



Inova Lab Una - Economic Radar: Mobile Application to Enhance Investment Attractiveness in Small Cities

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Abstract

The process of investing in cities and their businesses is an extremely complex issue that directly impacts the daily lives of citizens. However, agile and consolidated information is not always available so that people with less market knowledge can assess the possible attractiveness of investments in interior cities. Information often exists, but it is very widespread and fragmented. The general objective of this paper is to present a central platform to gather and make available fundamental information about the municipality and its surrounding region. The proposal is to create a robust and objective virtual environment, facilitating the analysis of companies that are considering possible investments in the area. Furthermore, the initiative seeks to promote the visibility of small cities, which are often neglected in the investment scenario. By providing detailed and updated information, our platform aims to highlight the economic, cultural and social potential of these locations, encouraging investors' interest in contributing to the sustainable development of these communities. The first experiment of this platform focuses on the city of Bom Despacho, a city with more than 50 thousand inhabitants, to provide accurate and relevant data, to not only attract investments, but also promote a more equitable distribution of economic opportunities, contributing to the construction of more resilient and prosperous communities. A Mobile application with interaction with public databases related to investments, with the ability to receive data and search in data available for access, was developed for experiments that can be used in other cities with the same profile.

Keywords: Economic Radar; Investment Attraction; Mobile Solutions; Interior Cities.

1. Introduction

According to Gomes (2021), Minas Gerais is a vast territory with 853 cities, offering several investment opportunities and technological advancement. This state possess a

strategic location in Brazil and diversified opportunities, such as: tourism, agribusiness and technological development hubs in urban centers such as Belo Horizonte, Uberlândia and Juiz de Fora. There is a real and interesting economic potential and innovation capabilities. However, small cities (rural towns or countryside village), face unique challenges, where economic, social and infrastructural demands intertwine, often resulting in difficulties to: attract investment, retain young talents and provide employment opportunities, leading to a population exodus to urban areas. Through this challenging behavior, information and communication technologies (ICT) utilization has stood out as an essential catalyst to improve the economic and social development of these cities.

According to Ignacio et al. (2024), Artificial Intelligence (AI) models such as ChatGPT® has demonstrated their ability to manage complex questions and processes improvements. Carrasco et al. (2023) describes: in the MIR 2022 exam in Spain, ChatGPT® had demonstrated its usefulness by correctly answering 51.4%, highlighting its potential to accelerate machine learning and data exposure (essential aspects for our collection data and presentation of indicators for investors).

There is a potential demand as small and medium-sized cities, still claiming investments. However, nowadays, there are technologies at their disposal, such as mobile applications, cloud computing and accessible public data. A composition of a solution can bring benefits to these cities (Godavarthi et al., 2023).

This research has as the main objective to demonstrate a project that aims to collect data and present indicators for fundraising in Minas Gerais small cities. To achieve this purpose, three specific objectives are highlighted: an analysis of possible variables that could score a attractiveness city; through the Adapted Canvas and BPMN (Business Process Model and Notation), design a mobile solution and; demonstrate the prototype and its performance on the cities scored for investment.

Those goals justify this research, bringing possibility to provide an agile and accessible environment to provide data to investors, strengthening the development potential of Minas Gerais small cities.

2. Material and Methods

2.1 Theoretical Framework Analysis

Fundamental concepts were evaluated. Firstly, the investment process in cities, according to the productive sector (Bagri et al., 2023). A city may (or may not) demonstrate itself as an option for investment. Whether initial, expansionist or market affirmation, a company considers demographic, political and social issues to allocate its resources. Some variables can be used to score these cities, between others, such as environmental license requirements, laws and taxes.

Through proposal based in economic premises, and focusing to development of a mobile solution to contribute at the investment scenario in small cities, concepts about quality tools to align the mobile application main concept were highlighted: Canvas (specifically: adapted version demonstrated by Santos et al., 2022) and BPMN.

The Business Model Canvas is a tool used to describe building, analyzing and business models. Santos et al., 2022, presents a version in which variables relevant to the construction of software of this type, identifying the points that would be necessary to execute the project, its pros and cons, among other information of utmost importance for the progress of this

research: *General Objective (blue part), Definition of Contributions and Data work (green part); references (purple part) and Challenges and Risks (yellow part).*

BPMN, according to Choudhary & Riaz (2023), presents a standardized representation process of activities flow. A pertinent issue for studies regarding to application to be developed.

