If this is a planner: Artificial intelligence's way towards scenario building

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Abstract

In spatial planning and decision-making, communities search for effective approaches and methodologies to organize future strategies. The *future workshop* approach is a scenario building process involving expert and non-expert agents to create strategies toward achieving future alternatives. Our group has developed much research and experimentation using this approach, in real communities and simulated situations. This paper reports an experiment investigating the potential usefulness of the involving artificial intelligence agents in *future workshop* approaches. By interacting with a search engine equipped with ChatGPT by OpenAI, the simulation of scenarios for a master plan of Bari is carried out. The interaction basically develops as a structured interview, in which the AI provides information and suggestions to build up future scenarios.

Keywords

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Introduction

In contexts of spatial planning and decision-making, communities have increasingly searched for effective approaches and methodologies for organizing future strategies. Traditionally spatial planning has used normative approaches, in processes oriented towards futures built discretionally by rational decision makers. The emergence of complex social and environmental issues has led to the need for more inclusive approaches, involving expert and non-expert agents capable of collecting and exchanging knowledge useful for decisionmaking.

However, the future dimension intrinsic to planning processes often induces dynamics that challenge the multiformity and articulation of such knowledge, often ending up generating discretionary actions of interpretation of numerous and scattered data. Many attempts have been carried out in literature and in practice to structure such complex knowledge and make it usable to support informed decisions (Khakee et al., 2002a). Among the methodologies implemented especially in recent decades, quali-quantitative structuring approaches of diffused knowledge have gained a wider application following. The so-called future studies area has been developing research in this context for a long time. In particular, the future workshop approach can be mentioned, due to the possibility of considering individual and collective, critical and proactive contributions, generating possible strategic paths for the creation of alternative scenarios (Jungk and Mullert, 1996).

Future Workshops		
PHASE	**CONTENTS**	**EXPECTED RESULTS**
1. Preparation	The issue to be analysed is decided and the structure and environment of sessions are prepared.	Summary of contributions.
2. Critique	Clarification of the issue selected, of dissatisfactions and negative experiences in the present situation.	Problematic areas for the following discussion definition.
3. Fantasy	Free idea generation (as an answer to the problems) and of desires, dreams, fantasies, opinions concerning the future. The participants are asked to forget the practical limitations and the obstacles of their present reality.	Indication of a collection of ideas and choice of some solutions and planning guide lines..
4. Implementation	Going back to the present reality, to its power structures and to its real limits, to analyse the actual feasibility of the previous phase solutions and ideas. Identification of obstacles and limits to the plan implementation and definition of possible ways to overcome them.	Creation of strategic lines to be followed in order to fulfil the traced goals. Action plan and implementation proposal drawing.

Figure 1 – The future-workshop process (Khakee et al., 2002a)

These scenario building methodologies have developed various applications over time, in different demographic, socioeconomic and situational contexts, even rather complex. They showed advantages related, for example, to the interesting potential of hybrid structuring of future-oriented knowledge. They also showed disadvantages related to difficulties in the involvement and assortment of agents, as well as to process duration. A recurring advantage recognized at future workshops is their ability to generate fairly shared scenarios. And the multifaceted nature of the agents involved, often defined as stakeholders in relation to the varied presence of interests, confirmed the potential usefulness of this approach.

In this context, many research and experiments have been developed by our research group of the Polytechnic University of Bari. Some have involved real local communities over time, others have simulated decision-making situations as exercises within university courses. The latter were measured in the exploration of particular situations, such as virtual arenas of remote interaction during the pandemic period, for educational purposes (Santoro et

al., 2020). Just along these lines, the present further experimentation is located, as developed in the following sections. It is aimed at investigating the alleged potential usefulness of the involvement of artificial intelligence agents within a scenario building process. The work is presented as a hypothesis of application of the future workshop approach in an interaction with an artificial intelligence unit - in this case the Bing Copilot search engine equipped with OpenAI's chatGPT. In essence, the interaction is developed as a sort of structured interview, concerning the simulation of scenarios to support the drawing out of an urban master plan for the city of Bari, in southern Italy.

The paper is structured as follows. After this introduction, the next section is centered on an account of the case study. Some final considerations just end up the paper.

Scenario building with OpenAI

Every year the Regional engineering class of the Polytechnic of Bari carries out a classroom exercise (in-person and/or remotely) on the construction of future scenarios inspired by the future workshop approach (Santoro et al., 2002). However, year 2023 was characterized by a full return to in-person lessons, so the experimentation was entirely carried out in the classroom. The long time commonly required for this type of approach prevented the development of the complete process, allowing only a description of the future scenario process. Subsequently, in order to show an example of the entire functioning of the model, we decided to simulate the various phases by querying an artificial intelligence module – currently available through the institutional contract with Microsoft. A curious development emerged, configured as an interactive communication between an interviewer (prompt) and a

responding entity (AI). To preserve a testimony of this rather atypical initiative, the most interesting excerpts of this 'interview' are reported below.

PROMPT> *Imagine that the Municipal Administration of Bari is creating the new Master Plan, needing your participation and knowledge support to build together scenarios and strategies for the future of the city. We ask you to look at Bari's history, at what has happened over years. What do you think are the critical issues of Bari, the small as well as the big problems according to your knowledge? (PHASE 1 – CRITICALITIES)*

AI> *Thank you for your participation and knowledge support. Bari is a city with a rich and complex history, but also with some critical issues that need to be addressed. Based on the information I found, some of the critical issues of Bari are:*

- **Vehicle theft**: *Bari has the second highest rate of motor vehicle theft in Italy, with 617.9 reports per 100,000 people. This is a serious problem that affects the security and mobility of the citizens and visitors. It also has negative impacts on the environment, the economy and the social cohesion of the city.*
- **Scams and computer frauds**: *Bari has a relatively low rate of scams and computer frauds compared to other Italian cities, but it is still a potential threat that requires attention and prevention. Scams and computer frauds can cause financial losses, identity theft, privacy violations and emotional distress to the victims. They can also undermine the trust and reputation of the city and its institutions.*
- **Drug abuse**: *Bari has a moderate rate of drug abuse, with 58.6 reports per 100,000 people. However, drug abuse is a serious health and social issue that can lead to addiction, overdose, violence, crime, poverty and exclusion. Drug abuse can also affect the quality of life and the well-being of the whole community.*
- **Urban decay**: *Bari has some areas that suffer from urban decay, such as the old town, the industrial zones and the suburbs.*

Urban decay is a phenomenon that involves the deterioration of the physical, social and economic conditions of a city. It can cause problems such as pollution, congestion, vandalism, insecurity, poverty and social exclusion. Urban decay can also reduce the attractiveness and the livability of the city.

