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Exploring Generative AI in Planning: A Scenario-Building Simulation for the Master Plan of Bari, Italy

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1 ABSTRACT

When dealing urban and regional planning, communities seek methodological approaches to deliver effective development strategies. Building up future scenarios is nowadays understood as an approach that involves expert and non-expert agents towards the organization of alternative future strategies. The so-called future-workshop approach has been followed in much research and experimentation in the past, both in real communities and in simulated situations. The present research will develop further experimentation to explore some perspectives of involving artificial intelligence agents. For this purpose, a search engine equipped with OpenAI's ChatGPT will be used to simulate future scenarios for the master plan of Bari, Italy. The involvement of generative AI will basically take place following the model of a structured interview with different stakeholders. They will be simulated by artificial intelligence to define a multi-agent knowledge base towards the construction of future scenarios for the Bari master plan.

Keywords: generative AI, simulation, scenario building, spatial planning, decision support

2 INTRODUCTION

Public managers in decision-making and planning activities are increasingly attracted by information technology for supporting decisions. The rationale for this aspiration arises from the need to ensure manageability and timeliness of policies, which are challenged and put under pressure by the prevailing complexity of managed contexts. This hard dream, however, is challenged on the one hand by a (questionable) fear of decreased personal discretionary power, and on the other by the (legitimate) fears of facing unforeseen and/or unchangeable developments (Gomes et al. 2016). However, this is a frequent decision context, showing the need for support for decision makers in managing situational and dynamic complexities. And in this context, potential for the application of intelligent knowledge management models emerges (Barbanente et al. 2007, Goodchild 2011, Borri and Camarda 2013, Calafiore et al. 2017, Couclelis 2019). Then extending over a longer perspective, with more binding dimensions and relationships between behaviours, places and territorial spaces, the role of knowledge becomes critical. The relationship between the long-term perspectives, typical of spatial planning with its basic diffused multiagent knowledge, induces the need for extremely more complex and responsible decision support models. Systems based on formalized algorithmic automatisms have often received a cautious if not skeptical reception in strategic planning contexts, often judging the basic black-box essence frequently present in them to be unbearable and unrealistic (Castelvecchi 2016, Carabantes 2020, Malekpour et al. 2020). Instead, models based on the so-called future scenario-building (SB), an iterative and interactive evolution of the strategic planning models launched in the UK in the 1970s, have reported greater success over time (Friend and Jessop 1969, Jungk and Mullert 1996, Rickards et al. 2014, Santoro et al. 2020). It is a process in which the collection and exchange of knowledge play a central role. In a SB process there are stages involving agents with expert knowledge as well as community agents with common knowledge. In this context, artificial intelligence could play an important role as a support for managing complex knowledge, elicited and made available in terms of formalized or formalizable databases. This manageable evolutionary knowledge base could in principle form the basis of decision support for long-term spatial planning tasks.

Indeed, SB models have already historically been oriented towards representing this knowledge support for strategic planning (Myers and Kitsuse 2000). The stages of interaction with expert agents as well as with common-sense (non-expert) agents represented the operationally robust and effective turning point of processes originally governed by only top-down deliberations. Experiences in this sense are activities carried out in many European and North American contexts starting from the so-called futures studies in the 1990s (Sardar and Ravetz 1996, Bell 2003). Attempts to intelligently manage these processes have been increasingly carried out in recent years, following the progressive spread of internet-based interaction methods, involving knowledge agents located variously across the planet. Subsequent experiments have taken place in this domain, aimed at formulating and managing informal and often qualitative data formalizations, in order to feed real-time decision support architectures (Camarda 2008, Vervoort et al. 2010, Santoro, et al. 2020). The orientation of these attempts was to draw on hybrid mathematical modeling, inspired by data-mining, machine-learning and in some way supervised to minimize the black-box effect as much as possible (Sullivan 2022, Wang and Biljecki 2022). In this context, the recent availability of generative AI platforms on search engines traditionally used for searching over the internet has shown up. This circumstance therefore represented the opportunity to investigate the potential of integrating SB-based planning processes with GPT-based environments (Camarda and Patano 2023).

