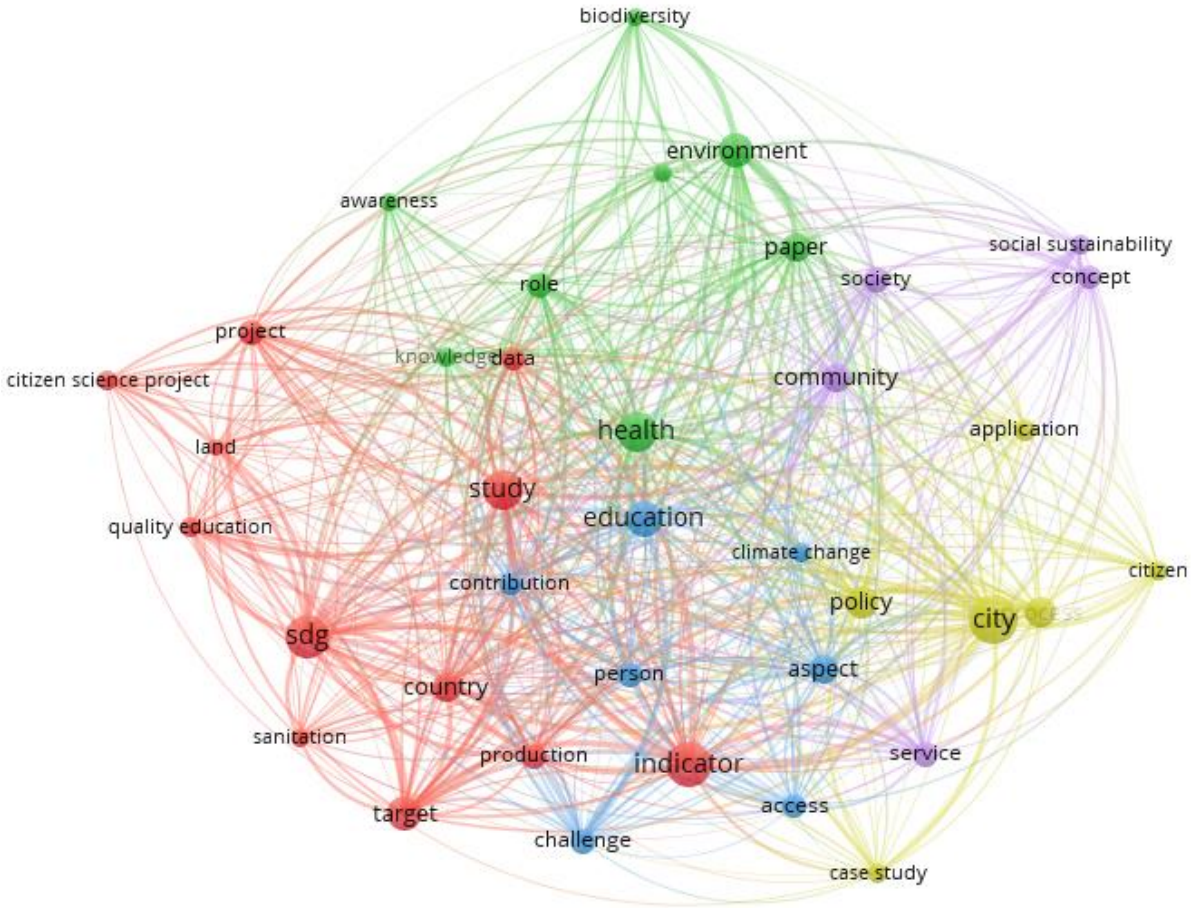
Table I – Search results

	Documents per year								
Year	2013	2014	2015	2016	2017	2018	2019	2020	2021
Number of Documents	1	0	0	2	5	7	12	29	23

Source: *Scopus*, 09 August 2021.

The analysis of words' frequency with the software VOSviewer demonstrated 38 items correlated in 5 different clusters, according to Figure I. The most mentioned terms in the red cluster are study, SDG, country, and target. The green cluster concerns health, environment, and biodiversity. The blue one present the words education, aspect, and person, while the yellow cluster contemplate city, policy, and process. Finally, the purple cluster evidence community, society, service, and concept.

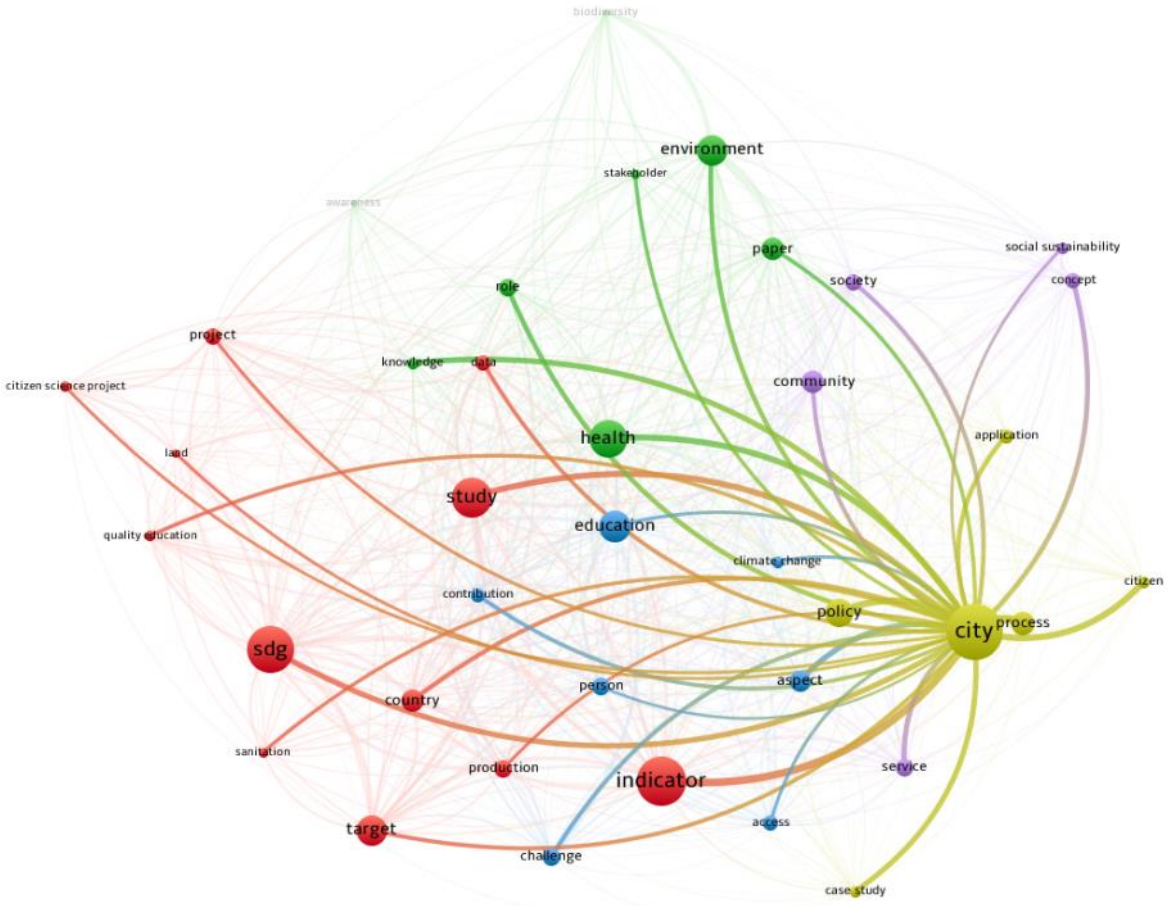
Figure **I** – Clusters of Keyword Search: Sustainability; SDGs; Quality of Life or Life Satisfaction.



