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Information System and Technology in Organisations and Society (ISTOS): Review Essay

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Introduction

One of the major issues of the "Tensions of Europe" (ToE) network concerns the influence of technology on the process of economic, social and political integration in 20th century Europe. This is clearly reflected in the three main lines of investigation followed across the different themes: the linking of infrastructures, the circulation of artefacts and services, and the circulation of knowledge. At the same time, this process -and the role of technology in it- is not seen as deterministic or uncontested. As the name of the network indicates, the need is well recognised to examine the tensions resulting from the possible divergence of technological possibilities and socio-economic realities.

It seems fairly obvious that information systems and technologies (IST) have played an important linking role even before the advent of the Internet. Thus, for example, the possibilities offered by IST have strongly influenced the way managers were able to exercise control and therefore constituted an important factor in the organisation of large-scale enterprise and their geographic extension. The same is true for governments and their statistical apparatus for instance. The recent integration of computer networks and electronic data exchange facilitated the creation of common databases and policies among governments, speeding up developments, which had started earlier. It also created new possibilities for business, for example enabling companies to develop new organisational practices (e.g. just-in-time). The popularisation of the Internet has also created new forms of bilateral and multilateral communications among individuals (e-mail and "chat") and consumption (e-commerce).

At the same time, there are a number of barriers that complicate these linkages and interchanges. The most obvious one is language, because it is the medium used for the storage and the dissemination of information. This is of particular importance in Europe, where there are not only the "official" national languages, but where regional languages have also been growing in importance over the last decades of the 20th century. A second barrier concerns national standards and industrial policies. Their influence can be seen in the development of the computer industry in Europe, where national efforts and rules might have played an important role in preventing European companies to become more competitive internationally. A third barrier, which usually receives less attention but is of considerable importance, derives from the national and cultural differences among the users of information systems and technologies, both in terms of individuals, organisations and society as a whole (cf. e.g. Hofstede 1980/2001; D'Iribarne 1998; Whitley 1999).

This theme of the network has therefore moved from producer-centred accounts of the development of IST towards the user dimension. It has looked at how the persisting differences in Europe have shaped the use of IST and either facilitated or hampered the process of economic, social and political European integration during the 20th century. More particularly, we have tried to examined the contribution of IST to shaping organisations, society and the individuals, which form parts of both. Among the issues here are for example the influence of IST on the balance between centralised and decentralised forms of control or the differences in the use of IST driven by a variety of parameters, including (national) culture and gender. This is based on the growing recognition that human-made artefacts are not neutral, but always include a symbolic dimension in addition to their material characteristics, leaving it to a certain extent to the user to fill them with meaning (cf. Pinch 1996).

This opens the possibility for different, sometimes competing interpretations of technology – interpretations influenced to a considerable degree by the characteristics of the users, e.g. their gender or their cultural and national background. Regarding information systems and technologies (IST), the potential for modifications resulting from national/cultural differences appears particularly high – both from organisational and individual perspectives. For example, one might ask to what extent the introduction of the same technology (e.g. a new filing system or standardised business software) in different countries is likely to reduce the existing differences and lead to an increasing similarity among organisations, even those operating within different

socio-economic contexts. This seems even more of an issue when these organisations are part of the same entity (e.g. a multinational) or have frequent interchanges of information (e.g. in a buyer-supplier relationship). In this context, it is important to recognise that individuals use the same technologies, e.g. a computer, in both a private and a work setting. If nationally or culturally determined user patterns are reproduced in the office, this might reinforce rather than eliminate existing differences. If, by contrast, a technology is first introduced at work, this will shape the ways it is used at home - thus possibly leading not only to a convergence of organisations, but also of individual behaviour.

Such a technology-driven process of convergence might be facilitated by the emergence of transnational communities of actors, both within the organisation and outside. As a result, the application of IST might be defined more by the rules of a professional group rather than the national/cultural setting in which it takes place. Another important phenomenon regarding IST therefore concerns the importance of intermediaries in shaping the use and interpretation of these technologies. This intermediation can be more or less personal. Regarding the use of the Internet for example, the billing structure is an important determinant of usage and might displace users from one form of communication to another (e.g. voice to text/data). Probably the most personal form of intermediation concerns the role of consultants in overcoming the tensions between new technologies and the organisation and its members. They have played this role in the introduction of new filing systems at the beginning of the 20th century (an early form of information storage and knowledge management) and continue to play them nowadays -at a much larger scale- in the introduction of complex IT-based systems of information capture and exchange (such as Enterprise Resource Planning).

Therefore, we not only reviewed the existing literature on the development of information systems technologies, but also looked at their role in organisations and society. The review consists of three sections, reflecting the main considerations raised above: (a) European competitiveness, with a focus on the producers of IST, but with their international, national, industry and organizational context; (b) Intermediaries and their role, looking in particular at professional groups/services, user organizations and hobbyists; (c) user practices.

European Competitiveness

Since the early twentieth century information systems and technologies (IST) have been used to enhance competitiveness in Europe, and since the inter-war years, they have become crucial for the social and economic development of modern mass society. Therefore, studies of these industries improve our knowledge of the dynamics of industry and technology in society. The IST industries were from the outset dominated by companies in the United States. Further, the dependency of the United States became a burden when war and warfare hampered supplies or as advanced technologies were withheld from Europe due to American distrust. West Germany experienced this for advanced electronics around 1950; France for sophisticated computers in the 1960s; for Eastern Europe this was true until the late 1980s.

This section reviews studies on European competitiveness based on what we believe to be three basic perspectives: national policy, business history and engineering. Most studies have their main focus in one of these categories and they also analyse their theme in a national context, but several studies cut across this division.

