

# Building a desirable future: is it possible to transform a city? How foresight can help building the future by means of collective and participatory training-action intervention.

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**Abstract**— Cristalina 2040 Project's aims to build a vision of a desirable and achievable future, that favors sustainability in the gem, jewelry, mineral crafts, and tourism cluster. The applied foresight methodology allows for long-term planning, formulating strategies for necessary changes and/or disruptions through renewed management that invests in people and adapts resources to possible adversities and/or opportunities that may arise in the territory or municipality. The Sustainable Development Goals of the UN Agenda 2030 have been considered to the sustainable development of Cristalina. Important results have been achieved through the stages developed. They include transformation of the applied foresight method into knowledge; co-creation of future hypotheses; construction of desired future with appropriation of knowledge by civil society and the creation of actions to make it feasible; commitment and support of public authorities; changes in public policies; implementation of 15.6% of total 77 actions planned for the 2040 horizon, by August 2021. Despite several challenges in the Cristalina 2040 project, the true appropriation of knowledge by society made it possible and desirable to achieve the goals set at the beginning of the project. The economic development that considers a transversal view of human beings and the environment seems to stimulate a systemic and integrated vision. It has been confirmed that it is possible to replicate this model in other areas or municipalities, if society is truly involved, so that initiatives are resilient resulting in development, community growth, strengthening of the economy, and consequently towards an intelligent, resilient, and sustainable city.

**Keywords:** Foresight, Prospective Process, Long-term Planning, Appropriation, Governance, Mineral-based cluster (APL), Agenda 2030, Sustainable City

## I. INTRODUCTION

The exchange of ideas between the Artisans' Association of Cristalina (AAC) and the Brazilian Institute of Information in Science and Technology (IBICT/MCTIC), led to the implementation of the foresight method to construct future scenarios for Cristalina's Gems, Jewelry, Mineral Crafts and Tourism Cluster, as a replicable model for strategic planning, to develop the production chain in this sector. This was seen as an opportunity for MCTIC to carry out an integrated action to support the structuring and consolidation of a mineral-based cluster.

Based on a survey conducted with the Gems, Jewelry, Mineral Crafts and Tourism Cluster of Cristalina, by 2018, it was found that government agencies and representative entities of this sector were interested in participating in a planning development that could contribute to the maintenance and strengthening of the work carried out by the cluster and local agents.

In order to develop an effective intelligence in the construction and/or reconstruction of the architecture of public policy, which allows coherence and effectiveness of public actions in the municipality of Cristalina, a territorial foresight approach was implemented, and a long-term planning was elaborated. This was done from the point of view of the sustainable development perspective of the Cluster of Gems, Jewelry, Mineral Crafts and Tourism of Cristalina.

Based on the history of the municipality of Cristalina, its economy was developed on the exploitation of crystals, exported for many years to various countries in Europe, including those used in jewelry for the nobility. The arrival of rural producers from the south of the country, in the 1970s, changed the economic situation. In addition to crystals exploitation, the cultivation of various crops was added, thanks to the mild temperatures and soil quality. The municipality benefits from more than 240 springs and rivers that allow the producers to irrigate the cultivation of different products. Thus, there is an even and constant distribution of water quantity, which allows this activity even in times of drought.

Table I presents geographic and economic data for Cristalina and its neighboring municipalities, considering the population on August 1, 2022, based on the IBGE 2022 Census (IBGE, 2022)<sup>1</sup>.

TABLE I: MUNICIPALITIES OF CRISTALINA AND SURROUNDING AREAS INDICATORS.