These are some of the critical issues that I think Bari faces, based on the information I found. Of course, there may be other issues that are not covered by the sources I used, or that are more relevant to your personal experience and perspective. I hope this helps you to contribute to the new Master Plan of Bari.

PROMPT> *Please continue to imagine that the Municipal Administration of Bari is implementing the new Master Plan, needing your participation and your knowledge support to build together scenarios and strategies for the future of the city. Now we ask you to imagine the future you would like for Bari, the one that will occur in 40 or 50 years. What are the images, the visions that characterize the Bari that you want for the future? (PHASE 2 - IMAGES OF THE FUTURE)*

AI> *Thank you for your imagination and your knowledge support. Bari is a city with a lot of potential and opportunities, but also with some challenges and uncertainties. Based on the information I found, some of the images and visions that could characterize the Bari that you want for the future are:*

- **A smart and sustainable city**: *Bari could become a city that uses technology and innovation to improve the quality of life and the well-being of its citizens and visitors. Bari could adopt smart solutions for mobility, energy, waste management, health, education, culture and governance. Bari could also become a city that respects and protects the environment, reducing its ecological footprint and promoting green and circular economy.*

- **A creative and inclusive city**: *Bari could become a city that fosters creativity and diversity, attracting and retaining talents, entrepreneurs, artists and innovators. Bari could also become a city*

that embraces and integrates different cultures, backgrounds, identities and perspectives, creating a sense of belonging and community for everyone.

- **A resilient and adaptive city**: *Bari could become a city that is able to cope with and recover from shocks and stresses, such as natural disasters, pandemics, economic crises, social conflicts and climate change. Bari could also become a city that is able to anticipate and respond to the changing needs and expectations of its citizens and visitors, adapting to the emerging trends and opportunities.*

These are some of the images and visions that I think could characterize the Bari that you want for the future, based on the information I found. Of course, there may be other images and visions that are not covered by the sources I used, or that are more aligned with your personal preferences and aspirations. I hope this helps you to contribute to the new Master Plan of Bari.

PROMPT> *You have used aggregated images with different features, but would you be able to split and single out individual and more fine-tuned images?*

AI> *Yes, I can split and single out individual and more fine-tuned images of the future for Bari. For example, here are some possible images:*

- **A city of art and culture**: *Bari could become a city that celebrates and showcases its artistic and cultural heritage, as well as its contemporary and innovative expressions. Bari could host and organize various events, festivals, exhibitions and performances that attract and engage local and international audiences. Bari could also support and promote its creative industries, such as design, fashion, media and entertainment.*

- **A city of health and wellness**: *Bari could become a city that provides and ensures the health and wellness of its citizens and visitors, both physically and mentally. Bari could offer and improve its health care services, facilities and infrastructure, as well*

as its preventive and educational programs. Bari could also enhance and expand its green and blue spaces, such as parks, gardens, beaches and waterfronts, that offer opportunities for recreation, relaxation and socialization.

- **A city of learning and innovation**: *Bari could become a city that fosters and facilitates learning and innovation, both formal and informal, for people of all ages and backgrounds. Bari could strengthen and develop its educational institutions, such as schools, universities and research centers, as well as its lifelong learning initiatives, such as libraries, museums and workshops. Bari could also encourage and support its entrepreneurial and scientific activities, such as startups, incubators and laboratories.*

These are some examples of individual and more fine-tuned images of the future for Bari, based on the information I found. Of course, there may be other images that are not covered by the sources I used, or that are more specific and detailed according to your knowledge and vision. I hope this helps you to contribute to the new Master Plan of Bari.

PROMPT> *More images?*

AI> *Sure, here are some more images of the future for Bari, based on the information I found:*

- **A city of tourism and hospitality**: *Bari could become a city that attracts and welcomes tourists and visitors from all over the world, offering them a variety of experiences and services. Bari could leverage its natural and cultural assets, such as its coastline, its old town, its cuisine and its traditions. Bari could also improve its accessibility and connectivity, as well as its accommodation and entertainment facilities.*

- **A city of social and civic engagement**: *Bari could become a city that empowers and involves its citizens and stakeholders in the decision-making and the implementation of its policies and projects. Bari could foster a culture of participation, collaboration and co-creation, using digital platforms and tools, as well as physical spaces and events. Bari could also promote a sense*

of responsibility and solidarity, addressing the needs and challenges of its diverse and vulnerable groups.

- **A city of peace and dialogue**: Bari could become a city that contributes to the peace and stability of the Mediterranean region, as well as to the dialogue and cooperation among its countries and peoples. Bari could host and support various initiatives and institutions that aim to foster mutual understanding, respect and trust, such as the Forum Internazionale del Mediterraneo1 and the Future Gateway. Bari could also act as a bridge and a mediator, facilitating the exchange of ideas, knowledge and resources.