Source: *Scopus*, 09 August 2021

The most recurrence term in the search was City, see Figure II, located in the yellow cluster, directly linked to the words "indicator, SDG, study, health and environment", having compatibility of relations and context with the topics discussed in the current study.

Figure II – City Correlations



Source: *Scopus*, 09 August 2021.

When including the word COVID in the search, the results are restricted to 3 publications, two of them related to education and the other one associated to environment. In conclusion, when adding the term ISO 37120 (Sustainable development of communities — Indicators for city services and quality of life), no publication appeared.

Method

The article consists of quantitative research of confirmatory nature. With this purpose, the study carried out a survey, composed by a structured questionnaire (Hair Jr., Black, Babin, & Anderson Rolph, 2018; Malhotra & Birks, 2006), applied to the citizens of a southern Brazilian city. Aiming to confirm the CityLifeSAT (Silva et al., 2019) validated scale in this

environment, the survey used the 49 attributes divided into 11 dimensions established in the previous study: Health/Well-Being, Economy/Decent Work, Environment, Recreation, Housing, Walkability, Mobility Services, Primary Services, Governance, Safety, and Social Integration (Silva et al., 2019) (Table II). Health and Well-being concerns to the individual citizens' satisfaction judgment related to the Cities and Communities, and emphasised the city infrastructure (Westphal, Franceschini, & Setti, 2018; Zenker et al., 2013). Economy and work is related to citizen's perception and satisfaction to the work/job opportunities (Bonaiuto, Fornara, Ariccio, Ganucci Cancellieri, & Rahimi, 2015; United Nations, 2020; Westphal et al., 2018). Environment concerns to the importance of protecting environment to the citizen personally (Bonaiuto et al., 2015; United Nations, 2020). Recreation concerns to the citizen's engagement with physical and cultural activities (Bonaiuto et al., 2015; Mouratidis, 2019). Housing concerns to the citizen's satisfaction on housing, streets and buildings (French et al., 2014; Giles-corti & Frank, 2013). Walkability is related to broader and more diverse mobility issues, the lack of encouragement of modes such as non-motorised transport, walking or autonomous vehicles (Moschen, Macke, Bebber, da Silva, & Benetti Correa da Silva, 2019). Mobility services concerns and meets the basic needs of mobility persons (Candia, Pirlone, & Spadaro, 2019; United Nations, 2020). The primary services shall as a multifunctional network of elements that provide benefits for the support and improvement of the Quality of Life and social well-being at multiple scales in a given territory (López-Ruiz, Alfaro-Navarro, & Nevado-Peña, 2019). Governance concerns citizen participation in the processes of information generation and decision-making in cities (United Nations, 2020) and is directly related to citizen engagement (Portney, 2005; van Eijk & Steen, 2014). Safety is directly related to citizen well-being and is important as it impacts on perceptions about general life satisfaction, neighborhood (e.g. crime, policing and service provision) and personal Quality of Life (personal safety) (Cordeiro, Kwenda, & Ntuli, 2020; Veenhoven, 2018). Finally , Social inclusion relates to the equitable distribution and redistribution of the benefits of a prosperous city, reduces poverty and the incidence of slums, protects the rights of minority and vulnerable groups, enhances gender equality and ensures civic participation in the social, political and cultural spheres (UN-HABITAT, 2012). The purpose is to apply the entire scale and validate the same attributes and dimensions confirmed in the previous study by CFA.

Table II – CityLifeSAT scale

Dimensions		Attributes
Health / Well-being	**HEA1**	I am pleased to live in my city.
	HEA2	I am satisfied with my life.

