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INCREASING PRODUCTIVITY USING COMPUTERS

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INTRODUCTION

About a century and a half ago, the western world was faced with a situation which was to change its existence more than anything had done for the previous thousand years. A way of life based essentially on agriculture was gradually replaced by one based on manufacturing industry and many craft-based skills learnt over generations became of little use. The "Industrial Revolution" had arrived.

Today, with the sum total of the world's knowledge being doubled every ten years, we are faced with a new revolution - the "Technological Revolution". But unlike the industrial revolution, the time scale in which we must learn to adapt is considerably shorter. Individuals may find themselves being retrained several times within their working lives and governments are having to re-examine traditional ways of thinking.

But probably the greatest challenge is that faced by the developing countries, whose success depends upon their seizing the opportunities presented by the new technologies to create new wealth for improving the quality of life without losing their traditional values and identity.

The Information Era

In recent years, there has been a tremendous growth in the field of microelectronics, which is a knowledge-based technological development. No individual, no organization and no nation (whether developed or developing) can afford to ignore the impact this is having on industry and on our lives.

Digital computers are forerunners of the microelectronics invasion. The applications of the computer have developed to such an extent that the economic and social organizations of our society and our way of life is being transformed as a result. We are entering into what is called an "information era".

Nature of Today's Change

The "Agricultural Revolution" of the Neolithic period was essentially related to survival. In the case of the "industrial revolution" changes were essentially related to the mastering of inanimate, permanent sources of power/energy and the extension and replacement of human mechanical dexterity. Current changes due to "Microelectronics revolution" are essentially related to the replacement and extension of human intelligence function, thus constituting a third major technological breakthrough in human history.

According to Alvin Toffler (the author of "Future Shock") mankind is now experiencing a revolution (he calls it the "third wave") which is being propelled by microelectronics. The revolutionary character of present changes is explained by the fact that for the first time in history we have a comprehensive and economic system to handle and process information based on a single type of signal - the electronic bit. This has been made possible by the interrelated developments of; (i) semiconductor technology (particularly silicon integrated circuits); (ii) computers; and (iii) telecommunications.

MICROELECTRONICS REVOLUTION

The invention of the microprocessor and the microcomputer provides the basic components for the "Information Revolution" in a fashion similar to the place of the wheel in the "Industrial Revolution".

Information Technology Trends

Digitalization is making an important contribution to contemporary society's need for informaton. In the 80's our society is becoming more informational. Telecommunication has an increasing role to play in this changeover. Until recently, the main instrument of telecommunication has been the telephone. We now have new non-telephone services, such as data communication, image and fascimile services. Voices travel through the telephone as analog information, for which analog networks have been the appropriate method of communication. But for data communication, fascimile, and image services, digital systems are superior in many respects, particularly for storage and processing. With the progress in the computer, satellite, and fiber-optics technologies, the move towards the information era is becoming quick.

Even though the phenomenal growth in computers is primarily due to the availability of low-cost microcomputers, not all of the technological advances have been at the low end of the market. A few of the advances that have been made in recent years are: (1) large computers that can rapidly search and manipulate massive data bases; (2) computers that can handle many user inquiries simultaneously; (3) computers that can monitor and control a large automated factory virtually without human intervention; and (4) computers that manage other computers in complex networks.

Microelectronics in Industry

Microelectronic devices have enormous advantages over older generations of mechanical, electromechanical, electric and electronic equipments used in industry. In addition to the well known reduction of cost and increase in performance, there are considerable savings in maintenance, energy and space. Microelectronics alter products and/or manufacturing processes by the introduction of one or more of the following factors:

(i) Replacement of mechanical components (e.g., watches, clocks, carburettors)

(ii) Replacement of electromechanical components (e.g., cash registers, typewriters)

(iii) Replacement of electric and old electronic components (e.g., computers)

(iv) Improving product design (by CAD)(Computer Aided Design)

(v) Improving production control (by process controllers)

INCREASING PRODUCTIVITY WITH COMPUTERS

Computers enable achievement of higher productivity through automation. Automation can be characterized as a process by which the relative importance of direct labour costs (office plus manufacturing) diminish. This can be achieved by absolute decrease of direct labour input and or increase in productivity (output hour) which in turn is obtained by withdrawing inefficient elements from the production process. Current computerization processes permit further savings, such as a more rational allocation and use of resources, smaller and tighter stocks (quicker turnover), automated or semi-automated warehouses and offices, optimization of distribution, close monitoring and higher flexibility of production, saving in space, energy, etc.

Automated or Semi-Automated Factories

Computers allow both high flexibility and automation in manufacturing industries. Even traditionally labour intensive textile industry is being invaded by computers.

The use of self-programming robotic arms for cutting, and computerized systems for design, producing patterns, monitoring quality of fabric and guiding laser beam cutters, are changing the face of the industry. Microprocessors are being used to control knitting heads (instead of the centuries old Jacquard's card), to control ink-injectors with high flexibility to change design and colours; they are used to control sewing patterns and fast stitching. These are part of a growing number of applications - the trend being towards a "total system concept which means the use of computerised techniques to detect flaws, keep track of patterns and orders, monitor the progress of work throughout the plant, automate the matching of patterns and the cutting and sewing".

In addition to the labour saving on the use of microelectronics there are other ones vis-a-vis developing countries. The transition of the industry to the "high technology" category implies greater emphasis on management, software, design (product and processes), quality, planning and marketing which have been traditional advantages of developed countries. The changes at all levels involve an increasingly software and R & D oriented industry. In fact, the links between end-producers, machine manufacturers and electronic/ computer firms have been multiplied in an application oriented joint effort to achieve higher levels of automation.

