Abstract

The idea of the Futures Polygon stemmed from reading about the Futures Wheel (Glenn, 1994) and realizing that the Futures Wheel lacked the concept of evaluating the likelihood of the forecasted impacts, indispensable in exploring the future. Two complementary problem areas emerge from the FW approach: the evaluation of the probability of an “impact scenario” generated by the FW; the determination of a “realistic temporal horizon” for the results of the FW. The FW stimulate more questions: What is the probability that the plausible events have to happen within a certain temporal horizon? How many years does the system require to register a first reaction to the impact? How many years does the impact intensity require to get to its maximum? How long does the impact last? What is the impact consolidation level? (as in Gordon’s Trend Impact Analysis, 1994). With the FP you try to answer the previous questions. The main issue of the method proposed in this chapter derives from the use of subjective probability and, in particular, of the conditional probability. The subjectivists believe that the probability is "the degree of confidence that a coherent individual attaches to the occurrence of an event" (De Finetti, 1937).

THE FUTURES POLYGON DEVELOPMENT

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Subjective evaluations and probabilities. Some reflections

Let us say that the main issue of the method proposed in this chapter derives from the use of subjective probability and, in particular, of the conditional probability.[1] The philosophy of subjective probability is mainly due to the contributions of de Finetti, but the probabilistic evaluations provided by subjects appear in the late seventies in the famous theorem of Thomas Bayes, in which, although it is defined as "a priori probability", its subjective nature emerges clearly.

In the theorem, the latter is corrected through the experimental evidence defined as "likelihood" (deriving from the empirical evidence of the data) and provides as an output a "posterior probability" containing the evaluations of both objective and subjective sources. The subjectivists believe that there are as many probabilities as the number of subjects, and that the probability is only a measure of the "degree of subjective belief", in particular, is "the degree of trust that a coherent individual attributes to the occurrence of an event". All bets are legitimate, except those that lead to a sure loss: such wagers are called inconsistent. The requirement of consistency is the only one to be respected, as a requirement of rationality[2]. A "belief" (which in the case of a future event can be assimilated to a prediction) is said to be incorrect when additional information reveals its falsehood. According to the subjectivists, however, this conception is wrong, because when the subjective evaluation is made the additional information is not yet known. It is the transition from a priori to a posterior probability, which includes changes in "beliefs" (Suppes, 1984).

De Finetti (1937) stated: "Whatever the influence of observation on the future prediction, it does not imply and does not mean at all that we correct the primitive

[1] It is, indeed, difficult to obtain subjective conditional probabilities, which are coherent with the Bayesian assumptions (Nair and Sarin, 1979; Moskowitz and Sarin, 1983).

[2] It can be shown that this conception of probability satisfies the Kolmogorov's axioms (Suppes, 1984).

probability evaluation $P(E_{n+1})$ after it was denied by the experience, substituting for another probability $P^*(E_{n+1})$ that conforms to this experience and, therefore, probably closer to the real probability. On the contrary, it manifests itself only in the sense that when we learn from the experience that A is the result of the first *n* trials, our judgment will no longer be expressed by the probability $P(E_{n+1})$, but rather by the probability $P(E_{n+1}|A)$, namely what our initial opinion already attributed to the event E_{n+1}, considered as dependent on the result A. Nothing in this initial opinion is either repudiated or corrected: it is not the function P that has been modified (replaced by another function P^*), but the argument (E_{n+1}), replaced by $(E_{n+1}|A)$, and it is just to be faithful to the initial opinion (as it manifests in the choices of P) and consistent in our judgment, that our predictions vary when a change occurs in known circumstances".

And, he goes on: "It is clear what is required to achieve the convergence of views among observers whose initial opinions differ".

On the question whether the information can confirm or deny an opinion, furthermore, de Finetti affirmed:

> "[…] observation can not confirm or deny an opinion, which is and can be nothing more than an opinion, therefore neither true nor false; observation can only give us information that is susceptible to influence our opinion. The meaning of this statement is very precise: It means that to the probability of a fact subordinate to this information - and distinct from that of the same fact not subordinated to anything else - we can actually attribute a different value."

On this, see also Suppes (1984) page 60.

The subjective data, however, is considered "scientifically weak" with respect to the objective data, and this consideration, which can certainly be shared, is justified by the lack of symmetry constraints between past and future in the former, which according to Hempel[3] are necessary conditions for the objective approach[4].

