State of the Future Index:
A Measure of the Global Outlook for the Future

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ABSTRACT

Over the past seven years, the Millennium Project of the World Federation of United Nations associations has constructed and experimented with a State of the Future Index (SOFI), a measure of the 10-year outlook for the future. This index uses variables which in the aggregate depict whether the future promises to be better or worse; the variables have been recommended by a world-wide expert panel. The SOFI is intended to show the directions and intensity of change in the global outlook and to identify the factors responsible for changes; it may therefore be useful in policy analysis by demonstrating the effects of proposed policies on a nominal State of the Future Index.

Keywords: State of the Future Index, Futures Research, SOFI, Global Outlook, Policy Analysis, Monte Carlo, State of the Future.

INTRODUCTION

The State of the Future Index (SOFI) is an index comprised of variables that one would include when answering the question: "is the outlook for the future improving or worsening?" This question was posed to the Millennium Project's Nodes (individuals and institutions in 30 or so countries) in order to compile a list of candidate variables for such an index. The first list was compiled in 2001 and the most recent in 2007. After redundancy among these variables was removed, some 29 variables remained and 20 years of historical data were collected. These data were extrapolated 10 years into the future by fitting with various time series. The forecasts were modified later to include probabilistic perceptions about the consequences of future developments. The historic data and forecasts were used to construct the index. This approach provides a mechanism for studying the relationships among the items in a system—how making a single change ripples throughout a system, in other words, creating some positive and intended consequences as well unintended results. Taken as a whole, the SOFI process is an example of the use of data to create information, and the use of information in a system that could improve policy making.

The process requires the collection of expert judgments about the variables that should be included, their weights, and the best and worst expectations for the values of the variables 10 years in the future. In order to collect this information, in each of its experiments, the Millennium Project tapped its global network of "Nodes" and secured the cooperation of more than 100 experts. The methodology used was the Delphi technique, and most recently, the Real Time Delphi approach, developed by the Millennium Project in which feedback of group information is provided to participants in essentially real time.

INDEXES HAVE DRAWBACKS

Combining many variables into a single index number is a synoptic way of representing a many-faceted situation, but unless the data behind the index are preserved and transparent, indexes can lead to oversimplification and loss of detail about the elements that make up the index. Further, creating an index requires judgments not only in selecting the variables to include but also in weighting them. An index of global conditions expressed as a single

number or time series can mask variations among regions, nations, or groups. The apparent precision of an index can easily be mistaken for accuracy. For these reasons, many people interested in tracking social or economic conditions prefer to keep the variables that they consider important separate and distinct. Hence, in SOFI work, great attention is given to the choice of variables that make up the index, seeking accurate historical data sources from primary and credible secondary sources, and tracking the history and forecasts over time.

NATIONAL SOFIs

Since our SOFI experiments began seven years ago, three types of SOFIs have been constructed: a global SOFI (depicting the world as a whole), national comparison SOFIs (which use standard variables and weights to facilitate nation to nation comparison) and national-focus SOFIs (designed to capture national nuances). The national-focus SOFIs allow the country itself to select the variables, weights, the direction of favorable changes, and other factors involved in the computation of SOFI in order to capture a true national perspective and cultural differences. As an example, consider population growth: on a global basis increasing population growth is considered to lower the state of the future, but in South Korea, where population shrinkage seems to be a looming problem, increasing national population growth is considered desirable and likely to improve their state of the future[1].

Some individual countries that comprise the Millennium Project's network have elected to construct national comparison and national-focus SOFIs; these countries include Turkey, South Korea, Venezuela, and China, and a similar project is underway in South Africa.

OBTAINING JUDGMENTS THROUGH REAL TIME DELPHI

The calculation of global or national SOFIs requires a number of judgments:

1) The selection of the variables themselves and the weights which should be accorded to them.
2) The "best" and "worst" estimates of the future values of these variables to provide guidance as to the directions of positive change (which is often but not always obvious), to provide a range of plausible expectations and for use in the later normalization process.
3) Selection of developments that can perturb the future course of the variables, the probabilities of these developments and their effects.

