SOCIETY NEEDS BETTER APPLICATIONS ORIENTED SOFTWARE

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The speaker pointed out that the title of the lecture had been deliberately chosen so as to be provocative. In his opinion, the problem of making more efficient use of computers in business, as the applications become more and more complex, is becoming more difficult. In many cases the computer solutions do not meet their expected targets. The three major factors contributing to this may be summarised as the changing balance between hardware costs and people costs, the increasing complexity of the application system environment, and the unanswered demands placed upon the design of the man-machine interface. The first of these is covered by MacKinsey and Co. who in their report analyse the "cost of computing" and they show that only about 35% of a firm's computing costs are connected with the hardware; the remainder is comprised of people costs (30% operations, 15% program maintenance and 20% new programs). Furthermore, there is a common tendency for people costs to rise steeply with time in relation to the hardware costs which are simultaneously decreasing.

To show the second point, Dr. Bell described the classes of applications of computers in industry and illustrated them with figure 1. Applications in the general and administrative area were considered by MacKinsey to have been the most successful to date. An important feature of computer applications is that once they are set up in their various fields, the next requirement is that they be integrated and linked into a complex network, for example as shown in figure 2. Such networks can become so large that one person may find it difficult to comprehend the whole picture. People thus need broader views and wider experience in order to manage such networks.

In discussing the organisation of a large system (figure 3) the speaker observed that while the hardware and the system control program can be fixed and well defined, the application program is often a conglomerate of many parts, created by different people. The man-machine interface offers scope for much improvement and this is likely to be brought about by recent advances in technology. The upper layers of the system consist of the user system (self-righteous computer operators and system programmers), the operator system (who use the computer output in the administration and organisation), the manager system (decision makers and managers of the organisation) and the chief executive (who is ultimately responsible for the people/computer system complex). The different layers have strictly divided functions and often interact little with each other, due to communications, administrative and technical barriers.

As an example of a complex computer application, the speaker described a project on fiscal planning in local government, upon which his group had worked in conjunction with Teesside County Borough. In response to Government demand, local authorities produce a long-range (25 years) urban structure plan for the development of their city. The assessment of revenues and expenditures implied by alternative plans is very complex. Furthermore, the accurate determination of resource availability and costs is essential if they are to balance and thus ensure the durability of the urban structure plan.

Teesside has a management structure consisting of 13 committees of elected council members representing fire, health, education, social services, ways and means, etc. Each committee has an executive staff to propose and administrate programs.

The scale of the operation can be assessed from the 1968 budget which was 38.4 million pounds, coming mainly from property taxes (40%) and government grants (40%).

Forecasting the population, housing requirements, employment etc. together with their distribution throughout the city is the job of the urban structure plan. Determining the availability of resources and the incurred expenditure across the thirteen managing committees over 25 years is indeed complex. The problem is further complicated by the large number of assumptions which must be made - many of them highly questionable - and the large number of policy variables which must be specified.

Before approving the plan, management will wish to satisfy itself as to the viability (i.e. resources and expenditures balance throughout) and the durability (i.e. will they continue to balance if changes in assumptions or policy occur) of the plan. In addition, management would like to assess the variations involved in either the viability or the durability of the plan due to possible extreme fluctuations in the environmental conditions.

Accordingly, a computer model was developed jointly by the project group which was highly complex. It consisted of 130 sub-models written in PL1. Each sub-model dealt with one development activity and was finalised after consultations with the management committees and after checking the acceptability of various budgeting assumptions. The model is being used to assess the consequences of certain decisions e.g. what would be the effects on population, social services, highways, education, finances, if changes of policy variables were introduced or if some of the initial assumptions made were incorrect, such as birth rate, pupil/teacher ratio, or if one area of the city were not used for housing development.

The model offered many benefits to Local Government, it enabled plans to be consistent, it enabled the determination of the sensitivity of the plans to changes in assumptions, it enabled quick response to key "what if" question such as "what if the policy and priorities of the Council changed after an election?". From this example it can be seen how all the aspects of the Local Government management structure have their operations linked in the planning process. More detail can be built in to provide a detailed budget as the principal control device for the operation of the city.