The combined emphasis on management and related, software, R & D and higher investment per employee has transformed the industry, posing problems for developing countries with export ambitions. The current trend in textiles and clothing suggests that there will be an uneven diffusion of the technology due precisely to the new emphasis. Furthermore the labour cost differentials are eroding as some countries industrialize (Hong Kong, Taiwan, Republic of Korea). In the medium term the competitive edge in textiles and garments will no longer be labour costs but technology. This

is already largely true at the upper end of the market, but will permeate the industry as a whole.

In general, computers help to achieve increased productivity in manufacturing industries through:

(i) better designed products;
(ii) improved quality products;
(iii) increased quantity production;
(iv) reduced production cost by waste minimization and tighter inventory control;
(v) higher efficiency and safety of workforce;
(vi) effective management information systems, etc.

Along with the startling progress in manufacturing productivity, growing automation of the paper work (office automation) is also contributing a lot to overall improvement in industrial productivity.

Office Automation

The marriage of computers and communications together with the drive toward greater productivity has opened the door to a wide variety of innovative technologies. Perhaps the best illustration of this is the automated office. Since the introduction of the telephone and the typewriter in the office early in this century, and the widespread acceptance of copiers in the 1960s and 1970s, there have been no major innovations in the way an office work group performs its task. Today, the marriage of computers and communications is changing not only the way in which office functions are accomplished, but also the structure and organizaton of the office itself. Within a few years, some businesses may find they do not even need an office as we know it today.

The rapid acceptance of office automation is being forced by two primary factors - (1) the need for greater productivity in the "white collar" segment of the economy; and (2) the diminishing number of people who are interested in clerical positions.

Some of the major components of electronic offices are:

(i) Small Business Computers;
(ii) Copiers;
(iii) Fascimile machines;
(iv) Word Processors;
(v) Personal Computers;
(vi) Telecommunication Links; etc.

Computers have made possible the collection, processing and dissemination of voluminous information very quickly and also economically. Thus it is becoming an important tool for management decision making. Computers can provide following types of information for effective decision making:

(i) Descriptive (historical) information;
(ii) Performance (current status) information;
(iii) Predictive (forecast) information; and
(iv) Simulated (what if) information.

Industrial organizations are already using computer for many activities, such as:

(i) market research;
(ii) product design;
(iii) process monitoring and control;
(iv) production planning;
(v) quality control;
(vi) materials control;
(vii) plant layout analysis;
(viii) financial control;
(ix) distribution networking; etc.

There are many software packages available in the market which are related with the above mentioned activities:

(i) Accounts receivable;
(ii) Accounts payable;
(iii) General ledger;
(iv) Inventory control;
(v) Material requirement planning;
(vi) Order entry and invoicing;
(vii) Production planning and control;
(viii) Payroll;
(ix) Sales analysis; etc.

There are also many MIS (management information system) and DBMS (data base management system) packages available for larger organizations.

COMPUTERS IN DEVELOPING COUNTRIES

Although computers are becoming very popular even in developing countries, there are still some mixed feelings regarding the wisdom of introducing computers in the underdeveloped world. The major arguments against the introduction of computers in developing countries are: (i) it replaces labour, and therefore will create more unemployment in the labour-surplus economies; (ii) it is a very advanced technology, and hence not suitable

for technology-poor countries; and (iii) it requires large amount of foreign exchange, which is scarce in resource-poor nations.

A Strategy

In many developing countries, the industrialization process is going through a change in emphasis from "import substituting industries" to "export oriented industries". However, the survival of export oriented industries depends solely on being competitive in the international market. If the competition is using computer technology to achieve higher productivity as discussed earlier, can the developing countries ignore computer use? Moreover, even in traditionally labour-intensive textile and garment industries, computerized automation is threatening the 'cheap-labour edge' some developing countries have. What should the developing countries do?

As shown in Table 1, we find noticeable increase in the world-wide use of small-scale computers due to: (i) sharp decrease in cost; (ii) tremendous improvement in functional capabilities; and (iii) considerable ease of use. In addition, we know that computers can be very useful tools for problem solving and technological development. Thus, properly selected computer applications may have the potential to reduce the north-south gap!

CONCLUSION

Computer technolgy promises an array of benefits, and the microelectronics age is already well underway. As it progresses during the last two decades of the twentieth century, it will lead to improvements in productivity in factories and offices, changes in the way information is processed, stored, and communicated, and alterations in the content of many jobs. Like all major technological changes, the transition to micro-electronics age will raise difficult political issues, among which the impact on jobs and employment is the most prominent. However, it is obvious that in developing countries, computer technology offers the prospect of enhanced productivity and the chance to vitalize some economic activities.

Y E A R	1960	1970	1973	1973	1983	1988
USA	5,500	65,000	110,000	200,000	400,000	700,000
WESTERN EUROPE	1,500	21,000	55,000	110,000	225,000	450,000
JAPAN	400	6,000	19,000	45,000	70,000	140,000
OTHER COUNTRIES	1,600	18,000	46,000	95,000	205,000	460,000
TOTAL	9,000	110,000	230,000	450,000	900,000	1,750,000
FOR THE WORLD MINICOMPUTERS IN %	--	40	60	70	85	90

(SOURCE: DIEBOLD EUROPE, 1979)

TABLE I - Number of computers in the world