	HEA3	I am satisfied with where I live.
	HEA4	I am satisfied with my city's health system (infrastructure/care system).
	HEA5	I often do some physical activity.
	HEA6	I often walk around the city.
	HEA7	I feel integrated in this city.
Economy / Decent Work	**ECO1**	I am satisfied with my current work situation.
	ECO2	I am satisfied with the financial situation of the people who live with me.
	ECO3	I am satisfied with the trade services in my neighbourhood or vicinity.
	ECO4	It is easy to find work in my town.
Environment	**ENV1**	I am satisfied with the air quality in my city.
	ENV2	I am satisfied with the level of noise in my city.
	ENV3	I am committed to fighting climate change with sustainable practices (select waste collection, water saving, endorsement of recyclable products).
Recreation	**REC1**	I am satisfied with the cultural options offered in my city (theatre, music, art, dance, street markets and cinema).
	REC2	I am satisfied with the open spaces of leisure offered in my city (squares and parks).
	REC3	I am satisfied with the spaces for sports practice in my city.
	REC4	I am pleased with the open spaces for leisure offered in my neighbourhood.
	REC5	I frequent the open areas in my city (squares and parks).
	REC6	I attend cultural activities in my city.
	REC7	Outdoor markets meet my needs.
Housing	**HOU1**	I am satisfied with the conservation of the buildings in my city.
	HOU2	It is easy to find a good house at a reasonable price in my city.
Walkability	**WAL1**	I am satisfied with the streets in my city.
	WAL2	I am satisfied with the sidewalks in my city.
	WAL3	I am satisfied with the quality of public transport stops.
	WAL4	I am satisfied with my walking routes in town.
	WAL5	I am satisfied with the pedestrian signs in the city.
Mobility services	**MS1**	I am satisfied with public transport in my city.
	MS2	I am satisfied with the transport to other cities departing from my city.
	MS3	I am satisfied with the distance between public transport stops (bus, train).
	MS4	I am satisfied with the ease of access to my neighbourhood to the important points of my city.
Primary services	**PS1**	Public energy services in my city help people efficiently.
	PS2	Firefighters Services efficiently help people.
	PS3	Generally, the security services (military, civilian and traffic police) in my city are efficient/adequate.
	PS4	The basic sanitation service (sewage treatment) serves my neighbourhood efficiently.
	PS5	The water supply serves my city efficiently.
	PS6	I am pleased with the cleanliness of my city.
	PS7	The solid waste collection and treatment services serve my neighbourhood efficiently.
	PS8	I am satisfied with the educational system of my city (Education/Information).
Governance	**GOV1**	I consider myself participatory in public decisions related to the city (charging managers, participating in public hearings).
	GOV2	Generally, my city's public administration is reliable.
Safety	**SAF1**	I feel safe in (city name).
	SAF2	I feel safe in my neighbourhood.
	SAF3	Generally, most people in (city name) are reliable.
	SAF4	Generally, most people in my neighbourhood can be trusted.
Social integration	**SI1**	The presence of immigrants is good for my city.
	SI2	My city's social programs work efficiently.
	SI3	Immigrants have a positive influence on our city's economy.

Source: Adapted from Silva et al. (2019)

The respondents had to evaluate each theoretical attribute of the Table II according to a 7-point Likert (1932) scale of agreement varying between "1-Totally Disagree" and "7-Totally Agree", demonstrating their perception with the affirmations. Additionally, the survey included a second part questionnaire where specific descriptive questions about the respondent's profile were performed to understand the characteristics of the sample and to ensure reaching all the different society sections (Hair Jr. et al., 2018). The survey was applied in two samples: one before the COVID-19 pandemic in Brazil, throughout December/2019 and January/2020, and the other one during the COVID-19 pandemic, in June and July/2020. The periods were enough to achieve the requirement of five validated questionnaires for each attribute of the survey (Hair Jr. et al., 2018). In both of the samples, data were collected via online questionnaire using the Google Forms platform in order to achieve the largest number of answers (Malhotra, 2010). Local radios and social media (private and public body's profiles) helped to provide the questionnaire link to the whole population.

In line with Hair, Jr. et al. (2018), with the aim of evaluating how the variables behave in each predetermined theoretical dimension, the study performed Confirmatory Factor Analysis (CFA). CFA analysed in which way the attributes and dimensions confirm the previous structure. As a premise to apply CFA, data were tabulated, cleaned and treated with statistical methods (Hair Jr. et al., 2018). Thus, questionnaires with more than 10% of missing data were removed, while the remaining ones used the average (Enders, 2010). Moreover, normality tests including statistic Z test, Mahalanobis distance, skewness and kurtosis, were applied to exclude outliers and spurious (Hair Jr. et al., 2018; Malhotra, 2006). With the validated data, the research conducted Convergent Validity analysis, excluding attributes with standardized regression weights under 0.5 (Hair Jr. et al., 2018; Johnson & Wichern, 2007). Subsequently, the researchers calculated Composite Reliability (CR) and Variance Extracted (VE) values to test the convergence of the attributes in each dimension, as well as Cronbach's Alpha to verify the internal consistency of the dimensions (Bagozzi & Yi, 2012; Fornell & Larcker, 1981; Hair Jr. et al., 2018). From the convergent validity results, the study ran the Discriminant Validity procedure as recommended by Fornell and Larcker (1981), comparing the shared variances and the extracted variances. Finally, looking for significant differences between the samples before and during COVID-19 pandemic, the Student's T-test (Hair Jr. et al., 2018) concluded the analysis. This test used just the significant perceived attributes and dimensions from the CFA to filter the important results. The software IBM SPSS 20.0, IBM SPSS AMOS® 20 and Microsoft Excel assisted the data analysis.

Results and discussions

The survey applied reached 388 questionnaires answered by the citizens of Veranópolis[1], southern Brazil, where the sample pre COVID-19 contained 210 replies and the sample during COVID-19 included 178 questionnaires. After tabulating data, the answers have passed through normality tests, removing the non-normal and missing data. Altogether, 32 instruments were rejected. As a result, 356 questionnaires remained in the analysis, making a total of more than five instruments per variable and the sample size higher than 100, enabling factor analyses (Hair Jr. et al., 2018), see Table III.

Table III – Sample Characteristics

Sample	Total Collected	Valid Frequency	Valid Percent
Before Covid-19	210	188	52.8%
On Covid-19	178	168	47.2%
Total	388	356	100%

Source: Data from research.

Sample profile

The descriptive section of the survey incorporated enquires about the respondents' profile. Table IV shows the main characteristics of the sample.