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[3] The German philosopher Carl Gustav Hempel is known for formulating the nomologic-deductive model, in which the set of knowledge necessary for explaining a phenomenon is said *explanans* and includes one or more cover laws and initial conditions. Whereas, the phenomenon that the explanation is to be provided is said *explanandum*. Following Hempel, the explanandum derives from an explanas that consists of a class of laws $L_1,\ldots,L_n$ and some initial conditions $C_1,\ldots,C_k$.

[4] In such cases, the use of methods as the Delphi, which facilitates the convergence of probabilistic evaluations, strengthens the subjective judgements, because reduces the dissent by generating a collective intelligence with high levels of consensus (Pacinelli, 2002).

Suppes, however, reminds us that while Hempel strongly defended his "thesis of symmetry", according to which explanation and prediction are structurally identical, Hume stated that "there is no logic guarantee that the future is similar to the past, or more generically that the unknown is similar to the known." (Suppes, 1984).

The Scottish philosopher asserts that if we think of past events as a guide to making predictions about future events, then the future must necessarily retrace the past. But, in his works, Hume demonstrated that it is equally logically correct to assume a universe in which past physical laws do not coincide with the present ones and that are not uniform in any area of the space.[5] The foregoing considerations are reflected in the literature, where it is distinguished between "Forecast" (or "prognosis") and "Foresight". In the first case, it is required the respect of the theory of symmetry which, in our case, is between past and future. So that the methods for obtaining images of the future can be bring back to analysis and extrapolations of trends and relationships derived from historical objective data. The second case does not require the respect of the symmetry conditions, and relies on methods that use subjective judgments (without renouncing to the support of the objective data). Even though subjective probabilities are unanimously considered "scientifically weak", they can be reinforced by methods that, in addition to using several subjective evaluations, use the procedure of "panels" which, by means of subsequent iterations, facilitates the convergence of opinions towards an evaluation interval shorter than the initial one (consensus). Another problem of subjective probability concerns "exchangeability", because a succession of tosses can respect the principle of exchangeability, but the same is harder to imagine if we consider events. Indeed, de Finetti himself states that: "A sequence of events is said, intuitively, exchangeable if the order in which the events occur does not affect their probability." That is a rather difficult situation when dealing with temporal events.

Even in the light of its limitations, the advantages of subjectivism are undeniable; for example, you can use or not the observed frequencies, or you can assign a probability to a completely new event and therefore without having objective data.

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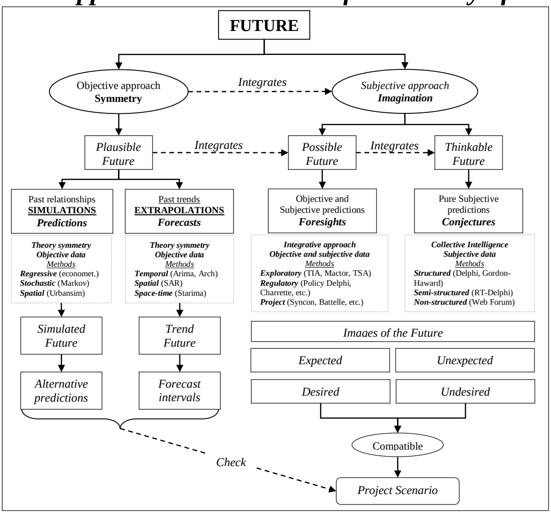
[5] In the exploration of the future, Bruno de Finetti distinguished between *prediction* and *foresight*. He believed that "say before" (prediction) is something other than "see before" (foresight), placing the subjective moment upstream in the first case and downstream in the second. In a foresight, all the available information must be taken into account, whether generated by objective or subjective data.

The development of social project scenarios, in particular, draws on three subjective sources: experts, representatives and citizens (or end users). From the last two, we get the "desiderata" that represent the images of the normative scenario, while the first ones provide assessments at different stages both in the explorative scenarios and in the normative ones[6]. The experts are involved especially in the project scenario, which implies the tactical choices needed to approach trend extrapolations (explorative scenarios) toward the desired images (normative scenario).

A comprehensive scheme, with the objective and subjective methods for studying the future, is reported in Fig. 1 (see also Pacinelli, 2012).

