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Article

The Ways of Informatization in Foresight Activities: Informatization in Foresight

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Abstract

The study deals with the new wave in the life cycle of foresight activities. It is associated with the new info-communicational technologies (ICT) and the artificial intelligence (AI) applied in wider and wider range of every field in social life. It makes difference between digitization and informatization. It highlights the ways and main characteristics of foresight activity during which the informatization of the whole process is carried out and it becomes an online real-time and interactive activity. This process will be underpinned by the analysis on the measure of informatization of examples from foresight research and practice.

Keywords

Digitization, Informatization, Foresight, Real-time tools, Online futures platforms

Introductory Thoughts

The paper deals with the new wave in the life cycle of foresight activities. That is, the spreading of foresight activity in an online and interactive style. It is associated mainly with new info-communicational technologies (ICT) and the rise of artificial intelligence (AI) applied in a wider and wider range of every field in social life. Of particular importance are the increasing quantity of easily accessible digitized and digitally produced databases and the software developments that can be used to enable communication, decision making and foresight processes online.

These online opportunities need to be exploited in a rapidly and chaotically changing social environment – for example, global climate change, the danger of newer pandemia and wars, the instability or crisis in some regions, spreading biotechnology and forming different solutions in recycling economy – affecting all inhabitants of the Earth in a growing uncertainty of the future in the present. For this reason, the technology underpinning foresight work needs to be upgraded. This modernization includes the development and dissemination of futures literacy among people in different types of societies, the use of advanced foresight techniques for dealing with uncertain futures in the preparation of professional decisions, and the cooperation of an ever-wider range of decision-makers and stakeholders in shaping futures at global, regional, national and local levels. To this end, one of the main tasks for futurists and foresight specialists is to develop online and interactive foresight methods, processes and platforms on different futures topics that are accessible and usable by everyday people and experts of different levels alike.

This paper intends to contribute to a deeper understanding of this task and the ways to solve it, recognize its social importance and accelerate its solution. To this end, first the difference between digitization and informatization is defined. Then, the paper highlights the ways and main characteristics of foresight activity during which the informatization of the whole process is carried out and it becomes an online real-time and interactive activity. This process is underpinned by analyzing the criteria and measure of informatization with some case study examples from foresight research and practice in the context of real-time and multiple interactivity characteristics of foresight processes. The conclusions drawn from the historical analysis of the development path taken to date hopefully will help to formulate further development directions and tasks in this area.

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Definition of Digitization and Informatization

Digitization is one of the basic categories of informatics. The Collins English Dictionary defines the verb digitize means 'to convert (data) to digital form for use in a computer' on the one hand and 'to convert (analogous physical measurements) to digital form' on the other hand. Digitization is therefore the process of making a physical quantity (text, figure, image, photo, moving pictures with space and time dimensions about events and stories etc.) processable on a computer, i.e. converting information that has appeared on another medium into a computer-readable, encoded form. The transformed information is then used for further information processing operations.

Informatization is not a category of information technology, but is rather the emergence of a set of new social relations that use emerging ICT – the tools and technologies needed for digitization and for the further transformation, processing and storage of digital information of different types – is becoming widespread in such a way that it changes the way the fields of exploitation operate is fundamentally changed (Nora & Minc, 1978, Hideg, 2009). In other words, it is no longer simply a matter of working with digitized and digital information; this new form of information also brings with it new possibilities, uses and ways of working in different fields of application. The development of informatized areas and their interconnectedness will together lead to the emergence of a new and modern information society (Kim, 2004) or an interactive or network society (Castells, 2001, Castells & Cardoso, 2005). As Kluver writes:

> By informatization, I refer to the process primarily by which information technologies, such as the world-wide web and other communication technologies, have transformed economic and social relations to such an extent that cultural and economic barriers are minimized. (Kluver, 2004, p. 427)

An essential element of the definition is the complex change that will result in the breaking of traditional cultural and economic boundaries. It is therefore in the interest of both disciplines and other social activity systems to adapt to the use and development of these new technical, information and social technologies. This shift can be characterized as generating a revolution in users' applications as dimensions of interactivity are emerging to provide humanity with capacities it simply did not have before (Paulin, 2019). This process has also been observed in empirical research (Roblek et al., 2021).