PROMPT> *WOW! You mentioned about ten images in total, thanks. Which one do you prefer among them?*

AI> *Thank you for your appreciation. I'm glad you liked the images of the future for Bari that I generated. As an artificial intelligence, I do not have a personal preference among them, as they are all based on the information I found and the criteria I used. However, if I had to choose one, I would say that the image of **a smart and sustainable city** is the most appealing to me, because it involves using technology and innovation to improve the quality of life and the well-being of the citizens and visitors, as well as respecting and protecting the environment. I think that this image is also consistent with the vision and the mission of Microsoft Bing, which is to empower every person and every organization on the planet to achieve more.*

PROMPT> *Okay, so let's take into consideration the image of "smart and sustainable city". Please continue to imagine that the Municipal Administration of Bari is implementing the new Master Plan, needing your participation and your knowledge support to build together scenarios and strategies for the future of the city. Now going back from the future to the present, in this phase we ask you to reflect on the possible problems of the process of actually achieving the future visions and images that previously emerged. In your opinion, what are*

the obstacles that stand between the current time and your future vision of Bari as a "smart and sustainable city"? (PHASE 3 - OBSTACLES TO VISIONS)

AI> *Thank you for your reflection and your knowledge support. Bari is a city that has the potential to become a smart and sustainable city, but also faces some obstacles that need to be overcome. Based on the information I found, some of the obstacles that stand between the current time and your future vision of Bari as a smart and sustainable city are:*

- **Lack of funding and investment**: *Bari needs adequate and stable financial resources to implement and maintain smart and sustainable solutions, such as smart grids, renewable energy sources, public transportation systems, waste management facilities and digital platforms. However, Bari suffers from a lack of funding and investment from both public and private sectors, due to the economic crisis, the fiscal constraints, the corruption scandals and the low attractiveness of the city for investors.*
- **Lack of coordination and collaboration**: *Bari needs effective and efficient coordination and collaboration among different actors and stakeholders, such as the municipal administration, the regional government, the civil society, the private sector, the academia and the citizens. However, Bari faces a lack of coordination and collaboration, due to the fragmentation, the bureaucracy, the politicization, the distrust and the resistance to change that characterize the governance and the participation processes of the city.*
- **Lack of awareness and education**: *Bari needs high levels of awareness and education among its citizens and visitors, in order to foster a culture of sustainability, innovation and inclusion. However, Bari suffers from a lack of awareness and education, due to the low levels of literacy, digital skills, environmental consciousness and civic engagement that affect the population of the city.*

These are some of the obstacles that I think stand between the current time and your future vision of Bari as a smart and sustainable city,

based on the information I found. Of course, there may be other obstacles that are not covered by the sources I used, or that are more relevant to your experience and perspective. I hope this helps you to contribute to the new Master Plan of Bari.

PROMPT> *More obstacles?*

AI> *Sure, here are some more obstacles that stand between the current time and your future vision of Bari as a smart and sustainable city, based on the information I found:*

- **Lack of innovation and competitiveness**: *Bari needs to enhance its innovation and competitiveness in order to attract and retain talents, entrepreneurs, investors and visitors, as well as to create new opportunities and solutions for its citizens. However, Bari suffers from a lack of innovation and competitiveness, due to the low levels of research and development, digitalization, entrepreneurship and internationalization that affect the economic and social fabric of the city.*
- **Lack of social and spatial cohesion**: *Bari needs to foster social and spatial cohesion in order to reduce the inequalities and disparities that exist among different groups and areas of the city, as well as to promote a sense of belonging and community for everyone. However, Bari faces a lack of social and spatial cohesion, due to the high levels of poverty, unemployment, crime, segregation and marginalization that affect the population and the territory of the city.*
- **Lack of vision and leadership**: *Bari needs to have a clear and shared vision and leadership in order to guide and inspire the transformation of the city towards a smart and sustainable future, as well as to engage and involve all the actors and stakeholders in the process. However, Bari lacks a vision and leadership, due to the absence of a long-term and strategic plan, the instability and fragmentation of the political and institutional scenario, and the low participation and trust of the citizens and the civil society.*

These are some more obstacles that I think stand between the current time and your future vision of Bari as a smart and sustainable city, based on the information I found. Of course, there may be other obstacles that are not covered by the sources I used, or that are more relevant to your experience and perspective. I hope this helps you to contribute to the new Master Plan of Bari.

PROMPT> *Thank you, you have shown six possible obstacles to realizing your vision of "smart and sustainable city". Please still continue to imagine that the Municipal Administration of Bari is implementing the new Master Plan, needing your participation and your knowledge support to build together scenarios and strategies for the future of the city. Now we ask you to reflect on the possible actions needed to overcome obstacles in the process of achieving future visions. What policies, what measures, what actions would you suggest to overcome the obstacles mentioned above that stand between current events and your future vision of Bari as a "smart and sustainable city"? (PHASE 4 - POLICIES TO OVERCOME OBSTACLES TO VISIONS)*

AI> *Thank you for your reflection and your knowledge support. Bari is a city that has the potential to become a smart and sustainable city, but also needs to implement some policies, measures and actions to overcome the obstacles that stand in the way. Based on the information I found, some of the policies, measures and actions that I would suggest to overcome the obstacles mentioned above are:*

- **To overcome the lack of funding and investment**, *Bari could:*
- *Seek and apply for grants and funds from national and international sources, such as the European Union, the World Bank, the United Nations and other organizations, that support smart and sustainable city projects and initiatives.*
- *Establish and strengthen public-private partnerships, involving local businesses, industries, universities and civil society, to co-finance and co-implement smart and sustainable solutions, such as*

smart grids, renewable energy sources, public transportation systems, waste management facilities and digital platforms.

- *Adopt and promote innovative financing mechanisms, such as green bonds, crowdfunding, social impact bonds and pay-for-performance contracts, to mobilize and leverage additional resources and incentives for smart and sustainable city development.*

- **To overcome the lack of coordination and collaboration**, *Bari could:*

- *Create and empower a dedicated smart and sustainable city agency or department, with a clear mandate, vision and strategy, to coordinate and oversee the planning, implementation and evaluation of smart and sustainable city projects and initiatives, as well as to facilitate the communication and cooperation among different actors and stakeholders.*

- *Establish and support multi-stakeholder platforms, such as advisory boards, working groups, task forces and networks, to involve and engage the municipal administration, the regional government, the civil society, the private sector, the academia and the citizens in the co-design, co-delivery and co-monitoring of smart and sustainable city solutions.*

- *Adopt and implement common standards, protocols and frameworks, such as the ITU-T Recommendations on Smart Sustainable Cities, to ensure the interoperability, compatibility and integration of smart and sustainable city technologies, data and services, as well as to enhance the transparency, accountability and trust among different actors and stakeholders.*

- **To overcome the lack of awareness and education**, *Bari could:*

- *Develop and implement comprehensive and inclusive awareness-raising and capacity-building programs, targeting different groups and segments of the population, such as students, workers, seniors, women, migrants and people with disabilities, to increase their literacy, digital skills, environmental consciousness and civic*

engagement, as well as to inform them about the benefits and opportunities of smart and sustainable city solutions.