| City                   | Population<br>2022 | Area<br>(km <sup>2</sup> ) | Density<br>(hab/km <sup>2</sup> ) | GDP per<br>capita (R\$) | HDI 2010 | HDI 2013 | HDI 2016 | HDI 2019 | GINI   | SDG   |
|------------------------|--------------------|----------------------------|-----------------------------------|-------------------------|----------|----------|----------|----------|--------|-------|
| Federal District (DF)* | 2,817,068          | 5,760.78                   | 489.01                            | 87,016                  | 0.824    | 0.863    | 0.742    | 0.873    | 0.6370 | 57.52 |
| Paracatu, MG           | 94,017             | 8,231.03                   | 11.42                             | 59,239                  | 0.744    | 0.704    | 0.685    | 0.854    | 0.5151 | 54.88 |
| Unai, MG               | 86,619             | 8,445.43                   | 10.26                             | 39,132                  | 0.736    | 0.723    | 0.651    | 0.847    | 0.5347 | 54.35 |
| Cidade Ocidental, GO   | 91,767             | 389,984                    | 235.31                            | 11,808                  | 0.717    | 0.706    | 0.641    | 0.814    | 0.5247 | 50.48 |
| Luziânia, GO           | 208,725            | 3,962.11                   | 52.68                             | 22,550                  | 0.701    | 0.689    | 0.602    | 0.831    | 0.5128 | 46.67 |
| Cristalina, GO         | 62,249             | 6,153.92                   | 10.12                             | 55,561                  | 0.699    | 0.716    | 0.587    | 0.814    | 0.5753 | 45.61 |
| Cabeceira Grande, MG   | 6,627              | 1,033.06                   | 6.41                              | 55,628                  | 0.648    | 0.638    | 0.542    | 0.788    | 0.4826 | 48.17 |

\*Population data, GDP, HDI, HDI L, HDI E, HDI I, GINI, are from IBGE, publication date in each cell.

\*\*DF: includes the cities Celândia, Sombinha, Plano Piloto, Taguatinga, Planaltina, Recanto das Emas, Águas Claras, Gama, Guará, Santa Maria

\*\*\* Demog. Density - Demographic Density

\*\*\*\* HDI: Human Development Index (Índice de Desenvolvimento Humano Municipal)

\*\*\*\*\* GINI index shows the inequality. The lower the index, the less unequal the municipality is.

\*\*\*\*\* The SDG index is published by IBGE IBGE - city sustainable development index (2023).

<sup>1</sup> Brazilian Institute of Geography and Statistics. 'Instituto Brasileiro de Geografia e Estatística' - IBGE (2022). Available at:

<https://www.ibge.gov.br/estatisticas/sociais/populacao/22827-censo-demografico-2022.html?=&t=resultados>. Access Jul. 2023.

The data of the surrounding area were selected because the territorial planning should consider the region where the Local Productive Arrangement (APL)<sup>2</sup> is inserted. It is observed that the educational dimension (IDHE) of the Municipal Human Development Index - IDHM<sup>3</sup> in Cristalina is one of the lowest compared to its neighboring municipalities. The GINI, an indicator of the level of inequality, presents similar values in relation to the neighboring municipalities and reveals income concentration. Cristalina has a high GDP<sup>4</sup> per capita due to its gems, jewelry, mineral crafts, and the tourism cluster, and the so-called “green gold”, a robust agricultural belt. Comparatively, it indicates a high purchasing power which can increase inequality when observing the GINI index.

Therefore, a high GDP, a lower IDHE combined with a lower GINI index, compared to the GINI index of the State of Goiás, which is 0.474<sup>5</sup>, can result in a typical social imbalance [1], [2], constituting an environment conducive to socio-economic exclusion and urban violence, not only in the municipality of Cristalina, but also in the surrounding areas and neighboring cities, mainly motivated by social inequality.

Thus, the main objective of the Cristalina 2040 project was to build a vision of a desirable and achievable future, considering the sustainable development of the Gems, Jewelry, Mineral Crafts and Tourism cluster, with specific objectives: to generate qualified geo-referenced data; to establish an application model based on the foresight process that supports the sector; to innovate products with added value; to replicate the foresight methodology in other clusters; to identify structural and technological needs to improve productivity; and to show the results and implications for the development of a sustainable and smart Cristalina.

The present study, in addition to this introduction that contextualizes and describes its objective, in session 2 presents the foresight method and in session 3 its application in Cristalina 2040 Project. Then, in session 4, it presents and analyzes the research results. In session 5, the final considerations are presented.