National and European policy perspectives

Most studies of industrial competitiveness with a national policy perspective are macro economic analyses, but several are based in history and sociology. The macro economic studies outline the production of IT in the various countries. However, they provide little insight into the crucial processes of development and production of IT beyond numeric macro indicators, like investment, production and productivity. Furthermore, the problem of reliability of some of these figures is rarely discussed. In contrast, the history and sociology studies provide better insight into the shaping of national industrial IT policy and its wider implications on society.

In the mid 1960s, the domination of the computer trade by the producers in the United States became obvious, as no substantial challenge emerged anywhere to IBM's successful proprietary standardisation of "main frame" computers in their System 360. This happened, as computers were becoming a crucial tool for governmental control of the economy in the various countries and in large businesses. In Western Europe this challenge was perceived as a "technology gap" and a macro

economic OECD study was completed of the situation of the computer industries in the various European countries, which provided a general description of the situation (OECD 1969). Policy studies in the various countries in Europe followed similar lines of reasoning; they legitimated government subventions to the computer industry and the merger of minor national companies into a "national champion" in each country. This policy differed from the United States government's strategy of subsidies through extensive military related development projects.

Edwin Layton's (1969) analysis of European advanced technology industries, which is based upon public information, argued for the European countries to counter the strong positions of American industry through co-operation in strategic industries. Also based upon public information, Pierre Gadonneix (1975/1989) studied the process in France, which led to the formation of the national champion, Compagnie industrielle pour l'informatique (CII). While these studies to a large extent were in the nature of contributions to the political discourse at the time, Martin Campbell-Kelly (1989) studied the establishment of the British national champion, International Computers Limited (ICL). He used the ICL archives and public information about government policy. This study gives rich insight into the intertwined industry and government strategies, which can be extended through the inclusion of archival material on the shaping of government policy.

Also, the European Economic Communities (EEC), now European Union (EU) acted on the computer technology gap for the dual purpose of enhancing the computer industry in Europe and extending the basis of the Communities beyond agriculture and free trade of industrial products. However, this EEC/EU policy-making process was also based on macro economic studies that provided limited insight into basic dynamics of competitiveness (cf. Sandholtz 1992). Arthe Van Laer's ongoing research on the emergence of a European policy on information technology is based upon archival material. It provides new insight into the process of formulating an EEC policy in this field and shows the possibilities of archival-based studies (e.g. Van Laer, 2003).

On the national level in the Second World War, punched cards - then the most advanced IT - became important for Germany's abilities to wage war and a national policy was established within the German autarchy policy of economic self-reliance. The shaping of the punched card policy is analysed from this perspective by Lars Heide (2004) based upon archival material. This analysis illustrates general structures

in the shaping of German industrial policy in the Nazi period. The German autarchy encouraged the development and production of distinct equipment suited for processing of operational statistics, which was important for the control of war efforts. However, according to Heide, this equipment did not facilitate the establishment of large registers of people, which could have been used to enhance the control of people. By contrast, Edwin Black (2001) had earlier claimed that punched cards were used by the Nazis in Germany to locate Jews for deportation.

After the war, computers became a tool in the competition between East and West in the Cold War. Paul N. Edwards (1997) studied the role of computers in the politics of discourse in the United States in this period. He argues that the social and cultural context shaped the growth of computer technology as much as politics was shaped by the technology. Similarly, Ross Hamilton (1997) addressed automation as a projection of Cold War tensions and worries. In Western Europe, building computers became an element in the modernisation of society between the Second World War and the late 1950s. The driving force was scientists who built computers financed through government appropriations, but the granting of these appropriations reflected national industrial policies and new ideas of making science useful for society. Many of these projects were subsequently translated into endeavours to establish national computer companies, which exemplified how government and business strategies were often intertwined. Multiple of these computer projects have been analysed in terms of failure in this translation (e.g. Petzold 1985; Asprey 1986). By contrast, several studies have considered the positive results of these attempts. They created insight into the objectives of the governments and the role of these projects in the modernisation of society (De Geer1992; Heide 1996; Ilshammar 2002; Carlsson, forthcoming; Paju, forthcoming).

From the late 1950s to the 1970s the Soviet government discussed several proposals to develop an automated management system for the Soviet economy based on a nation-wide computer network, which never came to fruition. Related to this objective, they strived to establish an appropriate computer production, including a production of a line of computers based upon the IBM System 360 computers to be shared among the East Block countries. These large IT initiatives had significant socio-economic and political dimensions, for they were seen alternatively as a vehicle of or an obstacle to cardinal reform in the Soviet economy, and also as an important element of the Cold War competition with the United States. Slava Gerovitch (2002

and forthcoming) studied the Soviet "economic cybernetics" movement based upon Soviet archival material. He argues that Soviet cybernetics was not just an intellectual trend, but also a social movement for radical reform in science and society as a whole. Followers of cybernetics viewed computer simulation as a universal method of problem solving and the language of cybernetics as a language of objectivity and truth. With this new objectivity, they challenged the existing order of things in economics and politics as well as in science.

Business history perspectives

The studies of industrial competitiveness with business history perspectives focussed on the business strategies of the companies. However, they do not including the content of the technologies and their shaping that are crucial to understand how to make the most of their business potential and distinctions between technology based business in various countries. Furthermore, most of the published studies were on successful mainstream companies; much could be learned from additional studies of corporate strategies in companies that failed, small companies and producers of analogue computing equipment.