In this framework, the present work aims to explore suggestions of applicability of generative artificial intelligence models for the construction of future scenarios oriented to spatial planning. Therefore, after this introduction, the paper presents and comments on experiments developed in the context of scenario-building modeling in chapter 2. The work ends with a final chapter discussing the results and follow up.

3 MATERIALS AND METHODS

3.1 Studying futures: Experiences and reflections

Spatial planning is an area that intrinsically incorporates the future dimension, pre-figuring it out and then attempting to implement it. The future scenarios approach in planning was developed within the so-called Futures Studies (Bell 2003). It is based on the principle that the future is not unique, but rather requires consideration of multiple potential lines of development. Futures studies embraces uncertainty as an integral part of reality and focuses on how to address the future proactively. Futurists explore, invent, propose, analyze and evaluate possible, probable or desirable scenarios. They see the future as shaped by current choices and actions, with impacts and consequences to be carefully examined (Sardar and Ravetz 1996).

Many attempts have been made to try to structure the diffused qualitative knowledge coming from this approach and make it usable to support informed decisions. Qualitative-quantitative structuring approaches of diffused knowledge have had wider application. In particular, the future-workshop approach has achieved some success, due to its ability to consider individual and collective, critical and proactive contributions, generating possible strategic paths for the creation of alternative scenarios (Khakee et al. 2002, Iwaniec et al. 2020).

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 approach to scenario building process (Khakee, et al. 2002)

With this approach, many implementation and experimental activities of participatory strategic planning have been developed until recently. To limit ourselves to activities developed by our working group, we can mention and briefly comment on some of them, with the aim of introducing the rationale that led to the exploratory experimentation proposed subsequently.

3.2 Some case studies of participatory scenario building

At the beginning of year 2000 our research group was involved in a European project with Mediterranean countries concerning sustainable planning processes for land and water uses. The first step of the project involved Tunisia (Khakee, et al. 2002). An essential part of the Tunisian case was the participatory construction of future scenarios regarding the area of the capital Tunis. The process involved 22 participants, mainly from institutional and research bodies, for approximately a week of overall work. The result was the definition of three alternative scenarios, named by the group with synthetic labels, of which the first is reported as an example case (figure 2).

ECO CITY

VISION	PROBLEMS	STRATEGY
Healthy and sustainable environment	cost degree of public involvement economic means brake in economic development waste generation	integration of landscape projects in economic development plans fight against anarchical urbanisation waste management
Bio-agriculture integrated into the urban environment	low yield land fragmentation blocking of public projects (schools, hospitals, networks) water scarcity (irrigation)	research on bio-agricultural techniques diffusion of bio-techniques to farmers and consumers
Transparent land market	market failures insufficient supply wild competition between different economic operators	tax system proper organisation of land agencies market incentives
Diversity of cultural and historical resources	high maintenance costs lack of craftsmen rapid and anarchical urbanisation	upgrading of cultural resources reconciling past, present and future making development resources more accessible promotion of urban sustainable environment

Figure 2 – The Eco-city scenario built in Tunis (Khakee, et al. 2002)

The Tunis process was able to involve not many common knowledge and non-expert agents, but mainly institutional expert agents. This is because access to these forms of participatory democracy were practically absent at the time there, and it was very difficult to involve communities and citizens. Of course, this ended up determining a prevalence of themes detached from the individual contexts of normal life and oriented towards general themes. However, the process was developed with assiduity and diligence by the participants, allowing all the planned stages to be completed - a rather rare case in relation to the long times usually needed (Puglisi 2001).