Figure 1. Approaches and methods for the study of the future



Subjective Impact Approaches

It is appropriate to precede the description of the Future Polygon (FP) method by some reflections, which are useful for locating it within the area of subjective impact analysis. Methods for the study of event impacts can be assigned to at least three different areas:

- consequential impact events when one or more events in a system happen: *Event Impact*;

[6] For the "Desiderata Stability" see Di Zio and Pacinelli, 2009.

- one or more events impact on a trend: *Trend Impact*;
- impacts among several events: *Cross-impact*.

Event impact analysis treats consequential impacts arising from one occurring event, which can be expected or unavoidable (as for some natural phenomena) or can derive from an intervention, political or other. It is possible to include the Futures Wheel (Glenn, 1972) and its derivative and complementary Futures Polygon method (Pacinelli, 2006) into this area. The FP has recourse to the Delphi procedure in order to obtain probability evaluations of each futures "wheel" event and to transform them into a polygon. The aim of the Futures Polygon is to graphically depict the occurrence probability of the whole set of events obtained by the Futures Wheel.

Trend impact analysis (TIA) is designed to study the impact of possible future events on the trend of certain quantitative or qualitative variable (Gordon, 1994). The approach governing these methods consists of correcting the extrapolated trend of one or more phenomena, on the basis of subjective evaluations which are formulated by experts on the effects that a determined set of future events may produce on that trend. The TIA can be integrated by other forecasting methods based on models.
Cross Impact Analysis allows consideration of the mutual impacts of a set of events with each other, generally collected into a matrix. Cross impact, based on the study of interactions among a set of events, is the richest among these methods, each of which has its own goal, depending on the objective for which it was created. Correcting the probabilities obtained by a Delphi (Dalkey and Helmer, 1963), tracing trajectories towards the future (Kane, 1972), or building scenarios (Brauers and Weber, 1988).[7] Cross-impact, in turn, can be classified in three different types, based on the approach used by the techniques which are part of it: a *simulative* approach, a *heuristic* approach or an *optimization* approach.

The idea of the Futures Polygon stemmed from reading about the *Futures Wheel* (FW) in Futures Research Methodology 1.0 (Glenn, 1994) and realizing that the Futures Wheel lacked the concept of evaluating the likelihood of the forecasted impacts, an indispensable element in exploring

7 Particularly, Cross-impact simulates different decisions compared to different future situations, aiming to determine optimal and/or preferable strategies.

the future. The inventor of the FW regarded *unanimity*[8] as a good indicator of the plausibility of events/impacts on which there is agreement, since the unanimity can be interpreted as a "guarantee" that the impact will happen within a "realistic temporal horizon". The plausibility judgment should precede any forecasting or scenario because if the event is not plausible it does not fall within the "cone of plausibility" (someone defines it as the forecast cone), which is a fundamental instrument of investigation about the future. The previous observations stimulate some questions:

- What is the probability that the plausible events have to happen within a certain *temporal horizon*?
- How many years does the system of interest require to register a first reaction to the impact?
- How many years does the impact intensity require to get to its maximum? How long does the impact last? What is the impact consolidation level? (as in Gordon's *Trend Impact Analysis*, 1994).

Two complementary problem areas emerge from the FW approach:

- the evaluation of the probability of an "impact scenario" generated by the FW;
- the determination of a "realistic temporal horizon" for the results of the FW.

From the previous, two different FP versions originate from them. To give an answer to the above questions, a first method, complementary to FW, was created with the capacity to give indications about the probability of the "impact scenario" (for each event and for the overall scenario), while a second version was finalized to yield a realistic temporal horizon evaluation. The method is called *Future Polygon* (Pacinelli, 2006) because the different probabilities of the events/impacts obtained by a FW and their own different years of occurrence generate a polygon if connected with a broken line.

The Futures Polygon

Future Polygon should be applied at the conclusion of the phases related to the scenario building activity and not after a single event impact evaluation.

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8 The *unanimity rule* (Wagschal, 1981) is an important point of reference for people using participatory methods (Pacinelli, 2007) but it is not sufficient to make a foresight, which needs an occurrence probability for each event/impact.

