Glenn, J.C. (2009, March). Some Long-Term Issues for the Pharmaceutical Industries and methods for bringing them together with government and the public. Power point presentation. Elementi per uno scenario farmaceutico workshop (author's note: Elements for a pharmaceutical scenario). Pescara, 21.

Hiltz, S.R., & Turoff, M. (1978). The Networking Nation: Human Communication Via Computer. Reading, MA: Addison-Wesley. Review in Hiltz, S.R., Turoff, M. (1993). The Network Nation, Revised Edition. Massachusetts: MIT Press.

Janis, I.L. (1982). *Groupthink*. Boston: Houghton Mifflin.

Krueger, R.A. (1994-2000). *Focus Groups: a practical guide for applied research*. 3rd edition, with Mary Anne Casey. Thousand Oaks, CA: Sage publishing.

Lévy, P. (1994). *L'intelligence collective. Pour anthropologie du cyberspace*. Paris: La Découverte.

Linstone, H., & Turoff, M. (1978-2002). The Delphi Method: Techniques and Applications. Reading, Mass.: Addison Wesley Pub. Co., Advanced Book Program. From http://www.is.njit.edu/pubs/delphibook/delphibook.pdf.

Owen, H. (1997-2008). *Open Space Technology: A User's Guide*. San Francisco, CA: Berrett-Koehler.

Pacinelli, A. (2004). *La Pianificazione Sociale Partecipata: approcci e metodi (author's note:* Participated Social Planning: approaches and methods). Pescara: Libreria dell'Università Editrice.

Pacinelli, A. (2008). *Metodi per la ricerca sociale partecipata (authors' note:* Methods for Participated Social Research). Milan: Franco Angeli.

Passig, D. (1993). *Reactions to Experts' Forecasts by a Group of Jewish Teenagers: An Imen-Delphi Exercise. An Applied Social Methodology. A variant of the Delphi Forecasting Technique*. Ph.D. Thesis. Minnesota: University of Minnesota.

Ranch, W. (1979). The decision Delphi. *Technology Forecasting and Social Change 15*(3). pp.159-69

Régnier, F. (1978). Une approche endoscopique du travail de groupe: l'abaque de Règnier. *Acta Endoscopica 8*(5-6). Paris: Springer. pp. 389-393.

Tapio, P. (2002). Disaggregative Policy Delphi: Using cluster analysis as a tool for systematic scenario formation. *Technological Forecasting and Social Change 70*(1). pp. 83-101

Turoff, M. (1970). The Design of a Policy Delphi. *Technological Forecasting and Social Change 2*(2). pp. 149-171.

Weisbord, M.R. (1987). *Productive Workplaces*. San Francisco/London: Jossey-Bass.

Weisbord, M., & Janoff, M. (1995). *Future Search: An Action Guide to Finding Common Ground in Organizations and Communities*. San Francisco: Berrett-Koehler.

Future of globalisation: scenario building hypothesis

Mara Di Berardo[1] & Antonio Pacinelli[2]

Introduction

Globalisation is often studied from a historical point of view, forcing to think about how we come to live in a world which is so interconnected and dependent from actions made by single subjects. If this historical dynamic is extended towards the future, there is the possibility to build scenarios about such topic. The scenario building gives a point of view which can orientate political decisions and actions, on the basis of normative scenarios influencing decisions into the present, and it is made by applying futures research with its orientated towards future methodologies.

Futures research is not a science: the results of a study depend on the ability people have to practise its procedures and on the methods applied, which can be qualitative or quantitative[3]. The aim of futures research is, in fact, helping to take better decision today, anticipating opportunities and strengths and considering the way to address them. It can be used to inform, to change priorities, to understand the present and to change attitudes because the forecasting activities can cause impacts on organizations and on the whole society in various ways.

If the objective is studying globalisation, aiming to define a planning project, it implicates the forecasting activity, and particularly the building of at least one normative scenario, exactly containing the *desiderata*, that is what is perceived as highly necessary or desirable. A scenario can be considered as an argumentation about possible futures and a research about the most probable one and its deformations[4]. Various scenarios classifications are given in literature, one of which, based on their aim, classifies them into

1 Corresponding author: mdiberardo@gmail.com.
2 Corresponding author: a.pacinelli@unich.it.
3 Glenn & Gordon 1989
4 De Jouvenel 1966

exploratory and normative scenarios. The exploratory (or trend) scenario is constituted by all possible images of future which are "plausible" with the present and it goes therefore from the present toward the future. The normative (or anticipative) scenario contains the *desiderata*, the images of futures to be pursued, and goes from the future toward the present. The combination between the exploratory and the normative scenario generates the project scenario, containing the *desiderata* which are plausible with the exploratory scenarios[5]. The normative scenario is very interesting in the public field because it can not only influence long-term governmental decisions and actions but also promote citizens participation when they are involved into the scenario building, giving the right importance to citizens desiderata.

Because the complexity of the globalisation phenomenon, the Pupils of Tampere Group has developed a research project with the participation of experts to various methodological applications, in order to investigate the theme and to define scenarios which can orientate decision-makers actions. The Pupils of Tampere can be considered as an international group, of experts coming from various universities and working together on the globalisation theme since 2001, when experts from La Sapienza" University of Rome and from the Tampere University first met in Tampere (Finland). Its principal aim is to understand how globalisation processes are perceived by people and its research objective is the individualization of possible social changes deriving from particular social flows influenced by "Globalisation", further trying to define policies to orientate the future of globalisation.

The Pupils of Tampere project is composed by three main phases which are following illustrated: an exploratory phase, where the terms globalisation, flows and governance of globalisation are defined and analyzed (par. 1); a system analysis phase, where globalisation is investigated by applying the structural analysis to define variables, actors and their objectives and to build a first scenario illustrating possible conflicts and alliances among them (par. 2); a third elaboration phase, in which globalisation trends based on historical data are redefined by considering events affecting them in the future (par. 3). In conclusion of the paper, a fourth phase is outlined, aiming to support future decisions by applying a Policy Delphi in order to define and evaluate policies based on *desirable* scenarios.

5 Pacinelli 2008, pp. 50-51

Pupils of Tampere exploratory phase

The first Tampere Group research activity was defining and executing an exploratory analysis of the globalisation phenomenon. During the first meeting in Tampere in 2001, positive and negative statements related to Globalisation were investigate by recurring to a face-to-face thematic clustering, putting on coloured post-it globalisation positive and negative aspects. At the end, post-its were clustered on each section of the board, collecting the ones referring to the same subject. The output was a global importance indication of positive and negative factors (in cluster terms).

Soon after, a *circle evaluation approach* was applied. Participants were invited to sign factors they considered important into three concentric circumferences, decreasing while going from inner to intermediate and more peripheral circumferences. Positive and negative statements were posed together, even if preceded by "+" and "–" signs when positively or negatively connected to the globalisation process. A textual analysis was conducted on the whole set of statements, identifying the more used lexical forms into the various textual corpuses by each participant.

Following to such meeting, 63 international privileged witnesses[6], as experts, academics, manager and administrators, were consulting by e-mail or fax in order to answer three questions dedicated to understand if globalisation has more positive or more negative aspects (question A), evaluate a list of preconditions and consequences of globalisation, ranking the ones they considered more important (question B), and eventually add questions or propose alternative aspects to the list. The results showed a generally positive overview of the phenomenon aspects and the following table illustrates the question B results.

Question Ba: Positive aspects – The following is a list of positive preconditions and consequences of globalisation. This list is not arranged by any particular order. Please, select the items you personally consider to be more important (not necessarily the entire list) and try to rank them accordingly to the way you feel.

6 Fabbris 1990

Issues	Position in the ranking															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	total
Ba1	2	1	1	1	1	2	-	-	-	-	-	-	-	-	-	8
Ba2	-	2	1	2	-	1	1	-	-	-	-	-	-	-	-	7
Ba3	2	3	-	1	-	1	-	1	-	-	-	-	-	-	-	8
Ba4	1	2	-	-	1	-	-	-	-	-	-	-	-	-	-	4
Ba5	-	1	1	-	-	-	1	-	-	-	-	-	-	-	-	3
Ba6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
Ba7	2	1	2	1	1	-	1	-	-	1	-	-	-	-	-	9
Ba8	-	-	2	-	1	-	-	-	-	-	-	-	-	-	-	3
Ba9	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Ba10	4	-	3	2	-	1	-	-	-	-	-	-	-	-	-	10
Ba11	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	1
Ba12	2	2	1	2	-	-	-	1	1	-	-	-	-	-	-	9
Ba13	-	-	2	2	2	-	-	-	-	-	-	-	-	-	-	6
Ba14	-	-	1	1	2	-	1	-	-	-	-	-	-	-	-	5
Ba15	1	1	-	1	-	1	1	-	-	-	-	-	-	-	-	5
Total	14	14	14	14	8	6	5	2	1	1	-	-	-	-	-	79

Table 1. Pre-conditions and globalisation consequences[7].