Most business history studies of industrial competitiveness were based upon public information. The potentials and limitations of this research strategy are exemplified by the studies of Saul Engelbourg and Alfred D. Chandler. Engelbourg's (1954/1976) case study of IBM analyses the development of the company's dynamic sales strategies starting in the 1910s. Chandler (2001) provides an overview of the worldwide development of the IT industry since the Second World War. Since Engelbourg wrote his study in the early 1950s, studies by several scholars have appeared based upon IBM archival material, which provides basis for more rich and comprehensive analysis of the shaping of the company's corporate strategies. For example, Geoffrey Austrian (1982) wrote a rich biography of Herman Hollerith, IBM's technological founder. Lars Heide (forthcoming) studied the business and technological development of the punched card industry between 1880 and 1945, which encompassed the shaping of IBM corporate policies in the United States. A comparison of these studies with Engelbourg's book shows that he his analysis of aspects of the corporate strategy related to the company's external relations, like sales strategy, still holds and only minor improvements in the understanding is achieved through the inclusion of extensive archival material. In contrast, discussion of internal

matters, like the shaping of new IT, can be substantially improved through the inclusion of the company's archival material. Similar observations pertain Microsoft, the current most dominating company in the IT industry, though the publications only seem to have been based upon public information and interviews (cf. Campbell-Kelly 2001).

A major shortcoming of the business history literature on the IT industry is its nearly exclusive focus on the successful and dominating companies in the United States and on the hard-ware producers. However, there are three studies based on relevant archives of IT companies in Europe, which all encompass the technological development to some degree. Martin Campbell-Kelly (1989) analysed the British national champion ICL and its predecessor companies. Two of the predecessor companies were affiliates of IBM and another American company and other predecessors originated as original British computer producers. Gunnar Nerheim and Helge W. Nordvik (1986) studied the history of the IBM subsidiary in Norway and provide insight into the relations within a multinational IT company.

Lars Heide (2004) develops this perspective further in his comparative study of the producers of punched card equipment in France, Germany, Great Britain and the United States. Particularly IBM allowed its German subsidiary extensive operational freedom, which between the late 1920s and 1945 encompassed the development and production of punched card machines distinct from the machines produced by IBM in the United States. This operational freedom eased IBM's business in the German autarchy since 1932, as the subsidiary took care of German customers and the authorities. However, this provided IBM little influence beyond optimising their profit, and equipment from IBM's German subsidiary were applied to optimise the German war efforts, as mentioned. Edwin Black (2001) raised the role of IBM in Nazi Germany on the basis of claimed complicity in the Holocaust. He did not substantiate this claim, but his book provides vivid accounts of the how an international company deals with a subsidiary in autarchy and war.

In addition, Martin Campbell-Kelly (2001) published an introduction to the recent business history of the software industry in the United States based upon public information. However, more studies of the software industry are needed, especially analysis integration the business and technological developments, which requires access to comprehensive internal information from software companies.

Engineering perspectives

The studies of industrial competitiveness with engineering perspectives are based in the history of technology field, which also looks at social, cultural and political aspects to explain technology development. Some of these aspects are discussed below in the sections on intermediaries and users. The studies with engineering perspectives focus on the development of the technology, while its production and sale attract less interest. The strength of this research perspective is that it helps to understand the technical design of IT hardware and software, which is crucial for its production and use, as well as appreciate the important role of patents, patent legislation and standardisation in the shaping of IT. This tradition has the shortcomings to focus on computer hardware at the expense of software, and it concentrates to a high degree on developments in the United States. A broadening of the scope of research in this field to encompass software and other nations, particularly non-Western nations, would open for a more rich study of the different ways technologies were adopted in various countries and how creative those processes were.

The facilitation of technical design in this research tradition can be exemplified through David Mindell's (2002) recent study of the shaping of fire control systems in the United States from the First to the Second World War. Mindell's study includes analysis of the issue whether control and computer technology should be analogue or digital, which is important from this perspective. The same applies to James S. Small's (2001) analysis of the electronic analogue computers in Britain and the United States between 1930 and 1975. The role of patents, patent legislation and standardisation is exemplified in Lars Heide's (1998) study of the shaping of the Bull punched card systems in Norway and France between 1918 and 1952.

This tradition tends to focus on the winning technological embodiments and disregard options that were subsequently discarded. There have been many excellent studies of the development of electronic, programmable calculators from the late 1930s through the Second World War in the United States, Great Britain and Germany, and the building of the first electronic computers (with stored program) in the late 1940s and early 1950s in Great Britain and the United States (e.g. Goldstine 1972; Lavington 1975 and 1980; Ceruzzi 1981; Stern 1981; Randel 1982; Petzold 1985). A major objective in these studies is to argue which nation accomplished firsts, a simple embodiment of competition. In contrast, the development and production of

the less sophisticated punched card systems and key office machines attracted less interest, in spite of the fact that, for example IBM earned more from its punched card business until 1962, than from their computers.

Further, while the commercialisation of computers in the 1950's is outside the focus of this research tradition, several scholars in this tradition studied the standardisation of "main-frame" computers. The dominance of the computer trade by companies in the United Sates was actualised through IBM's launching of their System 360 series of computers in 1964, which became an industry standard threatening the other computer producers in the United States and in Europe. IBM's internal dynamics in this process leading to the launching of System 360 was analysed in a set of studies by technical related IBM people, who took part in this process. These studies consequently emphasise the technological aspects of the process (cf. Pugh 1984; Bashe et al. 1986; Pugh et al. 1991). IBM's System 360 gave the competing computer producers a shock. The ensuing process at the British computer producer ICL was analysed by Martin Campbell-Kelly (1989: 243-264) based upon the company archives, and he aptly demonstrates the importance of archival material for the understanding of this process. Similar studies of the shaping of the reaction in other computer producers are needed.

Similarly, Michael Friedenwald (1999) and Thierry Bardini (2000) studied the technical shaping of early PC concepts and computers. Their books provide insight into this technical shaping process, but they only covers development outside IBM, which launched their winning PC in 1982. Therefore business concerns needs to be added in order to comprehend the strategies of the PC industry. The development of software in this research tradition is only starting to be explored. Computer scientists with internalistic approaches wrote the studies published so far (e.g. Wexelbalt 1981).