After obtain the analysis methods for the mobile application design process, two essential bases were researched:

- **Mobile solutions:** software capable of running on smartphones, capable of processing demands with lower computational resource requirements. They can receive support from cloud computing structures to optimize and enhance operational capabilities (Boduch et al., 2022).
- **Cloud Computing:** Computational structure represented by internet environment, possessing optimized resources to provision elements in the form of services, such as software, platforms and infrastructure (Boduch et al., 2022).

Such references supported this research.

2.2 Implementation Methodology

The solution implementation process followed three assumptions:

- **Delimiting the objectives of the software:** through adapted Canvas (Santos et al., 2022) and BPMN, the application's objectives definition has been built. So, a description of information flow and user interaction was developed.
- **Reference variables and investment attractiveness scoring – an initial evaluation:** to achieved the software objectives, variables in investment scenario were evaluated. This study was a first empiric relevance evaluation. The variables selection was based on the premise: public data should be used, which are accessible by any citizen, in order to have due respect for data protection laws. However, such variables should also provide a portfolio that could highlight a relevant scoring equation for the investor. Thousands of variables are not possible for the developed prototype, so a range of nine traditional investment assessment variables would be evaluated and the way in which their data would be collected, so that the set of possible answers is structured.
- **Performance interfaces modeling:** through the results of variables evaluation, it was built a graphical user interaction interfaces modeling process, both web and application (i.e., a responsive solution) was developed. Such development was divided into three versions, sequential and evolutionary, with increased functionality and automation.

So, the first prototype version can be envisioned and evaluated.

3. Results

3.1 Analysis of the Adapted Canvas and Process Flowchart

The solution modeling process was performed. A project reference was developed based on the adapted Canvas model, described in figure 1. The blue sector presents a general purpose of the tool was evaluated, the guideline of the project towards a solution that comes,

3.2 Modeling Application Versions - Process of Structuring and Interfaces Development

Evaluating among the variables in relation to the investment attractiveness process, the following variables were empirically incorporated into the application according this first study:

- Variable 1 – GDP (from: *PIB - Produto interno bruto*): gross domestic product
- Variable 2 – Mayor: Name of the acting mayor;
- Variable 3 – Population: number of people living in the city;
- Variable 4 – HDI: human development index;
- Variable 5 - Benefits offered by the Municipality? Confirm whether or not there is a tax reduction/exemption from the municipality;
- Variable 6 - Necessary Logistics? Whether access to the city is permissible or not for the business;
- Variable 7 - Geographic location: acceptable distance from consumption center points;
- Variable 8 - Law of economic freedom: Yes/No;
- Variable 9 - Area of Activity: Definition of the field to be researched;
- Variable 10 - Municipality requests: Employee qualifications – Is there already a qualified workforce? If not, is the municipality willing to qualify?
- Variable 11 - Requires an Environmental License for the activity: Combine yes/no and the rigor of this law.
- Variable 12 - Investment attraction incentive law: yes/no confirmation answer and the name of the law (if positive, the answer);

Once these variables were defined, three implementation processes were delimited resulting a application version:

- **First version – Manual Financial Attractiveness Analysis:** The user can insert data about the cities to be analyzed for investments by itself, and a graphical analysis is made available according to the previously defined variables. This version is the already in operation.
- **Second Version – Manual Financial Attractiveness Analysis by Industrial Sector:** This version will have automated scoring for investment attractiveness, with a calculation of weights for each variable, according to the interests of each user, which may vary, not only by cities, but by industrial sector, for investors with multiple sides of activity in the market.
- **Third Version – Dynamic Finance attractiveness analysis:** The investors will be able to enter their data, place the weights consistent with their interests, but will be assisted by a comparative analysis of a search via web crawler, based on economic references, to provide a consideration to their weights according to the investments under analysis.

The implementation of each version is carried out every six months, to validate the functionalities.

