

The economy and social equity in a period of major technoeconomic change

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Social cohesion and stability, the health and well-being of individual persons and populations, and work and job security are all related to the performance of an economy. Major technological changes can have profound socioeconomic effects that alter social cohesion and stability with negative effects on work, job security, and the well-being of populations. The relationships among technological change, economic growth, social change, work and health, and well-being are not well integrated into our understanding of how to cope with these changes.

In this presentation I attempt to integrate some of our knowledge about technological change, economic growth, stability of social environments, work, and the health and well-being of populations. One of the best markers of a prosperous and civic society is the overall health and well-being of the population (1, 2). We are currently in a period of major technological change in which some believe that the developed countries of the West could disrupt the social balance and stability of their societies and thus produce unstable intolerant undemocratic societies with adverse effects on health and well-being (3).

Technological change and society

Although many terms are used to describe the technological revolution that we are in (eg, information age, the information highway, the learning society, etc), I prefer a simple description, "chips for neurons". The substitution of low-level intelligent devices (they can sense, decide and act) for low-level human intellectual function is a deep and broad technological revolution, like the harnessing of fossil fuel as an energy source more than 200 years ago. Such deep and broad technological revolutions affect all aspects of society (5, 6).

We now have some sense of how major technological revolutions penetrate deeply into all activities in a

society and spread throughout society. This phenomenon has been described well in a paper by Lipsey & Bekar (7). The present revolution appears to be as powerful as the harnessing of fossil fuels to replace muscle and water power in the industrial revolution. We know the industrial revolution, which caused major social changes, was a crucial factor in western countries becoming rich and democratic with universal suffrage with massive improvement in the health and well-being of their populations (4, 5). Thus, in a space of 250 years, western societies moved from 80% or more of their populations living in relative poverty, serfdom, and slavery to 80% or more living in relative prosperity with the kinds of social cohesion and stability, civil liberty, democracy, and universal suffrage with which we are familiar in western societies.

The social changes and adjustments to the industrial revolution were traumatic to society and involved the creation of new institutions for public education, the evolution of unions, new forms of governance, more democratic governments, new labor market policies and workplace legislation, social security, and other measures to provide an educated healthy population and more stable equitable civic societies.

The present technological revolution may have as great or possibly an even greater effect on the economic, political, labor market, and social structure and character of societies than earlier major technological revolutions. Unfortunately, the full socioeconomic effects of major technological change are hard to predict. Some of the characteristics of this "chips for neurons" revolution that is changing the socioeconomic character of society appear to be:

1. The replacement of low-level intellectual functions by electronic devices — the bank machine, autonomous robotic devices, the "electronic pilots" of commercial aircraft, security devices, automated services, automated and flexible manufacturing, global infor-

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mation systems, and the like — this process is changing the nature of work, productivity, and the roles of individual persons in society.

2. The capacity to make enormous bodies of knowledge instantly available to people linked through electronic networks and the creation of learning networks that cross existing geopolitical boundaries. This feature appears to be changing our approach to learning and our educational institutions and will undoubtedly influence the perception that people have of the society, organizations, and institutions in their community and government.
3. The opportunity to interact through virtually instantaneous global networks for a variety of functions ranging from education and training to entertainment, financial markets and business, and military activities.
4. Virtually instantaneous global transmission to people in all regions through news media, electronic networks, and other institutions of "information", objective or biased. This possibility will influence the values, beliefs, and cultures of societies.

These changes are already influencing the economies, social cohesion and stability, and labor markets in many societies. Most of the developed world is struggling to cope with these changes. If we look at how human beings have coped with other deep and broad technological revolutions, there may be some insights that may be relevant to how we cope with the "chips for neurons" revolution. What is clear is that economic and social policies and institutions in western countries that helped sustain prosperity, political freedom, and stable civic societies for the developed economies in this century will not be easily sustained in the face of the economic forces unleashed by today's technoeconomic revolution.

A few generalizations can be made about the effects of technological changes, particularly information technology, on societies since the agricultural revolution (6).