Intermediaries and Their Role

In this section we would like to put forward the concept of intermediary actor as an important concept in the future research about the development of information technologies. We will start with exploring some of the important literature that leads us to the concept of intermediary actor. We will then describe some of the case studies that have already been being done or can be interpreted as such in terms of

intermediary actors. The concept of "intermediary actor" refers to actors that deliberately try to influence the space between the production and the consumption of technologies in order to realize their own agenda. Actors are intermediary between producers of technologies and the end-users (1). It must be clear from the outset that the concept is not only about mediation as such: of course there are a lot of mediation processes going on between production and consumption that shape the technologies. Nor is it purely about trying to exert influence. It is about constituting technology, and about negotiation.

The concept has two intellectual roots. The emergence of mass-production on the one hand, and mass-consumption on the other hand raised the question how all these goods were actually adopted by the consumers. The emerging space between producers and consumers was increasingly crowded by different sorts of actors, in different domains of technology. The other root is the literature about the role of adoption in the development of technology.

Literature review

The classic history of technology was a history of producers and inventors. As technical experts themselves had written most of these histories, the focus of these stories was on the production of the technical artefacts. In these kind of histories Britain and France were the important countries in the 19th century because the important innovations had been done there, like the steam machine in Britain. Studying technology development in other European countries like the Netherlands seemed an odd thing to do because these countries simply adopted technologies that already existed (cf. Braun 1999).

In the classic histories of technology the adoption of technology was not considered as an interesting topic to study. Adoption was considered as a process of simply copying the first inventions, artifacts, and products. From that perspective, the spread of electronic mainframe computing devices in the Netherlands would have been explained as a result of the ENIAC from Pennsylvania, or the EDSAC from Manchester, something which would not need further explanation. In the 1980s this perspective was severely challenged. In the Netherlands, Harry Lintsen c.s. started investigating adoption as a creative process. The way people dealt with technological options available to them was no longer considered as a self-evident thing (cf. Lintsen 1990).

In 1992, in the Netherlands Lintsen and others in the field of history of technology argued that processes of diffusion of technology could no longer be considered as passive processes, as something that spreaded unchecked. Processes of diffusion should be investigated as processes of innovation. Technological artefacts, systems and knowledge should be considered as soft as clay – people adapt them to their own needs. The 'people that adopted technology' were mostly small-scale companies and retail trade (Lintsen et al. 1995). One of the conclusions of the project on the history of technology in the nineteenth century was that the small-scale industry (the actor that was studied) in the Netherlands was extremely good at product- and process innovations that they had been able to improve their position in the market. So, although the small-scale industry didn't invent new technologies in the classic meaning of the word, they were very innovative in the process of technology adoption: they improved their market-position by changing technologies to their own needs.

In the early 1980 other bodies of knowledge developed to explain the development of technology. Nelson and Winter (1982) introduced the concepts of "variation and selection". The concept of selection implied a further "emancipation" of the process of adoption. Variation could be described by looking at the classic actors: engineers, R&D departments and companies. In order to study selection, new actors like the government were introduced to study the development of technology. However, what actually happened in this so-called selection environment remained quite unclear. Also the locus where this selection process took place remained vague. One of the conceptual problems was that variation and selection in the case of technological development could not be considered as totally independent processes. Van den Belt and Rip (1987) argued that, for example, firms deliberately aim at influencing consumer preferences. This implied a further study to the way consumers actually shaped their preferences.

In the 1980s, in another field of research, that of communication research, diffusion of technology was studied from a different perspective: "communication patterns" between buyers of technological artefacts like personal computers were now studied to understand how people decide to adopt a technology. One might say that the decision to buy a new artefact, or to use a new technology, was taken as the dependent variable. Rogers (1983 and 1986), for example, dissected a decision to adopt a technology in terms of (a) acquiring knowledge, (b) persuasion, (c) decision,

(d) implementation. In the process of persuasion among other things characteristics of the technology were crucial. In the process of decision making talking to other people, hearsay played a role. The buyer of technologies could be an individual or an organization.

Problematic (from the point of view of studying technology and society) was that the technology was still considered as an established entity. The production of the technology was out of sight. The technology just flows to the user: it is the decision process that is studied. Furthermore, this literature failed to recognize the feedback processes that take place in innovation: it is not the case – and certainly not in the case of information technologies – that the way individuals or organizations use a technology is a pre-given thing. In addition, most of these accounts assumed that it would be the most efficient technologies that were disseminated. This has been questioned in the literature on management technologies (cf. e.g. Abrahamson 1991). This literature has highlighted and studied the role of 'fashion setting communities' in the diffusion of innovations and the tendency of organizations to imitate what is perceived as 'best practice'.

The question that can be raised therefore, among other things, is whether organizations or other actors were active in persuading buyers of technology during their decision process. The question that follows is what kind of use these actors actually propagate. We may call these actors "intermediary actors": actors that aim at purposefully defining a certain meaning and function to a specific product or technology in order to influence consumption decisions. This question relates to the historical theme of the emergence of the consumption society in the 20th century (addressed in more detail in another ToE theme). In the twentieth century the emergence of mass-production implied among other things that the space between production of commodities and the consumption of it increased. It is far from evident why people started to buy all sorts of commodities. It was a surprise for example to find that during the economic crisis in the 1930s the consumption of the radio increased, and already became a mass product (de Wit 2002: 174).

Are there any "intermediary actors" that purposefully tried to shape the emerging space between producers and consumers? Marketing departments and advertisements try to put forward possible uses of products and technologies. However, in the analysis of technology adoption, looking at marketing departments is not enough: the point is that the consumer is then kept a passive entity. Marketing and

advertising cannot explain technological choice on their own. Consumers do not buy everything that is advertised (cf. Albert de la Bruhèze and de Wit 2002). The focus on the diffusion of technology in the history of technology in the Netherlands went parallel with a development in the international field of Science and Technology Studies (STS) in which the role of consumers became increasingly important and theorized. In the classic case about the bicycle, user groups like 'men' or 'women' mattered; they had an important role in the shaping of the technology.