The difference between the two categories has been emphasized, although their interconnection and interdependence can also be observed. Without digitization, informatization cannot take place, and the goals and forms of informatization that have already been achieved will influence how and in what directions digitization develops.

This paper focuses on the forms of informatization that are implemented only in foresight and its specificities. It touches on digitization only insofar as it is necessary to describe the process of informatization. Execution of informatization needs advanced ICT infrastructure that can use advanced digital service platforms for different purposes, aided by AI and new human users' competencies – especially information and futures literacy, ethical and legal sensibility – that enable people to act purposefully, effectively, responsibly and ethically in different interactive dimensions.

The Case Study Approach

Background

I have been working in the futures field and foresight for more than 40 years and have experienced drastic changes in the way I and other futurists deal with 'the future' during my research career. Initially, we used small-scale, manual, crafted methods to calculate trends, correlation and regression relations of different future components and write essays on development tendencies and possible futures. Later, futurists tried to foresee patterns of possible futures and explore future alternatives using different software packages and computer model calculations. Today, I find that almost all foresight activities involve ICT and AI to some extent.

My personal theoretical-methodological experience in postgraduate study and practical foresight experiences since then (Hideg, 2002, 2007, 2009, 2013, 2015), my learning processes and the changes in my research habitus

have generated this topic to explore how to systematize the changes in the purpose, approach, methodology and processes of foresight, as well as in the skills and abilities of a futurist's personality.

The paper draws on previous postgraduate study, and my experience in curriculum development and teaching futures studies and foresight in master and doctoral programs at the Corvinus University of Budapest, and my participation as an expert in the Millennium Project in two cases. This paper expands on the experience with the Project to present further personal experiences with other platforms to explore IT advances in recent applications and provide a comparative analysis of these applications, grounded in similar research results in the literature. The paper is, therefore, a progress report of current findings and can only provide a first and rather sketchy picture of these changes generated from a series of cases. This is not a formal research study therefore, rather it aims to stimulate others to think about this topic and consciously self-reflect on how it will affect foresight processes.

Identification of case studies

I conducted a historical analysis of the changes induced by the use of ICT and AI in the practice of foresight since 2020 after formulating a hypothesis: that foresight activity would become an online real-time and increase interactive activity, which implies not only the use of ICT and AI and digitization, but also that the informatization of foresight processes, namely a complete transformation of the way foresight is carried out in these years of 21st century.

I tested my hypothesis by undertaking an analysis of several platforms, followed by a detailed comparative analysis of the case studies that represent fundamental changes in the practice of foresight. I identified both the main components of informatization in foresight and carried out 'a deep dive' into the selected case studies to reveal their components and the changes and enrichment that characterize them. The case study platforms were identified by the following categories:

- the extent of digitization,
- the ability of the foresight activities to inform decision-makers,
- the range of participants involved in foresight activities,
- the role of the foresight practitioner,
- the speed and updatability of foresight activities, and
- the range and extent of interactivity provided in a range of existing platforms.

Using the above categories, the following platforms were identified: Real-Time Delphi Questionnaire developed by the Millennium Project, the website of JAVA Climate Model, International Futures Platform, Futures Platform, Asana Project Manager Platform, ChatGPT Foresight Navigator, Scenario Planning GPT and Frog Design platforms. All are based on AI applications, and each is discussed below.

Results

Online Real-Time Delphi Questionnaire

Process

The process of generating and collecting future information was developed and is used by the Millennium Project (https://millennium-project.org/), a global participatory think tank organization founded in 1996 under the supervision of the American Council for the United Nations University, and in many ways, bridges the gap between traditional and global and computerized world modelling. It was created to bring together, manage, and develop the world's global future intelligence through a Delphi Method, which only allows renowned and well-known futurists and experts in specific fields to participate. Everyone in this circle can participate according to their willingness and competence in exploring the possible futures of a topic that is currently affecting the world. The Millennium Project became independent in 2009 and now has 72 global nodes composed of globally renowned institutions that are engaged in futures studies and foresight. Currently, the organization encompasses 66 nodes and 6 regional networks.

