

# University Data Management as Part of the Information Society

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## Introduction

The statutes of most universities in Finland lay down that universities should promote free research and scientific education and provide the highest form of teaching in the fields that they represent based on these principles. A further requirement in the case of universities of technology is that they 'should promote technical and scientific development.'

The expression 'to promote...scientific education' is an interesting one from the point of view of the information society. The primary focus in practically all official information society strategies in Finland, and in the political decisions pertaining to these, has almost solely been on the development of technical aids for the purposes of this society. The visions contained in the information society strategy drawn up by the Finnish Council of State under the title 'Transforming Finland into an Information Society - National Guidelines' under the goal of becoming a networked information society and one of the leading countries in the world in the application of information and communications technologies and in the related industries (1). Apart from being too technically oriented, Finnish information society strategies have been criticized for placing emphasis on 'hard' values, mainly competitiveness, productivity and employment.

Our national strategies have included little or no discussion of the nature of the information society that we wish to create, and it is from this perspective that the legal obligation placed upon the University of Oulu for promoting scientific education is of particular importance. It is the task of the university to raise standards of scientific education in Finland, and this constitutes an essential element in the content of the information society. New data are generated through research, and the knowledge that accumulates in this way can be used to give the information society a meaningful content.

In addition to its contributions to information content, the research carried out at universities can be used as a means of enhancing the innovative application of information and communications technology, as stated in the national information society strategy. An excellent example of the contribution of the universities to the development of technical aids and devices for use in the information society is the joint research undertaken by the University of Oulu and the electronics branch of the Nokia company.

Seen from this perspective, the university can be regarded as an important element in the information society which makes an essential contribution to both its content and the technical aids and expertise required by it. University data management in turn

occupies a prominent position in the organization and communication of the information and expertise generated in the universities.

## **Information Flows and Reserves in Universities**

Universities can be regarded as highly data-intensive organizations, the information flows and reserves of which can be divided into internal and external types. The former are composed of the operative information system required for university administration and the systems used for teaching and research purposes, most of these being created through teaching and research or otherwise connected to such functions. The information systems related to teaching comprise lectures, computer-aided instruction and supplementary material used in teaching, primarily printed matter but also material in electronic form. Correspondingly, the needs of research are served by specialized systems, high-powered calculation facilities and data network services used by research groups representing different fields. University libraries are also connected with the information flows and reserves employed in teaching and research in a number of ways.

Not all the above information flows and reserves are recorded in networks, however, e.g. lectures remain outside the scope of these at present. As far as society at large is concerned, the most important resources are presumably library information, and above all that contained in the books themselves, and the university research database, which is currently under construction at most universities and colleges of higher education in Finland. This research database or register contains in highly compact form the information generated by the university's expertise and know-how. It comprises up-to-date details not only of the topics of ongoing research and other development projects (and often completed ones as well), but also of the researchers (experts) engaged in the projects, publications, sources of finance, timetables, other parallel or preceding projects and the national and international links maintained by the projects. These research databases are intended for general use and will be made available through the Internet, and the information on the participants will also involve details of their specialized fields and how they can be contacted. Since a significant portion of the information and expertise generated within a university accumulates in its research staff, a research database accessible via the telecommunications network can prove a valuable means of finding the necessary experts for particular purposes.

A university's external information flows can be roughly divided into its publicity and publications and its virtual library. The former is approached here from a wide perspective, in which it is understood as comprising all activities undertaken to make the work of the university known to the general public. The notion of a virtual library is not yet very well established, so that the interpretations assigned to it tend to vary slightly. In its most restricted form, it denotes the use of library display catalogues, or OPAC (Online Public Access), through a telecommunications network. At a seminar on virtual libraries arranged by the European Library Automation Group in 1993, Corrado Pettneati (2) defined a virtual library as constructed on three foundations:

- 1) the electronic library,
- 2) telecommunication services with all the opportunities that they offer, and

3) personal views of the end user, which will enable him to master the range of electronic libraries in fact closely resemble integrated library computer systems, in that they comprise catalogues of items accessible through computer displays, classification functions, loans, purchases, monitoring of incoming journals and the distribution of electronic documents.

This implies that in addition to catalogues, a virtual library can provide access to university research, publication and expert databases, teaching information and the university's electronic publications, for instance. Thus it will come to embody a major part of the expertise of the information-generating organization, presupposing that all members of the organization for their part, and within the scope of their working tasks and specializations, are able to contribute to the information reserves and flows that constitute the virtual library. Failure of the university to use its information flows to build up the reserves of the virtual library will result in its data remaining inaccessible to the general public or other institutions in society, at least via telecommunications network.