## II. FORESIGHT AND SUSTENTABILITY OF CRISTALINA

The foresight method (prospective process)<sup>6</sup> allows seeing far, with breadth, depth, daring, taking risks, and thinking about human being according to [3]. Reference [4] complements this with “seeing together and in different way, seeking for ideas, with appropriation, and using rigorous and participatory techniques and methods”. The foresight toolbox [5] is a combination of several scenario-oriented techniques [6] that supports the application of the method. The prospective process consists of three main stages: building the foundation through participatory workshops, identifying the main issues at stake, understanding the influence of the actors, and building scenarios [6]. Reference [7] states that the actors

are essential, and it is necessary to reflect on the level of detail desired in the development of the territory, considering the desired scenario of the future to be built.

To promote knowledge appropriation, it is fundamental to involve civil society. The more diversified and inclusive the process, the more comprehensive and enriching the interactions will be, favoring the formation of solid governance [8]. To achieve structured development, an active governance with different social actors is necessary, being responsible for elaborating the diagnosis of the cluster encompassing various dimensions, such as: economic, social, environmental, cultural, demographic, political, legal, technological, security and defense [8][10]. This governance is considered a crucial stage to coordinate, lead and conduct actions in a consensual with the participants of the prospective process.

To address and operationalize the resolution of challenges, the determination of a time horizon is essential, and should not exceed much the period of existence foreseen for the problem addressed. Being too distant, can mitigate the influence of the arbitrariness on the strategy for the period under study and on the present decision-making [9] [10]. During a foresight study, it is important to review lessons learned about past behavior that continue to influence the present, as well as identify that several situations in the present are unusual and not foreseen in the past. As a rule, a symmetric time retrospective is adopted, meaning that when planning the time horizon of ‘n’ years ahead, an analysis of the behavior of the variables in the past ‘n’ years is performed.

To support the sustainable development of a community, a combination of all 17 Sustainable Development Goals - SDGs are used. There are 3 important links, as follows:

- (1) Social well-being: the SDGs 1 No poverty, 2 Zero hunger, 4 Quality education, 5 Gender equality, and 10 Reduced inequalities are linked to SDG 3 Healthy life.
- (2) Economic outcomes: SDGs 6 Water and sanitation, 7 Renewable energy, 8 Decent work and economic growth, 9 Innovation and infrastructure, and 13 Combating climate change are linked to SDG 12 Responsible consumption and production.
- (3) Sustainability: social well-being and economic outcomes are linked to SDG 11 Sustainable cities and communities, together with the SDGs 14 Life below water, 15 Life on land, 16 Peace and justice and 17 Partnerships for Goals.

These links are shown in Figure 1.

<sup>2</sup> APL is the acronym for Local Productive Arrangement (cluster) and in Portuguese is ‘Arranjo Produtivo Local’.

<sup>3</sup> The Municipal Human Development Index (IDHM) is composed by three dimensions of human development: longevity (IDHML), education (IDHME) and income (IDHMR). Available at: [https://portalantigo.ipea.gov.br/agencia/images/stories/PDFs/livros/livros/atlasdo desenvolvimento human norms\\_o-indice-de-desenv.pdf](https://portalantigo.ipea.gov.br/agencia/images/stories/PDFs/livros/livros/atlasdo desenvolvimento human norms_o-indice-de-desenv.pdf). Access Jul. 2023.

<sup>4</sup> GDP: Gross Domestic Product. It is the standard measure of the value added created through the production of goods and services in a country during a certain period. Available at: <https://data.oecd.org/gdp/gross-domestic-product->

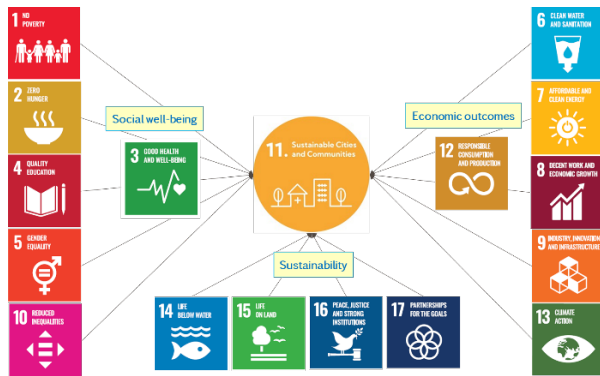
[gdp.htm#:~:text=Gross%20domestic%20product%20\(GDP\)%20is,and%20services%20\(less%20imports\).](#)

