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FLEXIBLE AUTOMATION: TWO APPROACHES TO
THE ASSESSMENT OF EMPLOYMENT IMPACTS

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PREFACE

This paper on flexible automation written by Dr. Goldberg was presented to a IIASA workshop which was held in June 1982 in Berlin (GDR) and organized by the Management and Technology Area in cooperation with the Academy of Sciences of the GDR.

This paper is particularly interesting in several respects. Firstly, it addresses the problem which corresponds to the Institute's interest. The main issue addressed is the impact assessment of flexible automation in employment. Two methodological approaches are presented in this paper.

Secondly, Dr. Goldberg selected the service sector in general and banking in particular as a case study. As flexible automation is more common in industry, especially in manufacturing, than in the services, his paper fulfills a certain pioneering mission.

Thirdly, the message of this paper can be interpreted as the study of selected social and societal effects of modern information technology.

Dr. Goldberg's paper proves that the impact analysis of modern technology deserves an interdisciplinary approach.

Tibor Vasko
Chairman
Management and Technology Area

FLEXIBLE AUTOMATION: TWO APPROACHES TO THE ASSESSMENT OF EMPLOYMENT IMPACTS

W.H. Goldberg

Aims, Overview, Conclusions

Applications of flexible automation (FA) at large have so far almost exclusively been confined to the materials conversion and production sector of industry. The potential for the application of FA in the realm of administrative and clerical work and thus in the so-called service sectors of the economy in general are at least as important and, thus, deserve proper recognition and treatment. This chapter does not aim at a comprehensive overview over applications and the potential of FA to the so-called third sector and its functions. It rather draws attention to some recent general studies of the field and then goes into some detail into the application of flexible automation in the banking sector. For that purpose, two studies of quite different thrust and aim, but both concerned with the banking sector, are being presented and, to some extent, compared.*

The study focuses on methodological approaches to the assessment of consequences of the introduction of flexible automation into service tasks (as illustrated by examples from the banking sector) rather than listing technological approaches and solutions to the field. The reason for this choice is that technology by necessity is different in character and importance when it comes to analyzing various sectors and subsectors within the field of interest. Technology also is changing quite rapidly and will change still faster once the service sector

* Permission to quote from Hedberg/Mehlmann (1982) has been kindly granted by the authors as well as by the publisher, Arbetslivscentrum, Stockholm.

becomes a central focus of interest for the introduction of flexible automation.

The two examples also demonstrate quite different points of view. Their points of departure and their missions differ: one example is a rather intensive description of a subset of an econometric model to the assessment of employment and economic consequences of the introduction of microprocessors not only into an industry, but also into a national economy. The other one aims at the assessment of employment and social as well as societal consequences of further automation in banking. It aims also at conclusions towards the development of strategies to cope with technological change in the banking industry.

Prologue

When attempting to define flexible automation operationally, as no exact definition exists, one may say that it aims at the solution of tasks implying degrees of variability which by traditional means would have requested the presence of human operators. The presence/participation of human operators is reduced by automata to a greater or lesser extent. The variability is achieved either by automatic or semi-automatic setting of parameters/variables, which may be activated by objects in treatment/process (e.g. their characteristics or by signals attached to them), by programs (which may be triggered by operators or by cues attached to objects under treatment) or by users. Combinations of those are not only possible but also quite common.

The definition of flexible automation in the service-sector is not identical with "information technologies", nor does it mean micro-electronization. It may, however, comprise both, to greater or lesser degrees.

Flexible automation, by this definition, is by no means confined/restricted to physical production processes but may very well comprise "services" of various kinds.

This chapter aims to exemplify applications of flexible automation to the service sector and, by means of examples, to explore some of the consequences of FA when applied to services. A total coverage of "the" service sector is not possible within the given frame of space (and resources). Thus, the methodological approach to the examples chosen will be emphasized rather than the examples as such. The aim is to demonstrate how in principle one could go about to assess the potentials as well as the consequences of various types of FA to other segments of the service sector or to administrative tasks/functions in general in industry, in the public sector or in similar fields.