### **Everyday data management**

Enormous advances in computing have been made in recent decades, and the achievements have mostly been favourable ones. The latest trends, first in industry and then in the universities, have been to discuss and organize data management setting out from new, wider perspectives. With the universities currently moving over from information technology to data management, it is necessary to consider the ways in which expertise and new information are generated and how these can be made accessible to the organization and converted into expertise, products and knowledge.

The aims of the new data management model adopted by the Finnish universities are:

- 1) to support the running of the university and the achievement of its output targets, and
- 2) to integrate information production by combining those instances responsible for data management strategy services within each university.

The Oulu University Data Management Scenario 2000 (3) acknowledges the fact that data management will be used as a strategic means for improving the university's competitiveness in all its fields of operation in order to guarantee the achievement of good results:

“The information required for the University's primary functions, i.e., teaching and research, and for administrative decisions and other supplementary functions should be made accessible to the various user groups rapidly, in a practicable, comprehensive and well-documented form and protected from outside interference, thereby promoting the creation and distribution of new data and the search for problems and their solutions.”

This concluding sentence of the scenario could equally well apply to the objectives set for the information society in Finland as a whole.

What aspect of university data management can be looked on as particularly important from the point of view of the information society? One answer to this has already been given above: that it organizes substantial data reserves and makes these accessible, i.e., it is of importance with regard to the content of the information society.

But university data management can also be thought of as possessing another, highly interesting dimension. If we compare it with the information society itself, we are inevitably led to the conclusion that the problems involved in it are highly analogous to those observed in the latter. Thus university data management can be regarded as a miniature “test laboratory for the information society,” acting as a vantage point from which to view its problems. By looking for solutions to data management problems in the university, we can also find new patterns for developing the information society and solving its problems.

### **The challenges of data management**

The basic problem affecting data management arises from the rapid and disorganized development of information technology, which seems to progress following regularities of its own, in a partly uncontrolled manner, and the wealth of equipment, software and services produced by it does not seem to conform adequately to the users’ requirements. The field of information technology seems to suffer from a variety of sudden quirks of the market which can prove costly for those lacking a complete mastery of the field, and progress it seems to lack any distinct, comprehensive direction, at least from a layman’s point of view.

### **Planning and directing data management**

Data management should be divided into directing and planning functions on the one hand and operative functions on the other. The problems which the organization of university data management is intended to solve are concerned with planning and directing functions in particular. The lack of coordination of data systems in universities is reflected in such factors as overlapping in data acquisition, the lack of back-up systems and documentation, heterogeneity and overlapping in the types of computers and software in use and failure to use them to their full capacity. Thus, the cost-benefit relation cannot be said to be very good.

The problem of the lack of coordination in data management is not restricted to the universities alone, however, as it is also encountered in the Finnish government administration and most obviously in the information society as a whole. The State Economic Inspectorate (4) examined the purchase of computer systems for government use for the first time in December 1995. The results were deplorable, indicating that tens of millions of Finnish marks had been wasted on unnecessary investments. The damage was limited in the most minor cases to inefficient completion of projects, while the greatest wastage resulted from incompatibility between the computer systems used by individual government institutions and departments, and in the worst instances actual failure to take the systems purchased into use at all. The Economic Inspectorate criticized the government administration for not having nominated anyone to supervise the use of computer systems, insisting that a decision should be made as to which authority was responsible for this. It also

recommended that more comprehensive standardization of the data content of such systems and the presentation of the data and laid down certain requirements for the quality of the systems purchased.

The continuous process of innovation in computing means that computer equipment and software tend to become obsolete within a short period of time. The question can be raised of who is responsible within the universities, government administration and other organizations of relevance to the information society for protecting these against uncontrolled changes in equipment and software. This would involve the use of standards, for example, to prescribe the accessibility and long-term usability of information under rapidly changing conditions, an approach which would be in complete harmony with the proposal of the State Economic Inspectorate.

### **Data generated for public use versus product development**

The universities are currently in a contradictory situation as regards the communication of information to the general public, in that they have to decide what information should be supplied free of charge and what should be made subject to payment, and also what information should be made public and what should remain confidential. In the traditional university system all information has been open to everyone and free of charge.

This is a question of a change in the nature of research work and its consequences for accessibility to information. An international group of researchers led by Michael Gibbons which has examined changes in the production of information claim in their book, *The New Production of Knowledge* (5) that a radical change is taking place in the nature of scientific research in the industrialized societies. The exact content of this change has still not emerged, however, although its general outlines can already be perceived.