The Project now uses the online Delphi method and usually starts with an online real-time questionnaire, which can be completed by participants during a given time interval. It is to modify their responses by studying the future ideas of the other participants. The questions are focused on either trend extrapolations based on the available quantitative information or providing a possible text response to each future problem in the questionnaire and asking for the participants' future ideas on it (Glenn & Gordon, 2009). Once the collection of future ideas has been completed, the main futurist experts organizing the project will produce scenarios based on the responses on the possible future of the topic under study.

The production of the final study is regarded as foresight activity with a report then made available for use within the United Nations and to be purchased by interested parties. In its more than 20 years of operation, the Project has produced and collected nearly 1000 scenarios, which can be easily updated whenever global events require it. The Project follows the same procedure when producing The State of the Future Index with both a global focus and for individual regions and countries of the world via the involvement of its nodes. The nodes are made up of renowned regional institutions that are engaged in futures studies and foresight.

Comments

An overview and analysis of the methodology of the Online Real-Time Delphi Questionnaire shows that it has made significant progress in the field of digitization, both in terms of computationally generated and textual futures information. Both types of future information are further processed in digitized form in an internet-generated virtual space with futurist participants and experts in an intensive online communication process.

This method brings informatization to the fore. Futurists and experts from all over the world can now participate in exploration of possible futures in virtual space. The processes of digitization have also adapted to the shift in foresight theory and methodology over time, whereby they explore future possibilities and help shape the future. In this case, a small number of foresight experts organize and facilitate the foresight process, providing the software and hardware background and input information, while others are involved as futurist experts in the process together with subject matter experts. This virtual methodology allows flexibility in adaptation for different subjects and for the same subject to be reproduced quickly and in the same format. In both cases, future alternatives already developed during previous work can be used as input. In this way, applying this methodology can ensure up-to-date future information is almost always available.

The methodology includes a wide range of interactivity. There is an interactive link between future information and databases that are already available and those that have already been produced, as well as new future information that is generated and evolving online and in real time in the virtual space. The main organizer of the interaction techniques is the interoperability of the internet and ICT tools. However, there remains a traditional form of interactivity, which implies direct and/or personal interactivity of the futurists who produced the final study.

The learning process plays a key role in the application of methodology. By allowing participants to inform themselves about other participants' perceptions of the future, participants themselves learn and teach by expressing and shaping their own ideas. In this way, the learning and teaching process becomes transversal in space and time.

The Java Climate Model, the Scalable World Interactive Model and the International Futures Platform

The Java Climate Model

The Java Climate Model (JCM) (https://jcm.chooseclimate.org/) is a quantitative and interactive model of the possible pathways of climate change over the long term. The interactive model was created by the Earth and Climate Research Centre in Catholic University of Leuven (TECLIM CU Leuven) and supporting by the Belgian Science Policy. The website has been maintained and updated since 2000. It is based on the IMAGE model system (Alcamo, 1994). The model can be manipulated online by selecting input variables and scenario types. Scenario types are aligned with the 4 scenario types defined in the IPSS report (Climate Change 2001, 2001). The model will produce climate change results within a short time after the selection of the input variables and scenario types, according to the conditions selected by the user.

The computer models model climate change in an interconnected system of population, economic and social

change. The main indicators are methane, nitrogen dioxide, carbon dioxide emissions, population, GDP, GDP at purchasing power parity, GDP per capita and exchange rate per country, annualized and from 1950, except for population, which is used from 1700. The number of variables in the model is around 200. Projections can be made up to 2100 for 15 regions and the planet. After selecting the input conditions and the regional unit (sometime country can be selected if it is very big), the model performs the calculations offline and displays the results to the user in tabular or graphical form.

The model can be used at 4 levels considering the users' level of knowledge. The lay person level requires no prior training but can be used immediately by selecting the input conditions. The normal level provides both an interactive visualized map and documentation as output. The expert level allows modification of input data and calculation scripts. In addition to the above, the developer level also allows modification of the tree describing the internal relationships of the model.

The model is user-friendly because it supports 11 languages, needs only a laptop, is free and can be used by anyone. This allows users to confront the potential dynamics of climate change quickly and to detect how sensitive climate change is to human activities. The model should therefore be used mainly in education, but the expert and developer levels are already capable of generating new research results.