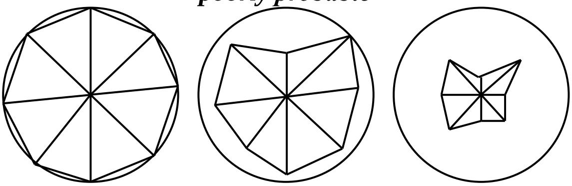
The principal characteristic of the event impact methods, as for example the Futures Wheel and its derivatives, is to build the scenario expansion from the events considered in it. In other words, each of the events which constitute a scenario can activate elements in its turn which make the happening of other events most probable. The application of event impact, with a set of n events constituting the scenario, generates for each of them an expansion of the scenario itself because other primary order impacts, deriving from the previous ones, are added in and the expansion can increase again if we also consider the second order impacts. The process is the following:

- First of all, the "wheel of futures", obtained by the Futures Wheel, is adopted. The application of the rule of unanimity for the plausibility evaluation of the impacts has eliminated the events on which there is no agreement among participants, so the work continues only on the impacts which are considered plausible. The requirement to work only on plausible events is really important because it excludes situations in which some experts could value impossible (or nearly) certain impacts;
- When the result of the Futures Wheel is ready, each Futures Wheel participant (or a new participant panel) is asked to attribute a probability of occurrence to the recognized impacts, following the well known *Delphi method* (Dalkey and Helmer, 1963). The group could in fact agree, during *face to face* discussion, on single probabilities (or intervals) to be assigned to the impacts, or subjective evaluations can be reinforced by structured communication procedures, as for example by means of the Delphi. The question, addressed by the facilitator, will be formulated as following: "What probability do you attribute to the occurrence of each plausible event deriving from the Futures Wheel within the defined time horizon?"
- When the assessment of the probability of occurrence within the settled date has been done for all the impacts of the Futures Wheel for a given event, the graphic representation is constructed, using a polar reference system. An O point, called the "pole", is fixed on the plane (it corresponds, in this case, to the event whose future implications must be studied), and a length, L, is chosen, with some value suitable for the size of the final graphic. The set of the n impacts is then represented as a collection of n radii, departing from the pole, evenly spaced in angle (i.e. the angular spacing between impact radii must be $360°/n$). The length of the radius representing an impact is proportional to the probability of the impact, namely set equal to pL, where p is the probability of the impact on which the group reached a consensus (the final interquartile range or the median of the Delphi) Of course, being $p \leq 1$, we have $0 \leq pL \leq 1$. After this,

the endpoints of the n radii are connected to form a polygon, contained within the circle of radius L (corresponding to a probability of 1), and having the general shape of Glenn's Wheel.

The higher the probabilities of the impacts are, the more the polygon will approach its maximum area, theoretically reachable when all the events are considered certain. Therefore, the proposed method can be also used to evaluate the result obtained by the Futures Wheel. The consideration of an impact as plausible by a group of experts, does not imply a high probability for it to take place within a certain time horizon, but it only implies that it is plausible if the principal event happens.

Figure 2. Examples of impacts evaluated as "certain", "very probable", "poorly probable"

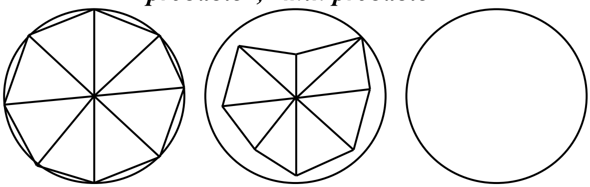


Starting from Fig. 2, it is easy to build a first measure for the evaluation of the scenario as a whole, for example by making the ratio between the sum of the "degrees of possibility" (from 0 to 100) of the impacting events $\Pr(impact)_j$ and the number of impacting events - say K – multiplied by 100. The use of the degree of possibility with values from 0 to 100 instead of the probability (which from 0 to 1), allows us to avoid the classical constraints of the latter, and is more easy understandable for the participants.
So, by considering a Futures Wheel (FW) with radius $1 \cdot 100$ and the impacts k_j (with $j = 1,2, \dots, K$) each of which is associated with a degree of possibility of occurrence $\Pr(k_j)$ - ranging from 0 to 100 - within the give time horizon, we have:

$$ESFP = \frac{\sum_{j=1}^{K} \Pr(k_j)}{K \cdot 100}$$

The measure $ESFP$ (Evaluation of the Scenario of the Future Polygon) is a simple composition ratio that provides the usual relative frequency, with a range from 0 (all the impacts of the scenario are impossible, i.e. have zero probability of occurrence) to 1 (all the impacts are certain, that is all have probability equal to 1).
In the first scenarios of Fig. 3 (left) the ratio $ESFP$ is equal to 1, since each impact has probability 1 to occur. In the second case (centre), the value of $ESFP$ is greater than zero and less than one, while in the third case (right) the measure is equal to zero.