1. Each major information revolution has tended to be associated with changes in the socioeconomic characteristics of a society, social order, culture, and the scale, scope and systems of governance. Some of these changes have been negative and others have been positive in terms of personal, and population health and well-being.
2. Some information revolutions have helped break the power blocks controlling societies and unlocked the creative power of the members of society and therefore led to enhanced prosperity and improved social and physical environments in which members of the society live and work.
3. Recently, in the history of western society, the printing press and the development of paper made it possible to provide information to a larger portion of the popula-

tion than that provided by institutions like the church, landlords, and the aristocracy and their forms of governance and control. This information revolution contributed to the undermining of the power and controls of persons and institutions in feudal societies and led to changes in economies, the territorial boundaries of societies, and institutions of governance (4, 6).

4. The freeing of western countries 300 to 400 years ago from feudalism, autocratic governance, control by the church and other groups led to a release of human ingenuity and the industrial revolution. The industrial revolution led to major socioeconomic, institutional, and political changes, as summarized earlier. One of the dramatic effects of this revolution and its effects on societies was the improvement involving considerable conflict in social cohesion and equity and the health and well-being of citizens in western countries. This improvement in health and well-being appears to have been primarily related to the effects of improved prosperity on early childhood (5).
5. Each major technological change produces major alterations in social structures and institutions and the way societies create and distribute wealth. Frameworks of understanding about economies and the social societies developed since the industrial revolution may be made inappropriate by the effects of the present "chips for neurons" technological revolution.

As stated earlier, one of the best markers of a successful economy and social order is the health and well-being of its population (1, 2, 4, 5). The health of a population is largely determined by the quality of the social environment in which children grow up and where people live and work (8, 9). This relationship, and the biological pathways involved in causing disease when people do not cope well with their tasks, were poorly understood until recently.

Our competence and coping skills are largely set during the early childhood period of development (10—12). Thus a marker of a society getting into trouble is when an increasing number of children show adverse behavioral effects during their early childhood, often expressed as problems when they enter the school system (13—15). These children have more problems in terms of behavior, learning, and health and well-being as teenagers and adults (10, 16, 17). They also have difficulties in adjusting to rapidly changing social environments and the changing nature of work.

Prosperity, social policy, social environments, social equity and technological change

A classic example of a country that failed to capture the prosperity of the technological revolution effectively in

this century is Great Britain (18–21). The pools of wealth that accumulated in the financial institutions in the United Kingdom, following the success of the industrial revolution, were not used to making substantial investments in new technologies and related businesses. Those controlling the wealth became more concerned with short-term returns from investments in financial markets (21, 22). As a result, Great Britain has slipped from being the world economic leader at the turn of the century to 23rd today. The health status of the population in the regions around the financial markets [London] is much better than that in the regions that were the heart of the original industrial revolution [Manchester, Newcastle, Liverpool, Sheffield, etc (23)]. Part of the socioeconomic change caused by inadequate investments in building the new economy can be picked up by the increasing income inequality, higher unemployment, and welfare in these regions remote from London. The most deprived regions of the United Kingdom have the poorest health status. In periods of major economic change, some countries will have difficulty developing policies for investing in the new technologies to create economic growth to produce the wealth that helps sustain high-quality social environments and social equity. The United Kingdom is an excellent example of a society that failed to cope with the new economy and technology and innovation throughout most of this century.

While we now have a better understanding of the determinants of health and human development, and the effects of the social environment in which people live and work, our understanding of major technological change and the determinants of economic growth and the effects on social environment is less complete. In its broadest sense, economic growth is about how societies create and distribute resources to sustain and enhance their standard of living, and the quality of their social environments. In discussing the subject of economic growth, *The Economist* magazine (24), in an essay entitled "Explaining the Mystery", pointed out that economists have had little to say about what determines economic growth. It pointed out that, when one focuses on the determinants of economic growth, there is a need to consider indicators other than gross domestic product and business cycles. Today, it is increasingly recognized that technological innovation is a major driving force in economic growth and that technological innovation is strongly influenced by socioeconomic factors (25, 26). Understanding and applying the full implications of this new knowledge in the theoretical framework of economics and public policy has been slow, particularly in English-speaking societies.

As discussed, Great Britain is an example of a country that failed to invest adequately in the technology of this century; it also introduced social programs that it could not afford and has developed increasing inequali-

ties in health (19, 21, 27, 28). Can our societies do a better job this time? The critical issue is how we, as societies, use this new knowledge in health, human development, and economic growth to cope with the changes.

