TECHNOLOGICAL FORECASTING IN PRACTICE. pdf

1: Call for Papers - Elsevier

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Scientific, operational, and, increasingly, business requirements determine what observations to make, how the information should be analyzed, and what products to create. The scientific understanding generated by developing and using these data and products, together with improvements in instrumentation and computation, lead to a new set of requirements. The new capabilities that emerge from this evolving system can change what the sectors are doing or want to doâ€”sometimes dramaticallyâ€”and thus directly affect public, private, and academic partnerships. Despite sharp declines in the telecommunications industry and Internet start-up companies, new technologies and products continue to be introduced at a rapid rate. This chapter reviews scientific and technological changes in the weather and climate information system that have the potential to affect partnerships. The committee focuses on how the evolution of technology might alter the balance between the sectors, rather than on specific technologies, which have been the subject of numerous reports. Effective Partnership in Weather and Climate Services. The National Academies Press. There are many computer and communications technologies that may have an impact on both the weather enterprise and the relationships among the partners. Examples include modeling, networking technologies, visualization, human-computer interfaces, and technologies for storing, structuring, and exchanging data. This report focuses on technologies that were deemed to have particular impact on partnerships. Predictable technological changes will have somewhat predictable impacts on public, private, and academic partnerships. However, there will surely be surprises as well, which will place unexpected stresses on existing partnerships and create new opportunities for cooperation. In either case, the weather and climate services offered in or will likely be very different from the services offered today. Observations were analyzed subjectively, and forecasts were based largely on the empirical skill of government forecasters. Weather and cli- Council, , Broadband: Technological surprises include the World Wide Web and the pervasive presence of the Internet in our lives, neither of which was foreseen a decade ago. Page 77 Share Cite Suggested Citation: Road Map for the Future a looked ahead to the year to much improved weather and climate forecasts and how information derived from these forecasts would be increasingly valuable to society. The report envisions weather forecasts approaching the limits of atmospheric predictability about two weeks and new forecasts of chemical and space weather, hydrologic parameters and other environmental parameters. It describes the use of ensemble forecasts that project nearly all possible future states of weather and climate and how these ensembles can be used in a probabilistic way by a variety of users. It asserts that as the accuracy improves and measures of uncertainty are better defined, the economic value of weather and climate information will increase rapidly as more and more ways are found or created to use information profitably. New markets, such as the weather derivatives market, will be created. Some markets will be strengthened e. Other markets may diminish, such as the role of human forecasters in adding value to numerical forecasts beyond one day or in preparing graphical depictions of traditional weather forecasts. The weather information system was run almost entirely by the National Weather Service NWS , with academia focused on basic research and the private sector just beginning to emerge. Advances in technology, including remote sensing from satellites, radars, and in situ sensors; computers; information and communication technologies; and numerical modeling, coupled with increased understanding derived from investments in research, have produced a weather and climate information system in the United States that is at the cutting edge of science and technology. As scientific understanding and computational capabilities improved throughout the second half of the twentieth century, private companies found opportunities to use government data to create value-added products for clients. However, as little as 10 years ago , federal government agencies still collected nearly all of the data and developed and ran the Page 78 Share Cite Suggested Citation: Today the situation is radically different. Declining instrument costs have permitted state and local government agencies, universities, and private companies to deploy Doppler radars and arrays of in situ instruments. Increased computing power 4 and bandwidth at rapidly dropping prices have enabled a substantial number of private companies and universities to run their own models or models developed by others. The development of new communications technologies e. Indeed, advances in networking have transformed the weather and climate enterprise Box 5. Finally, the widespread availability of visualization tools has made it easier for all sectors to display and better communicate weather information. These changes have made it possible for each of the sectors to provide services that were only recently in the domain of another sector e. Studying these different phenomena and developing products and tools to mitigate their impacts requires data of different spatial coverage and resolution, collected from a mixture of satellite instruments, local arrays, and independent stations. Satellite instruments provide high spatial and temporal resolution global coverage. The satellite observations are complemented by in situ measurements from radiosondes, aircraft, and surface stations. Doppler radars track and monitor small-scale severe storms and precipitation systems. Most instruments collect data continuously, but some are event driven. Examples include the lightning detection network, which is triggered by cloud-to-ground lightning strikes, and reconnaissance aircraft that fly into hurricanes. Other meteorological instruments can be adjusted to collect higher-resolution data