A Real Time Delphi study was conducted in early 2007 involving about 120 international participants selected by the Millennium Project's 30 Nodes as people with relevant expertise; the panel included primarily academics (29%), consultants (18%), employees of NGO's (7%), government agencies (11%), and private sector (13%). Self-identified authors, employees of international organizations, and those who placed themselves in the "other' employment category accounted for the rest. Geographically, the respondents were from Europe (33%), North America (32%), Asia (11%), Latin America (10%), Africa (10%), and the Middle East (5%).

The questionnaire provided the respondents with definitions of an initial set of variables (based on earlier research), a recent global data point for each variable, and the current "best" and "worst" value of each variable. They were asked for additions to the list and for their estimates of the global "best" and "worst" values the variables would attain in ten years. They were also asked to review a list of prospective developments that could affect these variables, add to the list, and to provide estimates of probability and domains of impact of these developments.

As the figures below show, the TIA results generally, but not always, fell between the group's estimates, and the TIA spread was narrower than the direct estimates.

VARIABLES INCLUDED IN SOFI

The most recent global studies have used the following variables:

1. Population lacking access to improved water sources (percent of population)
2. Literacy rate, adult total (percent of people aged 15 and above)

[1] The Millennium Project has created a free instruction manual for use in constructing national and focus SOFIs which can be accessed at: www.mpcollab.org/learning/course/view.php?id=3.

3. Levels of corruption (15 largest countries)
4. School enrollment, secondary (% gross)
5. Poverty headcount ratio at $1 a day (PPP) (% of population) (Low and Middle Income Countries)
6. Countries having or thought to have plans for nuclear weapons (number)
7. CO_2 emissions (global, kt)
8. Unemployment, total (% of total labor force)
9. GDP per unit of energy use (constant 2000 PPP $ per kg of oil equivalent)
10. Number of major armed conflicts (number of deaths >1,000)
11. Population growth (annual %)
12. R&D expenditures (% of national budget)
13. People killed or injured in terrorist attacks (number)
14. Energy produced from non fission, non fossil sources (percent of total primary energy supply)
15. Food availability (cal/cap)
16. Population in countries that are free (percent of total global population)
17. Global surface temperature anomalies
18. GDP per capita (constant 2000 US$)
19. People voting in elections (% population of voting age)
20. Physicians (per 1,000 people)(surrogate for healthcare workers)
21. Internet users (per 1,000 pop)
22. Infant mortality (deaths per 1,000 births)
23. Forest lands (% of all land area)
24. Life expectancy at birth (years)
25. Women in Parliaments (percent of all members)
26. Number of refugees (per 100,000 total population)
27. Total debt service (% of GNI) (Low and Mid Income Countries)
28. Prevalence of HIV (% of population)
29. Homicides, intentional (per 100,000 population)

In general, twenty years of historic data were obtained from primary or credible secondary sources; these data are fit with time series and extended ten years into the future to represent a surprise free base line. Surprise free SOFIs can be constructed using these data and extrapolations.[2]

TREND IMPACT ANALYSIS[2]

Trend Impact Analysis (TIA) is used to assess the consequences of future unprecedented developments on the extrapolations of the variables and the SOFI produced from them. As noted, an initial list of developments was extended in the Real Time Delphi which also provided estimates of the probabilities and domains of impact of these future developments. A Monte Carlo process was used to modify the baseline extrapolations of the variables on the basis of the assumed effects of the developments..