Motives to Automate

A few remarks should be made about the motives for and general attitude towards automation.

The motives to introduce automation are manifold and obviously not uniform in different sectors and industries. In a recent study of motives to automate (further) (Scholz 1982a) in a sample of 2,600 industrial enterprises in the Federal Republic of Germany, the following six (out of 14) motives are mentioned most frequently (rank orders, " = equal rank).

Table 1: Motives to Introduce Automation in Industry

	Producers of raw materials and semi- finished products	Producers of machinery	Producers of consumer goods	Food Producers
Speeding-up throughput time	3	1	2	3
Increasing production flexibility	5**	2	3**	4
Cutting cost of materials	2	10	6	5**
Cutting energy consumption	1	6	3**	1
Cutting cost of personnel	5**	3	1	2
Cutting waste	4	9	5	5**
Improving working conditions	5**	4	7	5**

The closer to the customer the production is, the more wages seem to matter. Flexibility, throughput time, savings of energy and, in the raw materials sector, savings of material matter. Also the increasing importance of the working environment is remarkable.

Certainly, the picture may shift not only from industry to industry, but also from enterprise to enterprise and between countries. (And, of course, it will also depend on the method of inquiry employed.)

Differences in attitudes in different cultural settings have been demonstrated many times. Recently OECD (1981) categorized differences in attitudes towards the introduction of automation based on microelectronics in the following way:

a) Japan pursues a technology-oriented, globally aiming development strategy, in which technological progress is a central aim, which is not put into question;

b) The traditionally positive attitudes towards technological progress in the United States see in microelectronics no

new dimension. Its positive effects on technology and the economy are taken for granted;

c) In some Western European countries (in particular in the Federal Republic of Germany but also in France) the attitude is split: on the one hand, microelectronics are needed to keep the countries in the forefront of technological leadership. On the other hand, questions are being raised as to the need of regulation of some technological developments based on microelectronics;

d) In Northern European countries, the general attitude has turned towards pessimism and suspicion towards the outcomes of new developments, including microelectronic-based technology. In Scandinavia and in Great Britain claims have been raised to control the introduction of new technology in general and of microelectronics in particular, e.g. by regulation, taxation or even prohibition. The main reason is the fear that further workplaces may be lost due to automation and that new technology, thus, should be restricted to certain uses only, where no new unemployment may emerge.

The OECD study does not cover socialist countries and thus gives no statement about them. One may, however, speculate that the attitude towards microelectronics there is positive at large: microelectronic-based technology is seen as a means to improve the technological standard, to push productivity, to reduce manpower bottle-necks, and to improve working conditions in certain industries.

The attitudes concerning technology are important insofar as they on the one hand influence the goals governing technology to be considered as factors enhancing/constraining the introduction of new technology. This point will be taken up below when discussing the differences between the technologically possible and the socially feasible objectives of (further) automation.

Studies of Automation and Its Consequences

Studies into future automation and its consequences may be roughly (and somewhat superficially) dichotomized into "fiction type" assessments of what may be possible from the point of view of technological development, and studies of employment (occasionally also of social or societal) consequences of automation. The latter type of studies by necessity must imply some deliberations into the realm of the former type: certain assumptions about the technological development are necessary in order to make possible estimations and calculations of qualitative and quantitative employment consequences. This study attempts to estimate employment consequences in a mid-term perspective and, thus, will essentially have to contemplate about the diffusion within a foreseeable time of already available technology.

The abundance of studies and reports on technological development and their employment consequences due to microelectronics or computer technology (it is obviously very difficult to draw a dividing line between the two, as they are quite frequently interdependent), have induced both authors and authorities to compile published results as well as to organize hearings and conferences, in order to not only summarize the many and often diverging, or even contradictory conclusions, but also to scrutinize methodologies employed and to draw conclusions as to what policies, measures etc. may be taken to enhance, support, amplify, control the development in general or in certain respects¹⁾.

