

Futures and Technology Assessment Research for Business Clients

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I'm delighted to be here to begin to exercise my new responsibility as Chairman of the Center's Scientific Advisory Board. My plan is to discuss business clients and their assorted characteristics and needs, based on 32 years of experience, five each at the National Science Foundation and at the U.S. Congressional Office of Technology Assessment and 22 years as the founding president of my own firm, which specializes in the study of the future.

If one is to serve any client one must know the key characteristics of that client both generically, with regard to the type of business or industry, and specifically with regard to the organization that one would assist. The characteristics that I see of various business types begins with big old firms. Most important is that they are very slow to change. It is not that they do not change its just that change is so intrinsically disruptive that short of an absolute crisis the movement toward doing new things or doing old things new ways or adapting new technologies or branching out into new products tends to be evolutionary rather than revolutionary. Second, unfortunately senior management which is often late middle-age or older has

risen to positions of responsibility not based on the future, but based on their past performance. There is therefore an unfortunate tendency for them to build their planning around their own past experience. It is a perfectly natural failure to believe that what got you to the top will continue to keep you there. Unfortunately, times often change more rapidly than past experience can accommodate. Third, in virtually all organizations the future and change are threatening. The bigger the change, the bigger the threat. The personal potential for change and evolution into new roles, new attitudes, and new behaviors is so threatening that opportunities and risks tend to be examined with a highly skeptical eye. Fourth, as shown by half or more of the corporate clients coming to us, especially in the first decade of our business, was the feeling that they were speaking to themselves too exclusively. That folding-in of thinking in the corporation could be deadly. To recognize talking only to themselves as a problem is a bright hope.

Finally even the most advanced of organizations tend to have an extremely limited view of the links in the buyer-seller chain beyond the few with whom they deal with directly. Fortunately that last point is slowly changing. We see more and more manufacturing firms, and other firms that primarily do business with other businesses rather than with consumers, increasingly concerned with what their own customers are learning about the ultimate consumers. There is a growing awareness, but still relatively limited practice in looking down and up the buyer-seller chain to understand what is going on. An interesting feature of that which we have experienced for a long time is that companies that sell directly to consumers tend to see their marketing department feedback from consumers as adequate insight into the future. It is a harsh universal lesson that market research is by no means the same as futures research.

The first is extremely foreshortened and tends to deal with incremental change and problems in the business. The latter is deeper in time, broader in perspective, attentive to opportunities, and more strategic in implications.

Let us turn to new big firms or those aspiring to become big, perhaps best illustrated by telecoms. The key characteristic of these firms they are new and the leadership is often quite young, perhaps on average half the age of heads of the big old firms. Hence they suffer a lack of a full range of business experience. Worse than that is a tendency to have a short time horizon on business matters based on a vague vision of what the future would be like when their super-duper technology sweeps the world or when their new gadget becomes the everybody must-have item. Those visions of the future are often anemic in richness and detail. The consequence is that new big firms tend to not think about the total system that they are involved in or would intrude into with a product or service. They often are seduced into blindness by their own enthusiasm. The enthusiasm of the inventor, the enthusiasm of the marketer, and the enthusiasm of the research director can have a deadly backfire, blinding one to the reality of how the market might respond, how competitors might respond, or to how slowly the new product may be adopted. We have a beautiful example of that in the total failure of the concept of the electronic office seen by some enthusiasts to completely wipe out the use of office paper. Paper use has in fact doubled. We are witnessing another example of this today in the extremely limited success of electronic books. The big new firms tend as a result of all the above conditions to be inept in planning.

Small firms are far and away on average the worst ones to deal with from a futures or assessment point of view. The small firms tend to have a zero time horizon and to have acutely

limited market intelligence. Except for their order book they often only learn of competitors or radical changes in the market when their order book shrinks. They generally are not committed to anything approaching basic research in terms of their product lines, but tend to focus on incremental improvements of the product. They tend to have no real interest in the future, being rendered blindly optimistic by past successes of their business.