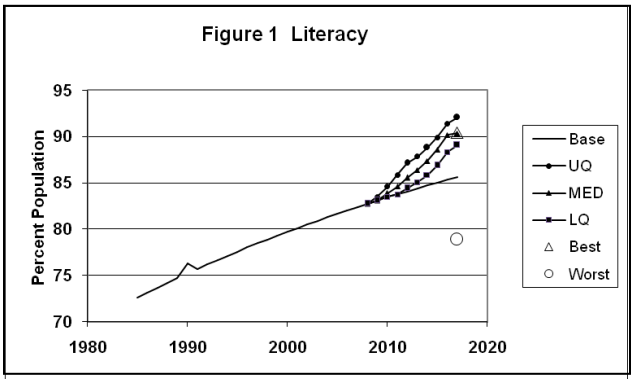
Examples of a dozen of the roughly 100 developments are presented below. The numbers in parenthesis are estimates made by the global panel of the probability of occurrence by 2017.

- A nuclear accident such as Three Mile Island (causes many nuclear nations to de-nuclearize). (10%)
- A very good, fast $150 laptop computer becomes available everywhere. (65%)
- Advent of a "teachers without borders" movement (50,000 new teachers in the field) (30%)
- A pandemic of the scale of HIV/AIDS (30%)
- At least 10 countries introduce effective policies designed to increase birth rates to avoid population implosion (75%)
- Automation and robotics increase productivity 25% in enough countries to make "jobless" economic growth (50%)
- Availability of a cheap effective anti-aging therapy (35%)
- Bad weather (storms, hurricanes, floods) cause wide-spread crop failures in at least one year (25%)
- Canada begins to export water (35%)
- Carbon sequestration used by 25% of carbon-based industries (50%)
- Cell phone evolution and wireless Internet leads to massive increases in Internet access. (75%)
- Concentration of the media (50% of all TV and newspapers in the hands of three or so firms globally) creates agenda and shapes public opinion (40%)

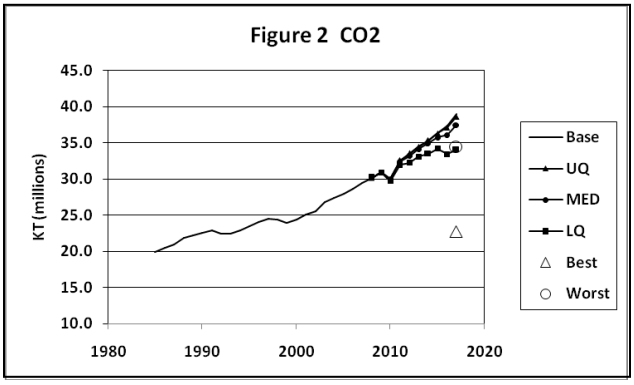
The selection of such developments, assumptions about their probabilities and impacts are, in effect, scenario assumptions about the future, made explicit and hopefully consistent across the set. Staff members provided assumptions about the impacts of all 100 developments, should they occur, on each variable and the timing of the impacts on the course of the variables.

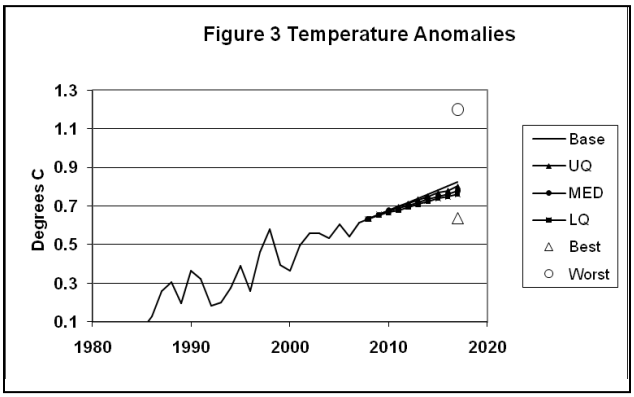
Figures 1-4 show four examples of the TIA results are shown below: (the Millennium Project's State of the Future reports include such charts for all 29 variables)