Theorizing the role of consumers in the process of technology development had its origins among other things in the agenda of making the role of women more important in the development of technology. The claim was that in the field of household technology questions about success and failure of technologies couldn't be answered without analysing the practice of households (the context of use), the way women represented these practices to producers, and the choices that were made by households. The household wasn't considered anymore as a passive entity buying the "best" product, or buying the "cheapest" product, but as an active entity shaping technology. The concept of consumption junction was introduced to argue that investigating the characteristics of households was crucial to understand why some products became successful and others failed (cf. Schwarz Cowan 1987). Success and failure were no longer considered in terms of "attributes" of the technology (like in the diffusion literature) but as the result of active decision making in households.

Making users more active in the explanation of technological development implies two things: first, it implies that users can be actively influenced; and second raises the question in what sense users actually organised themselves to influence the production side to fit their demands. Producers do not know their users face to face anymore. They have to configure their user as Woolgar (1991) called it in his article about the shaping of a micro-computer. But why would people buy a micro-computer in the first place? At the time (early 1980s) it was not at all clear why what we now call the personal computer should be an interesting commodity for households. What actors have been purposefully trying to promote the personal computer and how did they do that? What were their motives? This raises the question about intermediary actors. Which actors can be identified in the history of information technology that claimed the space between producers of computing devices (mechanical or electronic computers, software contracts and products) and consumers? How did they purposefully try to shape technologies according to their own agenda? In what sense

didn't they only try to shape the technologies but also the sociologies, economies, politics and cultures of the contexts as a whole which should adopt these technologies? How did they acquire definitional power?

Professionals, user organizations and hobbyists

The literature so far suggests that intermediary actors can be categorized in at least three groups. First, actors that have professional admirations: aiming at finding new markets for their expertise, professionals tried to create areas of knowledge and skills crucial for individuals and organizations to implement new technologies. Second, organisations representing users trying to look after their shared interests. Third, there is the group of amateurs and hobbyists relating to a new technology. Of course the boundaries between these three groups can be vague: for example in the case of household technologies the household professionals were also very active in the Dutch Society for Housewives. Groups of hobbyists may turn into a user group. The groups themselves must be considered as historical.

The first category is about experts that somehow aimed at defining a niche between the (enormous) supply of (mechanic and electronic) computing devices to offices and business and the needs of those offices and businesses. In most European countries offices grew in size in the late nineteenth century. Furthermore, the supply of machines increased. This created all sorts of problems that created opportunities for different categories of experts. Those taking advantage of the growing complexity of these information systems and machines were the consultants. In his overview of their development during the 20th century Kipping (2002) has shown how information and communication technologies – and their adaptation to client organizations – became an increasingly important, even dominant part of their services. In general, changes in the available "control technologies" (cf.) appear to have played an important part in the development of managerial ideologies (and practices) since the late 19th century (Barley and Kunda 1992).

But this growing niche was not only filled by outside experts. Thus, Guerriero-Wilson (2003) analysed the rise and fall of what she calls "Organisation and Method" experts during the 1930-1960 period. In Britain the Office Management Association, the leading exponent of the Organisation and Method experts, strived for modern office improvements: the new discipline Organisation and Method developed tools to reorganise work-processes to make them more efficient. However, they were very

much concerned with the people actually working in the office. Therefore they strived for in-house departments of experts to organise the office work. When the "computer" entered the scene, they claimed to have the ideal expertise to introduce the computer into the offices. However, the O&M experts would lose their position to purely technical experts who mostly came from outside and who would come to control the introduction and use of computers. According to Guerriero, the O&M experts really cared about the users: their loss of terrain to technical experts created a lot of misunderstanding and miscommunications between computer experts and computer users.

In the Netherlands, the "Dutch Society for Efficiency" (NIVE) and experts related to them claimed the organisation of the office as their domain of expertise. However, one of the differences with the Organisation and Method people seems to be that the Dutch experts explicitly connected the reorganisation of the office-work to the use of machines. Guerriero-Wilson argues that the use of terms like semi-automatic didn't mean that machines would be involved to make processes semi-automatic. However, in the Netherlands J.G. de Jongh (professor of accountancy since the late 1920s) did explictly argue that every operation which could be done by a machine should be done by a machine. Guerriero-Wilson argues that the O&M work was not purposefully trying to automate work by using machines. In the Netherlands they did.

Experts related to the NIVE developed a specific kind of expertise, called schemes, to reorganise office-work in the late twenties and thirties. These schemes would be the basis for the use of information technologies from the 1960s onwards. This was promoted by a new professional Association the Foundation for the Study of Administrative Automation, founded in 1959. (SSAA) This marks a second contrast with Britain: in the Netherlands this expertise developed in the NIVE would find a new field of application by the entrance of electronic computers. According to Guerreiro-Wilson, to some extent Auto-Countancy and other efforts at streamlining administrative systems represent a line of inquiry that was made redundant by the introduction of the computer. In the Netherlands that was certainly not the case, on the contrary. This line of inquiry was very helpful in processes of automation. It was exactly the process of redefining work that preceded the introduction of electronic computers.

Another example: Haigh (2001) described how the Management Information System was developed by what he calls the "systems men" of the Systems and Procedures Association (SPA) – an alliance of staff specialists in administrative methods, management consultants and business professors who were all seeking to legitimate themselves as technical experts in management in the 1950s and 1960s in the United States. The Systems men had brought expertise of F. W. Taylor and industrial engineering to the white-collar office work. When the electronic computer developed, it offered a great opportunity to improve their power in office and business. They organised themselves in the Systems and Procedures Association of America (SPA) in 1947.

One of the differences between all the three organisations claiming expertise to reorganise the office and somehow guiding the introduction of electronic computing is their rules about who could become a member. Of course, this reflects the agenda of these organisations. These examples show that a lot of research needs to be done. For example, insight into the connection between the content of the expertise and the actual agenda is still lacking.