Technological change, social policy and civic societies

Two primary goals of a society during a period of major technological change should be to (i) adopt policies that promote economic growth (based on our new understanding of the determinants of economic growth, not business cycles) and (ii) with diminished resources, help communities maintain stable social environments and civic societies during the economic change that minimize negative effects on early childhood development and vulnerable members of the adult population.

In light of Paul David's observations (29) about how long the change from electricity to steam (a deep and broad technological change) took, it may take our societies another 20 to 30 years to build a new economy based on the "chips for neurons" revolution. If we understand the time frame of the change we are in, the characteristic of the change, and the importance of maintaining cohesive stable social environments as we build the new economy and develop suitable social policies, we may build, in contrast to the pessimistic analysis of Dahrendorf (3) and others (30), prosperous, tolerant, socially cohesive democratic states for the future.

At present, in most western countries our institutional structures, policies, and incentives to invest in the new economy are weak, while the incentives to speculate in global financial markets are high (30, 31). Playing in global financial markets providing short-term gain does not build the new economy. Unless countries can set up policies, incentives, and institutional structures to make a high priority of investing savings in the new economy, they will have difficulty sustaining their prosperity and could suffer the same decline as the United Kingdom during this century, with corresponding negative effects on social cohesion, the social environment, and the health and well-being of individual persons and populations in their societies. Social policies will be strongly influenced by how well countries build the new economy and their capacity to set priorities. If we cannot build the new economy quickly, we will end up with increased income inequality, and the quality of our social environments will decline so that it will be difficult to maintain suitable social policies to help sustain civic societies. An unstable, uncivic society will severely handicap our capacity to build the new economy and new labor market and could lead to a more authoritarian form of governance.

To cope with the changes we are going through, a society should integrate its economic and social policies

and take into account what we now know about the effects of deep and broad technological change on the determinants of health and the determinants of human development and use measures that let us know how well we are coping with the changes.

There are a few things that can be done now:

1. Design and use a real measure of economic growth that takes into account an economy based on the power of ideas not objects. The gross national product is misleading and an inappropriate measure of the economy for the period we are now in.
2. Put in place policies that create incentives to build the new economy.
3. Develop and use measures that combine estimates of economic growth, new ways to use resources, and changes in social environments. A new socioeconomic index is needed that measures our prosperity and the civic quality of our society. One important indicator to put in place is a measure of health status changes against socioeconomic changes. This indicator allows a community to see how well it is coping with the changes. The Province of Manitoba has established a data system that allows it to monitor changes in the health status of the population against socioeconomic changes (32). This system allows continuous monitoring of the health and well-being of the population against changes in the economy and social environment. We need more measures of outcomes that can be used to assess how well communities are coping with socioeconomic changes.
4. Make the state of children the highest socioeconomic priority during this period of change and put in place regular measures of what is happening to children. Measures of readiness to learn when children enter school is an important outcome measure that reflects changes in the quality of the social environment and income equality and is a predictor of future development and health and well-being.
5. Take steps to avoid creating an underclass that excludes individuals from being participants in society.
6. Ensure that government programs help sustain cohesive civic communities — remember communities vary and recognize that there is no single best solution; ensure that government programs do not create barriers to communities' integrating the use of scarce resources to sustain their cohesion and support children; avoid excessively controlled, bureaucratic programs and depend more on accountability through outcome measures.
7. Set up programs to help communities define their problems and identify the resources that they have to try and solve their problems.
8. Use the new "information highway" to make it possible for communities to talk to each other. They can

learn from each other about what does and does not work in sustaining cohesive civic communities.

Establishing "national accounts" that can be used to monitor how well societies cope with change is probably crucial if we are to create an understanding and political will to meet the challenge. Since children are vulnerable during these changes, one important indicator is the health and well-being of children.

One indicator that measures how well children are supported during early childhood is "readiness to learn" when children enter the school system (13—15). This is a measure of both behavioral and cognitive characteristics. It is a simple measure predictive of academic performance, school dropout rates, and teenage delinquency. It also appears to be predictive of health risks in adult life. In most societies, when readiness to learn is assessed against socioeconomic measures, it is a gradient. That is, more children with higher socioeconomic status are ready to learn when they enter school, and a smaller portion at the bottom of the scale are ready to learn. However, as one moves from the top of the socioeconomic scale to the bottom, an increasing proportion of the children have problems when they enter school. Thus it is both a middle-class and a poverty question. In some countries the gradients are shallow; in others they are steep (33). This is one of the universal markers a society can use to assess the state of its children.