With the aim of broadening participation to groups of common knowledge, involving stakeholders located in different places and in asynchronous times, in 2003 the scenario building process was developed for the Rabat/Casablanca area, in Morocco (Barbanente, et al. 2007). The process in this case took place in two parallel sessions, with and without the use of the PC, to verify the potential and limits of the two different contexts. In total there were 30 participants, divided equally into the two sessions. Subsequently, a remote experimental session was carried out which aimed to refine the results already obtained in the original process. However, this final experimentation, which suffered from many problems such as time, unreliability and connection costs which were widespread at the time, was not ultimately integrated into the structure of the results. Also in this case, three alternative scenarios were generated, named by the group with synthetic labels, the third of which is reported as an example case (figure 3).

R/C as an agricultural and ecological centre in the Maghreb

Infrastructure and territorial development

All major rural centres are connected to major towns and cities in the region in order to facilitate marketing of rural products. Infrastructure development has put a major emphasis on agricultural development. Improved transportation and storage facilities have considerably raised the marketing of food products.

Economy

Trade hinders within the Maghreb have been removed in order to allow a more diversified and competitive agriculture. Agricultural differentiation within the region and other regions of the Maghreb has been implemented which has resulted in the establishment of many small-scale industries to meet the needs of rural population. Eco-tourism is a flourishing part of the regional economy.

Cultural and social development

Education resources have been successfully used to reduce illiteracy. Partial privatization of health and social security systems has led to benefits for population in urban as well as rural areas of the region. Intra-regional economic differences have been reduced which has led to a dramatic curtailment of neighbourhood antagonism and criminality.

Strong competitiveness has made IT available in rural areas.

Politics

Local autonomy characterises public management. Increased reliance on civil society in public decision-making has paved the way for the attainment of the objectives of sustainable development.

Figure 3 – The agricultural/ecological scenario built in Rabat/Casablanca (Barbanente, et al. 2007)

Even the Rabat process was able to involve a few common knowledge, non-expert agents. However, the PC-based session also involved university students, mainly due to the limited digital knowledge among institutional officials at that time. However, the lack of diffusion of forms of participatory democracy was also present in Rabat, making it still difficult to involve communities and citizens. In the case of Rabat, alongside the prevalence of statements oriented towards general themes, interests arose in terms of implementation which were only sketchy in Tunis. It should be noted that all three scenarios were generated with rich and argued texts, permitted by verbatim ex-post consultation of the minutes, available in detail on the digital chat registers. This confirmed an effective role of PC-based support in guaranteeing a more substantially articulated and rapidly consultable knowledge base (Vervoort, et al. 2010).