Evaluating the Employment Impact of Information Technology on the Banking Industry: A Programmatic Proposal Vs. an Applied Study

The remainder of this chapter will be devoted to a comparison of a programmatic proposal towards the evaluation of the employment impact of information technology, which is taking the banking industry as an example for a general approach (Henize 1981), and a study into the potential consequences upon employment in the banking sector in Sweden during the 1980's (Hedberg and Mehlmann 1982). The Swedish study was undertaken as one of several industry studies on behalf of a governmental committee looking into the effects of computerization (Data-effektutredningen). As both documents were written and published during 1981, the authors did not know of each others' deliberations.

An Econometric Approach

A recent review of the literature²⁾ took a very critical attitude vis à vis the rather unsatisfactory methodology as well as the meagre outcomes of many employment impact studies. Henize, who also had criticized the methods applied in a number of studies, was asked to propose an appropriate methodology for an assessment of the employment impact of information technology in the Federal Republic of Germany. Henize, who has one foot in information technology and the other in economics, proposes an econometric approach with proper recognition of cross-industry and cross-sectoral impacts of information technology. In order to illustrate the claims he raises on an econometric model to be employed, he selects the banking industry as an example, for several good reasons:

1) Mettelsiefen (1981); Mensch et al. (1980); Rothwell/Zegveld (1979); Ifo-Institut (1980); Henize (1981); Scholz (1982a+b); Lund (1981); Evans (1979); Kahlbhen et al. (1980); Dertouzos/Moses (1980); Vollebergh (1981); Nora/Minc (1979); Briefs (1978); Mertens et al. (1981); Rada (1980); Friedrichs/Schaff (1982); OECD (1981); Schmidt (1980); OECD (1979); Mertens et al. (1982).

2) Der Bundesminister für Forschung und Technologie, ed. (1980).

- The finance sector is a key sector in the economy. The banking industry thus is an important industry to study.
- It is heavily impacted upon by recent advances in computer and communications technology.
- Whereas output, efficiency and productivity measures are quite well defined for goods producing industries, such definitions are scarce, if available at all for the service industries. A successful analysis of a service industry thus is more likely to be applicable as a general model for further studies than an analysis of a more straightforward case from the goods producing industry.
- As the demand for banking services is a function of the general level of economic activity, the factors affecting it have to be specified and integrated into an initial aggregate model of the macro economy in any case.

Henize then analyzes the effects of information technology in banking.

Henize goes about to build up a micro economic model:

- Determining what qualities and quantities of different factor inputs are needed to provide a given quantity of each of the various types of banking services;
- Investigating how the detailed input-output relationships have changed over time and what technical changes may have caused them;
- Determining the motives behind the introduction of new methods, e.g. relative factor costs, factor shortages or constraints, competition, prestige, other technical factors.

An example is given demonstrating how the development of relative costs and even resource constraints induced the introduction of early computerization. Henize also demonstrates that the absence of relative cost advantages can offset the introduction of new methods, however attractive they may appear in other respects (electronic funds transfer at retail vs. wholesale banking levels). Against the example of the rapid growth of networks, Henize stresses that an additional effect associated with the introduction of new technology must be included in the analysis: the elicitation of new demand insofar as new technology not only changes the relative costs of performing certain types of services. It also may induce genuinely new services or new methods of performing old services, which now are becoming economically feasible.