Small is a relative concept. A few years we did a study of the future of the machine tool industry, where small business may have anywhere from 5 million to 75 million dollars a year in revenue. They often had the characteristics of being what are called mom and pop organizations, small businesses with the family often involved and frequently centered around a single person, the head of the firm, who is its key inventor or product developer. In undertaking that study we got surprisingly good cooperation from the industry's trade association. Recognize that often trade association see futurists as competitors. We soon learned why they were so cooperative. They had done a study which came up with fundamentally the same conclusions we later did and were rebuffed by their membership for delivering unrelenting bad news. In any case, without going into the details, our own study delivered extremely bad news, pointing out that the Japanese were—unlike them—not delivering in 18 months, but delivering immediately or at most in 2 months. Again, unlike their customary practice of rendering service by telephone, the Japanese had two people on the spot the next morning after a complaint, one to make repairs and one to translate. The failure of the industry to listen to the future message in any form led to a machine tool firm going out of business every single day of the year, over a thousand firms in a three year period. That is the price of being contemptuous of the future and arrogant about one's understanding of one's business.

Let us turn now to the question of why study the future. There are three reasons:

- Most organizations, both public and private, are at their core collections of experts. Those experts maintain their expertise through a constricted search of forces and factors operating in society which might in the future converge on and influence their concerns. So, the first reason for future studies is to widen horizons.
- Having widened horizons, the next reason is to show that the five to fifty year future has implications for present planning. If that were not the case it would make studying the future merely expensive entertainment.
- The third reason is the one overarching all others. It comes out of the observation that all kinds of organizations and institutions have histories of failure. The common feature in all institutional failure is that an individual or a small group at the top held assumptions about the future that were unsound. Therefore the primary purpose in the study of the future is to force people to become aware of the assumptions which they hold.

Now let's define technology assessment (TA). My experience with TA began at the National Science Foundation, which was the first federal agency to have a technology assessment program in-house. We built the program around some studies by the National Academies of Science and of Engineering, and drawing a little bit on the National Academy for Public Administration. I developed a definition of technology assessment as "the exploration

of primary and secondary consequences of the introduction into society of a new technology or the expansion of an already existing technology." The emphasis of course was on normally unexpected and unanticipated consequences. We developed a full picture of how the assessment should be done and the characteristics of the consequences of an assessment, being careful to avoid the notion that technology assessment was an anti-technology concept. In spite of that, many groups and a substantial number of businesses, without bothering to understand the concept and its background, saw it as anti-technology.

After five years in that program I moved to the Office of Technology Assessment of the US Congress as assistant to the Director, for quality control. I later also assumed responsibility for exploratory programs. Coming out of my technology assessment experience I saw two interesting developments. First, business had no interest in technology assessment as developed and used by the National Science Foundation Program, for the simple reason that no business has the plenary responsibility of government. Technology Assessment was conceived as a means of informing government. Business was and is much more interested in what we came to call "inverted technology assessments" — namely what will occur outside the business that may have an adverse or positive effect on the technological products or services of the firms. A common practice in all businesses, without using the term, are inverted technology assessments, which they usually pursue on a too limited basis.

In the early years of technology assessment some firms claimed they were doing technology assessment, but in fact they interpreted the concept to mean technological readiness. The OTA program had relatively little appeal to business, but because it was set up by government and had a fundamental commitment to broad participation, industries of all sorts were

drawn upon in advisory and oversight roles. Often small businesses, usually consulting firms, participated as contractors on projects. From my point of view most of the big business involvement in the OTA technology assessments was to keep an eye on what was going on and be prepared to be defensive, if necessary.

With regard to foresight and the study of the future, businesses are increasingly more open, because on a national or global scale the corporate external business environment is undergoing rapid change. New competitors are coming into play. New opportunities present themselves. Often there is unexpected competition at home and in other countries. Changing public attitudes and behaviors toward misfiring technologies and shortfalls and failures have made governments far more active and public interest groups more effective in imposing constraints that influence business. As business becomes more global and complex and more technologically sophisticated the risk and opportunities become bigger and more uncertain. Hence the growing awareness of the need to explore the future.

In doing an assessment or foresight or future study the central intellectual strategy is to recognize that anything whose future is worth studying has to be approached as a system. In doing that one must go through steps such as the following, with obvious alterations and variations depending on the topic and the users.

One, define the system which one is studying. This includes not just the economic and physical aspects, but the flows in and out, and even the history and reputation of the firm. It includes the labor force, the management, customers, and outside groups. Systems definition can easily fill a large part of a wall.