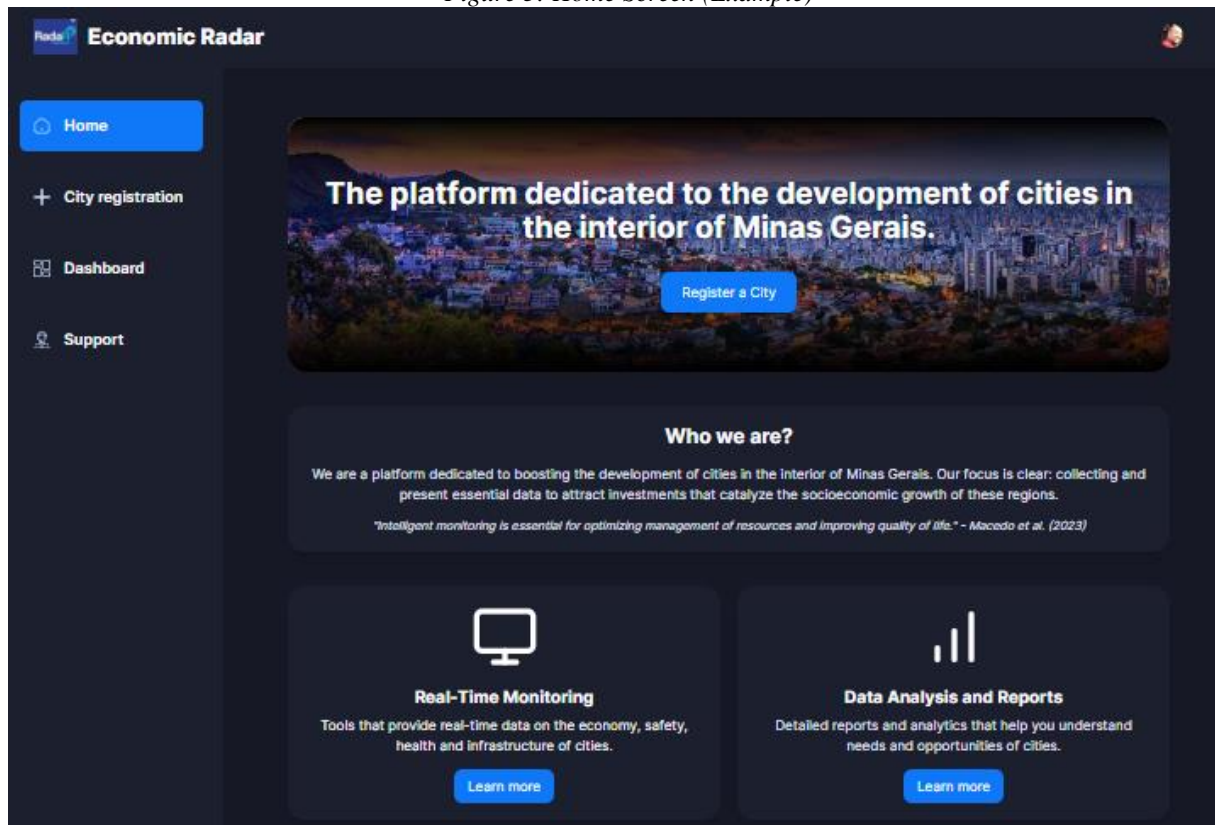
3.2.1 First version: Manual Financial Attractiveness Analysis

This version each user will obtain a data analysis, according to the cities in which they wish to evaluate them. Each user can enter data for the cities they wish to evaluate.

The interaction begins through the registration. After registering, the user will be on the Home screen (Figure 3) where they can choose to register data for a city of their choice and connect to a city registration screen (e.g. Figure 4). The registration is performed by filling out the form described in Figure 4, which provides the variables mentioned in the previous topic.