Over a period of time it is clear, that sub-models will change, forecasting techniques will be improved, report formats will alter. Programmers will change their employment, documentation becomes out of date, the management structure of the city may be changed.

If the effective running of the city depends upon the computer application, then unless the application program can be changed rapidly enough and effectively enough, then it is easy to see how the whole system can get out of control.

Normally it is the programmer or DP Manager who controls the computer programs but in the increasingly inter-related application/computer/human systems his perspective is inadequate to time, schedule and implement controls for the total system.

Control must be placed where it can be properly exercised, that is, by the non-computer specialist manager having total system responsibility.

The programming staff must efficiently cope with the tasks delegated to them. They must anticipate application program changes in the original design and be aware of a wide range of possibilities. They need carefully designed applications oriented software if they are to respond swiftly and adequately to the changes requested by the overall systems manager.

Currently applications software require effective solutions to traditional problems, such as efficiency, maintenance, flexibility, revision etc.

What is new is the significant change in degree caused by the increasing complexity of the applications and the symbiosis of the computer and the organization. Figure 4 lists some of the consequences of failure and the needs for solution.

Over the past decade the key technological improvements provided in computer science, such as high-level languages, macro processors, sub-routine libraries, operating systems and multi-programming have made great contributions towards improving the productivity of programs and the more efficient use of computing systems.

However, when one considers the coupling of a computer application to the human system organization using it and the subsequent inter-dependency between the two, then the problems referred to arise. Technological developments have done little to ease this problem.

In the past, the integration of applications and degree of dependency of the organization of them was not such as to cause great difficulty. Now and in the future this is going to be of paramount importance.

Many of the advances in the past have come as a result of an engineering improvement, and has thus indirectly depended upon the many years invested in research in the 'hard sciences'. The problems referred to in this presentation depend upon a better understanding of human systems, of their interaction with computer systems and of the design of computer software to support the human systems. Research into these areas is in its infancy and its progress is not matching the rate of arrival of problems.

Better applications oriented software is going to be required in society if the computer is to provide a basis for an effective control system for controlling complex human organizations. The speaker appealed to the Universities to explicate the nature of these problems and to research new approaches towards their solution.

FIGURE 1

COMPUTER APPLICATIONS

* G AND A :
  - PAYROLL
  - CUSTOMER BILLING
  - ORDER ENTRY
  - COST ACCOUNTING
  - FINANCIAL REPORTING

* COST OF GOODS:
  - PRODUCTION SCHEDULING
  - PRODUCTION CONTROL
  - INVENTORY MANAGEMENT
  - BILL OF MATERIALS
  - LABOUR RECORDING

* INCREASE REVENUES
  - DISTRIBUTION SYSTEM
  - AIRLINE RESERVATIONS
  - FREIGHT SCHEDULING
  - SCIENTIFIC COMPUTATION

* MANAGEMENT DECISIONS
  - FINANCIAL PLANNING
  - MARKET FORECASTING
  - SALES ANALYSIS

FIGURE 3

"THE SYSTEM ORGANIZATION"