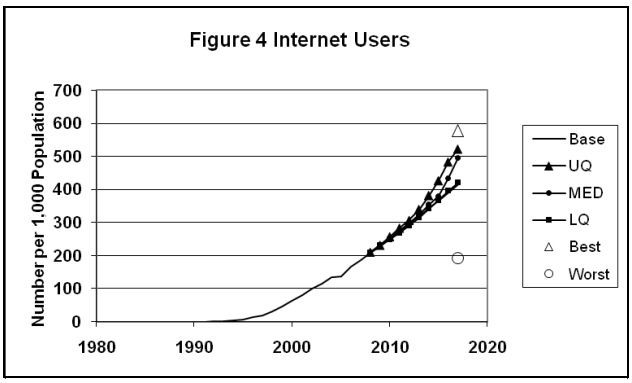
[2] A full report on the design of the Real Time Delphi and the SOFI analysis based on the results of the study can be found in Glenn and Gordon [1].



In this and the three following figures, 'UQ' means upper quartile of the TIA analysis- (that is, 25% of the computer runs gave higher results), 'Med' means median, (that is, there were as many runs above as there were below this line) and 'LQ' means lower quartile (that is, 25% of the runs gave lower results). Also shown on these charts are the panel's direct "best" and "worst" estimates of the future values of these variables.







The literacy curve shows the percentage of the population at age of 15 who can read and write a simple statement on everyday life [3]. The CO_2 curve shows annual CO_2 emissions in thousands of metric tons) [4.] Temperature Anomalies refers to the differences between the average global temperature of the 20th century and current and future expectations in degrees C [5]. Internet Users simply presents a past and anticipated headcount. [6]

CALCULATION OF THE INDEX

The projections of the variables were used to compute the State of the Future Index. First it is necessary in this process to express the value of each variable in percentage terms. In the current analysis the equation used was:

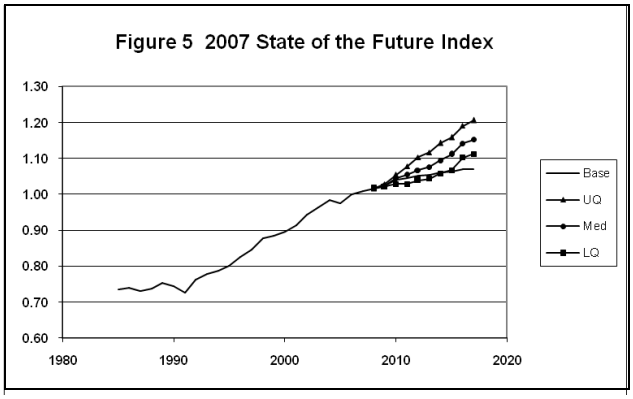
$$\text{Score} = 100 * (V - V_{best}) / (V_{best} - V_{worst})$$

where 'Score' is the non-dimensonalized value of a given variable in a given year, 'V' is the raw value of the variable in that year, 'Vbest' is either the judgmental "best" value from the Real Time Delphi or the "best" value in history or forecast, and 'Vworst' is the judgmental value from the Real Time Delphi or the "worst" value in history or forecast. This assures that the calculated values were between 0 and 100.[3]

[3] An alternate approach might have been to use the best value attained by any country and the worst value attained by any country in a given year. This "cross sectional" approach is used by the Human Development Index (HDI) of the United Nations Development Program and contrasts with the "longitudinal" approach used in our study. To use the cross sectional approach, one requires data from all countries in any given year, and this simply was not practical for our global or national computations. However the SOFI computation used in the IFs model will use the cross sectional approach.

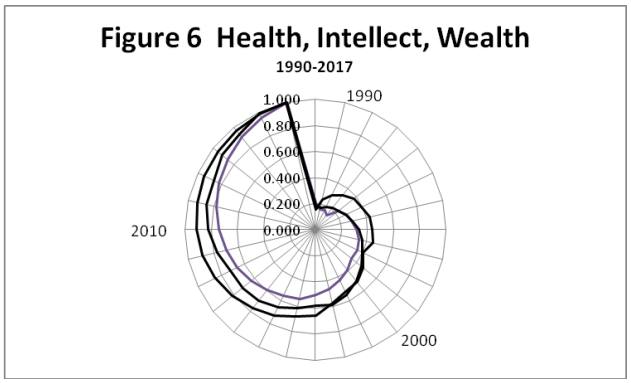
The scores for each variable were multiplied by the weights obtained in the Real Time Delphi. In each year the weighted scores were summed across all variables and these were divided by the sum for 2007 to obtain the SOFI value.