Table IV – Sample summary profile characteristics

Variable		Before Covid				On Covid				Total			
		Frequency	%	Valid %	Cumulative %	Frequency	%	Valid %	Cumulative %	Frequency	%	Valid %	Cumulative %
Gender	Male	92	48.9	48.9	48.9	58	34.5	34.5	34.5	150	42.1	42.1	42
	Female	96	51.1	51.1	100	110	65.5	65.5	100	206	57.9	57.9	100
	Other	0				0							
Total		188	100	100		168	100	100		356	100	100	
Age	18-30 years old	51	27.1	34	34	77	45.8	45.8	45.8	128	36	40.3	40.3
	31-45 years old	41	21.8	27.3	61.3	26	15.5	15.5	61.3	67	18.8	21.1	61.3
	46-60 years old	32	17	21.3	82.7	42	25	25	86.3	74	20.8	23.3	84.6
	More than 60 years old	26	13.8	17.3	100	23	13.7	13.7	100	49	13.8	15.4	100
	Total	150	79.8	100		168	100	100		318	89.3	100	
Missing system		38	20.2			0				38	10.7		

[1] Veranópolis is a Brazilian municipality in the southern region, in the state of Rio Grande do Sul. It is considered the Brazilian capital of longevity and the third city with the longest average longevity of the population in the world (IDHM Municípios 2010 | PNUD Brasil (undp.org)).

Total		188	100			168				356	100		
Schooling	Elementary school	1	0.5	0.5	0.5	0	0	0	0	1	0.3	0.3	0.3
	Incomplete secondary school	26	13.8	14	14.5	0	0	0	0	26	7.3	7.3	7.6
	Secondary school	59	31.4	31.7	46.2	26	15.5	15.5	15.5	85	23.9	24	31.6
	Incomplete undergraduate	33	17.6	17.7	64	40	23.8	23.8	39.3	73	20.5	20.6	52.3
	Undergraduate	40	21.3	21.5	85.5	65	38.7	38.7	78	105	29.5	29.7	81.9
	Postgraduate	27	14.4	14.5	100	37	22	22	100	64	18	18.1	100
	Total	186	98.9	100		168	100	100		354	99.4	100	
Missing system		2	1.1			0	0			2	0.6		
Total		188	100			168	100			356	100		

Source: Data from research.

According to the basic information from the sample, the largest proportion of respondents both before and on pandemic were women, with a total relation of 42.1% (150) male and 57.9% (206) female. Nearly half of the total sample (40.3%) had ages between 18-30 years old (34% before and 45.8% on COVID-19). Also, 92.4% have completed at least secondary school, 47.8% have already an Undergraduate Degree and 18.1% have a Postgraduate Degree.

Convergent Validity

The CFA procedure started with the Convergent Validity analysis, where attributes with extracted values under 0.5 were excluded to maintain 95% of reliability level (Bagozzi & Yi, 2012; Byrne, 2013; Hair Jr. et al., 2018). This article considered the attributes and dimensions validated in the preceding Exploratory Factor Analysis (EFA) calculated in the CityLifeSAT previous study from Silva et al. (2019), seeking to validate the same dimensions and attributes in a new CFA with the data from the current research. In Silva et al. (2019)'s EFA study, from the initial 49 attributes, 35 were validated, related to 10 new factors: Health/Well-being, Mobility Services, Recreation, Walkability, Social Integration, Safety, Primary Services, Environment, City Attachment, and Social Participation. After the CFA performed in this study, from the 35 initial attributes validated in the Silva et al. (2019)'s EFA, only 24 continued in the current evaluation, related to 6 of the 10 theoretical dimensions initially proposed. The dimensions entirely excluded were Primary Services, Environment, City Attachment and Social Participation. Moreover, to test the percentage of explained variance between the attribute's, VE was calculated, where all the 6 constructs presented values equal or higher than 0.5, indicating convergence. Subsequently, the CR results for the remained dimensions also showed

satisfactory values, higher than 0.7. The Cronbach's Alpha of all constructs were above the recommended score, with all values higher than 0.7 (Fornell & Larcker, 1981; Hair Jr. et al., 2018; Kline, 2015). The results are in Table V.

Table V – Composite Reliability, Variance Extracted, and Cronbach's Alpha

Variables	Factor loads	CR	VE	α
Health/Well-Being				
HEA1-I am pleased to live in my city	0.732	0.804	0.509	0.772
HEA2-I am satisfied with my life.	0.784			
HEA3-I am satisfied with where I live.	0.736			
ECO2-I am satisfied with the financial situation of the people who live with me.	0.585			
Mobility Services				
MS1-I am satisfied with public transport in my city.	0.735	0.840	0.513	0.832
MS3-I am satisfied with the distance between public transport stops (bus, train).	0.778			
WAL3-I am satisfied with the quality of public transport stops.	0.702			
MS4-I am satisfied with the ease of access from my neighborhood to the important points of in my city.	0.666			
WAL4-I am satisfied with my walking routes in my city.	0.694			
Recreation				
REC1-I am satisfied with the cultural options offered in my city (theatre, music, art, dance, street markets and cinema).	0.762	0.888	0.664	0.882
REC2-I am satisfied with the open spaces of leisure offered in my city (squares and parks).	0.860			
REC3-I am satisfied with the spaces for sports practice in my city.	0.826			
REC4-I am pleased with the open spaces for leisure offered in my neighborhood.	0.809			
Walkability				
WAL1-I am satisfied with the streets in my city.	0.652	0.799	0.500	0.808
WAL2-I am satisfied with the sidewalks in my city.	0.652			
PS6-I am pleased with the cleanliness of my city.	0.770			
PS7-The solid waste collection and treatment services serve my neighborhood efficiently.	0.746			
Social Integration				
SI1-The presence of immigrants is good for in my city.	0.811	0.817	0.599	0.771
SI2-My city's social programs work efficiently.	0.695			
SI3-Immigrants have a positive influence on our city's economy.	0.811			
Safety				
SAF1-I feel safe in my city.	0.824	0.876	0.638	0.874
SAF2-I feel safe in my neighborhood.	0.830			
SAF3-Generally, most people in my city are reliable.	0.768			
SAF4-Generally, most people in my neighborhood can be trusted.	0.771			

Source: Data from research.