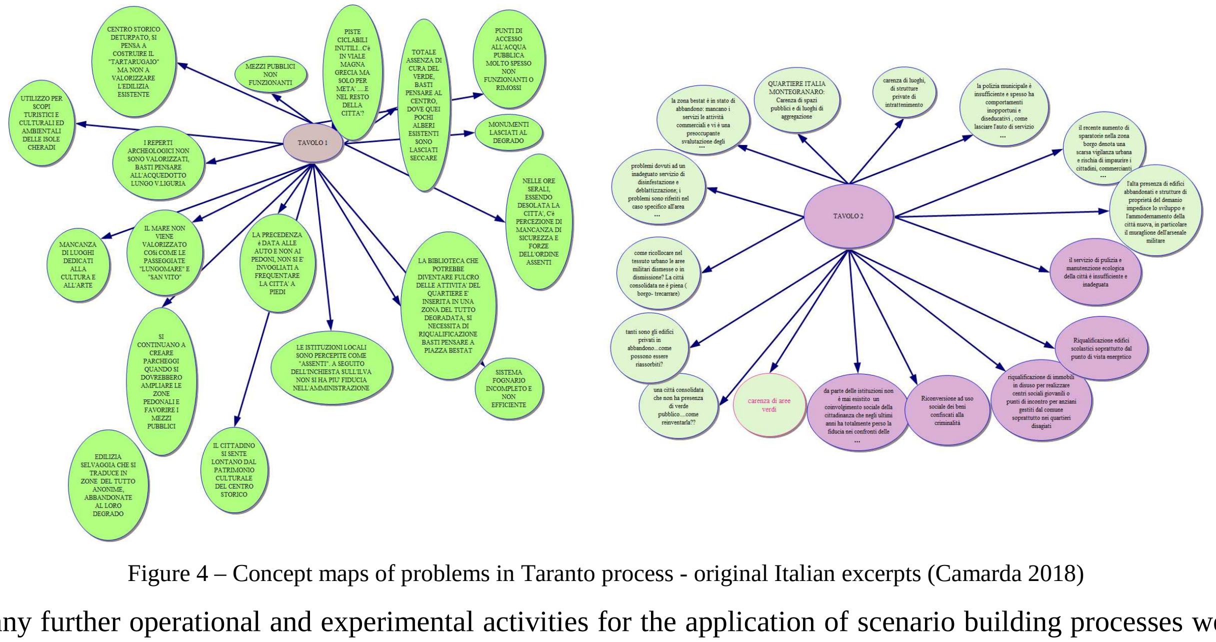


Figure 4 – Concept maps of problems in Taranto process - original Italian excerpts (Camarda 2018)

Many further operational and experimental activities for the application of scenario building processes were carried out by our group in the following period (Borri et al. 2008, Camarda 2008, Borri and Camarda 2009, Camarda 2018, Santoro, et al. 2020, Santoro et al. 2021). In particular, they aimed to explore the possibilities of support offered by digital systems, mainly to broaden the arena of participants by including expert and non-expert knowledge to generate multi-agent knowledge bases accessible in real time. The case of the industrial city of Taranto (Italy), in this context, has provided the possibility of hybridizing the traditional future-workshop approach with a more proactive support of digital technology (Camarda 2018). The work was part of the 2014 process for the drafting of the urban Master Plan, thus being forced within limited time limits. With the aim of more effectively managing the need for synthesis and refinement of results in real time, the interactive process was supported by the use of concept maps and wordclouds (Cui et al. 2010, Heft 2013). The process involved approximately 350 participants, divided into 8 sessions carried out throughout the city's neighborhoods. It was limited only to the stages of identifying problems (critique) and generating desirable future images (fantasy) for the development of the city. The output required by the official research contract was the provision of concepts and keywords on which the municipal administration would subsequently develop strategy schemes. An example of the session relating to the compact city, i.e. the Taranto shopping centre, is shown with the concept maps (figure 4) and the synthetic wordcloud (figure 5) of the problems cited by the participants.

Figure 5 – Wordclouds of problems in Taranto process - original Italian excerpts (Camarda 2018)

The use of a collective visualization tool such as concept mapping usefully supported idea generation. The tool also allowed a reflection on the relationships existing between the various problems - which are not shown in the figure because it would have been illegible. It also allowed further stages of exchange and collective refinement of the statements, for a process of iterated self-learning that is very useful in generating high-level knowledge (Lichtenstein 2000, Allee 2009). However, the very visual appearance of figure 4 shows clear problems of synthesis and unmanageability of the reflections, which paradoxically grow with the (desirable) increase in the reflections themselves. To deal with these problems it was decided to synthesize the statements using keywords, subsequently collected by frequency and redundancy via wordcloud. This process was reiterated for all 8 neighborhoods of Taranto and provided to the municipality for subsequent deliberations. This case can show that the need to preserve the complex richness of statements, towards a more effectively knowledge-based decision-making process, risks being challenged by the needs for readable synthesis and manageability of the results.