The second category of intermediary actors is about organised user's associations. In inviting us to also consider what takes place after the laboratory and the factory, Pursell (1999) gives us an excellent example of an institution linking producers and users in his study of women associations that mediated between the British electric manufacturers and utilities and home users of electrical devices. The interwar role of similar associations and related groups in the United States has been studied by Williams (1998) in his study of how salesmen of domestic electrical appliances in California could not by themselves convince potential users to buy their products. In her article on the role of professional housewives in diffusing the use of electric domestic appliances in interwar Germany, Hessler (2001) theorizes them explicitly as intermediaries by referring to them as "mediators" and "agents of diffusion," acting to bridge the gap between producers and users. In surveying the relevant historiography, Hessler mentions Williams (1998), Rose (1995) and Goldstein (1997) as having shown that such mediators created a context for the successful introduction of a new technology and worked on promoting it by making efforts to educate, instruct, and convince potential users.

Examples in the Dutch literature on other than information technologies are the role of the General Touring Association (ANWB) in the development of the car, or

the role of the Dutch Society for Housewives (NVVH) in household technology. Related to this typology of groups are the user groups that emerged around specific computers. On computing intermediaries, there is also Akera's (2001) article on the role of a 1950s IBM user group SHARE. Apparently, SHARE established, among other things, a terminology and a classificatory framework for software (cf. also Campbell-Kelly and Asprey 1996).

The third category of intermediary actors is the amateurs and hobbyists. Hobbyists simultaneously produce and use new information technologies. In the case of the first "stand-alone" computers for example, hobbyists bought components and soldered them in such a way that the machines had specific functionalities. Hobbyists "produced" the machine – by defining their own characteristics – and used them.

Douglass (1992) introduces a well-known example of communities of enthusiasts, that of the radio amateurs who had contributed substantially to the re-conceptualization of the radio, from a point-to-point communication technology (in the tradition of the telegraph and the telephone) to a technology for communication from a point to a mass of points. Examples of many other communities of enthusiasts from various technologists are mentioned in the collection of essays edited by Corn (1986). Of special interest for an historian of computing technology is Ceruzzi's (1986) chapter on the persistent mismatch between what the computer was though to be and what it ended up being in use.

These specific kind of "producers and users of technology at the same time" somehow seem to play a structuring role in the way computers would become distributed and used. What is for example the role of the Hobby Computer Clubs that established themselves in the late seventies? Did they "intermediate" in any sense between the production of the micro-computer and the massive adoption of this technology? Veraart currently investigates the role of the Dutch Hobby Computer Club in the adoption process of the computer for personal use. Saarikoski (2003) has studied computer hobbyists in Finland. Further research must shed light on the effect of the hobbyists in the shaping of personal computing. Were there hobbyists that became entrepreneurial? What happened to the network of people?

An interesting question concerning the influence of hobbyists relates to the question of private and public use. Computer hobbyists may have experienced (and still may) with new information technologies in their private life. But over time these people may have brought their competence and knowledge to their workplaces and

doing so, started to influence the public use of information technologies. A different question is whether there are Hobby Computer Clubs that succeeded in acquiring comparable status as user groups, like the General touring Association (ANWB), in terms of influence and definitional power.

Finally, as noted above, the history of information technology has mainly focused on hardware. Recently, the historiography has turned its attention to software (e.g. Hashagen ????). In his recent article on the emergence of computers programmers, Ensmenger (2003: 155) focuses on the "boundary disputes" of the 1950s and the 1960s about the role of early computer programmers as "mediators" between the computer and the existing structures and practices of organisations (cf. also Akera 2001; Haigh 2001). Software is a technology on its own: to put forward software programming as a mediator between hardware and users does not shed light on the concept of intermediary actor as put forward above. As was said in the introduction: the crucial characteristic is not the process of mediation as such: it is about deliberate negotiation at a specific locus in the process of technology adoption.

User Practices

The study of user practices must consider the various ways in which the user can be defined and perceived. Users and the issues facing them appear in many traditional areas of historical enquire – labour process literature, producer-oriented accounts of technological development as well as consumer literature. Consequently, users can be conceptualised in many ways. Users might be considered on an individual scale where the work and tasks of individuals can be seen to be shaped by information systems and technology. Often, users at this level are seen as passive recipients of the changes wrought by new systems and technology. In the most notable cases, this passivity equates to victimisation. Braverman's (1974) thesis of the 'deskilling' of labour by technology is an early and important exponent of technology users as being used, that is, exploited. However, literature on the development of office work and the changing role of women in offices in the late nineteenth-century sees women users of the new technology of the typewriter having a certain agency in the use of that technology Early female users of typewriters were not passive and not victims, but women

seeking to carve out an occupational niche for themselves that they deemed to be superior to shop work or factory work (Guerreiro-Wilson 1998: 238, 279-80).

In producer-oriented accounts of new technology, such as Campbell-Kelly's (1989) account of the growth of ICL, users take on a large-scale, institutional identity. They are 'manufacturers' and industry in general. They are the originators of the demand to which the post-war office machinery producers were responding. Their post-war demand originated from shortages of equipment and labour and a need for greater efficiency (p. 131). Users have as well been seen as states or governments. Systems and technologies are introduced to help the state keep track of and thus manage and control its people and the various state-operated organisations that used people. Heide's (2003 and 2004) work on the use of punch-card technologies in early census offices and then also by the Nazis sees the states themselves as the users. Further, users have also been observed as the producers of their own systems and technology. The case of the LEO computer, built by Britain's J. Lyons Company in the 1950s was a case of User Driven Innovation (Caminer, et al, 1996) where the company designed and implemented both systems and technology to serve its specific business needs for organizing and managing complex inventories and operations.