Soon after the meeting, each Pupils of Tampere member was asked to consult at least ten people in order to define the terms globalisation, flow and governance of globalisation and to list flows involved into globalisation. 109 privileged witnesses were consulted by choosing them among the group components acquaintances, paying attention to their fields in order to diversify them. It was asked to avoid the recourse to dictionaries, studies, researches and scientists works and to give an own definition by using terms based on their own languages because the objective was to obtain spontaneous and individual interpretation of the three terms.

A second meeting took place in Rovaniemi (Lapland) during 2005 and the theme was *Globalisation. Flows and governance of globalisation*. The number of participants was higher than in 2001 because many colleagues from the Rovaniemi University joined the procedure. During the meeting,

7 For an in-depth examination of this phase, see Camiz & al. 2005.

the experts were asked to show their preferences related to the previous list of definitions by making an open ranking of all the proposals received, therefore each component had the 109 definitions among which (s)he chose a certain number of variables. The chosen definitions were then ranked in order to define the first five voted ones, considering the evaluations. The procedure was the same for the three terms (globalisation, flows, governance of globalisation) and the results were clustered by homogeneous sectors (see the following table).

Cluster	Type of flow
Information, communication, news, knowledge flows	14
Education, training, skilled persons flows	7
Money, capitals, investments, financial movements, other economic issues flows	17
People, migration flows	17
Labour, work-forces flows	14
Production, firms and enterprises, marketing, commercial activities flows	21
Products, goods, commodities, foods flows	17
Cultural capitals flow	23
People mobility	5
Environmental issues	11
Immaterial issues	17
Social danger, security, criminality, drugs	8
Geographical shifting	10
Other	17
Not classifiable	7
Total	205

Table 2. Clustered globalisation flows.

Table 2. shows that the original 471 items were reduced to 205 different typologies of flows, which is a very high number denoting a remarkable sensibility by the respondents, who found many ideas outside the most recurrent meanings of the flow term.

Pupils of Tampere Structural Analysis

The second phase of the Pupils of Tampere project was applying the Godet's approach to realize scenarios, soon after having shared the working method and the previous exploratory phase results among the members. The Godet's approach involves the delimitation of the system from its environment by applying the Structural Analysis[8], which is really helpful to build a simplified image of the system on which the phenomenon, globalisation in the case, insists. Using the evaluation of a group of experts, the method allows representing the system by identifying its "key variables", subdivided into internal and external variables. The procedure can be resumed into the following three phases:

- System delimitation from the external environment and variables inventory;
- Relations among the variables description;
- Key variables specification.

On this base, one of the first Pupils of Tampere methodological steps was filling a list of variables sufficiently representing the system defined by globalisation and its flows definitions. The variables had to be sensible to globalisation and relevant for the future of the society. The respondents were the Tampere group members, therefore a small group of international experts coming from various scientific fields, who, basing on the previous steps of the research results, in depth analyzed the globalisation system. The members received the structural analysis questionnaire to list, in their opinion, variables, actors and flows composing the system and, in the meanwhile, to evaluate the inhibiting and/or incrementing effects on the flows generated by the variables. This phase produced 23 variables, reduced to twenty macro-variables while filling the matrix because their semantic abundance.

Afterwards, the structural analysis had recourse to the *Matrice d'Impacts Croisés Multiplication Appliquée à un Classement* (Micmac), created by Godet and Duperrin between 1972 and 1974. It specifies the key variables into an inventory after having described the relations among the variables. The Micmac method related therefore all the variables in the Pupils of Tampere

8 Godet 1986

inventory, also analyzing direct and indirect influences among them. The experts filled the matrix line by line, putting "0" in case of no direct influence and "1" in case of direct influence. The sum of the structural matrix lines gives the "Motricity" and the sum of columns elements gives the "Dependence". By systematically adding up the elements on each row, and then on each structural analysis matrix column, indications about each variable potential influence and dependence (respectively from the system in its entirety) can be defined. The Tampere Group filled in fact the structural analysis questionnaire specifying five key variables which, basing on this vision of the future, would have governed the system they are part of. A synthesis of the variables, obtained considering the number of times each variable appeared among the first 5 variables in each expert Micmac classification, showed the first 5 ones on the list, which are the determinant or "influent" variables:

V1 – Cultural Level, Science,
V2 – Economy, Commerce and Finance,
V7 – Poverty,
V12 – Emigration,
V17 – Technological Development.

In the Pupils of Tampere group application, the science and culture variable proves to be critical to increase industries and knowledge and to allow people flows standing out from poverty and misery conditions. Economy, commerce and finance are critical to develop the global system but risking that financial systems finance illicit activities. Poverty is the third variable on the list and it is critical for people's existences. The fourth variable on the list, Emigration, is crucial to help workers placing. Technological development, as transport and information, is instead critical tp information and communication and to knowledge and people flows. It is composed by the following elements:

- Technology: information, communication, people, capitals, goods and services, work possibilities, new products, scientific exchanges (+);
- Technological knowledge: knowledge (+);
- Technological development: information;
- Transport technological development: People (+).

The global experts opinion emerging from this analysis is that globalised society is governed by economy, finance, poverty, emigration, cultural, scientific and technological level. This is the point from which starting in order to build a future scenario because it is plausible that a future society development is connected to these variables development. Each single variable generates or influences people, knowledge, culture, goods or money. If it is true that a variable can activate different flows, it is also true that a flow can be generated or influenced by more than one variable, therefore they must be considered into the system and their effects must be simultaneously evaluated by the subjects having the rein of change in their hands, in order to reach the desired image of future. People flows is ruled, for instance, by all the five variables and this means that it is necessary to develop plausible evaluations on future variables regulating its development to make a forecasting on future flows which are tied up to people. A similar argumentation is valid for other flows.

Because behind each variable there are individuals who, with their chooses and behaviours, can more or less intensely influence the system, an in depth analysis needs to study the actors acting on the system, their objectives, their strategies to reach them and their possible alliances and conflicts. This gives a more complete frame and allows building scenarios which are adequate to the Pupils of Tampere information needs, that is to say making reliable forecasting on the society development related to the globalisation phenomenon.

The M.ACT.O.R. method[9], that is *Methode ACTeurs, Objectifs, Rapports de force,* allows substituting events with actors and strategic objectives. The method is based on the theory that the future of a system can be considered as a resultant of the evolutions among the actors strength relationships. This means that the actors in a system possess various means they are able to exercise through strategic actions, in order to reach the goals they have set and thus successfully carrying out their projects[10]. The M.ACT.O.R. method does not formulate any prevision on one or more happening events but it bases itself on the hypothesis that the future is determined by the actors of a system on which the phenomenon object of forecasting insists. The image of future constituting the scenario originates from the

9 Godet, 1990
10 Arcade et al., 2003, ch. 7, pp. 25-26

stronger actors strategic objectives and/or from the actors constituting the stronger alliance.

The list of actors and of their objectives defined by the Tampere Group are following illustrated:

Code	Actors
A1	States, Governments, Politics
A2	UN, NGOs
A3	World Trade Organization
A4	Multinational Companies
A5	Media
A6	Financial Systems, Banks
A7	European Union
A8	People, Society
A9	Religious Leaders
A10	Business
A11	Crime (Organizations)
A12	Science, Culture (Organizations)
A13	Military forces, police, etc.
A14	Migrant people

Table 3. Globalisation actors.

Code	Relevant objectives
O1	Economic and political international integration and cooperation
O2	Governance, environmental protection and human rights rules realization
O3	Goods circulation regulation
O4	Profit and patents regulation
O5	Instantaneous worldwide news circulation
O6	Economic investment and international aids
O7	Economic and political integration
O8	Quality life and socio-economic integration increase
O9	Religious/theocratic cultures development
O10	Costs lowering and market growth
O11	Destabilization of the social system
O12	Knowledge, multimedia productions
O13	Preventive and criminal use
O14	Employment and integration

Table 4. Globalisation actors' objectives.