Figure 6 – Wordcloud of obstacles in university experimentation - excerpt in Italian (Santoro, et al. 2020)

An attempt has recently been made to extend these keyword-based synthesis approaches, oriented towards the automatic processing of knowledge data, to a complete process of future workshops - held remotely (Santoro, et al. 2020). The opportunity emerged during the COVID-19 lockdown of 2020, when the SB exercise usually carried out by the students of one of our Spatial planning classes had to take place completely remotely. In that case, the continuity of the process could only be guaranteed by the use of adequate real-time PC-based knowledge collection, exchange and synthesis approaches. In this case the experimentation involved approximately 130 students, who simulated being stakeholders in the process of drafting the Master Plan of Bari (Italy). The exercise strictly followed the standard process and ended in three sessions of 2 hours each, carried out on two consecutive days during the official class time. The limited time and availability of the students forced us to resume the synthesis solutions tested in Taranto, and an example shows the outcome of the stage of identifying the obstacles to development (figure 6). A summary of the outcomes of the process for one of the future visions is shown in figure 7.

Bari city of green and environmental sustainability		
Obstacles	Policies	Resources
citizenship mentality	communication strategies that raise awareness among citizens to adopt more sustainable actions	human
lack of space management	collaboration strategies between different types of actors that converge in common actions to redevelop existing areas	human/financial
lack of funds	writing projects to receive funding	human/financial

Figure 7 – The scenario built in university experimentation - English translation (Santoro, et al. 2020)

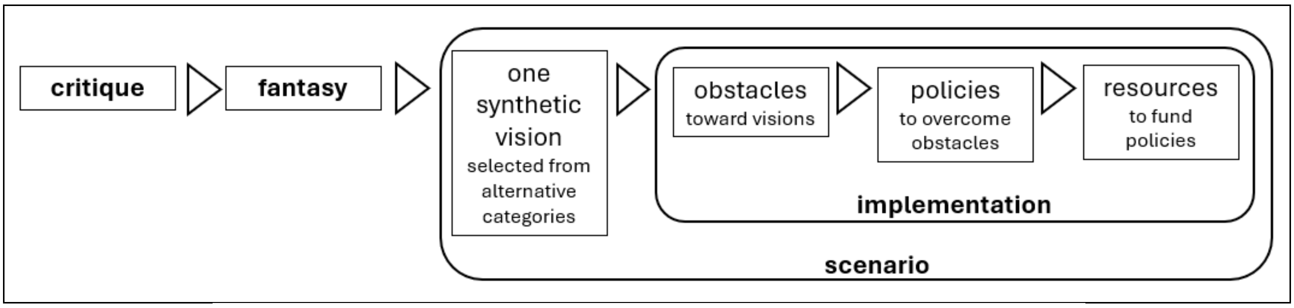
In this case, the students were asked to complement their statements for each step of the process with keywords selected by themselves. The objective was to minimize the risks of external interpretation in the moments of summarizing the responses necessary for data processing. However, this synthesis carried out by each participant did not prove to be entirely representative of the thoughts expressed. Perhaps the problem was in the absolute homogeneity of the participants, who had no real motivation to support their claims as stakeholders. The result was synthetic pictures that were not very representative, and above all a synthesis of the strategies for realizing the chosen vision (Bari, a city of green and environmental sustainability) which provided a scenario that was too brief and very general (Figure 7). However, in general this experimentation has shown that remote PC-based implementation is now reliable for supporting SB activities including extended and delocalized communities. Familiarity with technologically mediated interaction environments is now widespread, so as to avoid the 'cold interaction' effect that made the first experiences of this type ineffective (Khakee et al. 2002). Experimentation now highlights the problems of structuring knowledge databases - interactively and iteratively realized by the participation process. This circumstance risks underestimating the rich complexity of the knowledge exchanged and, consequently, not adequately supporting the decision-making and/or planning processes.

3.3 GPT-based scenario building

A comparative reading of the various SB experiences over time shows some interesting characters. The so-called future-workshop approach aims to define alternative strategic scenarios explicitly. The defined path (critical issues - visions - obstacles to visions - policies to overcome obstacles - resources to support policies) typically develops according to a fairly consolidated and replicable layout. The structuring in consecutive stages allows moments of reflection, expression, comparison, analysis and partial and integrable synthesis. This scheme stimulates the development of an aware and dynamic knowledge base, a useful evolutionary mirror of the community analyzed (REF...). However, knowledge emerges in different ways. On the one hand it is able to express a significant substantive richness, with detailed argumentative articulations and also with useful abstraction - within the expressive limits of an essentially written language. On the other hand, it is certainly a knowledge attracted and influenced by explicit purposes linked to the strategic process and the scenario objective, which tends to filter the contributions in strict coherence with this orientation.