Discriminant Validity

The discriminant validity analysis used the procedure suggested by Fornell and Larcker (1981). The constructs variances are extracted and compared with the shared variances. The

discriminant validity exists when the extracted variances (values in bold) from the dimensions are higher than the shared variances, demonstrating the difference level of two similar constructs (Hair Jr. et al., 2018). Table VI shows the discriminant validity results, indicating that the scale is different enough from the other similar constructs, and thus identifying the presence of DV.

Table VI – Discriminant Validity according to Fornell and Larcker (1981)

Dimension	Health/Well-Being	Mobility Services	Recreation	Walkability	Social Integration	Safety
Health/well-Being	**0.509**					
Mobility Services	0.215	**0.513**				
Recreation	0.187	0.376	**0.664**			
Walkability	0.289	0.349	0.304	**0.500**		
Social Integration	0.047	0.120	0.085	0.119	**0.599**	
Safety	0.223	0.229	0.141	0.259	0.171	**0.638**

Source: Data from research.

Comparison between Before COVID-19 and On COVID-19 samples

As a final analysis, the attributes in significant dimensions were compared in distinct moments: before and during the COVID-19 pandemic. To this end, the article performed the Student's T-Test, looking for statistically significant differences between the two samples (Hair Jr. et al., 2018). The results on Table VII demonstrate relevant differences (2-tailed) represented by values lower than 0.05. Except for Health/Well-being, all the dimensions evidenced attributes with changes in perceptions before and during the pandemic.

Table VII – Student's T-Test

		Group Statistics			Levene's Test for Equality of Variances	t-test for Equality of Means	
Dimension	**Attribute**	**COVID-19**	**Mean**	**Std. Deviation**	**F**	**Sig. (2-tailed)**	**Mean Difference**
Health/Well-being	HEA1	Before COVID-19	5.98	1.285	3.290	0.937	-0.010
		On COVID-19	5.99	1.092			
	HEA2	Before COVID-19	5.78	1.207	6.443	0.262	-0.135
		On COVID-19	5.91	1.060			
	HEA3	Before COVID-19	5.84	1.377	6.072	0.074	-0.239
		On COVID-19	6.08	1.097		0.070	
	ECO2	Before COVID-19	5.24	1.555	12.881	0.056	-0.283
		On COVID-19	5.52	1.178		0.053	
Recreation	REC1	Before COVID-19	4.29	1.666	0.451	0.001	0.590
		On COVID-19	3.70	1.749		0.001	

	REC2	Before COVID-19	4.61	1.570	2.563	0.002	0.548
		On COVID-19	4.06	1.770		0.002	
	REC3	Before COVID-19	4.57	1.523	4.836	0.170	0.238
		On COVID-19	4.33	1.746		0.173	
	REC4	Before COVID-19	4.29	1.703	0.187	0.132	0.281
		On COVID-19	4.01	1.810		0.133	
Walkability	PS6	Before COVID-19	5.32	1.298	0.175	0.093	-0.228
		On COVID-19	5.55	1.256		0.093	
	PS7	Before COVID-19	5.77	1.204	0.077	0.564	-0.076
		On COVID-19	5.85	1.267		0.565	
	WAL1	Before COVID-19	4.89	1.572	0.110	0.093	-0.279
		On COVID-19	5.17	1.548		0.093	
	WAL2	Before COVID-19	4.69	1.629	1.334	0.047	-0.338
		On COVID-19	5.03	1.565		0.047	
Mobility Services	MS1	Before COVID-19	4.67	1.518	0.785	0.135	-0.228
		On COVID-19	4.90	1.334		0.132	
	MS3	Before COVID-19	4.74	1.535	4.467	0.011	-0.381
		On COVID-19	5.12	1.227		0.010	
	WAL3	Before COVID-19	4.68	1.616	1.300	0.368	-0.149
		On-19 COVID	4,83	1.495		0.366	
	MS4	Before COVID-19	5.24	1.540	1.168	0.176	-0.214
		On COVID-19	5.45	1.418		0.174	
	WAL4	Before COVID-19	5.42	1.515	6.552	0.046	-0.300
		On COVID-19	5.72	1.281		0.044	
Safety	SAF1	Before COVID-19	5.12	1.450	4.608	0.001	-0.498
		On COVID-19	5.62	1.198		0.000	
	SAF2	Before COVID-19	5.25	1.518	7.167	0.004	-0.425
		On COVID -19	5.67	1.196		0.003	
	SAF3	Before COVID-19	4.81	1.539	7.004	0.058	-0.288
		On COVID-19	5.10	1.282		0.055	
	SAF4	Before COVID-19	5.04	1.504	2.045	0.057	-0.284
		On COVID	5.32	1.268		0.054	
Social Integration	SI1	Before COVID-19	5.15	1.536	1.942	0.001	-0.521
		On COVID-19	5.67	1.352		0.001	
	SI2	Before COVID-19	5.33	1.299	0.308	0.682	-0.056
		On COVID-19	5.39	1.262		0.682	
	SI3	Before COVID-19	4.93	1.493	0.103	0.001	-0.544
		On COVID-19	5.47	1.431		0.001	

Source: Data from research.

Two attributes of the recreation dimension were emphasized: “REC1 - I am satisfied with the cultural options offered in my city (theatre, music, art, dance, fairs and cinema)” with p<0.001, averages before COVID-19 of 4.29 and on COVID-19 of 3.70; and, “REC2 - I am satisfied with the open leisure spaces offered in my city (squares and parks)” with a p<0.002, average before COVID-19 of 4.61 and on COVID-19 of 4.06. In the Walkability dimension, the highlight was the attribute “WAL2 - I am satisfied with the sidewalks in my city” with p<

0.047, averages before COVID-19 of 4.69 and on COVID-19 of 5.03. In the Mobility Services dimension, two attributes were perceived: "MS3 - I am satisfied with the distance between public transport stops (bus, train)" with p<0.011 and 0.010, averages before COVID-19 of 4.74 and on COVID-19 of 5.12, respectively; and the attribute "WAL4 - I am satisfied with my walking routes in my city" obtained p<0.046 and 0.044, averages before COVID-19 of 5.42 and on COVID-19 of 5.72. Two attributes were perceived in the Safety dimension: "SAF1 - I feel safe in my city" with p<0.00 and 0.001, means before COVID-19 of 5.12 and on COVID-19 of 5.62; and the attribute "SAF2 - I feel safe in my neighborhood" with p<0.04 and 0.03, averages before COVID-19 of 5.25 and on COVID-19 of 5.67. Similarly for the Social Integration dimension, highlighting two attributes: "SAF1 - I feel safe in my city" with a p<0.01, averages before COVID-19 of 5.15 and on COVID-19 of 5.67; as well as the SAF3 attribute "Generally, most people in my city are trustworthy" with p<0.01, averages before COVID-19 of 4.93 and on COVID-19 of 5.47.

