

PREPARING WORKERS FOR THE 21ST CENTURY: THE IMPORTANCE OF STATISTICAL COMPETENCIES

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This paper argues that we need to generate more meaningful statistics about the workings of the rapidly changing labour market and the interplay between the supply of skilled manpower and the competencies required by employers. It makes the case that the new knowledge economy with its much faster labour turnover requires workers with mathematical and statistical literacy. It emphasizes the importance of statistical teaching in the educational system and argues that the teaching of statistics should focus less on statistical theory and formula and more on using statistics to describe and explain the world around us. It discusses some international assessments of mathematical literacy and gives examples of how statistics can help to illuminate everyday issues including the working of the labour market and its links with the educational system.

THE NEW WORKPLACE

The first premise of this paper is that measurement, statistics and indicators about education, training and the workplace are indispensable elements of well-functioning labour markets in the 21st century and need to be strengthened. On the one hand, we have insufficient knowledge about the education and skills of workers entering work and the acquired competencies of those already at work and, on the other, we have insufficient knowledge about the education, skills and competencies required by employers. Even more importantly, we have very insufficient information about the interplay between the supply of and demand for workers and how this is changing over time and among professions and countries. Some statistical practitioners (Garonna, 2000; Carlson, 2001) are concerned that labour market analysis lacks a fundamental theoretical basis and argue that the current statistical analysis of the labour market is a case of measurement without knowledge. As Garonna has observed “Measurement gaps and the lack of quality data are the main obstacles to shedding light on the crucial set of relationships between the acquisition and accumulation of knowledge and labour market performance”.

A second premise is that the increasing flexibility of labour markets places even more emphasis on the key role of statistics, indicators and measurement instruments to inform national and international policies, to provide basic information to workers and employers about the relative supply of and demand for labour in countries, i.e. about job creation and job loss, and to measure unemployment and underemployment and the characteristics of the unemployed and underemployed which vary a great deal among countries. These so-called ‘labour market dynamics’ bring with them the need for more relevant data, more frequent data and more intersectoral and inter-country data and indicators with new measurement instruments and databases.

A third premise is that today’s world of work requires workers to have problem solving and reasoning capacities and competencies in numeracy and statistics. We have gone from the machine age of the 19th century industrial revolution to the information age of the 21st century. Job creation is taking place in the fast-growing service and in the ‘knowledge economy’ sectors where workers must interact with customers and use technology in their daily work. Computers, computer software and communications technology began to replace the typewriter, and often the drawing board, a little more than a generation ago. Every year a higher proportion of workers are expected to be computer literate which indirectly means being numerate. The capacities of computer software far outweigh the demands placed on them and workers with greater mathematical literacy will use them more efficiently and be at a great advantage in the general labour market. Furthermore, new generations of technology are occurring at an increasingly rapid pace, especially in ICT. This means that workers need to be prepared to lose and gain their jobs more frequently. It also means that workers need to be able to upgrade their skills on an ongoing basis through lifelong learning, formal education and training, both on-the-job and outside the

workplace. ICT has made the workplace more efficient but at the same time it is placing more and more responsibility on workers to be able to manage the necessary technology in order to perform efficiently. And more new jobs are being created in the ICT sector where knowledge content is a growing required competency.

National and global labour markets are becoming more volatile as innovation speeds up, markets integrate and firms become larger and more concentrated. In April 2000, the US Federal Reserve Chairman Alan Greenspan said that even in times of a strong economy and low unemployment, rapid technological changes mean American businesses and workers will continue to face insecurities unless there are improvements in job training. At that time, the Information Technology Association of America estimated that nearly 850,000 jobs could be left unfilled because applicants lacked the necessary qualifications. These numbers confirm the results of Silicon.com's Skills Survey 2000 that found that 47% of European companies had IT positions they could not fill in these same skill areas. Just one year later the global recession began and this has completely changed the employment situation, from a skills shortage to a skills excess, after huge job cuts due to a confluence of economic factors. This puts workers without updated skills, in a doubly disadvantaged position. In Greenspan's view "we need to foster a flexible education system, one that integrates work and training and that serves the needs both of experienced workers at different stages in their careers and of students embarking on their initial course of study". Business partnerships with corporate and distance-learning universities and schools of management, community colleges and public agencies can play an increasingly important role and statistical teaching needs to be part of these events.