Figure 3. Impacts which are evaluated as "max probable", "very probable", "min probable"



Among the advantages of the FP there is (as it is also for the FW) the possibility of expanding the scenarios, so as to show both the direct and indirect consequences of its occurrence. Further, the FP allows the evaluation of the probability that the whole set of impacts happens within a certain time horizon or the evaluation of within which temporal horizon all the impacts, or a part of them, individuated by a FW, will happen. Another strength of the FW retained by the FP, is that, by hypothesizing an intervention of almost any kind, the flexibility of the approach allows the collection of information on possible impacts in each of the communities concerned, using the *mediated participation* (through the representatives) and/or the *direct participation* (through the citizens)[9]. However, it is worth noting that the FP is more suitable for the *technical participation*, which is that applied through the experts (Pacinelli, 2007), given the difficulties deriving from giving probability evaluations. The principal weaknesses of the FP, not present in the FW because it does not use probability evaluations as in all the other impact methods, are those relating to the use of subjective conditional probabilities. The use of the methods for the convergence of the

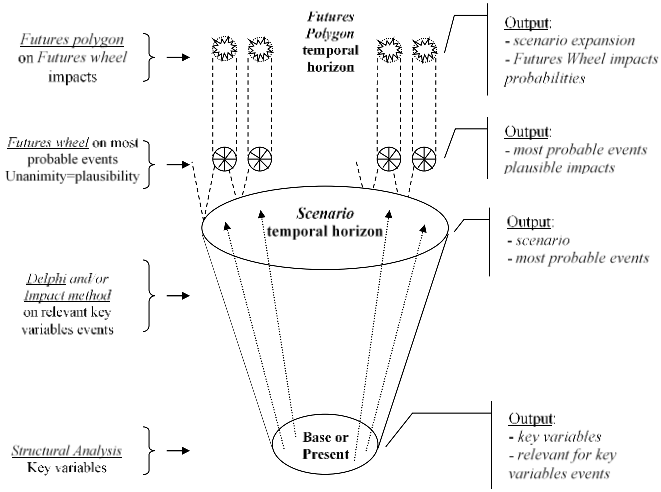
[9] On this, see among others Pacinelli, 2002.

judgements of the expert about the probabilities (as the Delphi method and its derivatives) reinforces subjective evaluations. In fact, their application generates a collective intelligence (Lévy, 1994) with high level of "share" but it is very difficult to obtain subjective conditional probabilities evaluations which are coherent with the Bayesian standards (Nair and Sarin, 1979; Moskowitz and Sarin, 1983).

The Futures Polygon for the scenario expansion

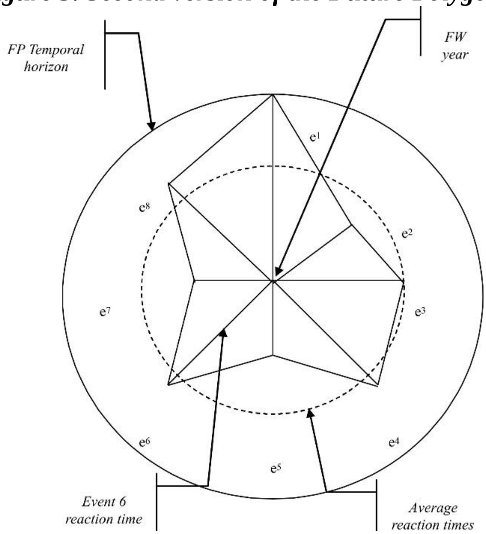
The FP is complementary to the FW method and therefore, having been created in symbiosis with it, their integration is implicit. In any case, the FP and the FW, integrated with other methods, allow the expansion of the scenarios extending the temporal horizon and enlarging the funnel of the considered set of events. Below is an application in which the Focus Group, the Policy Delphi, the Futures Wheel and the Futures Polygon are used in an integrated approach, applied to the development and expansion of a scenario on the job possibilities of disadvantaged workers. In Fig. 4, it is possible to observe a hypothesis of integration of methods, in which the output of one method is used as input for another method, which goes from the building of the scenario to its expansion.