By applying the M.ACT.O.R., the Tampere Group also evaluated the strength relationships among the "globalisation" system actors because possible alliances and conflicts depend not only on the actors' objectives hierarchy compared to the others' but also on the capacity each actor has to impose his priority to the others (or rather strength relationships). Strength relationships were analyzed by two matrixes, the direct influence one (MID) and direct/indirect influence one (MIDI). In the MID matrix, the potential influence an actor has on the others is evaluated by using a 0 to 4 scale with a generic a_{ij} element. The sum per row indicates the influence degree (or "strength") the actor has on the others, while the sum per column indicates how much the actor is submitted to the influences the others have on him (or "dependence"). The MIDI matrix also considers the indirect influences an actor called A_i has on all the other actors (a_{ik}), excluding the retroaction of an actor on himself.

From the matrix filled by the Tampere group experts, A12, Science and Culture Organizations, and A5, Media, proved to be two of the most competitive actors. The M.ACT.O.R. results obtained by the Tampere Group showed that the objectives towards which Scientific and Cultural Organizations (A12) are more favourable to are quality life and socio-economic integration increase (O8) and knowledge and multimedia productions (O12). On the contrary, the objectives towards which A12 is more unfavourable to are destabilization of the social system (O11) and religious/theocratic cultures development (O9).

The Media actor (A5), located at the second place of the list, can be very interesting for the Pupils of Tampere research. The actor turned out to be favourable to instantaneous worldwide news circulation (O5) and knowledge and multimedia productions (O12) and also not unfavourable to the other main A12 objectives. Media are also unfavourable to O9 and O11. Basing on the objectives listed for A12, it is possible to notice that it is not contrary to A5 objectives and vice versa. Consequently, they could probably ally rather than collide, trying to reach their O12 objective together thanks to an alliance.

From the various convergence matrixes, another easy alliance stands out among A12, the European Union (A7) and States, Governments and Politics (A1). They are contrasted by Criminal Organizations (A11), which is also the actor contrasting A12 the most. A12 should probably deal with Business (A10) and Multinational companies (A4). Basing on the objectives listed for A10 and A4, it is evident that they are on the same wavelength and therefore it is easier for them to eventually ally to reach costs lowering and market growth (O10) but also employment and integration (O14) and economic and political international integration and cooperation (O1). On the contrary, they would contrast religious/theocratic cultures development (O9), destabilization of the social system (O11) and governance, environment protection and human rights rules realization (O2). This shows that it is easy for them to ally to reach O10 taking from O9, O11 and O2.

Media (A5) is unfavourable to O9 and O11, as well as A10 and A4 are. A10 and A4 could be probably called as concerned in the matter by A5, Media, to disfavour by force the achievement of these objectives. However, also A12 is contrary to O11 and O9 and it could therefore help the contrast.

Pupils of Tampere Trend Impact Analysis

The previous analysis of the system gave an exploratory scenario on globalisation. The definition of time series and future events which could eventually modify them is the content of the next phase. Time series usually

obtain two definitions in literature, a classic and a modern one. The classic one considers them as an ordered series of time observations of the same phenomenon and they do not allow forecasting but only decomposition (into trend, cycle, seasonality and irregularity). The modern definition considers the time series as a finished realization of a stochastic process, allowing forecasting because the presence of probability. Considering the five most recurrent variables into the expert evaluations, on the basis of what previously defined, a resuming scenario containing the five key variables and flows connected to them can be built, together with a definition of each time series which better represents them. The next step of the Pupils of Tampere research is therefore individualizing the *trajectories*, which are events sequences or courses in a certain number of time intervals. Such procedure can be developed by applying structured communication methodologies to collect group opinions, later on illustrated, and by applying questionnaire surveys. The first questionnaire should contain a synthesis of the flows which are connected to the macro-key variables, asking the experts to add, for each item, the time series they consider representative of them. Those time series are connected to the key variables of globalisation, therefore they must derive from them.

Once established the time series, it is necessary to point out the (expected or hypothesized) future events which can modify the time series tendencies. Even if a trend is a time series with a constant tendency, it is possible that some events could happen having an impact on the time series. They must therefore be considered to better define the future scenario. If the government, for instance, decided to distribute personal computers for free in a whole nation, it would be an extraordinary event which would have influence on the national informatics alphabetization time series because it would rise. A second question should therefore ask to define expected or not (hypothesized) events which could insist on each time series defined during the previous step. These events should be plausible, potentially powerful in impact and verifiable in retrospect. The classic source of this list of events might be a literature search, a Delphi study, or an informal consensus among consultants, the Tampere Group in the specific. The events to be selected should comprise an inventory of potential forces that could lead to a departure from a surprise-free future[11].

11 Gordon 2003, ch. 5, p. 5

Following to the multiplication of the methods studying impacts of potential events, some elements can be found to re-conduct them to at least three approaches[12]:

- Event Impact, in which one or more events impacting on a specific system are studied;
- Trend Impact, in which one or more events impacting on one or more time series are analyzed;
- Cross-impact, in which impacts among various events are studied.

The event impact analysis manages questions concerning the consequential impact related to the happening of a certain event, which can be attended or unavoidable (as some natural events) or can derive from an intervention politics or other. Futures Wheel[13] and its derived method Futures Polygon[14] can be inserted into this area. The *Trend Impact Analysis*[15] is finalized to study events impacts on the trends of one or more time series and it is characterized by the integration of objective data with subjective data. The approach governing these methods consists in fact of subjective evaluations formulated by experts on the effects the impact of a certain set of events can generate on their trend. The *Cross Impact Analysis* considers all the impacts of a set of events among them, generally reordered into a two ways and one mode matrix (events). This area has more methods than the other ones at its disposal and each of them has its own history tied to the goals for which it was created, as correcting probabilities obtained by Delphi[16], tracing trajectories toward the future[17] or building scenarios[18].[19]

Some of the reasons why the Pupils of Tampere group decided to apply a Trend Impact Analysis (TIA) are the importance of the globalisation historical evolution to address its course and the knowledge its experts have about the phenomenon, which surely help reducing the uncertainty connected to the globalisation phenomenon and favours decisions to address

12 Pacinelli 2008, pp.163-164
13 Glenn 1972
14 Pacinelli 2001
15 Gordon, 2003
16 Gordon & Hayward, 1968
17 Kane, 1972
18 Brauers & Weber, 1988
19 Cross-impact allows simulating different decisions, facing various future situations, in order to define the optimal and/or preferable strategies.

it. Once defined the time series and the expected or not events which could influence the trends, the TIA can therefore be applied in order to study of the Globalisation phenomenon evolution. It allows creating a data base of key potential events, their probabilities and their impacts to build an anticipative control system with the time series representing (or connected to) the key variables. It also allows hypothesizing critical actors' actions-events influencing them[20]. In the forecasting made by the TIA, a time series is modified considering the perceptions of extrapolations changes made by future events, evaluating judgements about their probabilities and impacts. Pupils of Tampere opinions are once again crucial in this phase of the research, particularly to modify the surprise-free extrapolation with the evaluation of unprecedented future events. The evaluation of the events impacts could be specified in various way: the trend begins to be affected, the impact on the trend is largest, the impact reaches a final or steady-state level, the largest impact or the steady-state impact, and the times or the magnitude of the impacts when they are taken as independent[21].

The communication process among the Tampere group experts to evaluate the events can be managed by applying a Delphi-like structured communication. The classic Delphi method[22] is based on a type of "many to many" communication but with a structured communication process managed by a filter (moderator). It allows convergence into a group on opinions given to the same question and allows therefore the Tampere Group experts treating a complex problem working in a group but without the distortion generated by the contact. None of them in fact knows the origin of the answers, thanks to a code given to the experts. The main purpose of this methodology is to get the opinion convergence really better than the initial one, avoiding interaction biases (as leadership, groupthink[23], etc.) because the experts isolation. This is the reason why of a high reserve level in the method. A central role is given to each expert-forecaster because results are bound to their expertise and intuition but the moderator also plays a very important role because he/she's a communicational filter among the participants. The procedure is applied by subsequent administrations of the

20 Gordon 2003
21 Gordon 2003, ch. 5, pp. 5-6
22 Dalkey & Helmer 1963. The Delphi method was developed into the RAND corporation by Olaf Helmer, Nicholas Rescher, Norman Dalkey and others in the early 1950's.
23 Janis 1989.

same questionnaire and by a statistical synthesis (called interquartile range) of the previous iteration results. The interquartile range extremes (1st and 3rd quartiles) and each motivation to evaluations which are external to the range are communicated to the experts in anonymity. The next work is the iteration of such phase, asking to step by step reformulate the evaluations. In the next iterations, counter-motivations are added to initial motivations. This phase allows calling the method as Delphi-Conference but only when the third iteration is applied. It is usual (Delphi literature) to positively end a Delphi after about three or four administrations. The time elapsing from one iteration to one another can also be very short. Because the geographical dislocation (multi-localization) of the Tampere Group experts, the method should be on-line implement, by mail or by using the moodle platform the Finnish experts put at the Tampere Group's disposal.