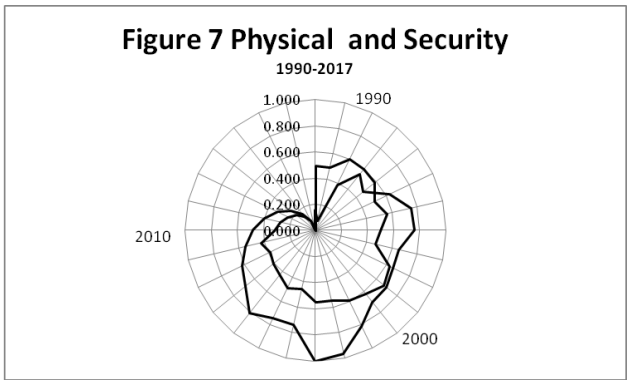
Including the TIA values for the projected variables in the computation yielded the following picture of the SOFI:



In this figure, the year 2007 was taken as the reference year. The line labeled "Base" is the SOFI solution without consideration of the future developments; UQ, LQ, and Med and the upper quartile, lower quartile and median of the SOFI solutions considering the future developments through the TIA.

Additionally, experiments in the dynamic presentation of the SOFI have been conducted. In one of these experiments, the variables were grouped into six categories: health, intellect, wealth, moral, physical, and security. These were plotted on polar graphs in which the outer rim represented the "best" and the hub, the "worst" forecast. The spokes represented years running clockwise from the past into the future. Stepping the values of the five categories year by year formed an animation; it was illuminating to see the graphs of health, intellect, and wealth spiral outward toward an improved state of the future, and the graphs of physical, and security meander without clear direction or move toward the hub in the forecasted years. This technique was first demonstrated by Zhouing Jin, Chair of the Millennium Project's China Node and was used by her to show the anticipated consequences of prospective Chinese policies- not just on the primary target but across the spectrum of elements represented in the SOFI





REMAINING WORK

The ability to compute global and national comparison SOFIs has recently been added to the International Futures model (IFs) at the University of Denver (Barry Hughes) [2] and will soon be on line and available for general use. Initial experimental runs have already been conducted with the model using a somewhat shortened list of variables. The results are extremely promising and will be included in the *2008 State of the Future* report. This tool will facilitate comparison of SOFIs among nations and allow users to experiment with policies designed to improve one situation and to show its consequences to national comparison and focus SOFIs as well as on the global SOFI. It is our hope that this will become a widely used and effective policy analysis tool.

It may be desirable to apply the SOFI concept to other systems including measurement of anticipated progress toward corporate goals and in fact in any application in which an aggregate measure of elemental variables is an indicator of progress or regress.

Once several countries have produced SOFIs to the same standards (and this may be possible soon using the IFs model) a systematic comparison could be accomplished and of particular interest would be an analysis designed to find whether country SOFIs (weighted by population) add up to the global SOFI. Several suggestions have been received for additional variables: one suggestion is a measure of national innovativeness and another is a measure of organized crime. On line data bases of variables and events might be constructed to facilitate national and other applications.

Finally, the analysis technique should be extended so that points of sensitivity are easily identified. The system might be set up to identify how forecasts of the State of the Future Index change with small perturbations of, for example, the probability of each development, or the weight of a variable. In this way, points of policy leverage or significant threat could be identified and serve as the basis for proactive policy discussions. Tests would be required to assess the whether or not the technique has the potential to improve real world decision-making.

REFERENCES

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