for specific eventsâ€”for example, geostationary satellites and radars, which can scan at a higher rate over areas of severe weather, thereby providing greater temporal resolution on the order of minutes 4 The computers running global prediction models are 20 times more powerful than those a decade ago. Cook, , Ahead of the weather, U. News and World Report, April 29, p. Page 79 Share Cite Suggested Citation: Advances in network technologies have enabled automated data collection, as well as remote access to specialized computing servers that support models and forecasting. Networking has also dramatically increased the speed at which weather products are available and the number of users they reach. However, networking is not monolithic. The networking required for remote sensors and data collection may be wireless and self-organizing and may or may not have to be high bandwidth. Distributed and remote modeling and forecasting require extremely high bandwidth reliable networks to specific locations. However, excessively high or reliable bandwidths are not required for disseminating weather forecasts, watches, warnings, advisories, and other information products to the public. The advances in networking rely to a large extent on improvements to underlying technologies. Terrestrial and satellite radio technologies provide access to instruments and enable operation in conjunction with ad hoc, self-organizing networks, a in which the sensors on the net may also play a role in the infrastructure of the network itself as routers and forwarders of traffic. First, as computer prices decline, home and office computers are becoming increasingly pervasive. The widespread availability of personal computers made the provision of network services possible, but it was the combination of e-mail, the World Wide Web, and web browsers that made them economically viable. Today, the majority of office workers in the United States have networked workstations on their desks. Second, the rise in the wireless cellular telephone and other wireless technologies is enabling people to stay connected while mobile. The combination of computer networks and wireless technologies dramatically increases the avenues for broad, rapid dissemination of urgently important weather information. Every time an antenna is turned on for sending or receiving, it uses significant amounts of power compared with the power required to make measurements or perform simple computations like data compression. The relationship between transmission distance and power is exponential. For an untethered device dependent on irreplaceable battery power, the trade-off is clearâ€”shorter and less frequent communication yields a longer life span of measurements. If one is placing devices in remote locations, there is great advantage to making every device a sensor, even if part of its responsibility is to relay information from neighboring sensors toward a concentration point. Such a system must be organized to both conserve power effectively and deliver the data, by turning nodes on and off as required. In such a system, the data will follow different routes at different times and work around nodes whose power has been completely depleted. Page 80 Share Cite Suggested Citation: Improved resolution provided by upgraded radars. The number and frequency of meteorological observations will increase over the next decade. Although most of this increase will come from new satellites, it also reflects expansions planned for the Cooperative Observer Network and other surface observational networks, additional aircraft reports, and additional radar data. This mixture of observing approaches is also a cost-effective way of meeting the needs of the diverse weather and climate communities. New observing systems currently being considered are intended to provide better accuracy, resolution, and coverage Figure 5. The latter is important not only for weather prediction but also for preserving the continuity of the climate record. Page 81 Share Cite Suggested Citation: Sensors that can be deployed on aircraft or on the ground are becoming cheaper, smaller, and more powerful, primarily because of the continued decrease in cost and increase in capability of semiconductors. As a result, universities, state governments, and the private sector can increasingly afford to purchase, install, and maintain low-cost sensors for purposes that would not have been considered in the past e. The growth of private networks raises both scientific and policy issues. Most data collected by private companies and some data collected by state and local government agencies are proprietary see Chapter 4. Since proprietary data and the methods by which they were collected cannot be scrutinized, it is difficult to determine whether the sensors were deployed in a scientifically rigorous manner e. This uncertainty limits the value of proprietary data to the weather and climate enterprise. Page 82 Share Cite Suggested Citation: Models for understanding the system and for generating forecasts are only as good as the level of scientific knowledge, quality and coverage of input data, and computer-processing capabilities permit. Numerical models incorporate the dynamical equations governing the changing state of the atmosphere and oceans and fill in the spatial and temporal gaps in the global observing system see Chapter 2 for an overview of weather and climate models. They will continue to do so as very high resolution data and algorithms describing processes such as cloud interactions and land-surface and boundary-layer physics are incorporated. Indeed, one of the primary constraints on the accuracy and quality of forecasts is the computational effort required 1 to process effectively the large volume of observations that are collected and 2 to run numerical weather prediction models with high spatial resolution. For example, a recent NRC report found that ensemble models require 20 Gflops each day for weather prediction and 2. For example, the new NWS supercomputerâ€”an IBM-built massively parallel machine that uses more than conventional microprocessorsâ€"will be able to resolve differences in weather for Manhattan and Queens.