Conclusions

The TIA application, considering the answers given to the questionnaire by a Delphi-like procedure, should anticipate the effects certain events have on the globalisation evolution, understanding how the extrapolation gets modified. Differently from quantitative methods, in which the historical data are used to forecast by extrapolating them into the future ignoring the effects of unprecedented future events, the TIA illustrates how future events defined by experts, including for instance technological, political, social, economic changes, may modify the extrapolation, analysing therefore consequences of future developments on certain future trends[24]. Given the key variables and identified the critical actors, the first ones are associated to the time series, helping to put them under control, while the actors are bound to eventual actions they can make in the future, describing the events as "action". Binding the actors to the hypothetical actions they can make, and not only to their objectives, shows how they insist on the key variables and on the actions. Understanding how events, and related actors actions, can modify a scenario by analyzing how such events impact on the globalisation trends is a valuable information to address globalisation in terms of decisions. Because the uncertainty of the globalisation phenomenon,

24 Gordon 2003, ch. 5, p.3

together with its complexity in terms of worldwide interrelation, addressing its effect can not be done without taking into consideration the whole system, the relations among all its variables and actors and the consequences of any decision on the system itself.

The TIA results could already be considered by decision-makers in order to decide and act basing on the impacts certain events have on the system evolutions (its trends) but the defined events impacting the trends do not give their desirability. An eventual fourth phase of the Pupils of Tampere project could moreover help taking better decisions by defining desirable and feasible policies which should be applied to orientate the phenomenon. Such phase could in fact try to build a normative scenario by applying another Delphi-like procedure, particularly the Policy Delphi one[25], in which not only decision-makers and experts but also citizens, or at least their social and political representatives, should be involved. A policy Delphi can be considered as a Delphi-like method evaluating not only issue and goal items, in terms of importance/relevance and/or priority/urgency, but also option items, in terms of desirability and technical and political feasibility. Differently from the classic Delphi, in which mainly experts take part, the Policy Delphi panels are wider and more heterogeneous, therefore policies are defined not only by experts but also by decisional and social actors. The Policy Delphi bases the evaluation on technical and political/social competences because it aims to define a project hypothesis in order to build a possible future by sharing objectives, scenarios and strategic actions. The list of items/policies to evaluate could contain the most probable events defined before applying the TIA, particularly the ones having a positive impact on the trends, and such list could also be enlarged by defining innovative and original politics, thanks to the Delphi-like convergence procedure[26].

Futures research helps decision-makers by building scenarios using both objective and subjective data, as illustrated in the Pupils of Tampere project example, especially when the actors of a system understand their decision influence on all the globalisation factors and the possibility to ally

25 Turoff 1970

26 Moreover, last step of the research could be investigating such desirable and feasible scenarios in terms of impacts by applying a Futures Wheel (Glenn, 1972), which allows to identify the subsequent order consequences (second and third order) for a certain examined phenomenon or event descending from it.

with other actors to reach certain *desired* scenarios, coherently with the structural analysis scenarios illustrated and following to the next step of the research execution. The Pupils of Tampere results are surely far from being statistically significant but they give an integrated point of view on globalisation, expressed by the convergence of many experts opinions, and can surely orientate action more accurately in terms of number and quality of variables to address, events to consider and reach and actors to involve, than how a single decision-maker could.

REFERENCES

Arcade, J., Godet, M., Meunier, F., & Roubelat, F. (2003). Structural Analysis with the MICMAC Method & Actors' Strategy with MACTOR Method. In Glenn, J.C. & Gordon, T.J. (Eds.). *Future Research Methodology – V2.0.* ch. 7, pp. 1-50. Washington DC, United States: AC/UNU Millennium Project.

Brauers, J. & Weber, M. (1988). A New Method of Scenario Analysis for Strategic Planning. *Journal of Forecasting 7,* Jan-March. pp. 31-47.

Camiz, S., Castorina, A., Salvi, R., Todisco, E. (2005). The Pupils of Tampere. *Geoeconomic, Linguistic, Statistical and Historical Studies for Regional Analysis Department Annals.* Rome: La Sapienza University, Economics Faculty.

Dalkey, N.C., & Helmer, O. (1963). An experimental application of Delphi Method to the use of experts. *Management Science n. 9*(3), April. pp. 458-467.

De Jouvenel, B., (1966). *Le rôle de la Prévision dans les Affaires Publiques.* Paris: Les Cours de droit.

Fabbris, L. (1990). Problemi statistici nella utilizzazione di dati rilevati presso Testimoni Privilegiati (*authors' note:* Statistics problems into using data collected from Privileged Witnesses). In Fabbris, L. (Ed.) (1991). *Rilevazioni per campione delle opinioni degli italiani (authors' note:* Italian opinions sampling surveys). Padova: SGEditoriali. pp. 89-115.

Glenn, J., & Gordon, T. (1998-1999). *Application of Futures Research. Factors required for Successful Implementation of Future research in Decisionmaking.* From http://www.millennium-project.org/millennium/applic.html.

Glenn, J.C. (1972). Futurizing teaching vs Futures Course. *Social Science Record IX*(3). Syracuse University, Spring. pp. 26-29.

Godet M. (1986). Introduction to la Prospective. *Futures 18*(2), April, pp.134-157.

Godet M. (1990). A Integration of Scenarios and Strategic Management. *Futures 22*(7), September, pp. 730-739.

Gordon T.J. & Hayward, H. (1968). Initial Experiments with the Cross-Impact Matrix Method of Forecasting. *Futures 1*(2), pp. 100-116.

Gordon, T.J. (2003). The Trend Impact Analysis. In Glenn, J.C., & Gordon, T.J. (Eds.). *Future Research Methodology – V2.0,* ch. 5, pp. 1-21. Washington DC (United States): The Millennium Project.

Janis, I.L. (1982). *Groupthink.* Boston: Houghton Mifflin.

Kane J. (1972). A Primer for a New Cross-Impact Language-Ksim. *Technological Forecasting and Social Change 3*. pp.129-142.

Pacinelli, A. (2001). *Sulla valutazione soggettiva della probabilità di eventi: dalla futures wheel al futures polygon (authors' note:* On events probability subjective evaluation: from futures wheel to futures polygon). Paper presented at the Convegno intermedio della società italiana di Statistica (*authors' note:* Italian Society of Statistics Intermediate Convention). Rome: Tor Vergata University.

Pacinelli, A. (2008). *Metodi per la ricerca sociale partecipata (authors' note:* Methods for Participated Social Research). Milano: Franco Angeli.

Wagschal, P. (1981). Futuring: A Process for Exploring Detailed Alternative Futures. *World Future Society Bulletin* (Now the Futures Research Quarterly), September/October, pp. 25-31.

Desiderata stability. Methodological considerations

Antonio Pacinelli[1], Simone Di Zio

Introduction

The "normative" scenario is distinguished from the "exploratory" scenario. The images of the future of the latter arise from the "trends" towards the future (known as trend scenarios). The images of the former emerge from the survey of needs/desiderata of the stakeholders and/or citizens in general. Before reaching the timeframe of a normative scenario, usually in a longer period, events may occur that change the citizens' opinions on the needs/desiderata. In general, needs and desiderata are taken as "images" of the scenario and, therefore, as targets of public intervention. For this reason it may be that, particularly in the longer period, the ongoing public interventions no longer meet relevant needs and desiderata of the stakeholders and/or citizens. To avoid this error, we thought to draw a simple control system for the "stability" of opinions in respect to the needs/desiderata, from which we derive the images of the normative scenario or strategic objectives.

Besides the usual methods for implementing scenarios, this work is based on panels and Markov chains.[2]

The use of a panel of end users makes it possible to estimate a transition matrix on the different levels of needs. These end users are recipients of a long term policy. The forward projection of the chain, obtained by successive powers of the transition matrix, will help us understand whether the assessments on the needs and desiderata inserted in the normative scenario (that have become the goal of a policy) can be considered "stable", until the horizon of the scenario. Otherwise, we will be deprived of the control on the normative future, pursuing strategic goals which are no longer shared.

---

1 Corresponding author: a.pacinelli@unich.it.

2 Марков 1906.

Kane J. (1972). A Primer for a New Cross-Impact Language-Ksim. *Technological Forecasting and Social Change 3*. pp.129-142.

Pacinelli, A. (2001). *Sulla valutazione soggettiva della probabilità di eventi: dalla futures wheel al futures polygon (authors' note:* On events probability subjective evaluation: from futures wheel to futures polygon). Paper presented at the Convegno intermedio della società italiana di Statistica (*authors' note:* Italian Society of Statistics Intermediate Convention). Rome: Tor Vergata University.