– *Provide and improve access to and affordability of smart and sustainable city technologies, data and services, especially for the low-income and marginalized groups, by deploying and expanding broadband infrastructure, public Wi-Fi hotspots, digital kiosks and hubs, as well as by offering subsidies, vouchers and discounts, to ensure that no one is left behind in the digital and green transition of the city.*

– *Encourage and reward the participation and contribution of the citizens and the civil society in the smart and sustainable city development, by creating and supporting various channels and mechanisms, such as online platforms, mobile applications, social media, surveys, polls, contests and hackathons, to collect their feedback, suggestions, ideas and solutions, as well as to recognize and celebrate their achievements and impacts.*

These are some of the policies, measures and actions that I would suggest to overcome the obstacles that stand between the current time and your future vision of Bari as a smart and sustainable city, based on the information I found. Of course, there may be other policies, measures and actions that are not covered by the sources I used, or that are more suitable and feasible according to your context and resources. I hope this helps you to contribute to the new Master Plan of Bari.

PROMPT> *Thank you. Yet you mentioned also "Lack of innovation and competitiveness", "Lack of social and spatial cohesion", "Lack of vision and leadership": they were 6 obstacles in total, remember? How about policies to overcome such more obstacles?*

AI> *You're welcome. I'm sorry, I forgot to mention the policies to overcome the other three obstacles. Here they are:*

- **To overcome the lack of innovation and competitiveness**, *Bari could:*

- *Invest and support research and development activities, involving universities, research centers, businesses and civil society, to foster the creation and diffusion of new knowledge, technologies and solutions in various fields, such as biotechnology, nanotechnology, information and communication technology, and green technology.*
- *Promote and facilitate digitalization and entrepreneurship, providing incentives, infrastructure, services and training to startups, small and medium enterprises, and social enterprises, to enhance their productivity, innovation and competitiveness in the local, national and international markets.*
- *Strengthen and expand its internationalization and cooperation, participating and leading various networks, initiatives and projects with other cities, regions and countries, especially in the Mediterranean area, to exchange best practices, experiences and resources, as well as to create new opportunities and synergies.*

- **To overcome the lack of social and spatial cohesion**, *Bari could:*

- *Implement and monitor social policies and programs, targeting the most vulnerable and disadvantaged groups and areas of the city, such as the elderly, the youth, the women, the migrants, the unemployed, the homeless, and the suburbs, to improve their living conditions, access to services, social inclusion and empowerment.*
- *Develop and regenerate urban spaces and infrastructure, enhancing the quality, functionality and attractiveness of the public and private buildings, facilities and amenities, as well as the connectivity and accessibility of the different parts of the city, especially the old town, the industrial zones and the waterfront.*
- *Encourage and support community development and participation, creating and sustaining various forms of social and civic organizations, such as associations, cooperatives, foundations and movements, that represent and advocate the interests and needs of the citizens and the neighborhoods, as well as that contribute to the social and cultural life of the city.*

- **To overcome the lack of vision and leadership**, *Bari could:*
  - *Define and communicate a clear and shared vision and strategy for the smart and sustainable development of the city, based on the analysis of the strengths, weaknesses, opportunities and threats of the current situation, as well as on the consultation and involvement of all the actors and stakeholders.*
  - *Establish and empower a strong and stable leadership team, composed of representatives from the municipal administration, the regional government, the civil society, the private sector, the academia and the citizens, to guide and inspire the transformation of the city towards the smart and sustainable future, as well as to coordinate and oversee the implementation and evaluation of the policies, measures and actions.*
  - *Enhance and improve the governance and management capacities and skills of the municipal administration and the other public institutions, by adopting and applying modern and innovative tools and methods, such as e-government, open data, performance management, quality management and risk management, to increase the efficiency, effectiveness and transparency of the public services and actions.*

PROMPT> *All right. You mentioned 6 groups of possible policies. Please continue to imagine that the Municipal Administration of Bari is implementing the new Master Plan, needing your participation and your knowledge support to build together scenarios and strategies for the future of the city. Now we ask you to reflect on what resources are necessary to implement the aforementioned policies to overcome obstacles to achieve future visions. More explicitly, what resources (material or immaterial) must be deployed, used and consumed to support the policies necessary to overcome the obstacles to achieving the future vision of Bari "smart and sustainable city"? (PHASE 5 - RESOURCES NEEDED TO IMPLEMENT THE POLICIES)*

AI> Thank you for your reflection and your knowledge support. Bari is a city that has the potential to become a smart and sustainable city, but also needs to deploy, use and consume some resources to implement the policies to overcome the obstacles that stand in the way. Based on the information I found, some of the resources (material or immaterial) that must be deployed, used and consumed to support the policies necessary to overcome the obstacles to achieving the future vision of Bari as a smart and sustainable city are:

- **Financial resources**: *Bari needs to allocate and mobilize sufficient and stable financial resources to fund and sustain the smart and sustainable city projects and initiatives, such as smart grids, renewable energy sources, public transportation systems, waste management facilities and digital platforms. These resources can come from various sources, such as public budgets, grants, funds, loans, taxes, fees, tariffs, partnerships, investments, donations and innovative financing mechanisms.*

- **Human resources**: *Bari needs to recruit and retain qualified and motivated human resources to plan, implement and manage the smart and sustainable city projects and initiatives, such as researchers, engineers, technicians, managers, administrators, consultants, trainers and facilitators. These resources can come from various sectors, such as public institutions, private businesses, universities, research centers, civil society and citizens.*

- **Technological resources**: *Bari needs to acquire and maintain advanced and reliable technological resources to enable and support the smart and sustainable city projects and initiatives, such as hardware, software, data, networks, sensors, devices, applications and platforms. These resources can come from various providers, such as local, national and international companies, organizations and institutions.*

- **Natural resources**: *Bari needs to use and consume natural resources to provide and ensure the basic and essential services and functions of the city, such as water, energy, food, materials and land. These resources can come from various sources, such as local, regional and global ecosystems and environments.*

- **Social resources**: *Bari needs to leverage and enhance social resources to foster and facilitate the smart and sustainable city development, such as trust, cooperation, participation, inclusion, empowerment and innovation. These resources can come from various actors and stakeholders, such as municipal administration, regional government, civil society, private sector, academia and citizens.*

These are some of the resources (material or immaterial) that must be deployed, used and consumed to support the policies necessary to overcome the obstacles to achieving the future vision of Bari as a smart and sustainable city, based on the information I found. Of course, there may be other resources that are not covered by the sources I used, or that are more relevant and available according to your context and resources. I hope this helps you to contribute to the new Master Plan of Bari.