Scalable World Interactive Model (SWIM)

The renewed version of JCM is the Scalable World Interactive Model (SWIM) developed by Metthews (2023). Its aim is to allow users to explore future development paths that are sensitive to policy decisions and scientific uncertainties in a web browser. The enhancement is very significant because the developer is using a new language, Scala3, and the model database will start from the year 1750 and runs until 2250. In the area of interactive modelling, a further development will be that the user can apply the model to regions of large countries as well as to small countries, i.e. users can zoom in and out of the model and out for their purpose. In addition, the developer is looking forward to suggestions for further development from experts and futurists. The improved website will also be freely usable by all, but the developer will give priority to the educational use of the model.

International Futures Platform

Very similar to JCM and SWIM is the International Futures Platform (IFP) because they are all concerned with the possibilities of the global future. While the JCM does this in terms of climate change, the IFP does it in terms of human well-being and showing potential global problems. The IFP was created by the Pardee Center for International Futures Institute at the University of Denver and founded in 2007. The website is currently hosted by the Josef Korbel School of International Studies (https://korbel.du.edu/pardee/content/international-futures-platform).

The website aims to project quantitative possible futures of the world's major regions and individual countries online and interactively. It is also a world model that deals with the dynamics of natural, economic social and human processes and their interaction in a system of models for human well-being (Hughes, 2019). Its database consists of hundreds of indicators from 186 countries around the world. The database runs from 1960 to 2100. The offline model calculations are capable not only of trend extrapolations, but also of generating stand-alone quantitative scenarios, whose conditions are specified by the user or by selecting the scenario of interest from among those offered by the structured tree method run by the model. By running the model, complex quantitative forecasts and scenarios can be generated up to 2040 or 2100 based on a continuously updated world database.

The website is primarily designed for educational purposes but is also suitable for commissioning research. Quantitative scenarios produced using the website can be downloaded and downloaded scenarios can be discussed and written up by students/users in a workshop to further develop by adding new conditions to the model to repeat the preliminary calculations. An interesting feature of the IFP is that it also provides guidance for classroom sessions. The model can be used online or downloaded to a computer. However, apart from English, it only allows the use of Portuguese.

Comments

All three websites run a digitized integrated model system in the background. Simulation results are also digitized and can be displayed in a data-driven visualized and mapped format. In the case of these websites, digitization is also subordinated to serving user goals, i.e. informatization. The model systems can be used to produce quantified scenarios according to the user's ideas. The staff (IT specialists and modelers and futurists) who run the websites regularly maintain the model systems, the databases and the interactive interface.

The two websites operate different model systems for different uses. While JCM focuses its modelling on global and regional climate change, SWIM and IFP focus on global regional or country social well-being. The potential range of users is also different. In the case of JCM and SWIM, four different types of users can use the website for their own purposes. For IFP, the potential users are not defined. Lay people can also use it, and competent users can make a more considered choice of scenarios and define their main characteristics with a higher level of background knowledge.

The interactions are very similar in offline working and the user's relationship with the website in the case of both websites. Also similar are the learning processes generated in the offline processes between computer scientists and modelers and futurists. However, there is a significant difference between the two websites in the generation of the learning process. In JCM and SWIM the learning can only occur between the website and the individual user, whereas in IFP the learning can be complemented by group interpretation and evaluation of the results in a workshop or a classroom session, for which the IFP provides the supporting material. In this way, it is also possible for members of the group sessions to carry out further model calculations on the website based on the knowledge acquired. It should be noted that group learning and feedback can be linked both to the JCM and SWIM for re-running model calculations but that is not part of these websites.

Futures Platform

The Futures Platform (FP) (https://www.futuresplatform.com/) has been operational since mid-2010 and is essentially a qualitative verbal and online futures modelling website. It is run by a Finnish-majority international community of futurists and was created with the aim of being a repository of foresight intelligence. To this end, the website collects and organizes a wide range of global regional and local trends and scenarios, makes them available to experts, decision-makers or citizens who wish to use the website, and evaluates and discusses them to draw conclusions and develop new scenarios for the future. Users can solve their own foresight tasks with the help of futurists and in a participatory way and leave their own possible futures and scenarios elaborated in the website database. FP is largely free to use, but for larger-scale tasks it is paid for. It is open to registered users, who also have the possibility to write a blog. The blog also acts as a form of feedback for the website operators.