2: Budgeting, Planning & Forecasting Process Improvement Best Practices

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Judgmental or Intuitive Methods Judgmental methods fundamentally rely on opinion to generate a forecast. Typically the opinion is from an expert or panel of experts having knowledge in fields that are relevant to the forecast. In its simplest form, the method asks a single expert to generate a forecast based on his or her own intuition. The potential for bias may be reduced by incorporating the opinions of multiple experts in a forecast, which also has the benefit of improving balance. This method of group forecasting was used in early reports such as Toward New Horizons von Karman, Forecasts produced by groups have several drawbacks. First, the outcome of the process may be adversely influenced by a dominant individual, who through force of personality, outspokenness, or coercion would cause other group members to adjust their own opinions. Second, group discussions may touch on much information that is not relevant to the forecast but that nonetheless affects the outcome. Lastly, groupthink 4 can occur when forecasts are generated by groups that interact openly. The shortcomings of group forecasts led to the development of more structured approaches. The Delphi Method The Delphi method is a structured approach to eliciting forecasts from groups of experts, with an emphasis on producing an informed consensus view of the most probable future. The Delphi method has three attributesâ€"anonymity, controlled feedback, and statistical group response 5 â€"that are designed to minimize any detrimental effects of group interaction Dalkey, In practice, a Delphi study begins with a questionnaire soliciting input on a topic. Participants are also asked to provide a supporting argument for their responses. Last accessed June 11, Persistent Forecasting of Disruptive Technologies. The National Academies Press. This process continues for several rounds, until the results reach predefined stop criteria. These stop criteria can be the number of rounds, the achievement of consensus, or the stability of results Rowe and Wright, The advantages of the Delphi method are that it can address a wide variety of topics, does not require a group to physically meet, and is relatively inexpensive and quick to employ. Delphi studies provide valuable insights regardless of their relation to the status quo. In such studies, decision makers need to understand the reasoning behind the responses to the questions. A potential disadvantage of the Delphi method is its emphasis on achieving consensus Dalkey et al. Some researchers believe that potentially valuable information is suppressed for the sake of achieving a representative group opinion Stewart, Because Delphi surveys are topically flexible and can be carried out relatively easily and rapidly, they are particularly well suited to a persistent forecasting system. One might imagine that Delphi surveys could be used in this setting to update forecasts at regular intervals or in response to changes in the data on which the forecasts are based. Extrapolation and Trend Analysis Extrapolation and trend analysis rely on historical data to gain insight into future developments. This type of forecast assumes that the future represents a logical extension of the past and that predictions can be made by identifying and extrapolating the appropriate trends from the available data. This type of forecasting can work well in certain situations, but the driving forces that shaped the historical trends must be carefully considered. If these drivers change substantially it may be more difficult to generate meaningful forecasts from historical data by extrapolation see Figure Trend extrapolation, substitution analysis, analogies, and morphological analysis are four different forecasting approaches that rely on historical data. Trend Extrapolation In trend extrapolation, data sets are analyzed with an eye to identifying relevant trends that can be extended in time to predict capability. Tracking changes in the measurements of interest is particularly useful. Several approaches to trend extrapolation have been developed over the years. Gompertz and Fisher-Pry Substitution Analysis Gompertz and Fisher-Pry substitution analysis is based on the observation that new technologies tend to follow a specific trend as they are deployed, developed, and reach maturity or market saturation. This trend is called a growth curve or S-curve Kuznets, Gompertz and Fisher-Pry analyses are two techniques suited to fitting historical trend data to predict, among other things, when products are nearing maturity and likely to be replaced by new technology Fisher and Pry, ; Lenz, Analogies Forecasting by analogy involves identifying past situations or technologies similar to the one of current interest and using historical data to project future developments. Research has shown that the accuracy of this forecasting technique can be improved by using a structured approach to identify the best analogies to use, wherein several possible analogies are identified and rated with respect to their relevance to the topic of interest Green and Armstrong, Green and Armstrong proposed a five-step structured judgmental process. The first step is to have an administrator of the forecast define the target situation. An accurate and comprehensive definition is generated based on Page 22 Share Cite Suggested Citation: When feasible, a list of possible outcomes for the target is generated. The next step is to have the administrator select experts who are likely to know about situations that are similar to the target situation. Based on prior research, it is suggested that at least five experts participate Armstrong, Once selected, experts are asked to identify and describe as many analogies as they can without considering the extent of the similarity to the target situation. Experts then rate how similar the analogies are to the target situation and match the outcomes of the analogies with possible outcomes of the target. Predefined rules promote logical consistency and replicability of the forecast. An example of a rule could be to select the analogy that the experts rated as the most similar to the target and adopt the outcome implied by that analogy as the forecast Green and Armstrong, Page 23 Share Cite Suggested Citation: The technique lends itself to forecasting in that it provides a structured process for projecting the future attributes of a present-day technology by assuming that the technology will change in accordance with the Laws of Technological Evolution, which may be summarized as follows: Increasing degree of ideality. Decreasing price and improving benefits result in improved performance, increased functionality, new applications, and broader adoption. The evolution of GPS from military application to everyday consumer electronics is an example of this law. Nonuniform evolution of subsystems. The various parts of a system evolve based on needs, demands, and applications, resulting in the nonuniform evolution of the subsystem. The more complex the system, the higher the likelihood of nonuniformity of evolution. The development rate of desktop computer subsystems is a good example of nonuniform evolution. Processing speed, disk capacity, printing quality and speed, and communications bandwidth have all improved at nonuniform rates. Transition to a higher level system. This law can be used at the subsystem level as well, to identify whether existing hardware and components can be used in higher-level systems and achieve more functionality. As a technology