It is demonstrated how qualitative factors are accounted for and how they may be quantified. As far as new technology is concerned one should investigate the life-cycles of new technology introduced in the not so distant past in order to be able

to estimate life-cycles with respect to cost and thus acceptance/feasibility of newer technology. Henize observes that not only relative cost advantages have accounted for the introduction of new technologies and/or services. To a certain extent even resource scarcities have put constraints on potential developments, e.g. access to specific types of personnel. (As a major example Henize depicts the introduction of automated teller machines, ATM. In a detailed exercise he calculates the net labour displacement of ATM to 1.32 full-time equivalent persons. When Henize in a later step also includes non-banking personnel he comes to an approximation 1:1, i.e. one ATM replaces one full-time employee inside and outside of banking. In a third step, Henize then introduces labour and capital requirements in producing ATMs and of subsupplies to ATM producers. He concludes in the end that although ATMs do not seem to have greatly changed the total amount of labour required, the type of labour input certainly has changed considerably. Bank tellers had been replaced by equipment designers, manufacturing workers, computer programmers, sales people and repair workers.)

In specifying his general model, the authors develops a number of aggregate labour productivity and cost functions. He then proceeds to a structural analysis of the banking and banking equipment industry, claiming that the analysis of the banking equipment industry must be performed in equal detail as that of the banking industry itself. This is necessary both in order to find the changes in basic factor cost relationships, that have provided the principal spur to the introduction of technological change in banking and to complete the analysis of the employment impact of technical change. Beyond determining the effects of new information technology on labour productivity within banking itself it is necessary to calculate the total employment effects of new technology within the aggregate economy. One needs to know both the effect that technological changes will have on the demand for additional banking services and the employment impact of these technology changes not only within banking but also within other industries. Given the very complex set of relationships which emerges, the author admits that in an initial analysis one must limit oneself to treating only factors of first magnitude significance, leaving the bulk of factors of secondary magnitude to later exercises if needed.

The author then turns to the estimation of new demand for banking services. He introduces a hypothesis that individuals' behaviour as to utilization of time or allocating budgets is quite conservative. "People tend to allocate a certain fixed amount of time per week to a given type of activity (e.g. to dealing with financial matters and/or carrying out various computation tasks). If the time required to accomplish such an activity is decreased, it may be that people, rather than re-allocating their time and effort, simply will increase the amount of that activity until the total time allocated to it remains the same. Or it may be that they will tend to assign a certain fixed proportion of their budget to such an activity. If the cost required to accomplish a given amount of that activity diminishes, the amount of the activity performed would

simply increase until the fraction of the total budget allocated to such tasks remains the same." The author further conjectures that activities within banking may be controlled by similar (conservative) rules of behaviour, although using new methods and technologies.

The last building-stone in Henize's overall model concerns the introduction of general economic determinants of the demand for banking services.

He then brings together the different factors and relationships (only briefly touched upon in this overview) into a model of systems dynamics type.

This is not the place to assess the feasibility of a grand scale model of a national economy to be employed for the estimation of employment effects of new technology of the type proposed by Henize. (As initially indicated, Henize uses the banking sector only as an example of a certain subset of such a general model of a national economy. Certainly the investigations to be performed, the amount of data needed, seem to be overwhelming. In this context, however, the exercise of Henize is being used only for a comparison with an investigation performed into the realm of Henize's example, the banking industry of Sweden).

A Scenario Approach

The task given to the Swedish authors is slightly different from that of Henize: to study the interaction between computerization, employment, content or quality of work and work organization. The investigation is undertaken on behalf of the Department of Labour. Its ultimate goal is to provide a basis for labour market policy. One major difference is that the Swedish study aims at the development of alternatives, which obviously is not intended in the Henize model. Whereas Henize essentially assumes technological determinism, Hedberg and Mehlmann have to integrate a "voluntaristic" view of technological development: it is not only the law of economics which controls technological progress but also human will. This accounts for the major difference between the approaches taken. The Swedish study employs to a major extent methods surprisingly similar to those proposed by Henize (and even comes to surprisingly similar results in cases of detailed calculations as e.g. for the effects of ATM utilization). It differs, however, drastically from Henize in the development of scenarios and in the utilization of group feedback methods when assessing the realism and feasibility of the (five) alternative paths to the future, which are depicted in the study. It thus also highlights the difference between the technologically feasible and the socially acceptable future, both of which are expressed in terms of employment consequences.