Pacinelli, A. (2008). *Metodi per la ricerca sociale partecipata (authors' note:* Methods for Participated Social Research). Milano: Franco Angeli.

Wagschal, P. (1981). Futuring: A Process for Exploring Detailed Alternative Futures. *World Future Society Bulletin* (Now the Futures Research Quarterly), September/October, pp. 25-31.

Desiderata stability. Methodological considerations

Antonio Pacinelli[1], Simone Di Zio

Introduction

The "normative" scenario is distinguished from the "exploratory" scenario. The images of the future of the latter arise from the "trends" towards the future (known as trend scenarios). The images of the former emerge from the survey of needs/desiderata of the stakeholders and/or citizens in general. Before reaching the timeframe of a normative scenario, usually in a longer period, events may occur that change the citizens' opinions on the needs/desiderata. In general, needs and desiderata are taken as "images" of the scenario and, therefore, as targets of public intervention. For this reason it may be that, particularly in the longer period, the ongoing public interventions no longer meet relevant needs and desiderata of the stakeholders and/or citizens. To avoid this error, we thought to draw a simple control system for the "stability" of opinions in respect to the needs/desiderata, from which we derive the images of the normative scenario or strategic objectives.

Besides the usual methods for implementing scenarios, this work is based on panels and Markov chains.[2]

The use of a panel of end users makes it possible to estimate a transition matrix on the different levels of needs. These end users are recipients of a long term policy. The forward projection of the chain, obtained by successive powers of the transition matrix, will help us understand whether the assessments on the needs and desiderata inserted in the normative scenario (that have become the goal of a policy) can be considered "stable", until the horizon of the scenario. Otherwise, we will be deprived of the control on the normative future, pursuing strategic goals which are no longer shared.

---

1 Corresponding author: a.pacinelli@unich.it.

2 Марков 1906.

The normative scenario in "Participatory social planning"

In "Participatory social planning"[3] the survey of available resources about the "needs" and "desiderata" of the society (or community) constitutes basis of approach. Needs and desiderata are the "norms" (that is the images of the future or the strategic targets) on which the *normative scenario* must be based. The normative scenario is necessary for the construction of the *project scenario*, which will be the main target of the strategic planning. For the Participatory social planning purposes, the exploration of the future is an obligatory step. However what is more important is the intention to reach a desired future shared by the biggest possible number of final users. For that purpose it is necessary to use methods of participation.[4]

There are various applications of scenarios. For example they are used for studying the limits of the human expansion on the planet or in planning the use of the available resources, but also for the identification of future strategies of companies[5]. Scenarios can be categorized in different ways but the most appropriate classification is the one based on the two purposes they pursue: the exploratory one and the normative one. The *exploratory scenario* (or *tendentious scenario*) consists of all the possible images of the future, which are "plausible", while the *normative scenario* contains the "desiderata", which are images of desired future. All the images of the exploratory scenario (included the ones generated by hypothesis of policy), which are compatible with the images of the normative scenario, generate scenario called *project scenario*.[6] In this work we are interested just in the project scenario because it is the heart of the strategic planning both in social and private fields. The political project for the improvement of the future conditions of the administrated/represented society needs one or more images of the desired future. Then it is possible to plan tactical activity (namely the policy interventions which are in progress until the scenario temporal horizon), which is aimed at reaching the strategic targets

3 Pacinelli 2008.
4 Pacinelli 2008.
5 It is necessary to remember that the scenarios are based on hypothesis and it's advisable to limit their number because, if it is high, the vastness of the possible combinations is such that any policies finalized to reduce its complexity is useless.
6 Pacinelli 2008.

(the images of the normative scenario). To realize a strategic planning, no matter the field (public or private), it is necessary to treat the future issue, defining possible futures generated by the trends in absence of new policies (exploratory scenario) and desired future (normative scenario). In the case of specific policies, abstracted from needs and desiderata obtained from final users, it's possible to produce elements which are necessary to build the project scenario. Therefore, in order to introduce the concept of *strategy* into the planning context, we need both the tendentious future and the desired future. Then, in order to approach the "planned" future, it is necessary to have a strategy that is a set of rules also implicating tactics which are consequential to the decisions to be taken. After all, in the planning context we can distinguish what fixes the strategic targets (strategy) from the means which are needed to reach them (tactics).

Let's enter into the issue of "the stability of needs/desiderata". Before reaching a temporal horizon of a social project scenario, which generally is a long period scenario, events modifying citizens' or stakeholders' opinions about the needs/desiderata may happen. Needs and desiderata are considered as "images" of the scenario and, therefore, as targets of the public policy. For this reason, in a longer period, the activated policies could satisfy needs and desiderata which are no longer "relevant/desiderata" for the citizens.

To avoid this error, this work tries to project a control system for the needs/desiderata "stability" derived from the normative scenario images which is the base of the project scenario and, as a consequence, constrains the future for many years.

On the basis of this work, there is the recourse, besides of the usual normative and project scenarios realization, to the Markov (1901; 1971)[7] approach, which in this case is specifically carried out to verify the "stability" of the desiderata by means of panel data. But first we will report a short section on panel data.

Panel Data

In recent years, particularly in the context of social sciences, it is more and more important to assess the results of social policies or to analyze the social

7 Markov born on June 14, 1856 in N.S. Ryazan and died on July 20, 1922 in Petrograd (Russia).

changes in the middle and long period. The basis for these analyses is the use of longitudinal data, which is resulting from the over time observation of statistical units (persons, households, firms, regions, etc.) on a number or variables.[8] Among the longitudinal data the most popular is the panel data, which has been collected from the same sample of individuals over many time periods (T). In other words a panel is a group of people who are surveyed periodically over a given time span.

It is important to note that only panels can give information about the difference between the gross change and the net change of a phenomenon. For example, if using two independent sample we observe an opinions' change from 20 to 25 percent, it is impossible to distinguish the change caused by new cases from the change caused by an actual change in the opinions of the same persons. It should be that 5 percent corresponds to the opinions of new persons included in the second sample, or it should be that 25 percent is caused by new individuals together with a 20 percent reverse change, or something in the middle. Only panels permit to study individual opinions' changes and dynamics of a social phenomenon.

In short, among the main objectives that are reachable using panel data we mention:

a) the evaluation of gross and net changes of a phenomenon;
b) the aggregation of individual data in a given time period (for example the sum of monthly incomes multiplied by 12 gives the annual income);
c) the evaluation of individual changes;
d) the analysis of the duration of an event (for example the average duration of the poverty);

But, the use of panels has also some disadvantages, because the survey may imply some problems. For example, from one year to another some persons may refuse to be interviewed twice, or reluctant individuals may give useless answer. It may happen that the respondents may be influenced by information received at the interviews (*contamination*). Some questions can provoke the curiosity of an individual and push him to inquire into the matter, and this may lead to a more informed person or even to a change in his opinions. Furthermore, each year it is difficult and costly to find persons who have moved, and this means that locating the sample of same respondents every year is very expensive.[9]

8 Bijleveld and van der Kamp 1998.
9 Kish 1995.

The *attrition* is the fact that some of the individuals originally included in the sample may be lost during the life span of the panel.

If the group of people, observed along the given period, has always the same components the panel is called a balanced panel. Otherwise, if some individual "disappears" during the time (*attrition*) or some other person not present in the previous surveys joins the group later (*new entry*), we have an unbalanced panel.

In household panels, the problems of attrition and new entries are very frequent, because they are consequences of many family events such as finding a new job, marriage, divorce, retirement, death, birth, and so on. But if the statistical unit of the panel is an individual these problems are less relevant.

In our case, of course, the use of a citizens panel has the objective of evaluating individual opinions' changes in order to control the stability of the needs/desiderata. In this case it is important to activate appropriate strategies for maintaining the contacts with the citizens (*tracking*) and to follow the possible movements of the persons (*tracing*). Considering that in general individuals tend to forget the answers given in a previous interview, especially when a long time has passed, it is important to consider long periods of time between two subsequent consultations in order to face the problem of contamination.

An outline of Markov "chains". Definitions and estimators

In the origin the *Markov chain* was referred to a "random sequence", while in the current literature it is common to speak about a "stochastic process". It is useful to specify that the "Markov chain" is a stochastic process where the spaces of the "steps" (in our case a step will be one consultation of the panel) and the spaces of the "states" (the needs/desiderata levels in our case) are discrete and finite. In all the other cases, we commonly talk about "Markov process". In particular, a finite Markov chain is a discrete Markov process with discrete parameter and with a finite number of states with discrete parameter.