In sum, the reality of today's workplace places a double emphasis on the role of statistics and statistics literacy and reasoning: 1) from the point of view of the increasing knowledge content of jobs, and 2) as a tool in itself to understand skills markets in the 21st century. Whereas 50 years ago, one aspired to work for a company 'from cradle to grave', today workers must expect to change jobs and prepare themselves to move from job-to-job, at the same time keeping their skills up-to-date. Whereas 50 years ago, job creation and job destruction was a national phenomenon it has now become an international phenomenon with multinational companies controlling more jobs within fewer corporations. This means that job creation and job loss are highly concentrated, thus a decision in the headquarters of a company does not affect jobs just in that country but also in countries around the world. Better and more accessible information and statistics are needed to help national labour markets and workers function in an increasingly global context. What does this new international skill market entail and what is the role of statistics?

THE NEW DEMOGRAPHICS

When we think of preparing workers for the 21st century it is natural that the first image that comes to mind is the incoming cohort of young workers and their preparation. Certainly this is an important group and particularly so in developing countries with deficient education systems that need to be upgraded to prepare future young workers more adequately. However, the reality of today's demographic transition is that the 21st century will be a society of increasingly older workers as people live longer, work longer and reproduce less. Peter Drucker has labeled the aging of the population 'the new demographics', a trend that is a centrally important statistical first principle in understanding the reality of the future workforce and its organizational structure and characteristics (Drucker, 2001).

Statisticians and the teachers of statistics have an important responsibility to clarify the impact of demographics on the characteristics and structure of the future workforce and on society as a whole. As noted by Drucker (The Economist, November 3, 2001) and the subject of numerous studies by international organizations like the UN Population Division and regional think tanks like the Latin American Demographic Center of the Economic Commission for Latin America and the Caribbean, the so called 'demographic transition' toward an aging society is taking place at an alarming rate in industrialized countries and at a rapid pace in many parts of the developing world. By 2050, people over 65 in Germany, the world's third-largest economy, will account for nearly two-thirds the size of the population of working age compared with just over a quarter now. If its birthrate continues at the present rate of 1.3 births per woman of reproductive

age the number of people of working age will fall from 60 million to 50 million. This demographic pattern is similar in other developed countries such as Japan, Italy, France, Spain, Portugal, the Netherlands, Sweden, and for a number of emerging economies, China being the most notable, but with others following suit, if at a slower rate. Meanwhile, life expectancy continues to go up.

Just what is the responsibility of statisticians and the teachers of statistics to illuminate and inform society, business and the workplace about the new demographics? In the view of the author, the statistical community has a vastly undervalued role that it is not playing at present: first to ensure that the basic demographic data are collected by all countries and that the necessary demographic calculations are applied to the data for the purpose of demographic analysis and projections. This is already a tall order in many countries with stretched budgets and limited technical resources to carry out this basic job but it is one that must be done and which the international community should assist to assure. Second, the statisticians and demographers need to 'get out of the box' and make their research available and accessible to policy makers, the private sector and the general public so as to inform their decisions. This may seem like dry stuff but when demographics are put into concrete productivity and societal contexts such as the impact the aging population will have on pension systems and dependency ratios then its central relevance becomes readily apparent.

Making national demographic facts available and accessible is not just the work of demographers but of the press, of strategic planners in government and the private sector. This is where the role of teaching enters. In today's society, in my view, the teaching of statistics and demography needs to begin in primary school and continue through secondary and post secondary education. Children understand that mathematics is a basic subject they must learn. So why not include in mathematics and in social studies both the exposure to the role of statistics and demography in society and the ability to apply statistical and demographic methods to real life problems such as calculating the size of the labour force and its characteristics?