The multipurpose strategic foresight website can provide services to practitioners in the following areas: automotive and mobility, consumer goods, data and digitalization, defense and security, energy, finance and banking, food and agriculture, transport and logistics, health and pharma, education, urban planning and construction. The 5-to-20-year time horizon is used for foresight activity, during which futurists constantly scan the changing world identify and analyze emerging trends based on the information accumulated by the website for tasks defined by users. Above them the website collects success stories in the areas that are regularly scanned, organizes webinars on changing topics and runs consulting services. It also offers forward-looking methods and tools (horizon scanning, trend analysis, futures workshop) for the users. Users participate in the selection of drivers, critical trends and in scenario building in the areas of their choice, empowering them to explore and shape their own future. In addition, futurists also offer traditional consulting services and to make complete foresight services.

Users are mainly from the business and public sector, and the FP aims to provide ongoing help and support for strategic planning, innovation, product and risk management for businesses and other organizations. As the website grows in serving its users, it also grows in accumulated knowledge about changes and potential futures in the areas scanned and in the scope of the areas to scan and analyze, as well as in online foresight creation expertise.

The FP’s content system is ever-expanding, translatable into 15 languages, and provides an increasingly global service, both in terms of content and users. The service is provided by the foresight analysis team who also run the website. They are well-trained foresights experts who understand not only foresight methods and tools, but also the specificities of the 11 areas of change they are involved in. They collect digitized information on the past, present

and future of these complex fields, mostly consisting of qualitative text, contextual diagrams, and flowcharts. This is the basis for the online service of the website.

The service can be either a traditional information and consultation service, or a service that actively involves the user by using interactive online tools. The service provided will also be presented in a digitized form and will be composed of possible development paths and scenarios in a specific field. In this way the FP will be able to provide a continuous personalized strategic foresight service, serving both global and local levels, and their interrelationships.

The website is theme-oriented and user-friendly, i.e. its structure and operation are determined by the computerized service delivery objectives. This is why the team of professional futurists is in the center of the foresight activity. The team uses some basic foresight tools and analysis and develops possible futures involving users in this work of exploring future possibilities. This ensures that the website not only formulates the future of an area in general terms but can also do so for the future of the business or public organizational clients. IT specialists are also important actors on the FP providing the working and communication links between professional futurists and business or other institutional users.

The platform operates quickly. The use of 15 languages allows users from all over the world to easily access foresight services and, because of feedback on foresight results and the incorporation of new future information obtained from outside the platform into the platform content, it is worth returning to the platform from time to time or monitoring it continuously as the platform content becomes richer and richer.

By providing online and user-engaging services, the interactivity in FP becomes more diverse. Interactivity between ICT tools, computers, IT and futurists and users will be achieved simultaneously and in alternating combinations via the internet. This interactivity also generates a learning process both between the human actors that make up the network and between the ICT tools and human actors. Both interactivity and the learning process serve the goal of providing online services that shape the future through foresight tools, independent of time and space, and personalized.

AI as an informatized foresight research generator

Asana Project Manager platform

COVID-19 has acted as a wild card in the development of foresight informatization. It has made the use of ICT more common in many areas of life, especially in higher education and in the context of homeworking in scientific research, which is important in this study. Related to this, the use of Google Teams (https://meet.google.com/), Microsoft Teams (https://www.microsoft.com) and other platforms for organizing and connecting different intellectual work has become widespread (Qiu, 2020; Zhang & Zhou, 2023).

The Asana Project Manager platform (APM) (https://asana.com) is well suited for foresight research assistance by automatically organizing strategy formulation and implementation as well as research processes, allowing for collaborative and shared work online and offline, documenting all work phases and contacts, correspondence and reporting. (Gáspár et al., 2023). For my research, APM was used in the care of The Futures Literacy Company (4CF) (https://4cf.eu/). The platform was easy to use, and it also allowed the integration of online Delphi and literature processing results into the platform. The platform was upgraded in 2024, which means the addition of an AI application, which sees AI as a teammate, a new type of participant in the project process (https://asana.com/product/ai).