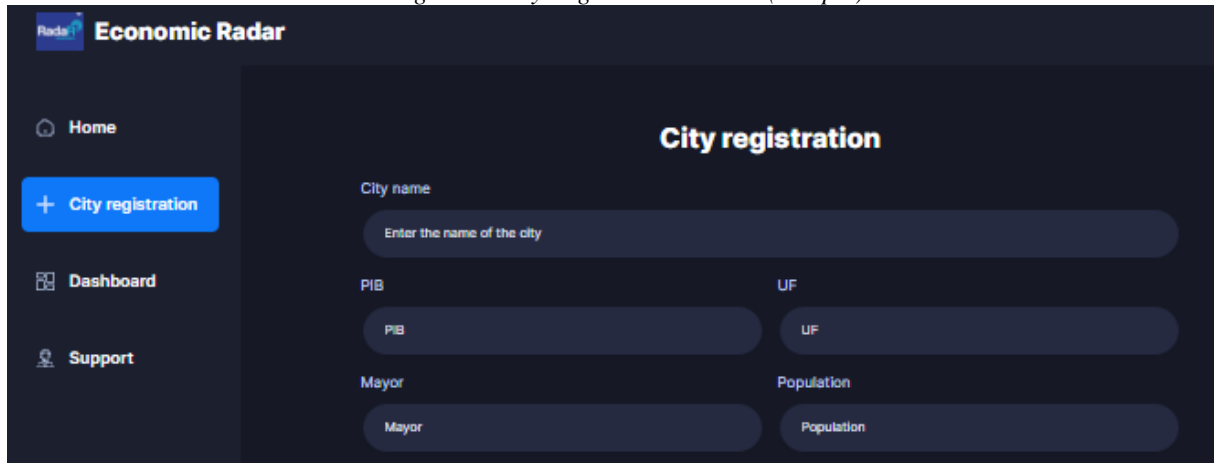
After the data insert process, in Figure 5, on the dashboard screen (sample), the user will be able to choose the inserted cities and view a comparative graphical analysis, with dynamic cities choose process. The user, for example, can insert ten cities, but choose, for a specific investment, four best profiles from those. The quantitative graphical analysis includes variables 1, 3 and 4 for a first assessment in terms of the number of people living in the city, compared with the prosperity index of these people (HDI). The graphical analysis already provides a glimpse of capabilities for business investments, including events, that have direct impacts on local society.

Figure 3: Home Screen (Example)



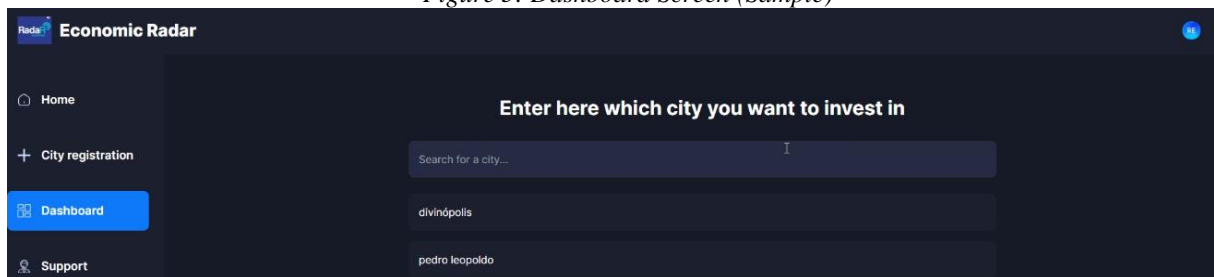
Source: (Authors, 2024)

Figure 4: City Registration Screen (Sample)

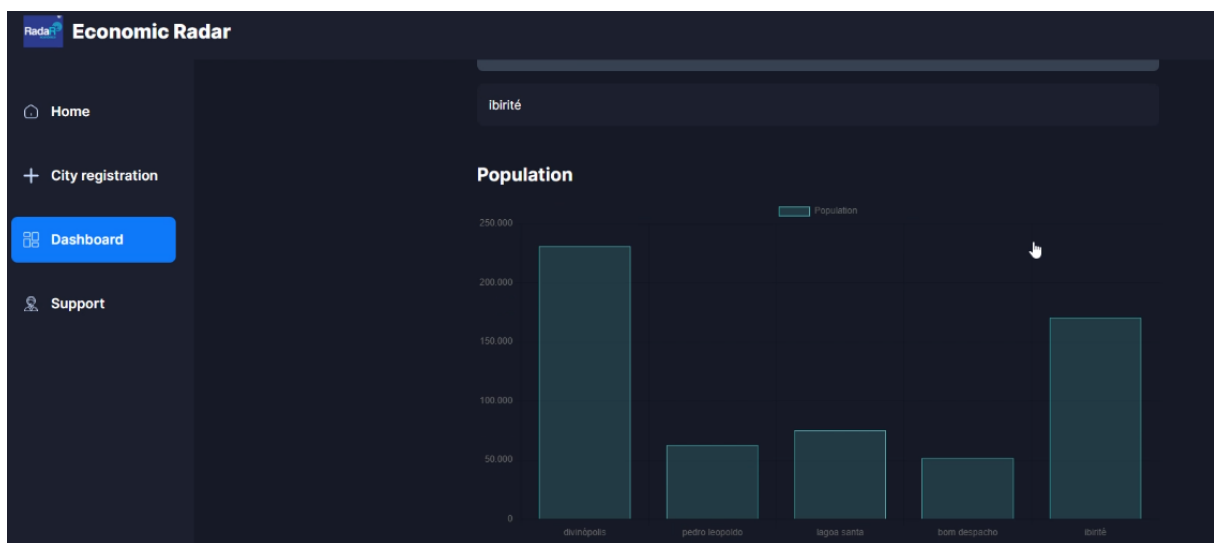


Source: (Authors, 2024)