Though seemingly very different, the case of computer hobbyists presents a similar sort of user to the creators of LEO. They too were both producers and users, building their own computer systems to serve their own purposes (Saarikoski, 2003). In most cases the 'building' was simply assembling different parts but hobbyists were important in developing programming skills and shaping the technologies they used by testing the limits of the machines' capabilities. Their role as users was important in that they acquired and disseminated technological knowledge at their own expense in both time and money. They took on the risks associated with new technology and established a foundation of knowledge in their national setting without the involvement of local businesses or their state. These institutions would eventually benefit from the knowledge thus acquired and spread, without having made the initial investment in education or training in a completely unknown field. There are some indications that the official education and training institutions could then be built on foundations set by these few, highly motivated 'modernisers.'

Users as passive or active actors

The views of users presented above reflect a duality that has been observed in how technology is viewed in various literatures. Either information technology is portrayed as the determining factor and users as passive, or users and organisations are viewed as acting in rational consort to achieve particular outcomes through the use of information technology (Doolin 1998: 303, citing Kaplan & Duchon 1988). Individual users can be seen as helpless victims whose work lives are negatively impacted by technology, or individuals can be seen as active and exploiting new technologies to serve their own work life goals. Institutional users can be seen as forced to adopt technologies for which they are not ready, or they see new technologies as tools to help increase their control over their assets or to improve the efficiency of their operations. Or users, whether institutional or individual, seem to find themselves beguiled by the modern. They act to create and adopt new technology but almost without any specific goal in view.

When it comes to the institutional user it is important to consider who the institutional user is – the corporate management, or the people working with the technologies? It has frequently been noted that decision-making about new information technologies often is done by other people within the organisation than the people who are actually going to use the technologies. For instance, in the Netherlands, already in the 1980s there was a lot of social science research about success and failure of automation projects. One of the results of this research was that the actual inclusion in the decision making process of the people who were assumed to work with the new technology greatly increased the chance of success of the new technology, because the perception of the users was much better than in the case when they felt they were enforced to work with the new technology.

Users and motives to adopt a new technology

A key issue in observing users is motivation to adopt a new technology. Are users of technology trying to achieve control? Are they seeking to improve efficiency? Or are they trying to be modern? And in these motivations – are the user's needs real or led by the existence of technology? Who or what does, in fact, lead change? Another issue of importance is how users handle technological choice, i.e. when they do have the technology, how is it actually used. It can here be noted that the use process seems to be much more creative than has been assumed until ten years ago. So there is a difference between the motivation for adoption and the actual use.

Even in the United States, the link between users and new technology appears almost accidental at times. There was not always a guiding intelligence judging user need and then responding by finding a way to answer it. Sometimes, especially in the case of the earliest office machines, technological innovations can appear to have predated any business application for them. Yates (1989: 21-2, 42-4) discusses the example of the typewriter, the developers of which envisioned their machine as an aid to the work of court reporters. Business use developed later. In such accounts, technological development drives itself and users come along later, bringing their specific motivations, and shaping the technology's use. Functions of new technologies are not pre-given but emerge during the actual use.

Nor did new technology automatically supplant existing systems. Yates notes that the spread of the use of the telephone in the US did not slow the increase in the volume of written communication. Oral communication could not satisfy the 'ideology of systematic management' in the way that written records of communication could. The new technology of the phone was only an aid to the transfer of information which was the key process of systematic management. But it was the ideology of systematic management that was important in the development of businesses in the US, not simply the spread of new technology (Yates 1989: 21-2).

In this view of technological development, the users were active, rational and in control, shaping the uses of the technologies available. The goals of the organization were what were important. How well an organization could fulfil those goals was what mattered, not how the goals were fulfilled. Heide's (2003) studies of European use of punch card technology by various census organizations should, in this light, be read not as backwardness or reluctance but rather as a rational perception that the new technology offered little improvement over the systems already in place, that had been developed over many decades and which served their purposes well. Campbell-Kelly (1998) notes that the fact that large scale data processing developed earlier in the US than the UK throughout the late nineteenth and twentieth century '...suggests that it was unconnected to the availability of information technologies but was the result of economic growth' (pp. 2-3). Likewise, he sees the US's earlier adoption of commercial computing after the 2nd World War as due to the 'dynamics of the U.S. economy' (p. 27).

In the US, as Yates describes it, the need for speed, control and efficiency would have been greater than elsewhere, if one follows the Chandlerian model of

large-scale bureaucratisation being a response to the large enterprises which grew out of the large markets and resources of the rapidly growing United States (Chandler 1977). In this light 'backwardness' amongst potential users of new technology in Europe can rather be read as rational responses to local requirements. Smaller scale enterprises, serving smaller national markets, using systems that had developed over a longer period than those in the United States would have been taking very large risks by the wholesale adoption of new technologies. The same was the case in the installation of a radically new punch card technology in the Dutch Giro Service (De Wit 2000).

Early developers vs. late adopters

The question of early developers versus late developers – whether in countries, regions, sectors or companies – represent a possibility for exploring tensions in IST user practices. However, care must be taken that 'late' and 'early' do not become value judgments. In some ways, focusing on the 'user', especially views of users as passive adopters, does focus on technology for its own sake. In this view technology is privileged as a signifier of 'progress' (which is also privileged as a virtue). Such reasoning creates the issues of some users being 'backward', because the introduction of technology is used as the measure of progress. But all users had their own, locally determined, ways and systems for handling their problems, which should perhaps only be judged and measured by their own achievements in their own localities and not by comparisons to US practice (e.g. the European censuses). Such a reading sees the users of technology as active, rational institutions shaping their own use of technology motivated by the goals of their institution.