FROM MANUFACTURING TO SERVICES IN 'KNOWLEDGE JOBS'

Not only are we in the midst of a demographic transition in today's society and workplace, we are undergoing a dramatic shift from manufacturing and agricultural jobs to service jobs and jobs where know-how is based on knowledge, information and their applications, replacing many of the assembly line manufacturing jobs. The knowledge and technology content of these jobs is greater and they are more and more jobs that women can do just as well as men. The high investment in heavy, costly capital goods characterized by traditional manufacturing with fixed costs and fixed location is not a constraint in many service sector jobs: telephone call centers, for example, are being located where the labour force is affordable and literate. The relatively lower investments in capital equipment of these new economy 'plant locations' mean that employers can more easily move their establishments to higher profit localities, leading to the large relocation of employment in the United States in recent years as jobs migrated from the high cost eastern corridor to more affordable locations such as Florida, Georgia and Nebraska. ICT made these moves possible, as did the availability of workers with the necessary skills. Where do statistics come in? The new economy jobs are built on information platforms and information and communication technologies where calculation and innovation are components of the hardware and software. Statistical and mathematical numeracy are at the heart of many of the jobs that produce the equipment that makes these service jobs possible and have become a more and more central element of the skills that service workers must acquire in order to perform their jobs properly. Understanding the skills and competencies needed by new economy workers and the available supply of workers in or entering the labour market are important tasks for the statistical community to pursue. Several examples of current research that needs to be extended to more countries and more national contexts are mentioned here.

The OECD'S *Programme for International Student Assessment (PISA)* to monitor the outcomes of the education system in terms of student achievement assesses the extent to which students approaching the end of compulsory education have the knowledge and skills needed for full participation in society. Data published in December 2001 were based on a first round of assessments that took place in 2000 with tests involving 265,000 15-year old high school students

in 32 countries almost all of which are members of the OECD (OECD, 2001). Similar reviews at three-yearly intervals in the future will make PISA the most comprehensive international survey of student knowledge and skills. In addition to covering student performance, PISA also reviews student attitudes and approaches to learning. The result is a series of internationally comparable indicators that give insights into the factors influencing the development of literacy skills both at home and at school in three subject areas and how these factors interact. These indicators provide policy makers with a unique benchmarking tool on which to base future policy choices.

PISA measures mathematical, scientific and reading literacy and its approach to the assessment of mathematical literacy should hold great interest for the statistics teacher. It does not focus on mathematic theory or mathematical operations but on the wider use of mathematics in people's lives. In the following extract from the PISA definition of mathematical literacy I have substituted the word "statistical" for the word "mathematical" to underline the central argument that this paper is putting forward. "*Statistical* literacy is used here to indicate the ability to put *statistical* knowledge and skills to functional use rather than just mastering them within a school curriculum. To engage in *statistics* covers not only simple physical or social actions, such as deciding how much change to give someone in a shop, but also wider uses including taking a point of view and appreciating things expressed *statistically*, such as having an opinion about a government's spending plans. *Statistical* literacy also implies the ability to pose and solve *statistical* problems in a variety of situations as well as the inclination to do so which often relies on personal traits such as self confidence and curiosity."

For those statistics teachers who have not read the PISA report, the leading countries in terms of mathematical literacy were Japan, Korea Republic, New Zealand, Finland, Australia, Canada, Switzerland and the UK in that order. Among these leading countries, Korea, Japan and Finland had the narrowest gap between the highest and the lowest performance in that order.

While PISA measures knowledge and skills of future workers, the International Adult Literacy Survey (IALS), managed by Statistics Canada and conducted in more than 20 countries, measures the skills and competencies of adults of all ages which provides comparable information within and among countries about the workforce as a whole, important readings for assessing current national competitiveness (OECD, 1997). Chile recently participated in the IALS and the findings from it have had tremendous impact on the awareness of the business community, workers and the public and have influenced government policies regarding education, training and proactive policies for foreign direct investment strategies.

NEW STATISTICS FOR THE LABOUR MARKET

Whereas in the past, employees tended to be much more stable in employment location, expecting with satisfactory performance to stay with a firm, this is no longer the case. The large increase in mergers and acquisitions removing the assurance of continuity in employment and the greater labour turnover has taken away much of the continuity of information about employees who have become ever more mobile in today's labour markets. Coincident with labour mobility is the evolution of part-time employment as older workers stay on and women increasingly enter the labour market. Traditional personnel information systems need to be redesigned in order to continue to be useful and the statistical profession has a significant role to play in working out these new methodologies.

The information revolution has brought with it the paradox of more data but not necessarily more information, especially the critical information coming from outside a company about factors likely to produce changes in company policy and which are critical for decision making. This is especially the case for small and medium-sized firms without sophisticated information systems or knowledge of how to access and use external corporate information resources and databases. The current government statistics and official statistical programs need to find ways to tap into large corporate databases and information systems.