Using other platforms in higher education and research, not only has their interactivity been accelerated, expanded and generalized across space and time, but significant advances have been made in the creation of new AI-enabled or AI-based foresight software packages and platforms. Among these, I briefly evaluated the ChatGPT Foresight Navigator, Scenario Planning GPT and Frog Design platforms.

Chat GPT Foresight Navigator

ChatGPT Foresight Navigator (F-GPT) (https://chatgpt.com/g/g-aD5CJJaxp-foresight-navigator) is part of the AI-based ChatGPT platform that has been operated and developed by the OpenAI company since 2022. The platform

consists of different sub-applications that can be used interactively. Each app follows the foresight process, i.e. it includes a section to explore and discuss changes, followed by a consensus search app to review scientific literature, and then a scenario builder app. F-GPT is all about communicating with the user quickly and in a way like human intelligence. It allows both the chatbot and the user to learn from the questions and answers in a series of questions. In addition, the platform presents further application possibilities, of which visualization deserves particular attention. The platform is free but has a time limit per user per day.

Scenario Planning GPT (SP-GPT)

The Scenario Planning GPT (SP-GPT) (https://chatgpt.com/g/g-JLTtsBpmR-scenario-planning-gpt) is also structured similarly to F-GPT, but this platform is more practice-oriented than F-GPT. It starts by asking 'What industry are you interested in doing scenario planning for?' and then proceeds to create and plan scenarios for the given topic. This is also free.

Comments

I have tested both platforms personally and with students and have found that the questioning technique, background knowledge and creativity of the user who asks the questions largely determines the scenarios the platform creates. Generally, the scenarios are short and sketchy, although they may have a literature backing, and there is no problem in increasing the range of scenarios the platforms can produce. The scenarios provided by the chatbot must be evaluated in a collective team effort and a decision must take on the direction of scenario building work, considering the objectives set. The negative experience can be summarized in the fact that users who do not know the logic of scenario building that logic remains hidden in the whole process, as well as the role that platform developers intend to give to AI applications.

For the time being, it is more realistic to think of ChatGPT platforms as part of a useful research assistant that is fast and understands and can perform the task given to it.

Frog Design

Frog Design Part of Capgemini Invent (FD) (https://www.frog.co/designmind/reframing-strategic-foresight-in-the-age-of-ai-and-algorithms) is a business-oriented foresight platform that openly embraces multi-purpose and large-scale use of AI. FD is an interactive application that supports enterprise strategic foresight in the development of growth, innovation, sustainability, commercial or startup-related scenarios and their AI-based generation, scenario planning and monitoring.

To deliver this wide range of new services, FD promises to reframe strategic foresight. The platform will present the service context in the insight section and specifically highlight the way it uses AI (https://www.frog.co/designmind/reframing-strategic-foresight-in-the-age-of-ai-and-algorithms). It should be highlighted that FD's stated goal is to apply AI to strategic foresight, expanding the innovation and opportunity space and accelerating the day-to-day knowledge in the business domain. It points out that the application of AI is neither problem-free nor perfect. The platform follows the principle that culture is paramount in human-AI collaboration and that data interpretation should be based on contextual understanding. The user should interpret and apply the results generated by the service provider and AI. The FD can be contacted by e-mail in English or French.

During the trial, the contact and response was very fast, the formulation of the task was a bit cumbersome, but afterwards a lot of information was provided by the FD. I found that only after that the difficulty came, because I as the user had to interpret the huge amount of data in the topic I formulated. A person can get lost in this, but if the user is a company, then it can be easier for a corporate team of specialists to do this interpretation and adaptation to the specific company.

Discussion and Comparison of Platforms

The case studies analyzed show the wide range of both digitization and informatization in foresight research over more than 20 years. The JCM, SWIM and IFP interactive websites develop world modelling but can also reflect on the problems of our present world by providing target variables for climate change and human well-being, respectively, and alternative possible scenarios. All operate model systems built from sub-systems of world-wide models that can now be simulated in an interactive form. This is a way of realizing time informatics (Pitlik, 1995). In both, the interactivity and learning process of the platform and the user is paramount. The goals of informatization have made it possible to use the results of digitization in a targeted and user-friendly way. Neither site can be considered as definitive since they are under continuous development.