Figure 5: Dashboard Screen (Sample)



A: Dashboard screen (part1)



B: Dashboard screen (part2)

Source: (Authors, 2024)

This first version, start a contributing process data evaluation and information to become shared, enabling the answer questions such as: Which are the most inserted and analyzed cities? What are the most recurring comparisons? How many cities are most compared during analyses? Which sectors are most required by our users? Among other possibilities.

3.2.2 Second version: Manual Financial Attractiveness Analysis by Industrial Sector

A second version manage the data collection. For this experiment, a possibility of scoring for cities was analyzed, according to the answers obtained and the weight that can be attributed

by reference to points of attractiveness. The table 1 shows the weight of each variable is evaluated according to a possible investment approach for restaurants.

Table 1: Example of assigning weights (empirical evaluation)

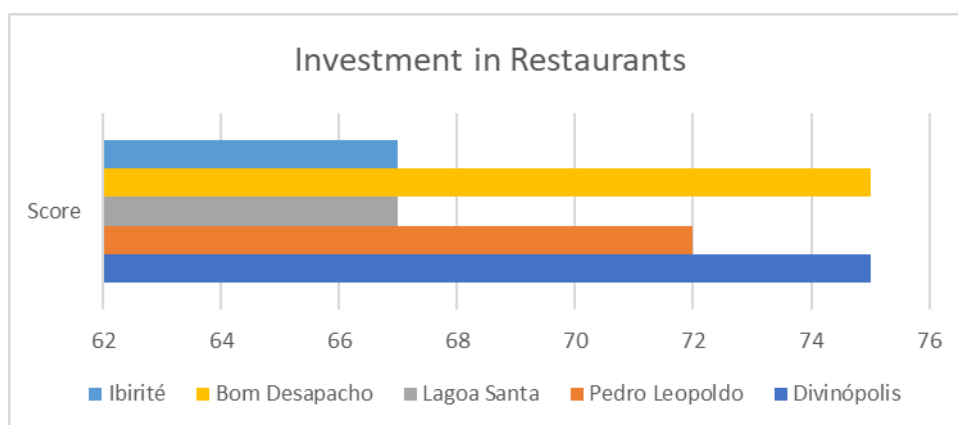
Variable	Weights (e.g. Restaurant Chain)	Examples of constraints
1	8	If it is higher than the state average
2	5	If you have a favorable policy
3	6	If it is higher than the state average
4	7	If it is higher than the state average
5	8	If yes or no
6	9	Favorable level or not
7	9	Depending on the investment
8	8	Yes or no
9	8	For analyzes with multiple branches evaluated
10	8	
11	7	Depends on the field of activity
12	8	Depends on the field of activity

Source: (Authors, 2024)

At this case, each weight will be evaluated by filling in the cities already created and a second type of dashboard will be applied, as a city score. With the empirical score suggested and demonstrated the evaluation, a graphical analysis of such scores will be delivered as shown in Figure 6. Note that in this graph the analysis is in relation to the same field of activity in five different cities. Weights can be inserted by the user according to their level of interest.

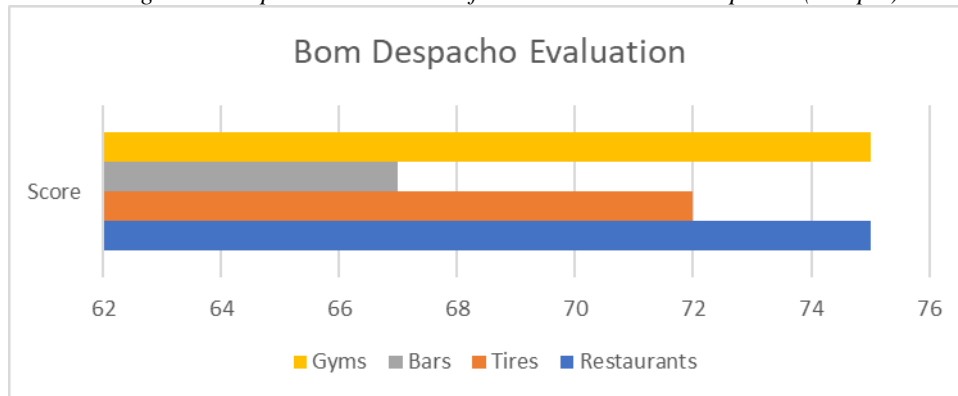
The graph in Figure 7 demonstrates an assessment in which the sector varies, but for the same city. Once again, weights can be inserted by the user in their interaction. In this second version, it will be possible for the user to point out, given their knowledge, or information from their own experiences, the format for evaluating the application of their resources.