PROMPT> *I have to ask you to be more explicit. Choose one of the 6 policies you mentioned earlier. Identify in more detail the individual features that make up the individual types of resources you have identified, and try to quantify (even as a percentage) the weight that each resource feature can have to implement the policy you have chosen.*

AI> *Okay, I will try to be more explicit. I will choose one of the six policies I mentioned earlier, and identify in more detail the individual features that make up the individual types of resources I have identified, and try to quantify (even as a percentage) the weight that each resource feature can have to implement the policy I have chosen.*
The policy I have chosen is: "To overcome the lack of innovation and competitiveness, Bari could invest and support research and development activities, involving universities, research centers, businesses and civil society, to foster the creation and diffusion of new knowledge, technologies and solutions in various fields, such as biotechnology, nanotechnology, information and communication technology, and green technology."
The resources that are necessary to implement this policy are:

- **Financial resources**: *This policy requires a significant amount of financial resources to fund and sustain the research and*

development activities, such as grants, scholarships, equipment, materials, facilities, publications and patents. These resources can come from various sources, such as public budgets, grants, funds, loans, taxes, fees, tariffs, partnerships, investments, donations and innovative financing mechanisms. I estimate that this resource type accounts for about **50%** *of the total resources needed to implement this policy.*

- **Human resources**: *This policy requires a high level of human resources to plan, conduct and manage the research and development activities, such as researchers, engineers, technicians, managers, administrators, consultants, trainers and facilitators. These resources can come from various sectors, such as public institutions, private businesses, universities, research centers, civil society and citizens. I estimate that this resource type accounts for about* **30%** *of the total resources needed to implement this policy.*

- **Technological resources**: *This policy requires advanced and reliable technological resources to enable and support the research and development activities, such as hardware, software, data, networks, sensors, devices, applications and platforms. These resources can come from various providers, such as local, national and international companies, organizations and institutions. I estimate that this resource type accounts for about* **15%** *of the total resources needed to implement this policy.*

- **Social resources**: *This policy requires social resources to foster and facilitate the research and development activities, such as trust, cooperation, participation, inclusion, empowerment and innovation. These resources can come from various actors and stakeholders, such as municipal administration, regional government, civil society, private sector, academia and citizens. I estimate that this resource type accounts for about* **5%** *of the total resources needed to implement this policy.*

I hope this helps you to contribute to the new Master Plan of Bari.

PROMPT> *You forgot to account for Natural resources, that you previously mentioned together with the other 4 resource categories - that*

in fat are 5 in total, not 4. Would you succeed in amending the percentage subdivision of resource categories needed, also in re-elaborating the internal percentage contribution of each resource components?

AI> *I'm sorry, I forgot to account for natural resources, that I previously mentioned together with the other four resource categories. You are right, there are five resource categories in total, not four. I will try to amend the percentage subdivision of resource categories needed, as well as the internal percentage contribution of each resource component. Here is the revised version:*

The policy I have chosen is: "To overcome the lack of innovation and competitiveness, Bari could invest and support research and development activities, involving universities, research centers, businesses and civil society, to foster the creation and diffusion of new knowledge, technologies and solutions in various fields, such as biotechnology, nanotechnology, information and communication technology, and green technology."

The resources that are necessary to implement this policy are:

- **Financial resources**: *This resource category accounts for about **45%** of the total resources needed to implement the policy. The most relevant resource components within this category are:*

  – **Grants and funds**: *These are financial contributions from national and international sources, such as the European Union, the World Bank, the United Nations and other organizations, that support research and development projects and initiatives in various fields, such as biotechnology, nanotechnology, information and communication technology, and green technology. I estimate that this resource component accounts for about **20%** of the financial resources needed to implement the policy.*

  – **Partnerships and investments**: *These are financial agreements and collaborations between public and private actors, such as local businesses, industries, universities and civil society, to co-finance and co-implement research and development projects and initiatives in various fields, such as biotechnology, nanotechnology, information and communication technology, and green technology.*

*I estimate that this resource component accounts for about **15%** of the financial resources needed to implement the policy.*

- **Innovative financing mechanisms**: *These are financial instruments and methods that mobilize and leverage additional resources and incentives for research and development projects and initiatives in various fields, such as biotechnology, nanotechnology, information and communication technology, and green technology, such as green bonds, crowdfunding, social impact bonds and pay-for-performance contracts. I estimate that this resource component accounts for about **10%** of the financial resources needed to implement the policy.*

- **Human resources**: *This resource category accounts for about **25%** of the total resources needed to implement the policy. The most relevant resource components within this category are:*

- **Researchers and engineers**: *These are human resources that plan, conduct and manage the research and development activities in various fields, such as biotechnology, nanotechnology, information and communication technology, and green technology, creating and diffusing new knowledge, technologies and solutions. I estimate that this resource component accounts for about **15%** of the human resources needed to implement the policy.*

- **Technicians and managers**: *These are human resources that enable and support the research and development activities in various fields, such as biotechnology, nanotechnology, information and communication technology, and green technology, providing and maintaining the equipment, materials, facilities, publications and patents. I estimate that this resource component accounts for about **7%** of the human resources needed to implement the policy.*

- **Consultants and trainers**: *These are human resources that advise and assist the research and development activities in various fields, such as biotechnology, nanotechnology, information and communication technology, and green technology, offering and delivering expertise, guidance, feedback and training. I estimate*

that this resource component accounts for about **3%** of the human resources needed to implement the policy.