moves from a rigid mode to a flexible mode, the system can have greater functionality and can adapt more easily to changing parameters. Shortening of energy flow path. The energy flow path can become shorter when energy changes form for example, thermal energy is transformed into mechanical energy or when other energy parameters change. The transmission of information also follows this trend Fey and Rivin, An example is the transition from physical transmission of text letters, newspapers, magazines, and books , which requires many transformational and processing stages, to its electronic transmission tweets, blogs, cellular phone text messaging, e-mail, Web sites, and e-books , which requires few if any transformational or processing stages. Transition from macro- to microscale. System components can be replaced by smaller components and microstructures. This stage involves studying the history of a technology to determine its maturity. Analysis of these curves can help to predict when one technology is likely to be replaced by another. This is the application of the above laws to forecast specific changes innovations related to the technology. The engineering problems that must be addressed to realize the evolutionary changes predicted in the roadmapping stage are then identified. It is in this stage that technological breakthroughs needed to realize future technologies are specified. Many forecasts would terminate in the problem formulation stage since it is generally not the purpose of a forecast to produce inventions. In spite of this, TRIZ often continues. This last stage involves an attempt to solve the engineering problems associated with the evolution of a technology. Although the attempt might not result in an actual invention, it is likely to come up with valuable information on research directions and the probability of eventual success in overcoming technological hurdles. Models These methods are analogous to developing and solving a set of equations describing some physical phenomenon. The use of computers enables the construction and solution of increasingly complex models, but the complexity is tempered by the lack of a theory describing socioeconomic change, which introduces uncertainty. The specific forecast produced by the model is not as important as the trends it reveals or its response to different inputs and assumptions. The following sections outline some model-based techniques that may be useful for forecasting disruptive technology. Some of them were used in the past for forecasting technology, with varying success. Theory of Increasing Returns Businesses that produce traditional goods may suffer from the law of diminishing returns, which holds that as a product becomes more commonplace, its marginal opportunity cost the cost of foregoing one more unit of the next best alternative increases proportionately. This is especially true when goods become commoditized through increased competition, as has happened with DVD players, flat screen televisions, and writable compact discs. Applying the usual laws of economics is often sufficient for forecasting the future behavior of markets. However, modern technology or knowledge-oriented businesses tend not to obey these laws and are instead governed by the law of increasing returns Arthur, , which holds that networks encourage the successful to be yet more successful. The value of a network explodes as its membership increases, and the value explosion attracts more members, compounding the results Kelly, A better product is usually unable to replace an older product immediately unless the newer product offers something substantially better in multiple dimensions, including price, quality, and convenience of use. Although the law of increasing returns helps to model hi-tech knowledge situations, it is still difficult to predict whether a new technology will dislodge an older product. This is because success of the newer product depends on many factors, some not technological. Arthur mentions that people have proposed sophisticated techniques from qualitative dynamics and probability theory for studying the phenomenon of increasing returns and, thus, perhaps to some extent, disruptive technologies. Chaos Theory and Artificial Neural Networks Clement Wang and his colleagues propose that there is a strong relationship between chaos theory and technology evolution Wang et al. They claim that technology evolution can be modeled as a nonlinear process exhibiting bifurcation, transient chaos, and ordered state. What chaos theory reveals, especially through bifurcation patterns, is that the future performance of a system often follows a complex, repetitive pattern rather than a linear process. They further claim that traditional forecasting techniques fail mainly because they depend Page 25 Share Cite Suggested Citation: The authors then report that existing methods for technology forecasting have been shown to be very vulnerable when coping with the real turbulent world Porter et al. Chaos theory characterizes deterministic randomness, which indeed exists in the initial stages of technology phase transition. It will have a material impact, it will incrementally improve the status quo, or it will fail and go into oblivion. A particular technology exists in one of three states:

3: Informatics & the Future of Nursing Practice | Nursing

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Excerpts from Survival Statistics - an applied statistics book for graduate students. Most people view the world as consisting of a large number of alternatives. Futures research evolved as a way of examining the alternative futures and identifying the most probable. Forecasting is designed to help decision making and planning in the present. Forecasts empower people because their use implies that we can modify variables now to alter or be prepared for the future. A prediction is an invitation to introduce change into a system. There are several assumptions about forecasting: There is no way to state what the future will be with complete certainty. Regardless of the methods that we use there will always be an element of uncertainty until the forecast horizon has come to pass. There will always be blind spots in forecasts. We cannot, for example, forecast completely new technologies for which there are no existing paradigms. Providing forecasts to policy-makers will help them formulate social policy. The new social policy, in turn, will affect the future, thus changing the accuracy of the forecast. Many scholars have proposed a variety of ways to categorize forecasting methodologies. The following classification is a modification of the schema developed by Gordon over two decades ago: Genius forecasting - This method is based on a combination of intuition, insight, and luck. Psychics and crystal ball readers are the most extreme case of genius forecasting. Their forecasts are based exclusively on intuition. Science fiction writers have sometimes described new technologies with uncanny accuracy. There are many examples where men and women have been remarkable successful at predicting the future. There are also many examples of wrong forecasts. The weakness in genius forecasting is that its impossible to recognize a good forecast until the forecast has come to pass. Some psychic individuals are capable of producing consistently accurate forecasts. Mainstream science generally ignores this fact because the implications are simply to difficult to accept. Our current understanding of reality is not adequate to explain this phenomena. Trend extrapolation - These methods examine trends and cycles in historical data, and