<sup>5</sup> GINI index. It measures the degree of income concentration in each group and varies from 0 (maximum equality) to 1 (maximum inequality). Available at:

[https://pt.wikipedia.org/wiki/Lista\\_de\\_unidades\\_federativas\\_do\\_Brasil\\_por\\_%C3%ADndice\\_de\\_Gini](https://pt.wikipedia.org/wiki/Lista_de_unidades_federativas_do_Brasil_por_%C3%ADndice_de_Gini). Access Jul. 2023.

<sup>6</sup> The term ‘foresight’, ‘prospective’ or ‘prospective process’, allows to identify initiatives of a similar nature and actions published on articles and on relevant international publications to assist on literature research (Author’s note).

Figure 1: Links between (1) Social well-being, (2) Economic outcomes and (3) Sustainability.



Source: SDG through the lens of social, economy and sustainability [11].

The development of the Gems, Jewelry, Mineral Crafts, and Tourism Cluster of Cristalina brought economic results through the implementation of actions. For the development of the municipality towards sustainable and resilient cities, it is necessary to improve the social side. Reference [12] states that *"smart city is an urban space oriented towards investment in human and social capital, sustainable economic development..."*. Thus, the actions carried out in the areas of education, health, and culture contribute to the Human Development Index in the areas of education (IDHE) and longevity (IDHL) leads to an expansion of healthy life. The balanced development of society leads to the reduction of inequality, represented by the GINI index, as the income of the population grows, as well as highlighting the improvement in infrastructure to deal with customers and tourists, one of the important actions of Cristalina 2040 project.

Several studies point to the need to understand participation in the process of public policy process, as well as the role, initiatives, and directions of civil society [13] [14] [15]. SDG 16 addresses the need to *"...ensure access to justice for all and build effective, accountable and inclusive institutions at all levels"* [16]. Therefore, civil society participation through organizations not formally linked to the public sector, acts in the processes of elaborating public policies [17]. Foresight (prospective) offers an organized, transparent, and flexible process that facilitates the exercise of creating sustainable and intelligent alternative future scenarios for the development of a resilient city, through the involvement, knowledge, and experience of a wide range of urban stakeholders at all stages during the construction of actions to achieve the desired future [18].

### III. DESCRIPTION OF THE PROSPECTIVE PRACTICE

The practice of the prospective process allows long-term planning, formulating strategies for necessary changes and/or disruptions through a renewed management that invests in people and adapts resources in the face of possible adversities and/ or opportunities that may arise in the municipality or territory.

The governance is composed of three committees with different social actors: direction, technical prospective, and local technical prospective with the proposal of elaborating the diagnosis with civil society participants covering nine dimensions as economic, social, environmental, cultural, demographic, political, legal, technological, security, and defense. For diagnosis, the last 20 years is considered, with a

focus on the creation of qualified data, whose objective is to explain the present from the past aiming to provoke conscious changes, based on facts and/or understand disruptions. The workshops aim to hunt for ideas, identify changes and disruptions, brakes, and inertia, build competence trees of the present, past, and future, analyze actors with strategies and projects that strongly interfere in themes and objectives, that are analyzed by social actors representing the governance committees [10].

Based on the collected information, the main key variables are identified, followed by a structural analysis, that brought out the impacts or driving forces for the construction of the strategic vision of the future, according to the desires of the participants, thus leading to the construction of scenarios with more criteria based on the scientific deepening. Then, the contractual-legal part for the execution of the plan, composed by the necessary actions and/or public policies for its execution, is carried out. The appropriation of knowledge for the development of the prospective process determines the success, as it offers increasing conditions and opportunities for knowledge appropriation and commitment.