Figure 4. Futures polygon for scenario expansion



Glenn (1972) with the FW and Gordon (1994) with the TIA afforded the opportunity to move from the theme of future "impacts", which had stagnated on the cross-impact for a long time, towards alternative approaches. In fact, the first proposes a method to individuate impacts (unanimously considered as plausible) which can occur as the expression of a certain event and is therefore related to an event impacting on a system, for example on a well-defined social or environmental system. The second, moving attention to the impacts that a set of events has on one or more time trends, allows focusing the attention toward an important concept: the *reaction time*. In fact, the experts of a TIA, among other things, are asked to formulate a subjective evaluation of the "primary impact time (or year)", referring to the "reaction time" that is the time to first noticeable impact (expressed as number of years, months or whatever, necessary for the trend to produce a first signal of reaction). It is obviously possible to go back to the *reaction time* from the *primary impact year* for each of the impacts obtained by the FW. Having the reaction times allows one to promptly program the corrective interventions, before the negative effects of the event manifest on the social tissue.

Figure 5. Second version of the Future Polygon



Lastly, two FP variants are proposed, both starting from the FW. While the first version, described above, brings the FW towards the scenarios expansion, up to a certain time horizon, the second type of FP studies the temporal horizon of each of the impacts individuated by the FW. In the second version, the length of the radius of an impact is set proportional to the reaction time for that impact, producing a reaction time representation for each event, rather than the probability representation. It is then appropriate to calculate the average reaction times and highlight the average year by a circumference. See Fig. 5 for an example.

Table 1. Synthetic recap of the Futures Polygon method

PHASES	Description of FUTURES POLYGON activities
1°	Participant selection and meeting organization
2°	Instructions about the method (probability evaluations) and acquisition of Futures Wheel results
3°	Inclusion of the impacts obtained by Futures Wheel first iteration questionnaire and pre-test
4°	Delphi evaluation on impacting events probability individuated by Futures Wheel
4_1°	Administering and collection of first iteration questionnaire according to Delphi procedure
4_2°	Elaboration of first iteration questionnaire data (interquartile intervals)
4_3°	Drafting of second iteration questionnaire
4_4°	Administering and collection of second iteration questionnaire
4_5°	Elaboration of second iteration questionnaire data (intervals and motivations)
4_6°	Drafting of third iteration questionnaire with intervals and spaces for motivations and counter-motivations
4_7°	Administering and collection of third iteration questionnaire
4_8°	Elaboration of third iteration questionnaire data (intervals, motivation and counter-motivations)
4_9° *	Calculation of interval median events (possibly corrected by the Gordon and Hayward method) Gordon and Hayward, 1968.
5°	Use of probability obtained by Delphi for Futures Polygon construction
6°	Group consideration of event probability evaluation obtained by Futures Wheel
7°	Results presentation and comment

*It should be noted that Phase 4 could be replaced by a Real Time Delphi.

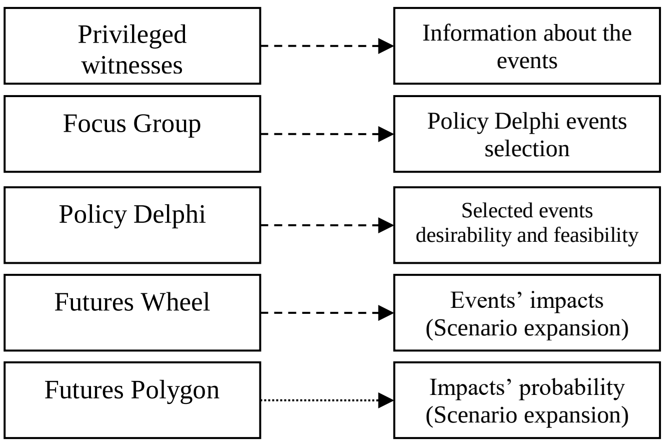
An application: the use of the Futures Polygon in integration with other methods

The experience is derived from a survey on "Identification of niches work demand for poor in the Chieti-Ortona area" (Italy), carried out within the European Project Equal-Linea (years 2002-2003). The action aimed for by the research was:

> "to favour social and working integration and re-integration of disadvantaged categories and/or of those population groups with higher exclusion risk from the local work market by removing individuated obstacles and barriers".