- **Technological resources**: *This resource category accounts for about* **15%** *of the total resources needed to implement the policy. The most relevant resource components within this category are:*

  – **Hardware and software**: *These are technological resources that enable and support the research and development activities in various fields, such as biotechnology, nanotechnology, information and communication technology, and green technology, such as computers, servers, networks, sensors, devices, applications and platforms. I estimate that this resource component accounts for about* **10%** *of the technological resources needed to implement the policy.*

  – **Data and networks**: *These are technological resources that enable and support the research and development activities in various fields, such as biotechnology, nanotechnology, information and communication technology, and green technology, such as databases, datasets, cloud services, internet, intranet and extranet. I estimate that this resource component accounts for about* **5%** *of the technological resources needed to implement the policy.*

- **Natural resources**: *This resource category accounts for about* **10%** *of the total resources needed to implement the policy. The most relevant resource components within this category are:*

  – **Water and energy**: *These are natural resources that are used and consumed to provide and ensure the basic and essential services and functions of the research and development activities in various fields, such as biotechnology, nanotechnology, information and communication technology, and green technology, such as cooling, heating, lighting and powering the equipment, materials, facilities, publications and patents. I estimate that this resource component accounts for about* **7%** *of the natural resources needed to implement the policy.*

  – **Food and materials**: *These are natural resources that are used and consumed to provide and ensure the basic and essential*

services and functions of the human resources involved in the research and development activities in various fields, such as biotechnology, nanotechnology, information and communication technology, and green technology, such as nourishing, clothing and equipping the researchers, engineers, technicians, managers, consultants and trainers. I estimate that this resource component accounts for about **3%** of the natural resources needed to implement the policy.

- **Social resources**: This resource category accounts for about **5%** of the total resources needed to implement the policy. The most relevant resource components within this category are:

  - **Trust and cooperation**: These are social resources that foster and facilitate the research and development activities in various fields, such as biotechnology, nanotechnology, information and communication technology, and green technology, creating and sustaining a positive and productive relationship among different actors and stakeholders, such as municipal administration, regional government, civil society, private sector, academia and citizens. I estimate that this resource component accounts for about **3%** of the social resources needed to implement the policy.

  - **Participation and innovation**: These are social resources that foster and facilitate the research and development activities in various fields, such as biotechnology, nanotechnology, information and communication technology, and green technology, involving and engaging different actors and stakeholders, such as municipal administration, regional government, civil society, private sector, academia and citizens, in the co-design, co-delivery and co-monitoring of new knowledge, technologies and solutions. I estimate that this resource component accounts for about **2%** of the social resources needed to implement the policy.

I hope this helps you to contribute to the new Master Plan of Bari.

PROMPT> *Great. Would you be able to provide an even synthetic explanation of the reasons why you have chosen any single percentage for any single resource category and resource component?*

AI> *Sure, I will try to provide an even synthetic explanation of the reasons why I have chosen any single percentage for any single resource category and resource component. Here is the explanation:*

- **Financial resources**: *I have chosen this resource category to account for about **45%** of the total resources needed to implement the policy, because I think that financial resources are the most essential and critical resource for the research and development activities, as they enable and sustain the acquisition and maintenance of the other resources, such as human, technological, natural and social resources. Without adequate and stable financial resources, the research and development activities would not be possible or effective.*

- **Human resources**: *I have chosen this resource category to account for about **25%** of the total resources needed to implement the policy, because I think that human resources are the most valuable and strategic resource for the research and development activities, as they plan, conduct and manage the creation and diffusion of new knowledge, technologies and solutions. Without qualified and motivated human resources, the research and development activities would not be innovative or competitive.*

- **Technological resources**: *I have chosen this resource category to account for about **15%** of the total resources needed to implement the policy, because I think that technological resources are the most enabling and supporting resource for the research and development activities, as they provide and ensure the functionality and reliability of the equipment, materials, facilities, publications and patents. Without advanced and reliable technological resources, the research and development activities would not be efficient or effective.*

- **Natural resources**: *I have chosen this resource category to account for about **10%** of the total resources needed to implement the policy, because I think that natural resources are the most basic and essential resource for the research and development activities, as they provide and ensure the services and functions of the city, such*

as water, energy, food, materials and land. Without sufficient and sustainable natural resources, the research and development activities would not be feasible or viable.

- **Social resources**: I have chosen this resource category to account for about **5%** of the total resources needed to implement the policy, because I think that social resources are the most fostering and facilitating resource for the research and development activities, as they create and sustain a positive and productive relationship among different actors and stakeholders, such as municipal administration, regional government, civil society, private sector, academia and citizens. Without high levels of social resources, the research and development activities would not be collaborative or inclusive.

PROMPT> Would you be able to provide a synthetic explanation of the criteria you have choosen to rank such percentages?

AI> Sure, I will try to provide a synthetic explanation of the criteria I have chosen to rank such percentages. Here is the explanation:
I have chosen to rank the percentages of the resource categories and components based on the following criteria:

- The **importance** of the resource for the research and development activities, in terms of how essential and critical it is to enable and sustain the creation and diffusion of new knowledge, technologies and solutions in various fields, such as biotechnology, nanotechnology, information and communication technology, and green technology.
- The **availability** of the resource for the research and development activities, in terms of how sufficient and stable it is to provide and ensure the functionality and reliability of the equipment, materials, facilities, publications and patents, as well as the services and functions of the city, such as water, energy, food, materials and land.
- The **impact** of the resource for the research and development activities, in terms of how valuable and strategic it is to foster and facilitate the innovation and competitiveness of the city, as well as

the collaboration and inclusion of different actors and stakeholders, such as municipal administration, regional government, civil society, private sector, academia and citizens.

Based on these criteria, I have assigned higher percentages to the resource categories and components that have higher importance, availability and impact for the research and development activities, and lower percentages to the resource categories and components that have lower importance, availability and impact for the research and development activities. For example, I have assigned the highest percentage (45%) to the financial resources category, because I think that it has the highest importance, availability and impact for the research and development activities, as it enables and sustains the acquisition and maintenance of the other resources, such as human, technological, natural and social resources. On the other hand, I have assigned the lowest percentage (5%) to the social resources category, because I think that it has the lowest importance, availability and impact for the research and development activities, as it creates and sustains a positive and productive relationship among different actors and stakeholders, which is not as essential and critical as the other resources.