The group refers to traditional scientific research as Type 1 and new forms of the production of knowledge as Type 2. The terms were selected to be as neutral as possible so as to prevent them from giving rise to erroneous images of the nature of the change. Type 1 denotes the traditional, scientific work carried out at universities in specific disciplines, and Type 2 application-specific, goal-oriented, mostly scheduled work performed in close cooperation with commercial companies, which will then gain possession of the results so that they will perhaps never be published in the form of conventional scientific papers. The most important form of communication of the information arising from Type 2 is the movement of research staff from one project to another.

The group regards the change as an indisputable fact, claiming that adjustment to it will become a question of life and death for traditional institutions. If they fail to adjust to the knowledge production requirements of Type 2, they will gradually wither away as their finance dwindles, whereas those that endeavor to adopt the new principles will attract commercial finance and maintain their position within the universities.

The change has major implications for data management. The emphasis on applications will reduce the proportion of basic research and thus lead to an

accumulation of highly specialized data which will apparently become obsolete within only a short period of time. It is difficult to use information of this kind for teaching purposes or to apply it to other forms of university research. In addition, if the trend is increasingly towards not publishing research results at all, these will never become available to other scientific communities through the agency of libraries. Projects will at best be represented only by summaries in the research registers, if that.

The spread of information production of Type 2 in the universities may have serious consequences for science at a more general level, for if a substantial proportion of the research results are systematically left unpublished, the achievements of science will never be communicated to the scientific community or to the general public, so that it will never manage to elicit any criticism. This is a vital issue from the point of view of the ethics and control of science, as the operation of scientific communities essentially relies on public funding.

The contradictions between Type 1 and Type 2 can also be said to reflect the conflicts which can be observed in Finnish society and the western world as a whole and which culminate in the work carried out in universities. There has been talk at the social level of openness, publicity and informed citizenship, which denotes citizens' rights and access to all information of relevance to the operation of society, whereas it has been stated at the same time that knowledge will gain a more important role as a factor in production, which would inevitably involve its commercialization and often its confidentiality.

It should be noted, however, that the concealment of extensive amounts of information would gradually undermine the long scientific tradition and hamper the critical, open, public operation of the scientific community, which should, therefore make every effort to emphasize these aspects throughout its operations, particularly as regards the appropriate publication of information generated as part of commissioned research.

### **University data management as part of the information society**

University data management is interesting from a social point of view, as all the major problems found in the information society are contained on a smaller scale within a university. Should the university find satisfactory solutions to the problems, these could be used as a pattern for solving corresponding problems in society as a whole. They would in any case at least serve as a means for gaining better understanding of the problematic nature of data management.

### **Applicability of the university as a model**

In their capacity as institutions carrying out research and generating data, the universities have quite understandably been using information technology throughout its existence. It should be noted, however, that as administrative organizations, they have been as unprepared for facing the problems arising in the information technology market as any other unit in society. Thus the universities have already become highly familiar with the consequences of the disparate nature of the market, thanks to their long experience, particularly as regards the difficulties arising from the unplanned application of information technology.

As far as data management and planning is concerned, the universities can be considered to represent reliably the problems found on a national scale. As long as expensive central computers were used and operated via simple terminals, the situation was under control. All universities had central computers of their own, administered by the information processing unit which also allocated user codes. Replacing the computer with a new one was an expensive process requiring years of preparation and support from various administrative bodies. These procedures lent a sense of organization to data management without any conscious effort at actual data management.

The spread of microcomputers and workstations and the drop in their prices altered the entire situation, however, for at the same time as the range of equipment expanded and purchases could be made more easily, the concept of top-down control was abandoned and responsibility shifted directly to individual output units. It is this that has led to the use of highly miscellaneous computer equipment and software in Finnish universities. The rationalization of the universities' computer centres is a further factor that has reduced the opportunities for coordination of data management, at the same time as output units are tending to differ more and more in their needs for coordination.

The computer market as a whole is developing at a rapid pace. One of the aims of product development seems to be to make the existing equipment obsolete before their time so as to ensure frequent replacement. This problematic situation is further exacerbated by the fact that the universities have been poorly prepared to withstand the pressures caused by the fragmented information technology market. Thus the very same fragmentation of information technology which exercises its influence on the society as a whole is even more forcefully present in the universities, which in any case always endeavor to be at the forefront of development.