Large multinationals in particular, which are accounting for more and more employment and productivity have vast multi-country, multi-subject information systems that are not in the public domain and which drive corporate decisions. Workers, government and public decision makers are at a real disadvantage in this evolving information concentration. Often they become aware of crisis only after jobs have been cut (Carlson, in press). Institutional investors, using

complex computer-driven models, fed by gargantuan information systems, and processed by large computer infrastructure, drive the stock market in the US. Individuals cannot compete with these systems but are subject to their impacts. Statisticians and public policy vis-à-vis statistics have an important societal role to play in untangling the vast disequilibria in the production and access to information and showing who is benefiting and who is not from this situation.

Understanding the structure, characteristics and dynamics of the workplace in the 21st century is another important competency where statistics education, training and information should play a key role and where the supply and use of information, and the development of information systems is becoming on the one hand more difficult and on the other more necessary. Traditionally household surveys have been the source of micro socioeconomic data on people, families and households and their economic and social behaviors including labour force participation. On the other side of the coin, establishment surveys have been the main source of business information structured to meet the requirements of the System of National Accounts. Increasingly, however, there has been a felt need for an interplay between household data and establishment statistics. The dominance of service sector jobs in many economies has placed more emphasis on understanding the characteristics of labour as products have moved from commodities to less tangible services where quality is more difficult to measure.

In the traditional wage labour model, workers would stay with one firm, moving up in seniority, and firm-based information systems, especially in larger corporations, provided the necessary information to understand the wage evolution of workers, most of who were full-time employees. Sample surveys and industrial censuses could capture the key statistics, to the extent they were implemented. However, today, especially in the ICT sector, a new generation of technology is born each 18 months, with huge accompanying capital investment. Some of these will become ‘winners’ but the great majority will not and which will live and which will die cannot be known beforehand. The uncertainty of business models brings with it a great uncertainty of employment. Probably the only ‘certainty’ is that there is no certainty.

What is clear is that the knowledge content of productivity is growing in the ICT service sector and with it the increasing need to understand better the microeconomics of productivity at the firm and sector levels. Consequently, today’s establishment information systems and formal surveys must be more flexible, and include more detailed information about the education, training and competencies of their workers, the expectations of their workers, their future training needs, etc. In other words, establishment and labour market information need to become more flexible to reflect the increasing flexibility of the labour market and business evolution. The international statistical community is contributing to this through providing fora for the exchange of information on the practices and future needs of national establishment surveys. As Susan Linacre observed in opening the Second International Conference on Establishment Surveys: “International cooperation is not a luxury but a necessity...it helps to build the coherence in the international dataset we increasingly need...at each conference as ideas becomes theory and theory becomes practice that spreads across boundaries” (Linacre, 2000).

Because of the increasing knowledge content of our service society, and the rapidity with which job creation and job destruction is taking place, there is an increasing demand for understanding the linkages between education and the workplace to which official statistics and practitioners need to respond. Geoff Lee and colleagues at the Australian Bureau of Statistics (Lee et. al, 2000) describe the demand in Australia for information, which links the performance of educational institutions with subsequent employment paths and careers. Surveys have sampled graduates from educational institutions and then interviewed their subsequent employers, and used independent samples of employers as a control group of expectations and attitudes. A similar example is a current research proposal of the author to sample recent graduates of the reformed curriculum of university teacher training in Chile and to follow the new teachers into their first teaching jobs in order to learn about their problems in integrating into the teaching profession and understanding the expectations of their schools and students.

CONCLUSION

What constitutes statistics training and teaching that is relevant to today’s workplace and participation in society? I share the views put forward by Kreft (The American Statistician, 2001)

that statistics should focus less on theory and more on the world around us by making students good consumers of statistical information in the popular press as well as scholarly journals. Teaching statistics as data analysis where statistical models are taught in relation to real problems and using the data analyses as an entry point allows teachers to introduce several ways of interpreting data. The emphasis here should be on the application of statistical tools to solve real life problems, on the lines of the PISA approach discussed earlier, rather than the mystification of statistics through obscure models and equations that require “being a member of an elite club of statisticians” in order to be able to communicate. It is not necessary to be a mathematician to be a statistician. Clear statistical thinking is a skill that we all need to be able to exercise to one degree or another in today’s world, especially today’s working world, and the more that statistics teaching can be made widely accessible the better.

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