The basic approach of the Swedish study is the following:

- "Historical" development (essentially the last ten years) of Swedish banking;

- The general economic development of Sweden as the major determinant of the environment for banking;
- Investment in computerization under way, productivity potential, new services (essentially an extrapolation);
- Development of five scenarios depicting five bank office prototypes of 1990;
- Comparison as to employment consequences of the alternatives;
- "The road from 1980 to 1990";
- Two composite scenarios, emphasizing enhancing and constraining factors;
- Personnel policies, personnel structure;
- Policy options.

Banking in Sweden During the 1970's

Banking in Sweden is technically more developed than in any other European country.¹⁾ In the beginning of the 1980's the Swedish banking system is at the absolute forefront of technological development (quite advanced banking systems exist in Holland, to some extent even in France). Some details in support of this statement about the Swedish banking system will be given in subsequent sections.

The introduction of integrated, on-line teller systems by Swedish banks and savings banks during the 1970's coincided with drastic market growth and a consequent growth in the volume of transactions. Practically all households in Sweden now have bank accounts. A well-known Swedish banker claims that in order to cope with the growth in accounts and transactions Swedish banks would have had to employ a major proportion of the Swedish work-force, if no technological change had accompanied the change in growth and conditions. At the same time the cost of taking care of the transactions did not increase, despite drastically growing costs of personnel.

1) For comparison concerning the degree of rationalization/computerization reached (1982 figures) here some very rough figures are given: Austria (population approx. 7.5 million) employs 67,000 persons (FTE) in the finance sector. With a population of approx. 8.2 million in Sweden this would mean roughly 72,000 FTE. Actual Swedish employment is 29,000 FTE. In the Federal Republic of Germany the corresponding figure is 550,000 FTE (population approx. 62 million). (A corresponding employment intensity would mean 72,500 FTE for Sweden.) A recent estimate foresees a long term reduction of finance sector employment of 60,000 FTE (which would correspond to about 8,000 FTE in Sweden. The Swedish study estimates the further reduction in the 1980's to 9-10,000 FTE).

Table 2: Employment in Swedish Banks

Year	Persons	Of which part-time employed	Corresponding full-time equivalents (FTE)
1969	21,960	1,530	
1975	29,620	4,730	28,000
1980	34,200*	9,920	29,000

* of which managerial positions accounted for 1,440, supervisory ones for 5,670 positions.

Table 3: Development of Administrative Cost in Swedish Banking (million Swedish Kronor)

Year	Cost of Personnel	% of Total Cost x	Other Admin. Cost	Sum Admin. Cost	Admin. cost in % of average balance sum* x
1945	78	1.04	25	103	1.20
1960	266	1.14	101	367	1.57
1970	828	1.35	462	1,290	2.10
1980	2,166	0.93	1,823	3,989	2.03

x administrative, financial and other cost

*x (balance sum beginning of year + balance sum end of year):2

The ratio between cost of personnel and administrative cost for banks on the average developed between 1955, 77%, to 1978, 54%.

During this time, the working hours were reduced, services drastically expanded. A number of mergers took place (with consequent closures of branch offices). The number of accounts and transactions mushroomed. Computerization was introduced. From the middle of the 1970's a new generation of computing systems was being installed comprising a nation-wide data-net and on-line interactive operations at tellers, introduction of automated teller machines etc. (The study gives no details about the growth in the number of transactions as pertinent statistics are not available. It has not been possible to compile the total investment in computerization so far).