Campbell-Kelly's (1998) study of the Post Office Savings Bank in the UK is instructive, as is the author's possible bias towards what seems to be the self-evident virtue of mechanization. As the first industrial nation, the UK's administrative systems developed much earlier than any other nation's. As such, they were manual systems. Improvements in efficiency therefore came through the use of machines only where appropriate and overall 'organizational perfection' (p. 3). It was not until the 1920s and 30s when 'office technologies became economically irresistible' that large-scale mechanization was undertaken. To say that Britain waited until technologies became 'economically irresistible' is to say that Britain waited until the

technologies were more or less perfected. This may be ‘backwardness’ or it may be that they were content to let others undertake the trials and suffer the errors.

Campbell-Kelly’s users in this case, were not driven by the availability of new technology. Although Campbell-Kelly does not always portray them so, they were active and rational users whose motivation for change developed out of the changes in their environment. The eventual impetus for undertaking some mechanization in the Post Office Savings Bank appears to have been external to the bank’s operations or even the quality of the machinery on offer. During and after the First World War, the demographic effects of the war translated into a shortage of clerical labour (pp. 24-5). In such circumstances, any mechanization that could reduce the need for such labour would be an economically rational step to take.

Demographic realities may also be part of the explanation for the US’s eager adopting of all new technologies for business use. Throughout the 19th century Britain had a growing population, almost all of whom were educated to standards that made them suitable for clerical work. The US’s population was also growing explosively in the 19th century but not as much with native-born children who became literate in English. Most American population growth in the 19th century was in the form of young adults who were either not literate or not native speakers of English. Such individuals were extremely useful on the industrial labour market but of far less value on the clerical labour market. In one country a shortage of possible clerks was one factor in the development and diffusion of mechanical office technologies. In the other country, a plentiful supply of clerical labour meant that there was no need to replace tested and dependable manual systems with newfangled machines. Early and late development was, in this light, not a consequence of being forward-thinking and modern or stubbornly traditional. But rather, early development and late development occurred perhaps because of very similar economic situations that happened at different points in time. In both cases, the users office managers themselves were behaving actively and rationally and shaping their use of technology according to their needs.

Events in the business environment also influenced J. Lyons, the British catering and food-processing company that built the first business computer in Britain. Lyons business was large and its operations complex, with huge numbers of small transactions. The clerical work was endless, routine, but requiring concentration and accuracy. Lyons managers considered that the time would come when the human

effort required for such unstimulating work and the increasing employment opportunities in 20th century Britain would eventually mean there would be a dearth of clerks (Hendry 1987: 77). Lyons was already committed to developing the best manual systems they could, but some level of mechanical or electronic technology seemed necessary. But no producer offered any such machine in Britain in the late 1940s; so Lyons decided to build its own (Caminer et al. 1996: xx).

Throughout the process of developing the LEO computer Lyons' emphasis and commitment was to make the machine fit Lyons' systems and employment practices. The technology was a malleable tool, to be shaped by the needs of the users. Such cases of users as autonomous and in control of technology may be unique to early periods of development in any technology. Early technology users truly did 'use' technology, that is, 'exploit' it for the ways in which it could help them achieve their goals. Such exploitation of technology also took place at the level of the individual. As was mentioned earlier, teenage girls, who actively sought training in typing in order to increase their value in the clerical job market while boys took 'office boy' jobs from which they might be promoted without any special skill, can be seen to have 'colonized' typing as a way to secure occupational territory for themselves. (Wilson 1998: 238). But over time that territory became the prison of the typing pool. The users became the exploited.

A broadly similar kind of experience can be seen on the institutional scale with increasing pressures for standardisation in late 20th century use of software systems. Since the 1990s, businesses appear almost as victims of the impacts of technology. Here the German company SAP can serve as an example. SAP has for more than a decade been a dominant player in the software field and as noted in the business press in the 1990s, never before has a software company outside the United States had such success. When the SAP system R3 first was introduced it was highly standardized and the number of processes embedded in the system was heavily restricted. It required all parts of a company to adhere to the same, precise practices, so for the users of the system, it often implied an organizational revolution. In the late 1990s, critique against this standardization was expressed as it was argued that a standardized system creates a standard, not only with respect to how information is handled, but also affects how the companies' activities are organized, their strategies as well as their cultures. This critique is well summarized in the title of an article by Davenport (1998) "Putting the Enterprise into the Enterprise System". A danger, he argues, is

that the business must be modified to fit the system instead of vice versa. The critique was sometimes combined with the remark that the system is from Germany, implying bureaucratic rigidity.

It can be claimed that the introduction of SAP/R3 was a forceful mean to create homogenisation among companies all over the world and by this significantly reduce the users' autonomy. The system's far-reaching ambition to integrate all functions in a company demanded a common classification and codification of information. By implementing the same standardised systems in different companies, management practices in these companies can be assumed to have become increasingly similar. But is this what was happening? When SAP R/3 was introduced in 1992, it was, as has been emphasized above, a very standardised system. But over the years, the number of best practices – a descriptive instruction of how a process, activity or routine best should be organised – has increased dramatically, and nowadays the customers can choose among them quite freely. The continuous development of the system and adaptations to different customers' various needs have increased the possibilities to more firm-specific solutions. In this process, the users have often taken an active part in the development of the system. This indicates that the users cannot be seen as passive victims. Rather they often play an important role in the development process. As a result, the tendencies towards homogenisation among different companies are nowadays relatively less obvious than when the system was introduced.

Discussion and Conclusion

To be written after Budapest

Notes

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1. While we have restricted our view of "intermediaries" to actors, one might argue that it could be extended to "actants" (cf. Latour 1987). Such a broader view would include, for example, journals. There is a rich historiographical literature on these

journals (cf. the review by Corn 1992a). In her study of the influential periodical *Popular Mechanics*, Mary Seelhorst (1992) argues that the publication influenced technological change through comparative tests of techniques, the supply of convenient instruction manuals and drawings, how-to advises, counselling and consulting columns, hosting letters by users and other interested parties, introduction to unforeseen uses, kit offers, etc. (cf. also Corn 1992b). Other important studies of the technical periodicals include Ferguson (1989) and Pursell (1999).

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