The research focus comprises: dropped-out young people without useful qualifications at a professional level, jobless adults (over forty or so), and physically or mentally disabled people. Various methods in integration, such as Focus Group, Policy Delphi and Futures Wheel, were used. The results of the Futures Wheel were subsequently used to apply the Futures Polygon technique. The study was structured into different phases, on the basis of a research design in which each output of a method was used as input for the following one. A synthetic design of the research plan is illustrated in Fig. 6.

Figure 6. Methods integration



The following issues emerged from the Focus Group[10]: territorial unease, work environment awareness, Coach Work project, social assistant as tutor, Job Sharing, working integration, work demand/offer match. A vast part of the information collected by the Focus Group flowed into the Policy Delphi. During the preliminary survey phase, a heterogeneous panel was constructed, formed by representatives from the communities in the study area, entrepreneurial associations, and professional orders; also technical competences (expertise) and local reality knowledge criteria were applied. The age of the participants goes from thirty to fifty-five years. Further, the involvement of a control group was considered secondary because the subsequent Futures Wheel implementation was deemed sufficient to analyse the validity of the emerged results.

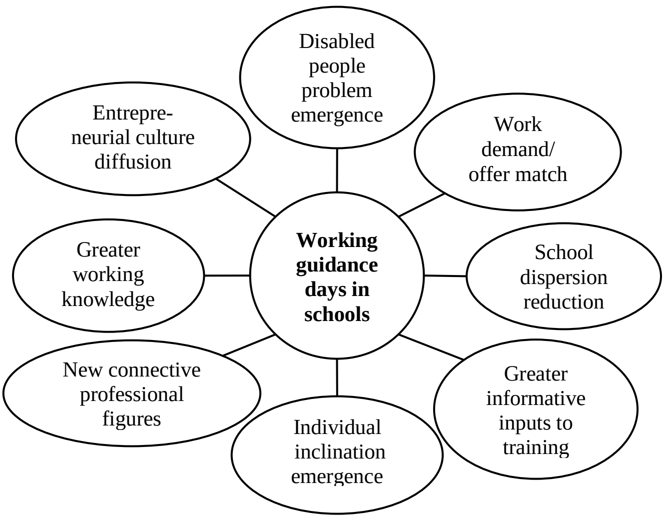
During the preliminary survey phase, the research group, on the basis of the results of the focus group, produced a first list of items/events which, once analysed, selected, and quantitatively reduced, resulted in a definitive drafting. Twenty-eight intervention hypotheses, divided between option items, or rather actions (projects or proposals), and goal items (objectives), were submitted to the panel. As regards the evaluation scale, we adopted the desirability and technical or political feasibility scales, comparing potential developments (feasibility evaluations) and desirable developments (desirability evaluations). In this way we moved from a "technical" or political forecasting dimension (expected or probable future analysis) to a "political" forecasting dimension (shared hypothesis about the desired future individuation). For brevity, the results of all the considered events are not reported in the present work. As an example, we show the event which prevailed in terms of desirability and feasibility, that is: "*Working guidance days in schools*".

This phase of the research proceeded on the basis of the integrative approach, so using the Policy Delphi results as inputs for the Futures Wheel (Di Giandomenico, 2004). The panel contained twelve participants who were invited to project themselves into the future and to imagine consequences (impacts) that the events, if realized, would have generated into the analysed territorial reality. With respect to the original protocol of the method, the research was carried on writing the name of the phenomenon (or event) into the centre of a piece of paper and drawing little

10 The work carried out in a focus group can generate interesting additional information if it is supported, as was the case in the present example, by its complementary technique called "debate evaluation".

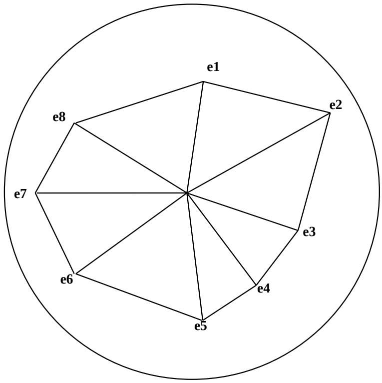
radii containing the primary order impacts (or consequences) at the extremity. Afterwards, secondary impacts forming the second ring of the wheel were reported for each primary order impact. The procedure went on until a useful and clear representation of the implication related to the event was obtained. All the panel members agreed about the real causality links between the main event and the primary impacts, and between the primary impacts and the successive ones, in respect of the unanimity rule. In Fig. 7, for practical reasons (readability of the diagram and aims of the present work), we report only the impacts of the first order (the application went on until the third order of impact).