Figure 6: Empirical evaluation of investment in a restaurant chain (Sample)



Source: (Authors, 2024)

Figure 7: Empirical evaluation of investment in Bom Despacho (Sample)



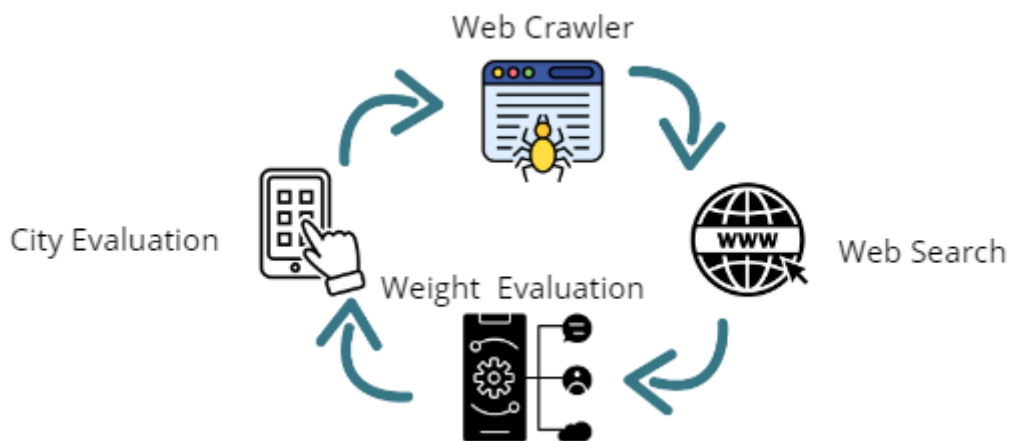
Source: (Authors, 2024)

3.2.3 Third version: Dynamic Finance attractiveness analysis

The assessment of investment attractiveness, in the last two versions, has been applied through investor guidance. Although data such as GDP, HDI and Population have reliable sources, where their changes depend on several factors, in addition to their changes not having a high frequency, it is possible to think: how to automate or bring a degree of certainty to the weights proposed in Table 1?

The third version to be implemented will feature an analysis where a web crawler will collect relevant information on the web to assist in weighing the weights, according to the user's research. Its operation is exemplified in Figure 8.

Figure8: Operation Process of the Third Version of the Prototype



Source: (Authors, 2024)

In essence, a survey, with reliable databases, such as IBGE (*Instituto Brasileiro de Geografia e Estatística* - Brazilian Institute of Geography and Statistics), official portals of Brazilian ministries, websites of city halls and state governments can serve as a reference for this next step of evolution, where the weights will be weighted by the statistics that are collected during your collection process.

4. Conclusion

The presented proposal can assimilate data on market elements in order to provide strategic decision support for a future investor. As demonstrated in this paper, the proposal

has evolution steps that make it interesting, both due to the user's ability to have freedom of action, and the future steps that will feature the possibility of automated contribution.

One of the extremely important points is that the platform aims to serve cities that are not always targets of investment by their local authorities and do not appear as possibilities for external investors. Thus, there is the possibility of the growth of previously forgotten small cities, which brings with it slow and disadvantaged growth for their community.

The studies demonstrated, for instance, in the first version, a possibility of greater investment in a city due to the population variable, where the investor can compare it with other cities. Furthermore, the second version demonstrates a possibility of evaluation, including with the variation of the market sector, showing the versatility of the proposal.

According to the economic contributions, the possibility of social benefits to those cities is evident. Therefore, cities that present a lower score may be highlighted by government authorities as priorities in public investment actions.

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