Concerning the attributes and dimensions that were not validated on CFA, the Environment dimension, despite not being perceived as a whole, had an increased perceived sensitivity in all its attributes: "ENV1 – I am satisfied with the air quality in my city" with p-value of 0.024 and 0.023, means before COVID-19 of 5.84 and on COVID-19 of 6.16; the attribute "ENV2 – I am satisfied with the level of noise in my city" with p<0.016 and 0.017, means before COVID-19 of 5.30 and on COVID-19 of 5.66; and the attribute "ENV3 – I am committed to fighting climate change with sustainable practices (select waste collection, water saving, endorsement of recyclable products)" with p<0.007, means before COVID-19 of 5.88 and on COVID-19 of 6.21.

Some attributes although not validated demonstrated a perceived significance. Relating the dimensions Health/Well-being and Walkability, the attributes that point out significant differences were "HEA5 – I often do some physical activity" (p<0.038) with 4.81 of mean before COVID -19 and 5.24 on COVID-19. The attribute "WAL5 – I am satisfied with the pedestrian signs in the city" with p<0.033 and 0.031, with 5.28 of mean before COVID-19 and 5.61 on COVID-19, showing the relationship with increased walkability and practice of outdoor physical activity. On regarding the Primary Services dimension, the attributes that presented a perceived significance were "PS2 – Firefighters Services efficiently help people" with p-value<0.001, 5.65 of mean before COVID-19 and 6.36 on COVID-19. The attribute "PS3 – Generally, the security services (military, civilian and traffic police) in my city are efficient/adequate" with p<0.016 result, and 5.10 of mean value before COVI19 and 5.46 on COVID-19. Concerning the Social Participation dimension, the attribute "GOV2 – Generally,

my city's public administration is reliable, p<0.010, with 5.07 mean before COVID-19 and 5.48 on COVID-19.

Conclusions

The change of behavior between citizens, added to the transformation of businesses and economic relationship made people identify attributes of quality of life that were not highlighted before. The survey confirmed 6 (six) of the 10 (ten) theoretical dimensions suggested by the metric used from the CityLifeSAT scale (Silva et al., 2019). The dimensions perceived with significant results were Health/Well-being, Mobility Services, Recreation, Walkability, Social Integration and Safety. In this research, we cannot state the reasons why the Primary Services, Environment, City Attachment and Social Participation dimensions were not perceived. New research and hypotheses would need to be carried out to obtain such findings, however, the indications of rigidity of lockdown guided by the public power, adding to the average of the high age elderly group, made the community not to leave home (stay at home), and, consequently, did not live with the environments and administrative policy of the city.

Theoretical Implications

The validated dimensions happened through the convergent validity analysis, demonstrating attribute weights up to 0.5, that is, CV> 0.5 - in this case, the factor loadings ranged from 0.585 to 0.860 and were considered satisfactory (Byrne, 2013). In addition, the Cronbach's Alpha coefficient and composite reliability values had a score above 0.7 (Kline, 2015), indicating that they have adequate reliability.

In the analysis of discriminant validity, it was possible to affirm that there is no direct relationship between each dimension: each one of them is measuring different attributes and elements. The 6 (six) dimensions perceived Health/Well-being, Mobility Services, Recreation, Walkability, Social Integration, and Safety proved a Discriminant Validity DV> 0.5 confirming the analysis suggested by Fornell and Larcker (1981).

When comparing the attributes before and during the pandemic, we can say that there are dimensions that are more perceived by users. Of the 6 dimensions, only Health/Well-being did not reveal perceived significant differences in the attributes, different from the other factors. Some attributes showed an increase in the means after the COVID-19 pandemic started: WAL2 – "I am satisfied with the sidewalks in my city", MS3 – "I am satisfied with the distance between

public transport stops (bus, train)", WAL4 – "I am satisfied with my walking routes in my city", SAF1 – "I feel safe in my city", SAF2 – "I feel safe in my neighborhood", SI1 – "The presence of immigrants is good for in my city", and SI3 – "Immigrants have a positive influence on our city's economy", demonstrating a higher satisfaction with walking situations in public spaces, as well as an elevated sense of security, and valorization of immigrants. The satisfaction decreased, during the pandemic, when citizens were asked about leisure and cultural options provided by the city, as showed the attributes REC1 – "I am satisfied with the cultural options offered in my city (theatre, music, art, dance, street markets and cinema)" and REC2 – "I am satisfied with the open spaces of leisure offered in my city (squares and parks)".

Managerial Implications

In the analysis, we identified that the interviewees perceived the lack of cultural events offered and its realization in public spaces. They also accomplished the importance of walking spaces in the city, and its connection between their homes and some modes of transport. Changing habits and behaviors were analyzed in the works of Anastasiadou et al. (2020). A direct connection between the use of these spaces and the increased sense of security was identified, as well as the link between this attribute and neighbors. When there is coexistence and occupation of spaces, there is greater appreciation of them and perceived safety. The relationship of domain and belonging can be elements to be explored in future research researches reasons to continue exploring the CityLifeSAT scale (Silva et al., 2019), 2030 Agenda and the SDG's (UN Statistical Comission, 2017), ISO 37120 (International Organization for Standardization & Associação Brasileira de Normas Técnicas, 2017) and the American Barometer (LAPOP, 2012; Rabier, 2003).