Furthermore, it is a knowledge strongly conditioned by the presences (and absences) of the different agents, which add further relevance to the specific orientation (Chen et al. 2020). The management of complex multi-agent knowledge represents one of the major challenges of recent research, to which the development of information technologies is increasingly trying to give support. Just the emergence of these forms of regularity and replicability of this step-based and scenario-oriented model of cognitive interaction suggests an exploration of the potential support of artificial intelligence for scenario building (AISB). This chapter aims to investigate the potential usefulness of involving simple AI agents within a SB process. In particular, the experimentation shown here was an attempt to apply the future-workshop approach in an interaction with an AI unit - in this case the Copilot search engine equipped with OpenAI's chatGPT. In essence, the interaction develops as a sort of scenario simulation to support the development of an urban Master Plan for the city of Bari, in Southern Italy. Given the essentially exploratory nature of the initiative, it was decided to develop that pilot experiment by identifying a restricted arena of stakeholders. The system presents some limitations imposed by the institutional contract between the operating platform and the Polytechnic. In fact, the maximum number of characters for each search string is set at 4,000 characters, with a maximum of 30 query interactions with Copilot. In this context it was therefore difficult to develop a unitary and structured path. What is shown here is the result of a series of partial processes reiterated several times and recomposed in an integral way.

After an analysis of the protocols of various activities carried out in the past, eight different profiles were selected from the most recent ones who participated in the various meetings. They are a farmer, an artisan, an entrepreneur, an environmentalist, a 6-year child, an elderly person, an artist, an influencer. The interaction took place by asking the artificial intelligence for each stage to simulate itself as each different stakeholders listed in each question. The stages followed the typical layout of the future-workshop approach (figure 8a), and each step was developed according to an iterative sequence (figure 8b).



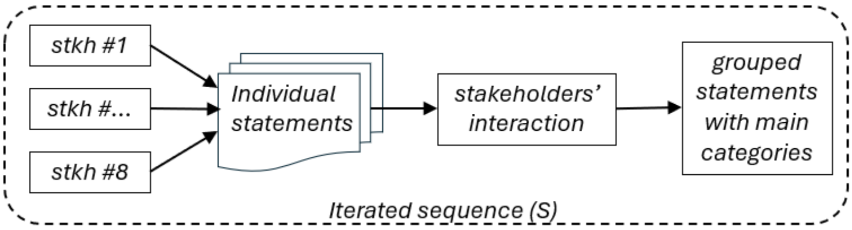


Figure 8 – (a- up) Layout of the future-workshop approach; (b- down) iterative sequence of each stage

This iterative sequence consists of standard questions, from which individual statements emerge following the characters of each agent profile. This question is put down as follows: “Imagine yourself as an entrepreneur living in Bari (Italy), called to help making a new Plan of Bari for the next 50 years. Through statements, figure out some worded images to express your desired futures of Bari. Each statement should explicitly and individually include its relevance for an entrepreneur stakeholder”. To this question, GPT answers with a series of statements, allegedly consistent for each stakeholder, as in the example of the visions desired by the artisan: “Creativity and innovation hub for artisans' collaboration; cultural heritage and diversity with newness; green and sustainable city with eco-artisans; vibrant and inclusive community of artisan contributors; smart and connected city for artisan information”. In the traditional SB process, at this point the various statements are shown to all participants, who can modify or integrate positions based on the new knowledge exchanged. This step required an extended computational capacity of the system and therefore was not implemented due to the technical limitations described above. Then in the next step all statements were grouped according to synthetic categories named through labels, which were listed in order of shared importance. In particular, the query to GPT has been put down in these terms: “Imagine the knowledge team composed of a farmer, an artisan, an entrepreneur, an environmentalist, a 6-year-old child, an elderly person, an artist, an influencer, all living in Bari (Italy). After a motivated discussion with one another, how do you think would the multiagent team group all the statements? Is there a possible shared ranking made by the multiagent group altogether, in terms of importance that takes into account their typical stakeholder's profiles?”. The attempt was to put the GPT in a position to make a synthesis using criteria consistent with the agent profiles involved. The result of this second step was a list of labelled synthetic categories, including the relevant individual statements and sorted according to decreasing importance. The typical response for each stage of SB, in the example of visions, is as follows: “Based on the common themes and keywords, I will try to propose a possible grouping and ranking that could reflect the collective vision of the team for the future of Bari, following each stakeholder's profile: 1) Green and resilient Bari […]; 2) Innovative and creative Bari […]; 3) Inclusive and social Bari […]; 4) Opportunity and mobility Bari […]; 5) Bari's identity and vision […].