General Economic Conditions in Sweden During the 1980's

The economic outlook for Sweden for the 1980's is bleak. The estimated average annual growth in the gross national product is expected to be 2.5% (a low estimate for the 1980's, however, foresees an average annual growth by only 1.1%). The labour market will continue to be sluggish, which means a slow growth

for banks to be expected as far as market growth or growth of transactions is concerned. As there most likely will be a very slow growth in volume, banks may have to compete with quality and services. Most likely new services will have to be taken over (e.g. to utilize the capacity of the general data-net of Sweden, which has been in operation since 1980 and which will be completed by 1985, allowing virtual message switching and distributed computing over the entire country).

Investment, Productivity Potential, New Services

The study comprises a stock-taking of on-going and decided upon investment into computers and systems; further interviews with a great number of banks on planned investment of the same type; further a number of studies in other countries concerning the banking systems there have been penetrated.

Interviews with Swedish bankers and personnel representatives have comprised organizational changes, new market segments, new services to be offered, the effects of new technology on the working situation etc. Interviews with banks and consulting organizations abroad as well as with computing and system firms abroad and in Sweden have been undertaken.

The study concludes:

- Investment into systems and computing under way or in mature planning stages reduce employment by between 9,000 and 10,000 full-time employees (equivalent);
- The number of branch offices will be reduced by one sixth;
- The net effects of planned investment will be of marginal type only as the personnel made superfluous will be kept employed in other tasks;
- New services under way or contemplated will not provide enough new jobs to compensate the rationalization effects of the new technology.

The investment under way to mature during the 1980's comprises:

Computer: main frames + 10 units
distributed approx. 280 units
together approx. 300 to 400 % of growth

Terminals: writers + 2,200, screens + 4,000 units
together: 1 terminal per employed

Automatic
teller
machines: up to 2,000 units

Bank note
boxes: up to 3,500

(the account goes into much deeper detail).

The consequences as to jobs being made superfluous as well as new jobs created have then been estimated, in cooperation with bankers, personnel representatives, consultants, etc. The estimate comes to minus 10,600 and plus 670 (for new FTEs).

New services to be offered during the 1980's are discussed and estimated as to their employment consequences. The main conclusions as to service development may be summarized in the following way:

- Extension of functions offered at present, as far as possible;
- Development of new services, for example
 - Household budget accounts (to "smooth" the cash flow of the individual household);
- Extended business services, e.g. information services, analytical services (helping in particular small businesses to analyse their accounts and to support other analytical services to improve/support management of those firms);
- (Extended) interactive banking;
- Service around the clock;
- Further development towards the "cash-less society" (e.g. by extending utilization of pay cards, many more services to become available "by plastic card" instead of by cash money, even to reduce theft, damage and robbery);
- Extended use of the "electronic vallet" (which is an alternative to the plastic card making the transaction less risky and also somewhat simpler for the recipient of money);
- Introduction of a "unity account", instead of having to attach specific conditions to specific accounts, making it possible to e.g. differentiate the interest paid/levied in one and the same account.

The employment creation potential of such new services is being estimated at 3,000 FTE by the year 1990 (this makes necessary a major educational and training effort for the banks).

The approximately 3,000 new jobs will, however, to between 30 and 50% be filled with persons, who are being kept employed, despite their jobs have been taken over by computers or lost

for other reasons. The new employment thus will be correspondingly lower.

As far as the organizational consequences for banks are concerned, technological development has made possible and will continue to make possible both decentralization and centralization of services and tasks.

Scenario Development to Visualize New Alternative Developments

So far, the Swedish study in principle follows the Henize proposal. It occasionally goes as much in detail as Henize proposes. However, it does not investigate for example the employment consequences in computer manufacturing industries etc.: the aim of the Swedish study is different from that of Henize's¹⁾.

What the Swedish study provides now is very different from Henize insofar as it, so to speak, projects a mirror image of the future and brings it before today's decision makers and the groupings interested in the future of banking and employment in it.

Based on the now available, to some extent also on developments discernible (and available e.g. in the United States of America), five major policy alternatives for banking are transformed into "model bank offices" of 1990. The five prototypes are called

- (a) Lending culture,
- (b) Finance boutique,
- (c) Automatic bank, (Autobanks)
- (d) Personnel - the banks' foremost resource, and
- (e) The economizing bank (Hibernation Strategy).