Analyzing the dimensions which did not confirm the previous theory, the environmental dimension, despite the adequate coverage result among its attributes in one dimension, showed in all its attributes a significant increase and difference in the average values on the pandemic moment. The attributes of the environment dimension, we can affirm, had their perception increased by the citizen in the pandemic.

It is recommended that this study be carried out in other municipalities during the pandemic, to identify the dimensions perceived by citizens, and compare them with studies before the pandemic. For those who do not have it, the present research itself will contribute to the current understanding of citizens' perceptions of quality of life. In addition, the same research may be accomplished in the future in the post-pandemic period, comparing data before,

during and after COVID-19 in the first case, or data during and after pandemic in the second case. Regardless of both situations, the suggestion is that we can even identify whether the dimensions perceived in a municipality are the same in other municipalities within a region, or of similar scales, or even in different localized cultures and geographies.

References

Adams, B. B., & Judd, K. (2016). 2030 Agenda and the SDGs : Indicator framework , monitoring and reportng. *Global Policy Watch*, (March), 1–5.

Anastasiadou, E., Chrissos Anestis, M., Karantza, I., & Vlachakis, S. (2020). The coronavirus' effects on consumer behavior and supermarket activities: insights from Greece and Sweden. *International Journal of Sociology and Social Policy*. https://doi.org/10.1108/IJSSP-07-2020-0275

Bagozzi, R. P., & Yi, Y. (2012). Specification, evaluation, and interpretation of structural equation models. *Journal of the Academy of Marketing Science*, *40*(1), 8–34. https://doi.org/10.1007/s11747-011-0278-x

Barrett, S., Dasgupta, A., Dasgupta, P., Adger, W. N., Anderies, J., van den Bergh, J., … Wilen, J. (2020). Social dimensions of fertility behavior and consumption patterns in the Anthropocene. *Proceedings of the National Academy of Sciences*, *117*(12), 6300–6307. https://doi.org/10.1073/pnas.1909857117

Bebber, S., Libardi, B., De Atayde Moschen, S., Correa da Silva, M. B., Cristina Fachinelli, A., & Nogueira, M. L. (2021). Sustainable mobility scale: A contribution for sustainability assessment systems in urban mobility. *Cleaner Engineering and Technology*, 100271. https://doi.org/10.1016/j.clet.2021.100271

Bonaiuto, M., Fornara, F., Ariccio, S., Ganucci Cancellieri, U., & Rahimi, L. (2015). Perceived Residential Environment Quality Indicators (PREQIs) relevance for UN-HABITAT City Prosperity Index (CPI). *Habitat International*, *45*(P1), 53–63. https://doi.org/10.1016/j.habitatint.2014.06.015

Bove, L. L., & Benoit, S. (2020). Restrict, clean and protect: signaling consumer safety during the pandemic and beyond. *Journal of Service Management*. https://doi.org/10.1108/JOSM-05-2020-0157

Byrne, B. M. 2013. (2013). *Structural equation modeling with Mplus: Basic concepts, applications, and programming*. Routledge.

Candia, S., Pirlone, F., & Spadaro, I. (2019). Sustainable urban mobility and urban safety and security: A case study of the city centre of Genoa, Italy. *WIT Transactions on the Built*

Environment, *182*, 187–198. https://doi.org/10.2495/UT180181

Cordeiro, M., Kwenda, P., & Ntuli, M. (2020). Crime and Life Satisfaction: Evidence from South Africa - Gauteng Province. *Applied Research in Quality of Life*, *15*(3), 715–736. https://doi.org/10.1007/s11482-018-9685-1

Dantas, H. S., Sousa, J. M. M. S., & Melo, H. C. (2019). The Importance of City Information Modeling (CIM) for Cities' Sustainability. *IOP Conference Series: Earth and Environmental Science*, *225*(1), 012074. https://doi.org/10.1088/1755-1315/225/1/012074

Donthu, N., & Gustafsson, A. (2020). Effects of COVID-19 on business and research. *Journal of Business Research*, *117*(June), 284–289. https://doi.org/10.1016/j.jbusres.2020.06.008

Enders, C. K. (2010). *Applied Missing Data Analysis*. New York: The Guilford Press.

Fornell, C., & Larcker, D. F. (1981). Evaluating Structural Equation Models with Unobservable Variables and Measurement Error. *Journal of Marketing Research*, *18*(1), 39. https://doi.org/10.2307/3151312

French, S., Wood, L., Foster, S. A., Giles-Corti, B., Frank, L., & Learnihan, V. (2014). Sense of Community and Its Association With the Neighborhood Built Environment. *Environment and Behavior*, *46*(6), 677–697. https://doi.org/10.1177/0013916512469098

Giles-corti, B., & Frank, L. (2013). *Sense of Community and Its Association With the Neighborhood Built Environment*. (July). https://doi.org/10.1177/0013916512469098

Gramberger, M. (2001). *Citizens as Partners. OECD handbook on information, consultation and public participation in policy-making*.

Hair Jr., J. F., Black, W. C., Babin, B. J., & Anderson Rolph, E. (2018). *Multivariate Data Analysis* (Seventh Ed; Prentice Hall, ed.). NJ: Bookman Editora.

International Organization for Standardization. (2017). *ISO 37120: Sustainable Development of Communities – Indicators for City Services and Quality of Life*.

International Organization for Standardization, & Associação Brasileira de Normas Técnicas. (2017). *NBR ISO 37120: Desenvolvimento sustentável de comunidades — Indicadores para serviços urbanos e qualidade de vida*.

Johnson, R. A., & Wichern, D. W. (2007). Applied Multivariate Statistical Analysis. In U. S. River: (Ed.), *New Jersey, US: Pearson Prentice Hall* (6th ed.). Pearson / Prentice Hall.

Kasser, T. (2017). Living both well and sustainably: a review of the literature, with some reflections on future research, interventions and policy. *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences*, *375*(2095), 20160369. https://doi.org/10.1098/rsta.2016.0369

Kline, R. B. (2015). *Principles and practice of structural equation modeling*. Guilford publications.