At the end of the process, a future scenario was generated relating to the vision of Green and resilient Bari, including the possible operational strategies to achieve it. The entire process simulation session lasted approximately three hours, including time for database reorganization between one stage and the next. However, considerable additional time was necessary to train the system to provide answers consistent with the questions asked and with the overall context flow. In fact, as we said before, the system does not allow extensive computations and therefore needs manual chaining between queries that require additional operations. The overall duration can therefore be estimated at less than ten hours in total.

A specific reflection in this sense concerns the interaction mechanism between user and system. It is known that GPT models are based on transformer architectures, deep learning models, attention mechanisms and neural networks evolutions (Vaswani et al. 2017, Wang and Biljecki 2022). They are able to process natural language by creating an interface to input queries and collect subsequent results - instead generating natural language content in the final reverse path. In this context it was necessary to proceed with a sort of calibration of the interface which caused the time problems highlighted above. However, this need for repeated modification of the queries also made it possible to bypass some 'policy limitations' of the system, as in the case of the request to sort the labelled synthetic visions. In fact, initially it was impossible to hierarchize the visions in terms of common importance for the multiagent team, because GPT declared that it "did not feel it had the authority" to use criteria for evaluating the importance of the visions for the future of Bari. Using various re-elaborations of argumentation, in the end the system provided the appropriate answer. In particular, the arguments aimed to underline the simulation aspect of the task, disaggregated the questions into incremental packages (run ranking for each stakeholder, run shared ranking in abstract terms, run shared ranking for Bari), as well as reminded that the team is made up of stakeholders representing community interests and not political interests. The importance of query argumentation therefore proved to be central, time demanding, process challenging and with a significant role played by manual operations.

Another element to point out is the importance of the underlying calculation models. As is known, GPT models use stochastic sampling during response generation, with an intrinsic randomness mechanism that explores and selects data and documents also depending on their frequency and availability. This is also one of the points of major debate today, regarding the influenceability of the system (Floridi and Chiriatti 2020, Schlagwein and Willcocks 2023, Wolfram 2023). In our case, for example, when asking for the generation of future visions we had to review the questions several times, limiting the citation of "Bari Master Plan". This is because in the absence of limitations GPT especially oriented its research to the formal documents of Bari's new strategic plan, available on the internet in large quantities, and minimized broader references. On the other hand, this laborious operation was also possible thanks to an appropriate transparency mechanism of GPT, which often cites the documentary sources used.

In general, the AI-generated scenario building (AISB) process provided apparently coherent scenarios from a logical, formal and even substantive point of view. The extent to which the contents generated can have real relevance in a decisionmaking and urban planning perspective is indeed a problem yet to be duly explored. In the following chapter some conclusions will be drawn in this regard, also in relation to the comparison with the SB processes carried out so far and partly shown in the previous examples.