Figure 7. Futures Wheel. Primary order impacts. Event: "Working guidance days in schools"



Finally, by using the FW we applied the Futures Polygon, with a time horizon of eight years. The results are reported in Fig. 8.

Figure 8. Futures Polygon "Working guidance days in schools"



References

Brauers, Jutta and Weber, Martin. "A new method of scenario analysis for strategic planning." *Journal of Forecasting* 7, no. 1 (1988): 31-47.

Dalkey, Norman C., and Helmer, Olaf. "An Experimental Application of Delphi Method to the Use of Experts." *Management Science* 9, no. 3 (1963): 458-467.

De Finetti, Bruno. "La Prévision: Ses Lois, logiques, Sef Sources Subjectives." *Annales de l'Institut Henri Poincaré* 7 (1937): 1-68.

Di Giandomenico, Monia. "L'applicazione della tecnica Futures Wheel finalizzata alla individuazione degli impatti sulla realtà chietina-ortonese dati dalla realizzazione di due soluzioni: "giornate di orientamento al lavoro presso le scuole" e "progetto coach Work", In *Fabbisogni lavorativi delle imprese dell'area chietino-ortonese,* Equal-linea, edited by Cannarsa, Vasto, 56-72. 2004.

Di Zio, Simone, and Pacinelli, Antonio, "Desiderata stability. Methodological considerations", In *Globalisation*, edited by J. Kultalahti, I. Karppi, O. kuktalahti, E. Todisco, 99-118. Finland, East-West Books Helsinki, 2009.

Glenn, Jerome, C. "Futurizing Teaching vs Futures Course." *Social Science Record*, 9, no. 3 (1972): 26-29.

Glenn, Clayton, J. "The Partecipatory Methodology" In *Futures Research Methodology*, edited by Jerome C. Glenn and Theodore J. Gordon, Washington D.C.: The Millennium Project, American Council for United Nations University, 1994.

Godet, Michel. *Prospective et Planification Strategique*. Paris: Economica, 1985.

Gordon, Theodore, J. "The Trend Impact Analysis" In *Futures Research Methodology*, edited by Jerome C. Glenn and Theodore J. Gordon, Washington D.C.: The Millennium Project, American Council for United Nations University, 1994.

Gordon, Theodore, J. and Hayward, Howard. "Initial Experiments with the Cross-Impact Matrix Method of Forecasting", *Futures* 1, no. 2 (1968): 100-116.

Kane, Julius. "A Primer for a New Cross Impact Language- KSIM." *Technological Forecasting and Social Change* 4, no. 2 (1972): 129-142.

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

Moskowitz, Herbert, and Sarin, Rakesh, K. "Improving the Consistency of Conditional Probability Assessments for Forecasting and Decision Making." *Management Science* 29, no. 6 (1983): 735-749.

Nair, Keshavan, and Sarin, Rakesh, K. "Generating Future Scenarios - Their Use in Strategic Planning." *Long Range Planning* 12, no. 3 (1979): 57-61.

Pacinelli, Antonio. "Sull'uso di metodi soggettivi nella Pianificazione Sociale Partecipata: verso la Democrazia Continua." *Statistica & Società* 1, no. 2 (2002): 23-28.

Pacinelli, Antonio. "A complementary method to future wheel: the future polygon." *Futures Research Quarterly* 22, no.1 (2006): 71-78.

Pacinelli, Antonio. *Metodi per la ricerca sociale partecipata*. Milano: Franco Angeli, 2007.

Pacinelli, Antonio. "The Futures polygon" In *Futures Research Methodology*, edited by Jerome C. Glenn and Theodore J. Gordon, Washington D.C.: The Millennium Project, American Council for United Nations University, 2009.

Pacinelli, Antonio. "I metodi della previsione" In *La previsione sociale. Introduzione allo studio dei futuri*, edited by Roberto Poli and Simone Arnaldi, 149-163. Roma: Carocci editrice, 2012.

Suppes, Patrick. *La logica del probabile: un approccio bayesiano alla razionalità*. Bologna: Clueb, 1984.

Wagschal, Peter. "Futuring: A Process for Exploring Detailed Alternative Futures" *World Future Society Bulletin* September/October (1981): 25-31.