LAPOP: Latin American Public Opinion Project. (2012). *LAPOP: Latin American Public Opinion Project and the AmericasBarometer*. Retrieved from http://www.vanderbilt.edu/lapop/Brochure_LAPOP_English_Final_Web_18Jul12.pdf

Likert, R. (1932). A Technique For The Measurement of Attitude, Archieves of Psychology: New York University. *Archives of Psychology*, (140), 1–55. https://doi.org/2731047

López-Ruiz, V. R., Alfaro-Navarro, J. L., & Nevado-Peña, D. (2019). An intellectual capital approach to Citizens' quality of life in sustainable cities: A focus on Europe. *Sustainability (Switzerland)*, *11*(21). https://doi.org/10.3390/su11216025

Malhotra, N. K. (2006). *Marketing Research: An Applied Orientation* (5th ed.). New Jersey: Prentice Hall.

Malhotra, N. K. (2010). *Pesquisa de Marketing: Foco na Decisão* (3rd ed.). https://doi.org/10.1017/CBO9781107415324.004

Malhotra, N. K., & Birks, D. (2006). *Review of Marketing Research* (3rd ed.). https://doi.org/10.1108/S1548-6435

Moschen, S. A., Macke, J., Bebber, S. S., da Silva, M. B. C., & Benetti Correa da Silva, M. (2019). Sustainable development of communities: ISO 37120 and UN goals. *International Journal of Sustainability in Higher Education*, *20*(5), 887–900. https://doi.org/10.1108/IJSHE-01-2019-0020

Mouratidis, K. (2019). Built environment and leisure satisfaction: The role of commute time, social interaction, and active travel. *Journal of Transport Geography*, *80*(April), 102491. https://doi.org/10.1016/j.jtrangeo.2019.102491

Nakamura, H., & Managi, S. (2020). Effects of subjective and objective city evaluation on life satisfaction in Japan. *Journal of Cleaner Production*, *256*, 120523. https://doi.org/10.1016/j.jclepro.2020.120523

Ntounis, N., Mumford, C., Loroño-Leturiondo, M., Parker, C., & Still, K. (2020). How safe is it to shop? Estimating the amount of space needed to safely social distance in various retail environments. *Safety Science*, *132*, 104985. https://doi.org/10.1016/j.ssci.2020.104985

Portney, K. (2005). Civic engagement and sustainable cities in the United States. *Public Administration Review*, *65*(5), 579–591. https://doi.org/10.1111/j.1540-6210.2005.00485.x

Rabier, J.-R. (2003). *Entretien avec M.Jacques-René*. 1–5. Retrieved from

http://ec.europa.eu/commfrontoffice/publicopinion/docs/entretien_rabier.pdf

Schnorr-Baecker, S. (2021). Well-being in urban and rural areas, challenges, general policies, and their monitoring: Some evidence for Germany before and during the COVID-19 pandemic1. *Statistical Journal of the IAOS*, *37*(2), 495–515. https://doi.org/10.3233/SJI-210803

Silva, M. B. C. Da, Bebber, S., Fachinelli, A. C., Moschen, S. D. A., & Perini, R. D. L. (2019). City life satisfaction: a measurement for smart and sustainable cities from the citizens' perspective. *International Journal of Knowledge-Based Development*, *10*(4), 338. https://doi.org/10.1504/IJKBD.2019.105126

UN-HABITAT. (2012). State of the World's Cites 2012/2013: United Nations Human Settlements Programme. *United Nations Human Settlements Programme (UN-HABITAT)*, 152. Retrieved from www.unhabitat.org

UN Department of Economic and Social Affairs. (2018). *The speed of urbanization around the world*. 2.

UN Department of Public Information. (2018). *68% of the world population projected to live in urban areas by 2050*. pp. 1–3.

UN Statistical Comission, U. C. (2017). Global Indicator Framework for the Sustainable Development Goals and Targets of the 2030 Agenda for Sustainable Development. In *Work of the Statistical Commission pertaining to the 2030 Agenda for Sustainable Development*. RES/71/313. Work of the Statistical Commission pertaining to the 2030 Agenda ….

United Nations. (2015). *TRANSFORMING OUR WORLD: THE 2030 AGENDA FOR SUSTAINABLE DEVELOPMENT*. https://doi.org/10.1201/b20466-7

United Nations. (2020). The Sustainable Development Goals Report. In *The Sustainable Development Goals Report 2020*. https://doi.org/10.29171/azu_acku_pamphlet_k3240_s878_2016

van Eijk, C. J. A., & Steen, T. P. S. (2014). Why People Co-Produce: Analysing citizens' perceptions on co-planning engagement in health care services. *Public Management Review*, *16*(3), 358–382. https://doi.org/10.1080/14719037.2013.841458

Veenhoven, R. (2018). Co-development of Happiness Research: Addition to "Fifty Years After the Social Indicator Movement." *Social Indicators Research*, *135*(3), 1001–1007. https://doi.org/10.1007/s11205-017-1554-z

Westphal, M. F., Franceschini, M. C., & Setti, A. F. F. (2018). How Can the Healthy Municipalities, Cities and Communities Strategy Advance the Sustainable Development

Goals Agenda? Lessons from Agenda 21 and the MDGs in Brazil. In *World Sustainability Series* (pp. 265–282). https://doi.org/10.1007/978-3-319-69474-0_16

Yeh, H. (2017). The effects of successful ICT-based smart city services: From citizens' perspectives. *Government Information Quarterly*, *34*(3), 556–565. https://doi.org/10.1016/j.giq.2017.05.001

Zenker, S., Petersen, S., & Aholt, A. (2013). The Citizen Satisfaction Index (CSI): Evidence for a four basic factor model in a German sample. *Cities*, *31*, 156–164. https://doi.org/10.1016/j.cities.2012.02.006

Zenker, S., & Rütter, N. (2014). Is satisfaction the key? The role of citizen satisfaction, place attachment and place brand attitude on positive citizenship behavior. *Cities*, *38*, 11–17. https://doi.org/10.1016/j.cities.2013.12.009