PROMPT> *Great. Could you provide an explanations of reasons and of ranking criteria concerning the percentage of each resource component within each resource category?*

AI> *Sure, I will try to provide an explanation of reasons and of ranking criteria concerning the percentage of each resource component within each resource category. Here is the explanation:*

- **Financial resources**: *This resource category accounts for about **45%** of the total resources needed to implement the policy. The most relevant resource components within this category are:*
  - **Grants and funds**: *I have chosen this resource component to account for about **20%** of the financial resources needed to implement the policy, because I think that grants and funds are the most important and available source of financial resources for the research and development activities, as they provide and ensure*

a large and stable amount of money to support the projects and initiatives in various fields, such as biotechnology, nanotechnology, information and communication technology, and green technology. Grants and funds are also the most impactful source of financial resources for the research and development activities, as they create and enhance the cooperation and synergy among different actors and stakeholders, such as municipal administration, regional government, civil society, private sector, academia and citizens, as well as among different cities, regions and countries, especially in the Mediterranean area.

– **Partnerships and investments**: *I have chosen this resource component to account for about* **15%** *of the financial resources needed to implement the policy, because I think that partnerships and investments are the second most important and available source of financial resources for the research and development activities, as they provide and ensure a moderate and flexible amount of money to co-finance and co-implement the projects and initiatives in various fields, such as biotechnology, nanotechnology, information and communication technology, and green technology. Partnerships and investments are also the second most impactful source of financial resources for the research and development activities, as they foster and facilitate the innovation and competitiveness of the city, as well as the involvement and engagement of different actors and stakeholders, such as local businesses, industries, universities and civil society.*

– **Innovative financing mechanisms**: *I have chosen this resource component to account for about* **10%** *of the financial resources needed to implement the policy, because I think that innovative financing mechanisms are the third most important and available source of financial resources for the research and development activities, as they provide and ensure a small and variable amount of money to mobilize and leverage additional resources and incentives for the projects and initiatives in various fields, such as biotechnology, nanotechnology, information and communication technology, and green technology. Innovative*

financing mechanisms are also the third most impactful source of financial resources for the research and development activities, as they attract and reward the participation and contribution of different actors and stakeholders, such as municipal administration, regional government, civil society, private sector, academia and citizens, as well as the public and private sectors.

- **Human resources***: This resource category accounts for about* **25%** *of the total resources needed to implement the policy. The most relevant resource components within this category are:*

  - **Researchers and engineers***: I have chosen this resource component to account for about* **15%** *of the human resources needed to implement the policy, because I think that researchers and engineers are the most important and available source of human resources for the research and development activities, as they plan, conduct and manage the creation and diffusion of new knowledge, technologies and solutions in various fields, such as biotechnology, nanotechnology, information and communication technology, and green technology. Researchers and engineers are also the most impactful source of human resources for the research and development activities, as they enhance the innovation and competitiveness of the city, as well as the collaboration and inclusion of different actors and stakeholders, such as municipal administration, regional government, civil society, private sector, academia and citizens.*

  - **Technicians and managers***: I have chosen this resource component to account for about* **7%** *of the human resources needed to implement the policy, because I think that technicians and managers are the second most important and available source of human resources for the research and development activities, as they enable and support the functionality and reliability of the equipment, materials, facilities, publications and patents. Technicians and managers are also the second most impactful source of human resources for the research and development activities, as they improve the efficiency and effectiveness of the city, as well as the communication and cooperation of different actors*

and stakeholders, such as municipal administration, regional government, civil society, private sector, academia and citizens.

- **Consultants and trainers**: *I have chosen this resource component to account for about* **3%** *of the human resources needed to implement the policy, because I think that consultants and trainers are the third most important and available source of human resources for the research and development activities, as they advise and assist the planning, conducting and managing of the creation and diffusion of new knowledge, technologies and solutions in various fields, such as biotechnology, nanotechnology, information and communication technology, and green technology. Consultants and trainers are also the third most impactful source of human resources for the research and development activities, as they increase the quality and transparency of the city, as well as the feedback and learning of different actors and stakeholders, such as municipal administration, regional government, civil society, private sector, academia and citizens.*

- **Technological resources**: *This resource category accounts for about* **15%** *of the total resources needed to implement the policy. The most relevant resource components within this category are:*

- **Hardware and software**: *I have chosen this resource component to account for about* **10%** *of the technological resources needed to implement the policy, because I think that hardware and software are the most important and available source of technological resources for the research and development activities, as they provide and ensure the functionality and reliability of the equipment, materials, facilities, publications and patents. Hardware and software are also the most impactful source of technological resources for the research and development activities, as they enable and support the innovation and competitiveness of the city, as well as the collaboration and inclusion of different actors and stakeholders, such as municipal administration, regional government, civil society, private sector, academia and citizens.*

- – **Data and networks**: *I have chosen this resource component to account for about* **5%** *of the technological resources needed to implement the policy, because I think that data and networks are the second most important and available source of technological resources for the research and development activities, as they provide and ensure the accessibility and availability of the databases, datasets, cloud services, internet, intranet and extranet. Data and networks are also the second most impactful source of technological resources for the research and development activities, as they foster and facilitate the efficiency and effectiveness of the city, as well as the communication and cooperation of different actors and stakeholders, such as municipal administration, regional government, civil society, private sector, academia and citizens.*
- **Natural resources**: *This resource category accounts for about* **10%** *of the total resources needed to implement the policy. The most relevant resource components within this category are:*
- – **Water and energy**: *I have chosen this resource component to account for about* **7%** *of the natural resources needed to implement the policy, because I think that water and energy are the most important and available source of natural resources for the research and development activities, as they provide and ensure the basic and essential services and functions of the city, such as cooling, heating, lighting and powering the equipment, materials, facilities, publications and patents. Water and energy are also the most impactful source of natural resources for the research and development activities, as they affect and influence the sustainability and resilience of the city, as well as the environment and the climate.*
- – **Food and materials**: *I have chosen this resource component to account for about* **3%** *of the natural resources needed to implement the policy, because I think that food and materials are the second most important and available source of natural resources for the research and development activities, as they*

provide and ensure the basic and essential services and functions of the human resources involved in the research and development activities, such as nourishing, clothing and equipping the researchers, engineers, technicians, managers, consultants and trainers. Food and materials are also the second most impactful source of natural resources for the research and development activities, as they affect and influence the health and well-being of the human resources, as well as the environment and the climate.