then use mathematical techniques to extrapolate to the future. The assumption of all these techniques is that the forces responsible for creating the past, will continue to operate in the future. This is often a valid assumption when forecasting short term horizons, but it falls short when creating medium and long term forecasts. The further out we attempt to forecast, the less certain we become of the forecast. The stability of the environment is the key factor in determining whether trend extrapolation is an appropriate forecasting model. The concept of "developmental inertia" embodies the idea that some items are more easily changed than others. Clothing styles is an example of an area that contains little inertia. It is difficult to produce reliable mathematical forecasts for clothing. Energy consumption, on the other hand, contains substantial inertia and mathematical techniques work well. The developmental inertia of new industries or new technology cannot be determined because there is not yet a history of data to draw from. There are many mathematical models for forecasting trends and cycles. Choosing an appropriate model for a particular forecasting application depends on the historical data. The study of the historical data is called exploratory data analysis. Its purpose is to identify the trends and cycles in the data so that appropriate model can be chosen. The most common mathematical models involve various forms of weighted smoothing methods. Another type of model is known as decomposition. This technique mathematically separates the historical data into trend, seasonal and random components. A process known as a "turning point analysis" is used to produce forecasts. ARIMA models such as adaptive filtering and Box-Jenkins analysis constitute a third class of mathematical model, while simple linear regression and curve fitting is a fourth. The common feature of these mathematical models is that historical data is the only criteria for producing a forecast. One might think then, that if two people use the same model on the same data that the forecasts will also be the same, but this is not necessarily the case. Mathematical models involve smoothing constants, coefficients and other parameters that must decided by the forecaster. To a large degree, the choice of these parameters determines the forecast. It is vogue today to diminish the value of mathematical extrapolation. Makridakis one of the gurus of quantitative forecasting correctly points out that judgmental forecasting is superior to mathematical models, however, there are many forecasting applications where computer generated forecasts are more feasible. For example, large manufacturing companies often forecast inventory levels for thousands of items each month. It would simply not be feasible to use judgmental forecasting in this kind of application. Consensus methods - Forecasting complex systems often involves seeking expert opinions from more than one person. Each is an expert in his own discipline, and it is through the synthesis of these opinions that a final forecast is obtained. One method of arriving at a consensus forecast would be to put all the experts in a room and let them "argue it out". This method falls short because the situation is often controlled by those individuals that have the best group interaction and persuasion skills. A better method is known as the Delphi technique. This method seeks to rectify the problems of face-to-face confrontation in the group, so the responses and respondents remain anonymous. The classical technique proceeds in well-defined sequence. In the first round, the participants are asked to write their predictions. Their responses are collated and a copy is given to each of the participants. The participants are asked to comment on extreme views and to defend or modify their original opinion based on what the other participants have written. Again, the answers are collated and fed back to the participants. In the final round, participants are asked to reassess their original opinion in view of those presented by other participants. The Delphi method general produces a rapid narrowing of opinions. It provides more accurate forecasts than group discussions. Furthermore, a face-to-face discussion following the application of the Delphi method generally degrades accuracy. Simulation methods - Simulation methods involve using analogs to model complex systems. These analogs can take on several forms. A mechanical analog might be a wind tunnel for modeling aircraft performance. An equation to predict an economic measure would be a mathematical analog. A metaphorical analog could involve using the growth of a bacteria colony to describe human population growth. Game analogs are used where the interactions of the players are symbolic of social interactions. Mathematical analogs are of particular importance to futures research. They have been extremely successful in many forecasting applications, especially in the physical sciences. In the social sciences however, their accuracy is somewhat diminished. The extraordinary complexity of social systems makes it difficult to include all the relevant factors in any model. Clarke reminds us of a potential danger in our reliance on mathematical models. As he points out, these techniques often begin with an initial set of assumptions, and if these are incorrect, then the forecasts will reflect and amplify these errors. One of the most common mathematical analogs in societal growth is the S-curve. The model is based on the concept of the logistic or normal probability distribution. All processes experience exponential growth and reach an upper asymptopic limit. Modis has hypothesized that chaos like states exist at the beginning and end of the S-curve. The disadvantage of this S-curve model is that it is difficult to know at any point in time where you currently are on the curve, or how close you are to the asymtopic limit. The advantage of the model is that it forces planners to take a long-term look at the future. Another common mathematical analog involves the use of multivariate statistical techniques. These techniques are used to model complex systems involving relationships between two or more variables. Multiple regression analysis is the most common technique. Unlike trend extrapolation models, which only look at the history of the variable being forecast, multiple regression models look at the relationship between the variable being forecast and two or more other variables. Multiple regression is the mathematical analog of a systems approach, and it has become the primary forecasting tool of economists and social scientists. The object of multiple regression is to be able to understand how a group of variables working in unison affect another variable. The multiple regression problem of collinearity mirrors the practical problems of a systems approach. Paradoxically, strong correlations between predictor variables create unstable forecasts, where a slight change in one variable can have dramatic impact on another variable. In a multiple regression and systems approach, as the relationships between the components of the system increase, our ability to predict any given component decreases. Gaming analogs are also important to futures research. Gaming involves the creation of an artificial environment or situation. Players either real people or computer players are asked to act out an assigned role. The "role" is essentially a set of rules that is used during interactions with other players. While gaming has not yet been proven as a forecasting technique, it does serve two important functions.