While the main goal in the development of JCM is to make the model system scalable, its SWIM version's aim is to allow users to explore future development paths that are sensitive to policy decisions and scientific uncertainties in a web browser. In this new version, SWIM is particularly helpful for users in small countries, as it allows them to produce country-level foresights that can be presented in their wider regional and global context at the same time.

The IFP could be further developed towards multilingual accessibility, as it is currently only available in English and Portuguese. The integration of the already implemented teaching aids into the website could contribute to the development of the website by providing feedback on the teaching experience.

The further development of both JCM and SWIM and IFP from a user perspective would help to improve their informatization if all users had the opportunity to express and discuss their experiences and further needs regarding the use of the website and the application of the results, either through blogs or other feedback forms on both websites. Without this information, it is impossible to assess the quality and practical usefulness of interactive foresight websites at a time when more and more similar services are appearing on the internet. From a research point of view, it would also be important to develop a system for comparing and evaluating interactive foresight websites, setting up a minimum rating system for the range of websites that can be recommended for different uses as it was offered in the case of Delphi method (Landeta & Lertxundi, 2023).

FP monitors trends and changes in 11 themes, from which users can create scenarios for their own purposes. It is self-improving because it continues to expand its information base. In addition, the staff intends to improve the website's services. The direction of development will be, according to the developers, a stronger use of AI. Their philosophy of using AI primarily as a scientific assistant is noteworthy, i.e. they want to continue to put digitization into the service of informatization. The application of AI will take the form of a new search engine and a 2 axes interactive and online scenario building tool (Plan for FP). These two tools will facilitate and accelerate trend analysis, the generation of scenario variations and timeline paths through the exploration and analysis of a growing range of future content on the web. Of course, the work of users and futurists will continue to be necessary even with the use of AI. This line is supported by other research findings. Pratt, Bisson & Warin, argue that the scientific results of human intelligence for decision making and AI-assisted data processing should be combined in an integrated framework, in which human intelligence should play a dominant role at the decision points. The conditions for this can already be met from the data science side (Pratt et al, 2023).

Furthermore, it is already known that there are results in scenario building that use AI while keeping the human actor group actively involved in the scenario building process (Retek, 2021). In this prototype level development, the built-in AI guards the collection of an increasingly complete and non-overlapping set of driving forces and the correctness of the axe's selection logic. This built-in AI utility also teaches participants to understand and follow the rules of text writing of scenarios, even if they have never been involved in such a process before. In addition, the AI also performs analysis and evaluation of the texts of scenarios from the aspects of their inner consistence and the internal logic required by the axes of the scenarios (Retek, 2023).

The Millennium project's real-time online questionnaire as a website tool has been used effectively for many years and for a wide range of tasks. The internal communication between users allows not only simple processing of the questionnaire answers, but also the creation of complex thought maps and/or future alternatives. This digitalized foresight tool is complex, even in its current form. It also uses AI and feedback within a process ensures that the process can be further developed and is repeatable.

In APM, it is an exaggeration to predict that AI is a tool for project management. Based on my experience so far, AI is currently only a very useful research assistant. A similar perception is held by the FD application. On the

contrary, F-GPT and SP-GPT unfortunately do not comment on the context of the service they provide, nor on the trustworthiness of AI as a product.

Finally, the use of these platforms for foresight in higher education and research is on the rise. At the institutional and enterprise level, however, these types of applications are still scarce (Ködding et al., 2023).

Other Platforms

The use of AI-applying foresight platforms is expected to continue to expand and there are a growing number of new AI-powered foresight platforms – for example, PreEmpt, Imagine Your Tomorrow (https://www.preempt.life/), Shaping Tomorrow (https://www.shapingtomorrow.com/, NEXTATLAS (https://www.nextatlas.com/foresight/ai) and 4CF developed applications (4CF Flex, 4CF HalnyX, 4CF Pnyv and 4CF Stranger Futures (https://4cf.eu/)). These platforms should be tested continuously before application, especially in terms of the context in which they use AI and what they use AI for.