There are six stages in the implementation of the process, based on the theory of [10] [18][20][19][4] and the practical experience of the Instituto Prospectiva Inspro:

1. Conjunctural analysis: a dynamic portrait of a reality and not a simple description of facts that occurred in a specific place and time [21].
2. Structural analysis: environmental variables are identified, through their direct action and through indirect influences on the environment of the region, as well as identifying the interrelationship and relevance of the variables [19][4].
3. Competence trees [22]: past, present, and future dynamics are analyzed, in their skills, vocation, attitudes, knowledge (roots), processes, execution, organization (trunk), and products and/or services (fruits). Changes are considered and strengths and weaknesses of the environment and future needs are identified. Actions of the necessary competencies are built.
4. Morphological analysis: possibilities triggered by the combination of different hypotheses from the deepening of the key variables and key actors are identified [19][4].
5. Scenario construction: repositioning and description of partial and global scenarios, according to [18], and creation of actions to achieve the possible, desirable, and achievable scenario.
6. Evaluation of the prospective process: through the results and impacts allows its verification, whether they have contributed or not and whether the objectives have been achieved, monitoring during the process and after its completion [10].

### IV. RESULTS OF THE PROSPECTIVE PRACTICE

Identified in the UN Agenda 2030, the Sustainable Development Goal SDG 11 Sustainable cities and Communities, whose mission is to "make cities inclusive, safe, resilient and sustainable", the development of the Cristalina cluster, in the long-term vision, has allowed the creation of a participatory community ecosystem making the "Cristalina 2040" project a solid foundation for its growth.

Behind economic development there is society and its members. Foresight offers anticipation and guidance to

develop actions that count on the participation and commitment of society, enabling the necessary and expected changes both in the individual development of people and in the integration of economic activities. This is essential to face the challenges and take advantage of the opportunities that emerge over time, through processes of collective reflection and studies of future scenarios.

The diversity of participation not only enriches the prospective process, but also contributes to finding solutions and generating a collective commitment to building the future. In October 2020, before the elections, a Letter of Commitment was drafted, presented to and signed by Cristalina's pre-candidates, so that the planned actions would be implemented throughout the project's timeframe.

For the construction of desirable, possible, and achievable scenarios, committed actions stand out: the development of public policies for the integration of gems, jewelry, mineral crafts and tourism activities; environmental protection with the establishment of parameters for the characterization of a geographical area recognized for its characteristics; the adoption of participatory municipal administration models of municipal management; the strengthening of organized civil society; the institutionalization of governance; the expansion of public policies with a long-term perspective; the increased people's engagement and awareness of new generations; a permanent information channel with the support of society for effective appropriation of knowledge; the attraction of new investments, the expansion of mining, handicrafts, tourism and agriculture in the economy of Cristalina; and the development of resilient and sustainable city.

Divided into four themes: Economy, Politics, and Infrastructure; Governance and Management; Education, Technology, Innovation, and Sustainable Development; and Synergy and Collective Strengthening, a total of 77 actions were committed. Table II presents the action plan for the first five years, starting in 2021.

TABLE II: SUMMARY OF CRISTALINA 2040 ACTIONS PLAN

| THEME   | NAME                                                          | Nº ACTIONS TOTAL | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 |
|---------|---------------------------------------------------------------|------------------|------|------|------|------|------|------|------|
| Theme 1 | Economy, Politics, Infrastructure                             | 17               | 2    | 5    | 6    | 1    | 1    | 2    |      |
| Theme 2 | Governance and Management                                     | 21               | 5    | 6    | 7    | 1    | 1    | 1    |      |
| Theme 3 | Education, Technology, Innovation and Sustainable development | 13               |      | 3    | 3    | 4    |      | 2    | 1    |
| Theme 4 | Synergy and Collective Strengthening                          | 26               |      | 10   | 12   | 3    | 1    |      |      |
| TOTAL   |                                                               | 77               | 7    | 24   | 28   | 9    | 3    | 5    | 1    |

The action plan has been considered from the very beginning, considering the 2040 horizon to ensure continuity and maintenance. Attention has been paid to innovations that can be incorporated, making it a truly living project. The first results, obtained through the participation of civil society, have been materialized in initiatives and projects that have been included in the development plans of Cristalina and that the public authorities have expressed their commitment, are as follows:

1. In 2020: during the development of the project, specific actions began to have a long-term perspective, changing dimensions and scope of responsibilities over time; a face-to-face meeting of governance team and representatives of the

Executive and Legislative authorities to align actions to implement the desired scenario.