4: Technological Forecasting and Social Change - Journal - Elsevier

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Public policy for open innovation: Frameworks, priorities and mechanisms Global and innovative solutions to climate change and its effects on the economy and society The implications of climate change demand a response through changes in technology policy, lifestyle, and economics. In terms of human response, the answers to this challenge are unlikely to come from isolated solutions. Instead, the global repercussions of the problem also demand global responses that entail the participation and collaboration of different groups and interests. Digital transformation of social theory There once was a time when leaders could both appreciate books and govern empires without knowing how to read and write Dutton, ; Pascal, Though hardly ever away from keyboard, we scholars in general and social theorists in particular relate to the dominant media of the 21st century as if we still lived in the Gutenberg Galaxy McLuhan, , as exemplified in the prevailing use of computers and Internet mainly to write books and articles to store and search for in online libraries. The situation is even more remarkable in that we not only continue to treat the new media like traditional media, but also produce more and more traditional media on the new media. Today, there are publications on the digital transformation of almost everything. Global Shifts in Technological Power This special issue connects various fields of innovation studies and related theories - with national and international perspectives worldwide - that include: Currently, there are few research or scholarly works that attempt to bring these streams of research together in a form that better serves humanity. This Special Issue seeks to synthesize the emerging knowledge and understanding in these areas of research and contribute to theory, policy and practice. The aim is to produce and disseminate fresh knowledge in the field of Innovation and Development from a range of country perspectives, by ensuring that the papers selected for the special issue focus on: However, due to the ever-increasing challenges coming from this kind of rapidly increasing economic development, China and Korea have turned their focus toward the sustainable quality of economic development, implying that the slow-steady transition toward the harmonized economy and transparent society is much more important for the future. Instead of quantitative economic performance measures such as GDP, these countries became more concerned about the undesirable effects of current resource-intensive current economic structures, and thus shifted the policy paradigm toward the sustainable society. However, these countries face challenges and bottlenecks to the sustainable governance transition. Therefore, challenges in the transition economies such as China and Korea should be analyzed in more detail for the social and economic effects accompanying green technologies and policies. Changing Organisations and Markets: Please note, however, that only papers by participating authors who thoroughly review relevant studies that have been published in TFSC will be considered for inclusion in the Special Issue. In this context, open innovation has become a key determinant of growth in the globalized knowledge society. However, there are limitations in related research in that there exist only a few multi-faceted approaches. Further, dynamic aspects of open innovations have not been investigated enough. Grassroots and Inclusive Innovations: Conceptualizing Synergies and Complementarities Background and Context We attempt to initiate the description of the context of grassroots and inclusive innovations with a help of two examples, both coming from development economies. These, and the rest of this section, are to stimulate and excite interest in these phenomena, and to create a venue for dissemination of related ideas. Smart Cities for the 21st Century Smart cities have played a key role in transforming different areas of human life, involving with sectors such as transportation, health, energy, and education. Identifying and obtaining valuable information from large amounts of weather data can be extremely beneficial in terms of agricultural development. Governments have begun to embrace smart city ideas to improve the living standard of their citizens and to implement big data applications. Surveillance and monitoring in the cities can be tracked in real-time. Any suspects of terror attacks and fraudulent activities can be detected and cities becomes intelligent to respond to any critical moments. Such transformation enables cities to adopt the learning principles and requirements of the applications of the smart cities by executing main smart environment characteristics, which include, sustainability, resilience, governance, improved quality of life, business opportunities, collaboration and intelligent management of natural resources and city facilities. This trend was particularly discernible until after which we have seen narrowing of the growth differentials and the increasing awareness of the emergence of the so-called middle-income trap in the emerging and transition economies. Background and Context In the last 5 years, empirical evidence suggests the rise of a new category of Entrepreneurship: Digital Entrepreneurship, as a relevant socio-economic and technological phenomenon, which can be considered as the joining of traditional entrepreneurship with an emphasis on leveraging new digital technologies in novel ways, such as social, mobile, analytics, cloud and cyber-solutions, all in order to shift the traditional way of creating and doing business in the digital era.