As noted in previous sections, however, the adoption and use of any AI platforms requires learning and the acquisition of new ways of working by foresight specialists. A fear that machine intelligence can only be mechanical and stifle the creativity of human participants must be overcome. The best antidote to this is for the foresight specialist to gain an in-depth understanding of how software and AI applications work and impact on human participants, and how machines and human intelligence can work together and learn from each other in solving a foresight task. As the platforms applying AI – F-GPT, SP-GPT and FD – can be used with a human-to-platform language communication, it should be possible to transfer future information acquired there to platforms that allow group discussions and presentations, so that participatory foresight processes can be activated. I hope that with this experience, new integrated types of foresight platforms could be developed, and all foresight tools can be informatized and digitized.

A development path?

The presentation of the cases in chronological order can be seen as a development path. First, the exploration of wide range of future possibilities based on quantitative modelling and the gathering of qualitative future options and ideas became digital. When foresight also realized that the human factor was playing an increasingly important role in shaping the future, the trend towards foresight and its participatory cultivation came to the fore. This period started in the end of 1990s (Hideg, 2002, 2009, 2015; Gidley, 2017). The digitization and informatization of foresight started in the years around 2000, and since then there has been the development, emergence and popularization of foresight AI websites. This has involved the digitization of both quantitative and qualitative information, and its subsequent production, processing, and availability on the internet in digitized form. As AI applications make possible human-like communication in interactivity, the spreading of AI in foresight applications opens a new stage in its informatization.

As it has been seen under the subheading definition of categories, informatization was first conceived as a future concept and gradually separated from digitalization. Today, however, both categories and their interdependence are the subject of the design of online websites, and their implementation is also the subject of analysis and further development. The characteristics of the components of informatization are becoming richer and more consciously developed with the emergence and further development of interactive online websites. The solutions and development goals of more than 20 years or so have not yet exhausted the potential of digitization. A strong and targeted integration of AI solutions into informatized foresight activities is still an exciting research challenge.

The Dangers of AI in Futures Practice

The recommendations produced by Policy Horizons Canada, the government of Canada's center of excellence in foresight, are very important for foresight specialists who support the use of AI and consider it important in shaping future perceptions. Their recommendations draw attention to the benefits of AI and the dangers of non-transparent AI applications (Rigillo, 2023), Among the benefits, the widespread and rapid generation of new content, text, images, video, audio and synthetic data is highlighted – these enable the new generation of future-oriented mindsets

and outlooks and their applications in foresight activities for decision making at every level of life. But people will need to develop new competencies in AI and AI aided applications to achieve these benefits.

Policy Horizon Canada sees the main dangers as, first, the lack of knowledge of the deep learning process and database of AI software, which may lead to an over-representation of certain cultures and perceptions available on the Internet, while others may be absent because they have not yet been digitized. Second, the lack of knowledge of the content of the deep learning process also raises the possibility of privacy rights and ethical norms being violated. These issues are also permeating the process of AI applications, which may suggest false futures. Therefore, it is considered imperative to evaluate and further develop AI-generated future images and scenarios in a live or online participatory process led by foresight specialists. The validity of this assertion is confirmed by my personal and foresight education experience using AI foresight platforms mentioned.

Conclusion

Digitization and informatization have entered foresight practice since the turn of the millennium. The selected case studies support the hypothesis that informatization provides the framework for user-friendly application of digitization in interactive online foresight platform solution and guides further developments. These platforms are oriented towards increasingly versatile interactivity and speed and ease of use, and encourage active participation and learning by users, including lay people. They also indicate the development of AI in foresight, together with possible paths for further development.

The solutions represented by the case studies are currently mainly for research and educational purposes but also offer hope for the application and uptake of foresight in service delivery. In doing so, the foresight specialist and manager will need to be involved in the whole process of informatizing participatory foresight activities, and in the development of applicable and critical solutions for digitization, in particular AI as well.

Informatization in the case of foresight means that foresight activities can be placed in cyberspace more widely and deeply using different service platforms backed by AI. Its development and use depend on the extent to which competencies in information and future literacy of foresight specialists, civil users and potential stakeholders are currently developing. At the level of present development, AI can only be a useful research assistant, and foresight specialists and other human participants in processes must have the possibility to revise or control AI activities and must facilitate human stakeholders' activities in those processes at the same time.

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Conflict of interest

The author declares that there is no conflict of interest.

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