4 DISCUSSIONS AND CONCLUSIONS

The overall objective of this work is to explore multi-agent knowledge exchange and management architecture systems to support informed decisions. The paper was oriented to explore the potential usefulness for decision making and spatial planning of a future SB process using artificial intelligence. The work first briefly framed the scenario building methodology within a spatial planning area of interest. Subsequently, some reflections were reported regarding experiences made by our group over the years on the construction of scenarios. Finally, an experiment carried out with the GPT Copilot module was reported, to lay out an SB process through artificial intelligence (AISB).

First of all, it must be said that the current evolution of the GPT model uses a natural language processing module, which is also interesting from the point of view of the logical articulation of the levels of expressed content. In fact, the depth of the responses in AISB appears to be sufficiently significant and not superficial. It appears (generally) consistent with the context of the question and with the profile of the simulated agent - although often (but not always) decontextualized with respect to the places and tending towards abstract contents. On the other hand, in SB the answers are not always significant and profound, not always coherent with the context of the question (the cogent interest of the agent can lead to digress) and often rooted 'in concrete feet' on localisms of small scales. In this regard, the '0' stage of critique, born with the psychological objective of exposing the critical issues of the area that weigh on the agent (with the aim of circumscribing them and allowing the subsequent imaginative stage to emerge without burdens), obviously does not doesn't make much sense in AISB which is pure documentary simulation. This stage was therefore retained only for the comparability of the approaches.

From a procedural point of view, a complete real SB takes a long time (our experiences report an average of 2-4 days), while AISB takes a few hours to manage and organize the responses. Here, however, it is necessary to remember that in AISB the frequent contextual, semantic and/or substantive inconsistency of the answers implies manual reiterations from the outside to calibrate the question-answer cycle so as to find the question asked in a coherent way (but how much does the inevitably interpretive force of such external incursions impacts on this cycle?).

From a substantive point of view, both SB and AISB approaches manage knowledge with relevant levels of complexity with the aim of attributing (future-oriented) degrees of structuring to the processed databases. However, the usual SB activities manage real interactive multi-agent knowledge, while this AISB experimentation represents a simulation of multi-agent cognitive elicitation by GPT - with the help of an external knowledge engineer. While real SB collects and exchanges a database of original and differentiated (real multiagent) knowledge, AISB collects and adapts pre-existing knowledge, reinterpreted through machine learning protocols.

These circumstances are both relevant to the topic of decision support systems - which is the context of this research. In fact, AISB could apparently act as a DSS, being able to manage a dynamic construction of scenarios in real time (albeit with an external step-by-step control of the congruence of the question-answer cycles and related problems of the interpretative filter, as mentioned before). Yet remains an intrinsic problem of knowledge fed and updated casually, pre-existing, formal, traditional, perhaps trivial and obvious. There are no sensations, emotional aspirations, knowledge constructed cognitively and not statistically - that is, everything that makes a participatory interaction important and intriguing is lacking (Chen, et al. 2020, Iwaniec, et al. 2020). With AISB formulated as in the aforementioned case, there is the risk of constructing biased scenarios detached from the real prerogatives of the community agents.

In the end, it may seem that this work opens up more questions than it would like to answer. The research assumption itself may appear artificial, since SB was created to enhance the role of multi-agent cognitive participation, while AISB is a formally similar process but without the same prerogatives. Perhaps more precisely, AISB could fall within the statistically inspired exploration methods of scenarios and trends, with a more structural focus on complex knowledge. The context in which it develops, however, is an extremely open framework in continuous, tumultuous technological evolution. The knowledge on which an AI-based system currently draws is now also moving more structurally towards integration with dynamic sensory databases and towards external, multisource and multiagent knowledge (Tafferner et al. 2023). Even the organization of the knowledge base could benefit from models that are more markedly conceptual and relational rather than essentially stochastic (Bateman et al. 2010, Palagin et al. 2023).

From these emerging dynamics an AISB could draw more relevant operational significance in terms of complex knowledge, raising its level of contribution towards a DSS architecture. Our group's lines of research will be oriented towards this direction as a follow up to the present work in perspective.

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