Societies that can preserve their civic qualities will do better than societies that become captured by narrow self-interest groups. The latter societies become two-tiered and show increasing income inequality with negative effects on children and the health and well-being of their populations. These are clearly markers of difficulties in developed countries. For example, the United Kingdom, the United States, and Sweden all show increasing income inequality in their societies (34). However, while the United States and the United Kingdom have increased the proportion of children living in poverty, Sweden has not (35). Others, such as Japan, Taiwan, Canada, and West Germany, have yet to show these changes (34, 35). The magnitude of this change in the United States is of concern. According to our new understanding of the determinants of economic growth, the United States has performed poorly over the last 20 years, with a relative decline in its economy (not based on gross domestic product) (36, 37). In association with this economic change, measures of the quality of society in the United States have shown a decline since 1970 (38, 39). The change is manifested by an increasing proportion of children and teenagers in difficulty. Since 1970, teenage suicides have increased by 83%, children living in poverty have increased by 48%, and, for families in the bottom 60% of society, wages have decreased by nearly one-third. This trend is not

surprising since much of the employment growth in the United States has been in low-wage and part-time jobs. The United States is becoming a two-tiered society with increasing social instability and a need for tough security measures (30, 31).

If societies understand the nature of the socioeconomic changes, can they do anything about it and what does this mean in terms of the future of worklife?

Coping with socioeconomic change

Intelligent communities will be those that understand the issues that have been discussed and can come together to address them. Societies that engage in chaotic individualism and do not come together to define their problems in order to meet the challenges will probably not make it in terms of being prosperous and civic, with political liberty for all citizens. Societies that express the needs of individual persons in a social context will probably do a better job (civic communities). The attitudes and values necessary for civic communities will largely be driven by forces at the local or regional level of countries (23, 40), and thus effective governance will be strongly local during the present period of change. There are some who see the present technological revolution as leading to smaller units of government.

There are, based on the knowledge we now have, some steps societies can take to achieve economic growth, social cohesion, and political freedom during this change:

1. Improve our understanding and integration of knowledge about economic growth, health, and human development with emphasis on the present technological revolution and its effects on the determinants of economic growth and social institutions that affect the civic quality of a society. Create incentives and institutions that will help us build a new economy and new arrangements and conditions for work. This step will require a fundamental change in many policies that affect institutions, including tax policies.
2. Develop policies and strategies to help communities sustain, with diminished resources, stable equitable civic societies during this change in order to maintain quality social environments. [Privatization of health care and the curtailment of public education are examples of actions that could weaken the civic strength of communities.]
3. Monitor how effectively we are supporting young children during this socioeconomic change and take steps to reverse negative trends.
4. Ensure the development and application of new technologies (eg, the information highway) to augment

the social structures that are needed by humans to survive and are not used to create chaotic individualism and poor social environments which will ultimately have a negative effect on economic growth and the health of persons and the well-being of individual persons and the communities.

5. Ensure that citizens appreciate that the change taking place will considerably alter institutional structures and lead to new concepts of work, family, social organization, territoriality, income distribution, and governance. This process will require policies that help communities develop organizations to buffer the effect of change.
6. During the changes, ensure that people have things to do in society that are of meaning to them and their communities. This should be a primary goal of social and economic policy. It will require a broader definition of what we mean by work.

Summary

I am optimistic that, if we use what we know about economic growth, social order, human development and health and well-being, and the relationship among these factors, intelligently during this period of major technological change, we will be able to continue our experiments in civilization and sustain prosperous, civic, democratic communities. This action cannot be taken if we continue to fail to integrate our knowledge about economic growth, health, and human development. Integrating this knowledge is a difficult challenge. Government departments, programs, and our political institutions currently have substantial barriers to the integration of this knowledge and the development of suitable policies. New institutional arrangements, particularly at the community level will have to emerge if western societies are to cope with the forces of economic change and maintain prosperous, civic, tolerant, democratic societies.

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