5: An Overview of Forecasting Methods

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Circumstances and time horizons dictate strategic agenda at each company subject to one vital caveat: To maximize returns in dynamic markets, new and seasoned finance professionals apply state-of-the-art, flexible budgeting, planning and forecasting technology in tandem with best practices. Is your budgeting, planning and forecasting process siloed or holistic? Mindful correlations across key business drivers integrate key information visible on income statements, balance sheets and cash flow statements. Stress on a single thread can alter the contour of current and future financial risk with significant implications for every business unit. As soon as companies begin to mature, growth depends on seeing how, why and where financial stress and growth opportunities emerge and predicting outcomes. A holistic approach to budgeting, planning and forecasting expresses end-to-end, organic views of financial risk at the core of every business in a complex environment. Do you rely on spreadsheets that require significant manual intervention to generate results? In astonishingly short time, growing companies armed with excel or point solutions find themselves ill prepared to handle new complexities resulting from company growth and dynamic market conditions. So long as general ledgers report income from a handful of sources and routine expenses, manual entries might keep up. When expanding supply chains, product development and funding sources still depend on manual processes, never mind greater potential for error. Delays hinder action when urgency is paramount. Sluggish forecasts miss competitive threats. Just when companies should prepare to challenge a rival, those that still depend on manual intervention cannot make pivotal decisions that require current information. Are you satisfied with the predictive value of your forecasting process? No one sees the future with absolute clarity, least of all companies that build forecasts with rigid spreadsheets designed as rear view mirrors. Yet every nimble manager knows that expecting change is imperative. Flawed decisions use stale data or wait too long for fresh data as rivals sprint ahead. Too long can mean years, months or, in some cases, days or even hours. Robust forecasts balance qualitative models that rely on lots of human judgment with quantitative models that scour petabytes of data for embryonic trends. Modern companies juggle dozens of urgent priorities, from research and development to investor relations. When the Economist Intelligence Unit asked C-suite and board level executives to rank their top priorities, replies left no doubt. Planning, budgeting and forecasting was number two, after growing the business â€” and make no mistake, growth hinges on effective planning, budgeting and forecasting. Is there clear accountability or "ownership" for accurate inputs into plans, budgets and forecasts? Accountability is like quality. Both are glaringly visible when absent. Without clearly defining which business units and individuals will own results, the outlook is cloudy at best and doomed at worst. Failure is an orphan; success confers credit on the un-involved. On the other hand, a diligent approach to budgeting, planning and forecasting bakes accountability into the process at the outset. An eye to potential outcomes elevates accountability to the level where ownership must reside if the outcome matters. Do you contend with multiple versions of the truth? Sound budgeting, planning and forecasting foster debate over strategy, not friction over competing notions of the truth. Unfortunately, multiple versions of the truth crop up too easily in many companies. A single set of facts can support more than one logical opinion. When units go in too many directions, overarching strategies lose traction. Variances proliferate at every stage of the reporting process, leading to friction instead of accord where growth is concerned, and strategic decisions become shots in the dark. Is there universal agreement on core data definitions, a common business language, key metrics and standard processes for establishing budgets? Strategies can maximize performance only where solid foundations rest on core data definitions. More granular than mission and goals, a common business vocabulary supplies the framework that gives context to data. No terms are so basic they can be left to assumption, from sales, costs, revenue and net profits to a roster of performance metrics. Slight departures can compromise results if, for instance, commission targets leave a key metric open to more than one calculation. Shifting markets and business combinations impose a constant need to review and instill a common business language. Failure to police agreements on core definitions compounds the business risks that companies face every day. Meaningful strategy and vision are rooted in robust budgeting, planning and forecasting. A strategic loop starts with a plan, shapes a budget, anticipates resources companies will have to deploy to compete effectively, all culminating in a strategy. As strategies evolve, the loop informs budgeting, planning and forecasting attuned to the next annual, quarterly, weekly cycle, as competition and market condition demand. Does your scenario analysis generate multiple what-if budget models? The future is uncertain and as such robust planning, budgeting and forecasting tools enable companies to test alternative scenarios. Off-the-shelf general ledgers with limited forecasting capabilities restrict what-if scenarios which allow more informed strategic decisions. Companies need to test line items that can get them to a goal of, say, boosting revenues by 7 percent and margins by 30 percent â€” or any growth configuration. Are rolling forecasts feasible, credible and distinct from annual plan detail and duration? Other than birthdays and retirement parties, surprises are not welcome â€” even when the news is good. Rolling forecasts monitor the pulse without missing a crucial beat. Routine contact with business units supports and updates a holistic picture of risks and opportunities amid fluid market conditions. Routine planning discussions, open communication and forecast updates as needed capture real business cycles, instead of cycles that calendars dictate. True rolling forecasts separate reactive finance departments from pro-active finance departments, a distinction that gains significance as urgency and stakes increase. Now that you have a solid foundation for making your technology decisions, feel free to explore our Budgeting, Planning, and Forecasting product listing , where you will find filtering capabilities and product reviews from financial professionals.

6: Financial Forecasting in the Budget Preparation Process | Government Finance Officers Association

A major forum for those wishing to deal directly with the methodology and practice of technological forecasting and future studies as planning tools.