### **Outstanding differences**

Universities also have certain properties and functions which distinguish them from other institutions in society. Information technology is used at the university level for a variety of purposes which to some extent differ from those in other establishments. This can be illustrated by the fact that administrative or factories, for example, generally use computers for clearly defined purposes which usually include automation of information processes connected with their main operative functions, whereas data processing in universities usually involves all imaginable forms of processing, which are far from being straightforward or easy to define. This is clearly more of a threat than an opportunity from the point of view of data management.

The fragmented nature of university data management is in practice due to fundamental differences between the traditional management of science and modern data management. The everyday management of science is characterized by elected leaders appointed for a certain period of time, strong scientific units and highly skilled, scientifically resourceful top-level researchers. Scientific work emphasizes autonomy and nowadays to an increasing extent the ability to react to market needs, i.e. external demands, and at the same time to challenges and opportunities arising within the science itself. Data management calls for long-term, purposeful, yet flexible administration and rational compliance with mutually agreed rules.

Universities should be able to create an applicable long-term data management strategy in order to secure continuity of their most important functions, an ability to utilize outstanding technical innovations and to ensure protection against the problems caused by the fragmented, random nature of the information technology market. Data management should also possess a parallel strategy in case trends do not follow the expected lines, i.e. measure should be taken to anticipate practically all types of situation and to enable the university to continue to operate in a controlled manner.

The fact that information processing is taught and examined in most universities in Finland also affects the operation of the units responsible for computing functions. Data management as such is also taught as a specialization of its own in some universities in Finland.

Most universities are also concerned with information research and provide teaching on this subject, formerly known as librarianship or informatics. Likewise all the universities have their university libraries with a long organizational tradition and established practices, which, like the universities themselves, have been at the forefront in adopting computer techniques. Librarians and information officers possess the training and distinct objectives required for organizing information and ensuring that it can be made use of over a long period of time. The author has proposed earlier in a number of connections that universities could exploit the traditional fields of expertise of their libraries for the purposes of data management in particular.

Those universities that possess both the teaching and research units mentioned above should have access to exceptionally well trained and probably also highly motivated staff for investigating planning, directing and implementing data management. The administrative short-sightedness and fragmentation typical of scientific departments nevertheless would seem to hamper the development of rational data management.

### **Libraries in data management**

The lifespans of individual data resources can be approached most conveniently by examining the progress of information from one output unit to another once it has entered the sphere of data management upon being generated by a particular department. The notion of lifespan can be simplified here by focusing on the most essential instances responsible, which from the point of view of the university as a whole include its own data processing centre and its library, and the local archives and museum as representatives of external organizations. In brief, the data processing centre can be said to be responsible for guaranteeing the security of the data being generated, particularly as regards regular backup copying and the storing of confidential material, while the library is responsible for ensuring the availability and accessibility of materials intended for a wide range of users, the archives mainly for the active use of documents and the storing of materials that are no longer in active use and their availability to researchers (mainly historians), and the museum for displaying data carriers and data processing equipment that are no longer in use (the data recorded on them are no longer of relevance at this stage).

General approval of the above highly straightforward, perhaps even exaggerated, interpretation would obviously assign the libraries a prominent position in storage and

communication of publicly available data which are still of practical use. It should be noted, however, that the actual division of labour in this respect is by no means as clear-cut as is suggested above.

## **Summary**

The crucial point in the above discussion of the role of data management as part of the information society is that university data management in fact resembles, on a smaller scale, the field of problems typical of the information society as a whole and its achievements and difficulties. Universities possess a long experience in the use of computers and information networks and still have access to the most advanced computer technology and software.

The fragmented, miscellaneous nature of university data management is the most evident indication of the indisputable difficulties encountered in this branch of administration. If the universities are incapable of organizing their data management in the proper manner, it is no wonder that the situation is at least fragmented in society as whole. It seems that our view of the primary purpose of data processing and telecommunications, i.e. higher level objectives connected with data management in society and the universities, has either become obscure or has ever existed at all. This means that information technology is being developed and introduced at an accelerating pace without considering the larger entities on behalf of which this is being done or thinking of the increased benefits that could be gained by it. Decisionmakers are perhaps tempted by the belief that problems can be solved merely through the adoption of powerful technology.

Research, teaching, planning and organization connected with data management should be able to return to the roots of the problems, as it were. The basic point of departure should be people themselves and their need for information, and it is this that should constitute the core area of information research. It should be noted, however, that this research should also view data management, with all its problems and difficulties, as one its basic objects.

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