2. In 2021: in the City Council, during the review of the Multi-Year Plan (PPA) projects, the inclusion of 2022 actions in the Budgetary Guidelines Law (LDO)<sup>7</sup> were made, and for the period 2021-2024, with state and federal deputies, the inclusion of Cristalina 2040 actions in parliamentary amendments.

3. In August 2021: a hybrid seminar was held at the City Council with elected Executive and Legislative team, Secretary of Tourism, State and Federal Deputies, Organized Civil Society, Technical education entities, Entrepreneurs, Artisans and Citizens from neighboring cities and representatives of MDR, MCTIC, IBICT, CETEM and INSPRO<sup>8</sup>.

4. The Secretary of Post-pandemic Recovery of the State of Goiás included job creation programs and promotion of actions aligned with the long-term vision of Cristalina 2040 Project. It stimulated actions in other municipalities and productive arrangements, strengthened the economy, job creation program and income generation by promoting entrepreneurship and training professionals from various locations.

The highlighted results of Cristalina 2040 Project include: organization of qualified data about the cluster; transformation into knowledge using the prospective methodology process for mineral-based clusters with training-action interventions; workshops for sharing ideas, future scenarios and setting actions; knowledge appropriation by Civil Society to achieve the desired scenario; engagement and support from public authorities; documentation and e-book of the Cristalina 2040 Project; 15.6% of actions (12 out of 77) implemented and/or being implemented by August 2021; and economic, social and environmental impacts evaluated annually.

## V. CONCLUSIONS

The Cristalina 2040 project was launched in February 2019, and an action plan was finalized in December 2020. This highlighted the participation of organized civil society including voluntary citizen adherence and collaboration for in-depth studies of the variables. From April 2020 onwards, the project faced the challenge of having virtual meetings and other issues caused by the pandemic.

The Territorial Prospective Process confirms the need of participation with the appropriation of knowledge by various social actors. This project integrates actions in accordance with the Sustainable Development Goals - SDG of 2030 Agenda, with emphasis on SDG 12 - Responsible Consumption and Production, which contributes to the achievement of SDG 11 - Sustainable Cities and Communities and incorporates actions of Strategic Objective 5 of the Brazilian Smart Cities Charter in the economic dimension of the Cristalina's Gems, Jewelry, Mineral Crafts and Tourism Cluster.

Governance of the project is crucial and concerns the structures, functions, processes, and culture of society to ensure that objectives are achieved in an effective and

<sup>7</sup> Budgetary Guidelines Law: LDO is the acronym for 'Lei das Diretrizes Orçamentária'. (Author's note).

<sup>8</sup> Ministry of Regional Development, MDR: 'Ministério do Desenvolvimento Regional'; Ministry of Science, Technology, Innovation MCTIC: 'Ministério da Ciência, Tecnologia, Inovação'; Brazilian Institute

of Information, Science, Technology, IBICT: 'Instituto Brasileiro de Informação, Ciência, Tecnologia'; Mineral Technology Center, CETEM: 'Centro de Tecnologia Mineral'; Prospectiva Institute, INSPRO: 'Instituto Prospectiva'.

transparent manner, including people from organized civil society, the public sector, and the citizens of Cristalina. This dynamic process must be maintained and renewed through attracting future generations with long-term thinking practices.

Given the intervention of training-action model as well as the appropriation of knowledge by society, it has been confirmed that replicating the Prospective Process in any mineral sector cluster is possible, if society is really engaged so that initiatives to have resilience within the defined time horizon resulting in development, community growth, and consequent evolution of a sustainable municipality.

Despite several challenges of the Cristalina 2040 project, the true knowledge appropriation by the society makes it possible to achieve the desired goals set during the development of the project. The continuous monitoring of the evolution and the situation of Cristalina 2040 will allow a real ex-post measurement and effectiveness of the scenario choices and the implementation of actions in building the desired future.

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