We know that in applying Markov chains there are many limits and here it is important to consider that:

- **The probabilities are constant**: it is a homogeneous system. Projecting it forward, keeps the original permanence and transition probabilities obtained by the panel which will always remain the same for all the steps of the forward projection of the system. In fact, if the transition probability associated with the n-th step doesn't depend on n but the parameter remains constant, the Markov chain is called homogeneous[10]. This can not always be true since the behaviour of the process can not be stable in time, especially in the case of an economy disturbed by external factors, such as wars, new economic policies and so on. So, the transition probabilities can change over the time and, therefore, the needs/desiderata of the normative scenario may change in the long period. The aim of this work is derived from this "desiderata stability" problem[11].
- **The community is closed:** this condition is less important for the purpose of this study, even if the phenomenon of the attrition in a panel must not be undervalued.

Given a finite number of possible outcomes or states $s_i (i = 1,2,...,r)$, in a Markov chain the transition probabilities are collected in a square stochastic matrix P, with p_{ij} a generic element which represents the transition probability from the state s_i to the state s_j, and such that:

$$0 \leq p_{ij} \leq 1 \text{ and } \sum_j p_{ij} = 1.$$

The Markov approach is conditioned to the study of the stochastic processes, that is to say it is based on the conditional distributions of the random

10 The Markov processes are base on the dependence $Pr(x_t|x_{t-1},x_{t-2},...)=Pr(x_t|x_{t-1})$, where x_t (t=1;...;T) is a random variable and the first member indicates the conditional probability density function and, remembering that $P(x_0,x_1,...,x_T)=P(x_0)P(x_1|x_0)P(x_2|x_0)...$, for a Markov process we can write $P(x0,x_1,...,x_T)=P(x_0)\Pi_{(0)}P(x_t|x_{t-1})$. Let's indicate the set of possible states with S and if we consider two generic s_i e s_j states and assuming that if $x_{t-1}=si$ and $x_t=s_j$, then we can write $P(x_t=s_j|x_{t-1}=s_i)=p_{ij}(t)=p_{ij}$ (for each t), where p_{ij} is the constant transition probability associated to the passage from the i-th to the j-th state (Lee, Zellner e Judge 1970). The assumption of the constancy of the transition probability matrix at different steps is like considering an homogeneous Markov chain in respect to the time (Vitali, 1966, 1967). Therefore, the probability in the previous is simplified into $Pr^{(1)}_{ji}=Pr_{ij}=Pr[x_k=s_j|x_{k-1}=s_i,]$ for all k, because the transition probabilities will remain the same to the next stage for any instant of the process.

11 Besides, the collectivity is closed (if it is applied to a certain collectivity, its projection ahead keep it), this second condition is less important for the aim of our work.

variables.[12] In other words, the probabilities at time *t+1* depend only on the outcome of the immediately preceding step, that is the state at the time *t*. Let's make an example by using cigarette brands. The probability that at the time *t+1* there is a passage from the use of Brand A to that of Brand B depends on the previous state, that is A was the previously smoked brand. Such probabilities are estimated by the flow data collected by means of a consumer panel interviewed in subsequent instants of times. Such probabilities are estimated by the flow data collected by means of a consumer panel interviewed in subsequent instants of times.

The transition probabilities among the states of a Markov chain can be obtained in many ways according to the nature of the available data[13]. In the approach based on a sequence of trials linked as a chain, the transition probabilities are "a priori" known, while when these probabilities are not available, it is necessary to use appropriate estimates. Such estimates can use both flow data and stock data but considering that stock data can produce absurd considerations their use is not advised.[14] Using flow data, obtained by means of a panel, the transition probabilities are estimated, prevalently by the maximum likelihood method (ML) which, in literature, is considered as one of the best estimation method[15], both because it is lower only to Bayesian estimators and because it is very easy to calculate[16].

The fact that the probability distribution of an outcome depends only on the outcome of the preceding trial is known as the first order dependence:

$$\Pr(x_t|x_{t-1},x_{t-2},...) = \Pr(x_t|x_{t-1}), \text{ for all } t.$$

Then, the probability of an ordered set of sequences is given by the multiplication law of conditional probabilities:

$$\Pr(x_0,x_1,...,x_T) = \Pr(x_0)\Pr(x_1|x_0)\Pr(x_2|x_1)....$$

12 Kemeny & Snell 1960

13 Following Lee, Zellner and Judge's (1970), we consider: stock data, stock data and fixed constraints, flow data, flow data and fixed constraints, stock data and partial flow data.

14 Pacinelli 1990.

15 Lee & Judge & Zellner 1970.

16 For details see Lee & Judge & Zellner 1970.

As a consequence, to obtain the transition matrix from flow data, it is useful to define a stationary Markov process as follows:

$$\Pr(x_0, x_2, \ldots, x_t) = \Pr(x_0) \prod_{(t)} \Pr(x_t | x_{t-1}) \tag{1}$$

Finally, the ML estimator is simply obtained by dividing any element of the matrix for the correspondent row total:

$$\hat{p}_{ij} = \frac{n_{ij}}{\sum_j n_{ij}} \geq 0 \tag{2}$$

This estimate of the maximum likelihood function permits the calculation of the transition matrix by a very simple procedure, which is that of the normalization of the flow matrix by row. Lee, Judge and Zellner[17], by Monte Carlo experiments, examined the sample properties of many estimators and the results indicate that the ML estimator is the best among the non Bayesian estimators, while the Bayesian estimators are better than all the other estimators. Furthermore, by the Monte Carlo experiments, the sample properties of the estimators were verified in the estimation of the transition matrices. The results demonstrated that the Bayesian estimators are more efficient than all the other estimators, particularly when the a priori distribution is leptokurtic.[18]

The needs/desiderata "stability" control

The control of the needs/desiderata stability proposed in this work, can be summarized in the following steps:

Step 1: collection of the data coming from the questionnaires filled in by a end-users/citizens sample and which inspired the strategic targets;

17 Lee & Judge & Zellner 1970.

18 Even when a priori platykurtic distribution was used, the results for the Bayesian estimator were better than the ML estimators (GLS, MCS).

Step 2: repropose a synthesis of the questionnaire to the same sample (panel) aimed at the verification of the stability. The questionnaire must contain all the questions which inspired the strategic targets;

Step 3: elaboration of data, construction of the flow matrix and the stability indicators and, through the normalization by row, maximum likelihood estimation of the 1st stochastic matrix of transition;

Step 4: calculation of the subsequent powers of the transition matrix and, by using the initial vector of the valuations (that is the results of the first iteration of the panel), forward projection of the Markov chain, until the temporal horizon of the scenario;

Step 5: check of the stability by comparing the scenario targets and the results of the forward projection and, eventually, correction of the targets;

Step 6: repropose the questionnaire of the step 2.

...

further iterations

...

Step k: in case of prolonged stability, the check could theoretically be necessary until the last possible iteration (i.e. the year before the end of the temporal horizon). But in that case it would be too late to take actions. Therefore, the number of checks are decided by the final decision-maker, the ultimate responsible of the policy.

The transition matrix can be obtained by arranging at least two iterations of the panel which gave the needs and the desiderata, strategic targets of the normative scenario. Let's make an example. The needs and desiderata levels can be included at the discretion of researcher, provided that they vary from the minimum possible needs/desiderata (*useless*) to the maximum one (*indispensable*). Moreover it is suggested to adopt at least 7 ordinal categories. On the rows we put a description of each need/desiderata and on the columns the evaluation levels, or needs/desiderata categories (Table 1).

Table 1. Questionnaire for Needs/Desiderata survey (iteration n. 1)

	needs/desiderata levels				
Needs	*1*	...	*v*	...	*V*
D_1					
...					
D_i					
...					
D_d					

As in the first iteration, also in the second one (Step 2) the panel components were asked to choose only one of the evaluation level for each of the item (needs) considered, proposing again the same questions as in the first consultation[19] and clarifying that the aim is to get the possible opinion changes.

The panel components could confirm all the previous evaluations or varying just some, or many, or even all of them. Therefore the given data permits to carry out evaluations on the "desiderata stability", defined as the "maintenance of the initial opinion"[20]. Then, the second step will allow us to obtain a square matrix of absolute frequencies (n_{ij}), containing the "permanencies" and the "transitions". In the principal diagonal we have the "permanencies" in the same evaluation level of the first iteration ($n_{ij}, i = j$), while in the remaining cells ($n_{ij}, i \neq j$) there are the "transitions" from one evaluation level to another (Table 2).

A first stability indicator, for instance, could be the ratio between the trace of the flow matrix (sum of the elements on the principal diagonal) and the total of the evaluations for the generic need:

$$SI = \frac{\sum_{i=j} n_{ij}}{\sum_{ij} n_{ij}}$$

19 It is necessary to propose the same questions because, if modified, they could be one of the cause of the opinion change.