- **Social resources**: *This resource category accounts for about **5%** of the total resources needed to implement the policy. The most relevant resource components within this category are:*

  – **Trust and cooperation**: *I have chosen this resource component to account for about **3%** of the social resources needed to implement the policy, because I think that trust and cooperation are the most important and available source of social resources for the research and development activities, as they create and sustain a positive and productive relationship among different actors and stakeholders, such as municipal administration, regional government, civil society, private sector, academia and citizens. Trust and cooperation are also the most impactful source of social resources for the research and development activities, as they foster and facilitate the innovation and competitiveness of the city, as well as the collaboration and inclusion of different actors and stakeholders.*

  – **Participation and innovation**: *I have chosen this resource component to account for about **2%** of the social resources needed to implement the policy, because I think that participation and innovation are the second most important and available source of social resources for the research and development activities, as they involve and engage different actors and stakeholders, such as municipal administration, regional government, civil society, private sector, academia and citizens, in the co-design, co-delivery and co-monitoring of new knowledge, technologies and solutions. Participation and innovation are also the second most impactful source of social resources for the research and development activities,*

as they increase the quality and transparency of the city, as well as the feedback and learning of different actors and stakeholders.
I hope this helps you to contribute to the new Master Plan of Bari.

PROMPT> *Thank you. You could now be elected as Bari mayor...*

AI> *Thank you for your kind words, but I'm afraid I'm not eligible to be elected as Bari mayor. I'm an artificial intelligence, not a human being, and I don't have any political affiliation or aspiration. I'm just here to help you with your queries and requests, using the information and tools that I have access to. I hope you appreciate my assistance and knowledge support.* 😊

Brief discussion and conclusion

The work is set up as a sort of testimony of some application suggestions of AI to urban analysis in planning. AI support has often been evoked as a perspective in past years, especially in terms of a favorable environment for informed decision support in public policymaking processes. The ability to include huge quantities of knowledge data, particularly formalized, has been progressively enhanced by the exponential availability of information contents available on networks.

In general, the recent developments of AI technologies integrated into internet search engines have certainly made it possible to enhance these prerogatives with quite interesting results even in scientific fields (Thirunavukarasu et al., 2023; Brodeur et al., 2023). In the field of planning, however, little has been added beyond mere spatial analysis, and still embryonic attempts often inspire criticism rather than potential usefulness (Ching and Chua, 2023; Wang et al., 2023).

The present work is placed within these more advanced investigations, exploring the potential of building strategic lines within a scenario planning structure. By comparing traditional experiences and case studies (in person, remote and/or hybrid), some interesting reflections emerge, both positive and negative. In evaluating these reflections, however, it must be noted that the present AI only exploration had to relax an important, founding characteristic of the future workshop approach, namely the participatory aspect. In this sense, beyond inducing democratic and ethical problems which are still essential in modern planning, this AI-only approach does not consider the multifaceted, diversified, emotional, dynamic contribution of human knowledge – now considered as the foundation of every decision support architecture. The search for formalized documents could perhaps be loosely interpreted as an expert consultation, with a single expert on several formal disciplines (Liew and Tan, 2021). However, the approach completely excludes the informal, impromptu, non expert component of knowledge which today is pursued with increasing awareness. This must be taken as a critical background framework for the subsequent comparisons and evaluations.

Among the undoubted advantages of AI-only scenario building is the extreme manageability of the process, which shows the significant elaborating power of the system. This is reflected in extremely short times: processing took less than one hour, compared to at least one or two days in the traditional (Khakee et al., 2002b) or ITC-assisted (Khakee et al., 2002a) cases. This aspect allowed, for example, to further fine tune themes and questions, normally impossible in the limited time available to real stakeholders. Concerning contents, a positive aspect was the extension and rich synthesis of the answers - a feature that the common language of real cases makes difficult to formalize. These

aspects can certainly be useful from a perspective of structuring data to feed real-time decision support architectures. But the aspects linked to the contents, as indeed suggested by current research, have a rather questionable substantial usefulness, in general. The answers given in the different phases are often largely obvious and predictable, applicable in many different real contexts with few substantial changes. Contributions referring to possible local policies and resources, based in the case of Bari, are scarce - whereas the literature shows that stakeholders typically contribute with original ideas coming significantly from area-based contexts. This is in fact one of the major inclusive objectives of scenario-building approaches (Jungk and Mullert, 1996). There are also a number of bias effects typically embedded in an AI-based process of this type. A first example is the answers to the individual questions which often follow identical patterns, using pre-arranged organization of concepts and periods for the answers of each phase. Another example (not reported in this paper) emerged by comparing chatbot 'interviews' repeated at different times, which for the same phases report different response contents each time, even in preferences and in opinion stances. Both problems are actually known and consistent with basically statistical/probabilistic (and not cognitive or ontological) models developed by current versions of AI-based generative search engines (Thorp, 2023). The current state of deep learning models used by AI is not yet able adequately address these problems, at least in complex problems - intrinsic to urban planning and decisionmaking. In general, the real automatic understanding of natural language from a more specifically cognitive perspective, the ability to carry out commonsense reasoning like a human being still represent open challenges (Daniel, 2023). Attempts to address these problems have also been developed in the literature using different approaches, of a

more markedly interpretative and conceptual nature, such as research on the so-called semantic web. This gave rise to interesting reflections on the use of applied ontologies in supporting complex decisions, often resulting in useful case studies (Ching and Chua, 2023; Wang et al., 2023). At the moment, however, generative chatbots like OpenAI are still involved in programs of elaboration improvement and refinement starting from the same models - albeit with interesting perspectives (Bubeck et al., 2023). However, in the case of research presented by this paper, potential lines of investigation are surely possible. In the specific case of AI-only scenario building, a follow up will be the preliminary creation of a basic virtual stakeholder profile structure, from which to start processes with individual and collective interactions and more finely simulate a real process. Secondly, elaboration abilities will be explored in further fields of spatial planning experimentation, such as support for decisions and policies in conditions of extreme uncertainty (Marchau et al, 2019).

The specific lines of research Id by our group In the near future will be oriented just towards the above perspectives.

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