Two, one then looks for the forces, factors, and trends influencing the elements of the system. In addition to the following lists, which are so universal to affect almost everything, one has to identify particular trends influencing individual business or enterprise. The generic forces are demographic factors, information technology, social value changes, science and technology, business practices, and globalization. Each of those generic categories may involve a dozen or more trends. Three, one is then ready to put one and two together to define alternative futures. In doing futures work its essential to reject the notion of "the future." The notion of defining what actually will occur with any high degree of detail, reliability, and utility 5 to 50 years in the future is unrealistic. What is realistic is to define a range of a few to a dozen or more alternative futures in the complex multi-dimensional landscape of alternatives. Selecting those futures is done on the basis of one's experience, policy richness, and for the diversity of elements in the system.

Fourth, one moves on to identifying the implications for the client and from there to, number five, the actions that are appropriate for the clients to take. Sixth, one must look at what kind of unexpected events might occur that would upset the analysis. Finally, seven, particularly in democratic societies one must look at the stakeholders, that is, the individuals and groups who either affect the system or are affected by it. One must understand their goals, motivations, interests and the factors that could influence change in their attitudes and behaviors. Those seven steps will create a useful study of the future.

Foresight studies are basically no different from the above. In the American approach the outreach to participants or their representatives is implicit in executing a good future study. In Europe one of the features of a foresight study is to reach out to as many of the

stakeholders as it is practical and engage them in a useful and instructive way in probing their interests, how future developments might effect them, and what goals and objectives appeal to them. That outreach has in the past been less common in Europe than in the United States, hence the use of "foresight" to reinforce the idea of broad public participation, in contrast to a futures study executed solely by experts.

To effectively reach out, one must however go to the stakeholders with information. One must be a credible receptacle and one must tell people how their participation will be used. Finally one must go back to them at the end of the project and deliver information about outcomes. Participation can be effective in constituency building.

In a technology assessment one has to be sure to look at the alternative ways in which the system can be implemented. One must also consider macro alternatives. If for example one is looking at photovoltaic applications in remote areas one will have a badly flawed analysis if one ignores how electrical energy can be supplied in remote areas by other entirely different technologies. One must then also be ready to look at what gaps there are in knowledge and how those gaps may be filled. One of the things coming out of technology assessment for example may be a research agenda.

One also needs to look at the institutionalization of the technology, who might be responsible for institutionalizing it, and what government's role might be in assisting, controlling or regulating it. Strong emphasis in technology assessment has to be given to uncovering issues, that is, points of conflict among and between stakeholders which must be resolved. Issues are not problems to be solved but are only to be resolved by striking a balance among

conflicting interests.

Let us turn now to look at a few trends that are driving business today:

First is information technology, which brings about effects of two different types. First are the effects on efficiency and effectiveness. These are the characteristic goals in the introduction of all technologies which are substitutes for existing technologies. The second type of change comes about when the technology becomes cheap, familiar, widely available and well understood. These transformational effects are basic changes in the organization of a business and institution or user.

Every enterprise is becoming an information machine in which the plans, organization, and operation of that machine are essential to effectiveness, irrespective of what product or service it produces.

Another broad trend is globalization, which as noted above involves three relationships—everyone competing in the home country, everyone competing in the competitor's country, and both competing in third countries. The great advantage of globalization is that it opens new markets. The consequences of opening new markets are positive even for those who suffer some business setbacks, in that it introduces new methods, new techniques, new modes of doing business, new innovations, and new social technologies. Globalization is a primary factor in the transfer of physical, biological, and social technologies.

Research and development is a big factor in all global change, particularly in mid-size

and large companies. As dependency in R/D grows government is being called upon to alter the relationships it has had with business, and relationships among businesses, in order to facilitate research and to get more productive results at lower costs using fewer professional resources..The preparation of the scientific and technological workforce and governmental R/D programs have to be critical to businesses of any size even if R/D is not conducted internally. There must be policy with regard to sources of new devices, services, machines, and applications.

Numerous other drivers are affecting business, but let me turn to my last point. Poland is a transitional economy on the edge of becoming, but not yet an advanced nation techno-economically. It is in close proximity to the advanced nations of Western Europe and accessible to the rest of the world. If a carefully worked out developmental model were in place to link government and business cooperatively, Poland could prosper. In the US for far too many decades business has generally seen government as its enemy, not its friend, as a negative regulator and as a brake rather than as a facilitator of competitiveness. Poland should avoid that hostility.

Look into the activities of the British government in their Foresight study. It identified the most important technologies benefiting the economy and the most important technologies benefiting the quality of people. Then they combined them to identify the most beneficial of these two subsets.

The project was so successful that it has been permanently institutionalized. It could be a model for Poland.