20 We don't speak about "incoherence" because it cannot be considered an incoherent person that changes opinion after occurred events, whether they are expected or unexpected. Moreover, we are fully conscious of the complexity and numerousness of the variables which can influence an opinion. Therefore we don't go into the subject but only refer to the vast literature (Fabbris, 1990).

This indicator assumes values from zero (*perfect instability*) to one (*perfect stability*). Consider that, in order to compare several needs, it is possible to use this indicator only if the needs have the same number of evaluation levels[21].

Let's hypothesise that for the generic need D_i (for instance potable water, nursery school, etc.), after 2 iterations the theoretical flows n_{ij} among the evaluation levels of a panel of citizens are that of Table 2.

Table 2. Flows matrix for a generic need D_i

		1	2	...	*j*	...	*k* − 1	*k*
	Desideratum levels	*Essential*	*Very useful*	...	*Useful*	...	*Not much useful*	*Useless/ Superfluous*
1	*Essential*	$n_{1,1}$	$n_{1,2}$	...	$n_{1,j}$	...	$n_{1,k-1}$	$n_{1,k}$
2	*Very useful*	$n_{2,1}$	$n_{2,2}$	...	$n_{2,j}$	...	$n_{2,k-1}$	$n_{2,k}$
...	...	...	...	...	...	...	...	...
i	*Useful*	$n_{i,1}$	$n_{i,2}$	...	$n_{i,j}$	...	$n_{i,k-1}$	$n_{i,k}$
...	...	...	...	...	...	...	...	...
k − 1	*Not much useful*	$n_{k-1,1}$	$n_{k-1,2}$	...	$n_{k-1,j}$	...	$n_{k-1,k-1}$	$n_{k-1,k}$
k	*Useless/ Superfluous*	$n_{k,1}$	$n_{k,2}$	...	$n_{k,j}$	...	$n_{k,k-1}$	$n_{k,k}$

Let's analyze the two extreme positions which contains (in an imaginary "continuum") all the other possible intermediate situations: "*perfect stability*", that is the confirmation of all previous evaluations (Table 3), and "*perfect instability*", that is no previous evaluations is confirmed (Table 4).

21 The proposed indicator is used also in the marketing field and it is known as a "brand loyalty" indicator.

Table 3. The case of "*Perfect stability*"

		1	2	...	*j*	...	*k* − 1	*k*
	Desideratum levels	*Essential*	*Very useful*	...	*Useful*	...	*Not much useful*	*Useless/ Superfluous*
1	*Essential*	$n_{1,1}$	0	0	0	0	0	0
2	*Very useful*	0	$n_{2,2}$	0	0	0	0	0
...	...	0	0	...	0	0	0	0
i	*Useful*	0	0	0	$n_{i,j}$	0	0	0
...	...	0	0	0	0	...	0	0
k − 1	*Not much useful*	0	0	0	0	0	$n_{k-1,k-1}$	0
k	*Useless/ Superfluous*	0	0	0	0	0	0	$n_{k,k}$

In Table 3 the introduced stability indicator (SI) assumes value *1* (*perfect stability*) because the trace of the matrix corresponds to the denominator of the index.

Table 4. The case of "*Perfect instability*"

		1	2	...	*j*	...	*k* − 1	*k*
	Desideratum levels	*Essential*	*Very useful*	...	*Useful*	...	*Not much useful*	*Useless/ Superfluous*
1	*Essential*	0	$n_{1,2}$	...	$n_{1,j}$	...	$n_{1,k-1}$	$n_{1,k}$
2	*Very useful*	$n_{2,1}$	0	...	$n_{2,j}$	...	$n_{2,k-1}$	$n_{2,k}$
...	...	...	...	0	...	...	...	...
i	*Useful*	$n_{i,1}$	$n_{i,2}$	...	0	...	$n_{i,k-1}$	$n_{i,k}$
...	...	...	...	...	...	0	...	...
k − 1	*Not much useful*	$n_{k-1,1}$	$n_{k-1,2}$	...	$n_{k-1,j}$	...	0	$n_{k-1,k}$
k	*Useless/ Superfluous*	$n_{k,1}$	$n_{k,2}$	...	$n_{k,j}$	...	$n_{k,k-1}$	0

On the contrary, in a situation of perfect instability (Table 4) the same indicator is SI=0, because the matrix trace corresponds to *0*.

What has been illustrated until now falls into the "certain domain", but the next discussion moves toward the "possible domain", where it is useful to assume the probability as a level of possibility of the events. But in order to work with probabilistic data it is necessary to produce them. By a likelihood estimate applied to the observed flow matrix, calculated

through a simple row normalization (dividing each element of a row with the total of the same row), we can obtain a stochastic matrix **P** (Table 5: here the value $n_{i,\circ}$ represents the total for the row *i*) and hypothesize that it governs a Markov chain. The forward projection of the chain that, as previously said is obtained by subsequent powers of the matrix, will help us to understand if the evaluation on needs and desiderata included into the normative scenario (and made target of a policy) can be considered "stable" until the scenario temporal horizon[22].

Table 5. Theoretical transition matrix **P**

	1	2	...	*j*	...	*k* − 1	*k*	
Desideratum levels	*Essential*	*Very useful*	...	*Useful*	...	*Not much useful*	*Useless/ Superfluous*	**tot**
Essential	$n_{1,1}/n_{1,\circ}$	$n_{1,2}/n_{1,\circ}$	...	$n_{1,j}/n_{1,\circ}$	...	$n_{1,k-1}/n_{1,\circ}$	$n_{1,k}/n_{1,\circ}$	1
Very useful	$n_{2,1}/n_{2,\circ}$	$n_{2,2}/n_{2,\circ}$	...	$n_{2,j}/n_{2,\circ}$	...	$n_{2,k-1}/n_{2,\circ}$	$n_{2,k}/n_{2,\circ}$	1
...	...	...	...	...	...	...	...	1
Useful	$n_{i,1}/n_{i,\circ}$	$n_{i,2}/n_{i,\circ}$	...	$n_{i,j}/n_{i,\circ}$	...	$n_{i,k-1}/n_{i,\circ}$	$n_{i,k}/n_{i,\circ}$	1
...	...	...	...	...	...	...	...	1
Not much useful	$n_{k-1,1}/n_{k-1,\circ}$	$n_{k-1,2}/n_{k-1,\circ}$	...	$n_{k-1,j}/n_{k-1,\circ}$	...	$n_{k-1,k-1}/n_{k-1,\circ}$	$n_{k-1,k}/n_{k-1,\circ}$	1
Useless/ Superfluous	$n_{k,1}/n_{k,\circ}$	$n_{k,2}/n_{k,\circ}$	...	$n_{k,j}/n_{k,\circ}$	...	$n_{k,k-1}/n_{k,\circ}$	$n_{k,k}/n_{k,\circ}$	1

On the contrary, we would loose the control on the normative future, pursuing strategic targets no longer "shared". For instance, if it takes 10 years to reach the temporal horizon of the scenario and we only have two iterations of the panel, we need 9 powers to observe the matrix of the probabilities of the needs/desiderata evaluation levels at the scenario temporal horizon. This way, we will know what is the probability that the panel, under the Markov hypothesis (that is constant probabilities), attributes to each evaluation level for each need/desideratum, at the time of the scenario temporal horizon. This information will allow us to adjust the strategic targets on the basis of participation that, broadly speaking, we could also consider a first step toward the "*continual participation*". In fact,

22 Even until the limit matrix if the process is ergodic. It's implicit that it is sufficient pre-multiply the transposed vector of the initial distribution of the evaluations by the matrices obtained with the subsequent powers to obtain a numeric estimate of the distribution of the panel components opinions, at the scenario temporal horizon.

the panel offers an important contribution to start a participation process because, even in a passive context (consultation), it can be considered a method which allows us to realize a kind of "*continual participation*"[23]

A numerical example

Let's suppose the availability of a probabilistic panel composed of $n=1000$ citizens, express their opinion about one of the needs, using an evaluation scale with $k=7$ desiderata levels. Let's also suppose having obtained the following flow matrix (Table 6), for instance after some consultations of the panel (we've said that the minimum number of consultations is two, but by growing this number the bias of the estimator comes down).