The purpose of the financial forecast is to evaluate current and future fiscal conditions to guide policy and programmatic decisions. A financial forecast is a fiscal management tool that presents estimated information based on past, current, and projected financial conditions. This will help identify future revenue and expenditure trends that may have an immediate or long-term influence on government policies, strategic goals, or community services. The forecast is an integral part of the annual budget process. An effective forecast allows for improved decision-making in maintaining fiscal discipline and delivering essential community services. The GFOA recommends that governments at all levels forecast major revenues and expenditures. The forecast should extend several years into the future. The forecast, along with its underlying assumptions and methodology, should be clearly stated and made available to stakeholders in the budget process. It also should be concisely presented in the final budget document. The forecast should be regularly monitored and periodically updated. The key steps in a sound forecasting process include the following: The first step in the forecasting process is to define the fundamental issues impacting the forecast. The results of this initial step will provide insight into which forecasting methods are most appropriate and will help create a common understanding among the forecasters as to the goals of the forecasting process. There are four key questions to consider when defining assumptions for the forecast: What is the time horizon of the forecast? This might make it harder to balance the budget, but reduces the risk of an actual shortfall. Therefore, a government should be transparent concerning its own forecasting policy and underlying assumptions. Be aware of current laws or expected changes in laws that affect forecasts. What are the major revenues and expenditure categories? To support the forecasting process, use statistical data as well as the accumulated judgment and expertise of individuals inside and perhaps also outside the organization. For instance, department heads may have an insight into activities within their own section. This would also include events that could cause a disruption in the operating environment and in prevailing trends. Both are important for forecasting because they allow the forecaster to more intelligently build quantitative models and to make a forecast using his or her own judgment. Assumptions should be documented for future reference, so the financial forecasting process has some basis to start from at the beginning of each cycle. Also, become familiar with other longer-term planning efforts of the organization or other organizations that impact financial decisions and the fiscal environment. The analysis should include an examination of historical data and relevant economic conditions. This improves the quality of the forecast both by giving the forecaster better insight into when and what quantitative techniques might be appropriate and also is useful for supplementing forecasting methods. The forecaster is looking for consistent patterns or trends. In particular, the forecaster should look for evidence related to: Does the revenue or expenditure tend to vary with the level of economic activity in the community or are they independent of cycles? How do broader market forces impact key expenditures, such as pension contributions affected by investment returns? Outliers and historical anomalies. Does the data contain any extreme values that need to be explained? Are there important relationships between variables that could aid in forecasting? Keep in mind that the chosen method for one program may differ for another. While complex techniques may get more accurate answers in particular cases, simpler techniques tend to perform just as well or better on average. Also, simpler techniques require less data, less expertise on the part of the forecaster, and less overall effort. Three basic models of forecasting to consider include: Extrapolation uses historical revenue data to predict future behavior by projecting the trend forward. Trending is very easy to use and is commonly employed by forecasters. Moving averages and single exponential smoothing are somewhat more complex, but should be well within the capabilities of most forecasters. Regression analysis is a statistical procedure based on the relationship between independent variables factors that have predictive power for the revenue or expenditure source and a dependent variable expenditure source being predicted. Assuming a linear relationship exists between the independent and dependent variables, one or more independent variables can be used to predict future revenues or expenditures. Hybrid forecasting methods are very common in practice and can deliver superior results. Making the forecast and using forecast ranges are included within the implementation methods. Put into practice one or more of the forecasting methods described above. It may be wise to develop a range of possible forecast outcomes, with the use of different scenarios. Multiple projections should be a part of a well-planned and thoroughly discussed approach. The purpose of a forecast is to inform and assist in decision-making. Three items that are essential to a compelling and informative forecast presentation include: Credibility of the forecaster. Have a transparent forecast process. Address how the forecast compares to widely accepted economic or financial forecasts from outside organizations. Describe forces acting on your revenues or expenditures that might cause the actual results to be higher or lower than the forecast. Stay within acceptable accuracy tolerances for forecasts. Note to the audience that years estimated farther out are less reliable. Be careful about using forecasts to raise an alarm about an impending crisis. A good forecast presentation revolves around a clear message. The following steps can be helpful in promoting clarity: A clear, simple, and reasoned statement of the forecast message is vital. Build the message around a baseline set of assumptions that represent a reasonable level of consistency with status quo conditions. Such exceptions should be clearly stated. The assumptions should be made very clear, and be supplemented with salient information. The forecaster should explain how the assumptions lead to the forecast, without delving into the details of the specific methods. The message should address the implications of the forecast in terms of budget shortfalls or surpluses, changes in reserve levels, and other metrics that would be meaningful to the audience. Involving other staff in the forecasting process in these steps will also help ensure that understanding of the method is shared by key potential supporters. It may even prove possible to involve other staff directly in the presentation, which may increase credibility. Linking forecast to decision-making. In order to maximize decision? This means imparting a long? The following financial policies might be particularly helpful for promoting interest in financial forecasting: A reserve policy, which establishes the desired level of reserves to maintain. A policy on reserves implies the need for forecasting tools to see if reserve levels will remain within desired parameters given future spending and revenues. A policy on maintaining structural balance, which requires recurring expenditures to be covered by recurring revenues. A forecast is required to tell if this will occur into the future, facilitating the considerations of long-term implications of decisions. A long-financial planning policy, which commits officials to considering the long? Capital improvement plans should employ a long-term planning horizon.

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