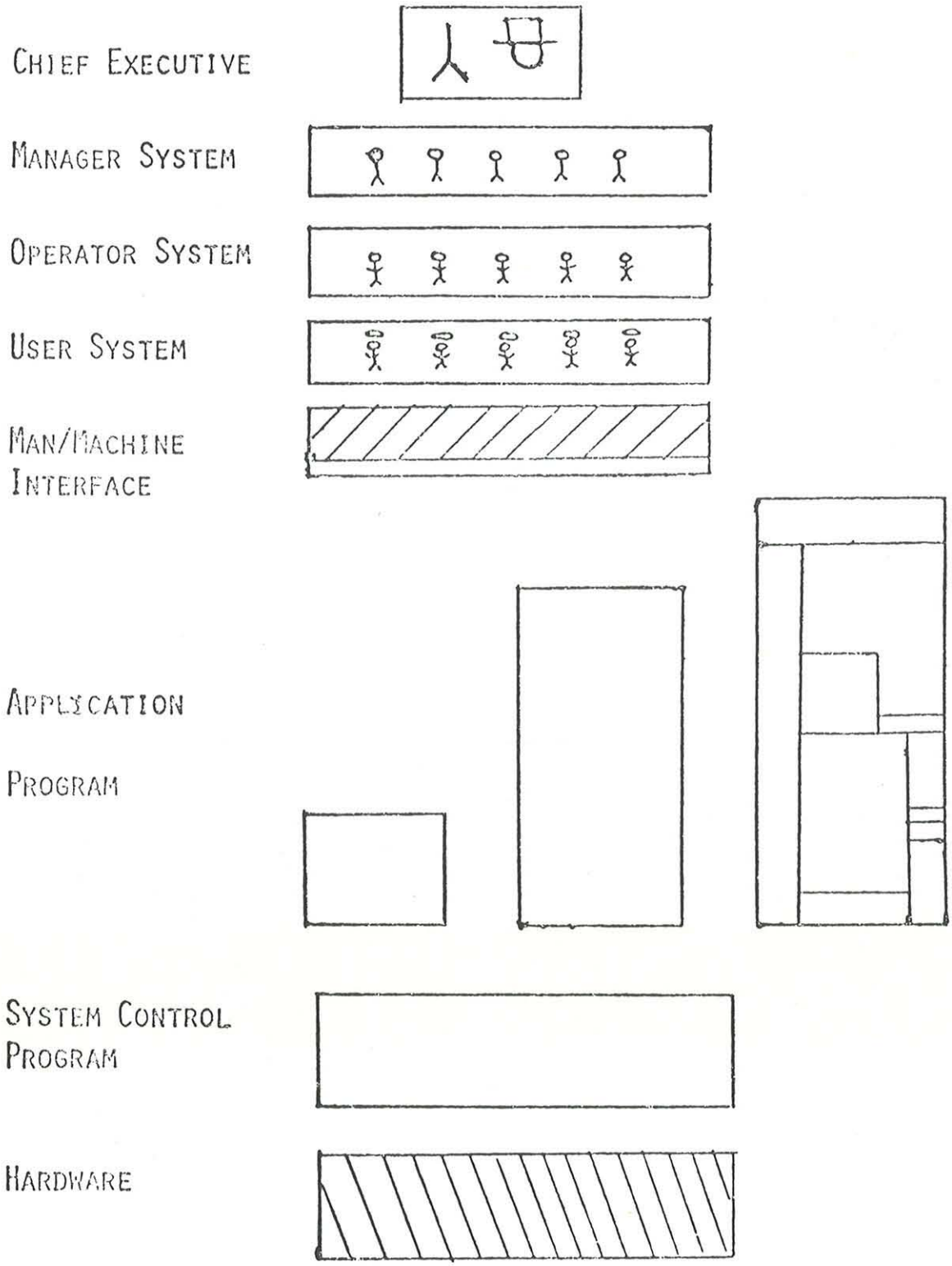

FIGURE 4

SYSTEMS MANAGEMENT?

* CHIEF EXECUTIVE LOSES CONTROL
* MANAGEMENT LOSES CONTROL
* COMPUTING CENTRE LOSES CONTROL
* APPLICATIONS STAFF LOSE CONTROL

SOLUTION

* PUT CONTROL WHERE IT BELONGS
* MAINTENANCE - ERRORS, MODIFICATIONS
* EFFICIENCY - RESPONSIVENESS
* IMPROVEMENTS - ENHANCEMENTS, SAFETY
* FLEXIBILITY - CHANGE IN SPECIFICATIONS
* REVISION - NEW ANNOUNCEMENTS
  - TO APPLICATION PROGRAMS AND THEIR DOCUMENTATION