Table 6. Hypothetical matrix of flows

		1	2	3	4	5	6	7	
	Desideratum levels	*Essential*	*Very useful*	*Quite Useful*	*Useful*	*Little Useful*	*Not much useful*	*Useless*	**tot**
1	*Essential*	45	10	13	15	20	29	18	**150**
2	*Very useful*	6	38	18	20	23	27	18	**150**
3	*Quite Useful*	8	16	44	26	38	34	34	**200**
4	*Useful*	12	14	22	64	30	36	22	**200**
5	*Little Useful*	3	6	8	11	33	19	20	**100**
6	*Not much useful*	4	5	9	12	8	39	23	**100**
7	*Useless*	2	4	7	10	15	19	43	**100**
	tot	**80**	**93**	**121**	**158**	**167**	**203**	**178**	**1000**

From that and by simply normalizing by row (ML method) we obtain the following transition matrix, for the desiderata levels (Table 7).

23 Pacinelli 2003.

Table 7. Transition matrix P

		1	2	3	4	5	6	7	
	Desideratum levels	*Essential*	*Very useful*	*Quite Useful*	*Useful*	*Little Useful*	*Not much useful*	*Useless*	**tot**
1	*Essential*	0.30	0.07	0.09	0.10	0.13	0.19	0.12	**1.00**
2	*Very useful*	0.04	0.25	0.12	0.13	0.15	0.18	0.12	**1.00**
3	*Quite Useful*	0.04	0.08	0.22	0.13	0.19	0.17	0.17	**1.00**
4	*Useful*	0.06	0.07	0.11	0.32	0.15	0.18	0.11	**1.00**
5	*Little Useful*	0.03	0.06	0.08	0.11	0.33	0.19	0.20	**1.00**
6	*Not much useful*	0.04	0.05	0.09	0.12	0.08	0.39	0.23	**1.00**
7	*Useless*	0.02	0.04	0.07	0.10	0.15	0.19	0.43	**1.00**

Given the results of the first iteration the 1000 citizens panel voted the need D_1 as follows (Table 8):

Table 8. 1000 citizens panel first iteration results – v_t

	1	2	3	4	5	6	7	
Desideratum D_i	*Essential*	*Very useful*	*Quite Useful*	*Useful*	*Little Useful*	*Not much useful*	*Useless*	**tot**
n	150	150	200	200	100	100	100	**1000**

It is evident that 700 participants, equal to 70%, consider the policy at least useful and therefore it has a wide consensus supported by a strong majority. In the Markov way, pre-multiplying the vector of the situation at time t (that is at the first iteration) for the hypothetic transition matrix $\lfloor v_{(t+1)}' = v_{(t)}' P \rfloor$, we get the first forecasting result (Table 9).

Table 9. first forecasting result

1° projection	1	2	3	4	5	6	7	
Desideratum D_i	*Essential*	*Very useful*	*Quite Useful*	*Useful*	*Little Useful*	*Not much useful*	*Useless*	**tot**
n	80	93	121.5	157.5	166	202.5	178	**1000**

It is immediately evident that the number of people considering the policy at least useful significantly falls passing from 700 to 452 and, considering

the attribute in addition (4 against the 3 contrary ones), the situation can be interpreted as a sudden inversion of the opinions trend. This could be due to some events not considered by the policy maker and which could emerge from a possible anonymous conference ended up with the convergence of opinions. However, in order to activate the anonymous conference, other iterations are necessary.

The product between the transition matrix and itself (P^2), gives the Markov evolution of the system at the subsequent step, being the panel consulted one year later. This result can be considered the situation at the end of next year.

Table 10. Markov product between the transition matrix and itself (P^2)

		1	2	3	4	5	6	7	
	Desideratum levels	*Essential*	*Very useful*	*Quite Useful*	*Useful*	*Little Useful*	*Not much useful*	*Useless*	**tot**
1	*Essential*	0.12	0.07	0.10	0.13	0.16	0.22	0.19	**1.00**
2	*Very useful*	0.05	0.11	0.11	0.14	0.17	0.22	0.19	**1.00**
3	*Quite Useful*	0.05	0.08	0.12	0.14	0.18	0.22	0.22	**1.00**
4	*Useful*	0.06	0.08	0.11	0.18	0.17	0.22	0.19	**1.00**
5	*Little Useful*	0.04	0.07	0.10	0.14	0.20	0.22	0.23	**1.00**
6	*Not much useful*	0.05	0.06	0.10	0.14	0.14	0.26	0.24	**1.00**
7	*Useless*	0.04	0.06	0.09	0.13	0.17	0.23	0.29	**1.00**

Pre-multiplying the previous matrix by the vector of the 1° iteration we obtain the situation of the Table 11.

Table 11. Results of the 2° forecast (three years after the 1° it.)

1° projection	1	2	3	4	5	6	7	
Desideratum D_i	*Essential*	*Very useful*	*Quite Useful*	*Useful*	*Little Useful*	*Not much useful*	*Useless*	**tot**
n	60.00	78.00	106.00	145.50	170.50	225.00	215.00	**1000**

Forecasting the system one more year, the quantity of people that consider the policy at least useful, becomes even smaller passing to only 389 people, to 372 in the following year and so on. The more the system is forecasted, the smaller the number of people considering the policy useful will be and it is possible to carry on till observing the situation at the time of the scenarios temporal horizon. Anyway, it is necessary to remember that, as already said, the probability is constant and therefore the initial ones remain always the same.

Finally, it is important to specify that the results of the application of the proposed procedure must be interpreted into the "*domain of the possible*", therefore they only give a probabilistic informative contribution to the public decision-making process.

Concluding remarks

We have seen that before reaching the timeframe of a normative scenario, some events may change the citizens' opinions on the needs/desiderata. Given that needs and desiderata are taken as targets of public intervention, in the longer period, policies that were originally initiated with best possible information may cease to meet the needs and desiderata of the citizens.

To avoid this error, we have proposed a control system for the "stability" of opinions in respect to the needs/desiderata, based on panels and Markov chains.

A point worth noting is that the frequency of the panel could not allow us to understand at the right time the impacts of events that can sensibly change the probabilities of the transition matrix and, hence, the predictive dynamic of the Markov chain. This is because the interval between the first and the second consultation is not sufficient to guarantee appropriate "intervention times" for modifying the strategic targets.

Moreover, from the first to the second consultation we could have a period more than the half of the whole scenario's temporal range. Therefore there would be no sense to carry out even a single transition matrix, because in such case we would go beyond the established planning horizon.

On the other hand, we have seen that it is preferable to consider long periods of time between two subsequent consultations of the panel, in order to face the problem of contamination.

For all these reasons it could be useful to recur to methods that allow the control of the desiderata stability for periods that are shorter in respect to the frequency of the panel. This is equivalent to the problem of verifying the

possibility of embedding the matrix of transition, namely the opportunity to put it in the continuous. This is possible through the identification of a matrix that can be powered to fractions of time and, therefore, it allows us to obtain intermediate situations along the time interval between two consultations of the panel.[24]

REFERENCES

Bijleveld, C.C.J.H. and Van der Kamp, L.J.Th. (1998) *Longitudinal data analysis: designs, models and methods*, London, Sage.

Fabbris, L. (1990) Le rilevazioni per campione delle opinioni degli italiani, SGE Padova.

Kemeny J, Snell J.L. (1960) *Finite Markov chains*, van Nostrand, New York.

Kish L. (1995) Survey Sampling, Wiley, New York.

Lee, T.G., Judge G.G, Zellner A (1970) *Estimating the parameters of the Markov probability model from aggregate times series data*. North Holland, Amsterdam.

Марков, А. А. (1906) "Распространение закона больших чисел на величины, зависящие друг от друга". "Известия Физико-математического общества при Казанском университете", 2-я серия, том 15, ст. 135-156,.

Markov, A.A. (1971) "Extension of the limit theorems of probability theory to a sum of variables connected in a chain". reprinted in Appendix B of: R. Howard. *Dynamic Probabilistic Systems, volume 1: Markov Chains*. John Wiley and Sons.

Pacinelli, A. (1990) "Sulla stima delle matrici di transizione da dati di stock", in atti dell'Associazione Italiana di Ricerca Operativa (AIRO), Sorrento.

Pacinelli, A. (2003) Metodi soggettivi per la Pianificazione Sociale Partecipata: verso la Democrazia continua, *Statistica & Società*, anno I, n. 2. pp. 23-28

Pacinelli, A. (2004) *La pianificazione sociale partecipata: approcci e metodi*, Collana di Scienze Manageriali, n. 2, Libreria dell'Università editrice, Pescara;

Pacinelli, A. (2008) *Metodi per la ricerca sociale partecipata*, F. Angeli, Milano.

Singer and Spilerman (1976) The representation of Social Processes by Markov Models, *American Journal of Sociology*, 82(1), 1-54.

24 Singer & Spilerman 1976, pp. 1-54; Gori 1984.

Part III

Human mobility and development