The alternative scenarios are extremes insofar as most likely none of them will materialize in its "pure" form. For this reason and after thorough discussion of the five alternatives in a great number of groups, the scenarios were collapsed into two scenarios, Alpha and Beta (see below).

1) Neither Henize (whose aim it is to estimate the total employment effects) nor Hedberg/Mehlmann (who are concerned with employment in banking only) pay attention to the secondary employment effects of the drastically extended banking services during the period under study, neither the retrospective one nor the time to come. Even if many of the services offered are of genuine banking type, not affecting employment elsewhere, a major part of them certainly will have had and will have effects on employment elsewhere, e.g. in firms or at work places (cash payments have practically disappeared, with the exception of desk sales. The Swedish social insurance e.g. has completely abandoned all kinds of cash services).

Depositor - or Lending - Culture

Banks are traditionally dominated by the borrowing or credit culture. Promotion is via credit departments. In principle money is made available from depositors and given, against proper fees, to firms or people who need to, temporarily, borrow money from the banks. Since the capacity of banks to, profitably, make money available to borrowers depends on the amount and duration of deposits made, banks have to stimulate depositors to put their savings at the bank's disposal. The banking policy "lending culture" or "depositors' culture" implies that more emphasis is paid to the hitherto neglected "supply side". (The shift in emphasis in this direction took place about six to seven years ago. The experience has been quite positive. The policy emphasis permits further development implying in particular consultation and advice given to depositors as to how to make the most of their money.)

This prototype implies further development of consultive services, differentiation of depository services, placements and so forth. In its extreme form it will to some extent be at the expense of teller services, which will be automated as far as possible.

The qualifications of the personnel will shift quite drastically. This type of banking is personnel-intense. It will, compared to the present situation, mean a reduction amounting to approx. 4,000 jobs by 1990.

Amongst the pros and cons enhancing or constraining this type of development, external conditions seem to be most important (fiscal/financial policy, general economic climate, political tendencies towards socialization etc).

The "Finance Boutique"

The "finance boutique" is being built around the idea of banks being mediators. A bank item often starts with a connection made, in which the bank may or may not play a role. It ends with a financial transaction. Given the fact that banks have access to powerful data-nets, they may attract branch offices of other businesses to their branch offices or, under specific circumstances, also act as agents for other firms. A finance boutique may consist of a bank office, which also houses a travel agent, an insurance agency, a mail order agent, a lawyer's office, perhaps also a social security or similar office. As mentioned, some of the services may or may not be offered by the banks. It should be reminded of that for example banks often act as legal advisers. This type of banking service might be offered to a wider range of customers.

A prototype finance boutique may be characterized in the following way: it will not be the general branch bank but rather comprise only approx. one sixth of the branch offices. It will provide both manual and automatic bank services. It will assemble a number of cash transfer points, which now are

dispersed and distributed. It will imply active selling of bank services, e.g. capital broking in combination with electronic services of different types including access to networks, teletyping and telecomputing services and so forth.

Although this type of service implies active selling of bank services, its employment consequences would imply a greater reduction of jobs than the previous alternative.

This type of arrangement is in operation already, although to a very limited extent. It will most likely never be the most frequently applied type of bank branch. Nevertheless, under certain circumstances it has a good future.

The Automatic Bank

The automatic bank is the most intensely automated alternative, implying the most drastic reduction in personnel. It would utilize all the technological possibilities available and capitalize on the surprisingly positive reception the automated teller machine has experienced. People have learned to operate simple automatic machines. The teletext development may be pushing this type of alternative forward. However, it will also make necessary the availability of "full service offices" elsewhere. It would, thus, mean a centralization of qualified bank services and counselling. The customer must be prepared to accept this centralization. It would also imply a further development of prepared documents (e.g. prepared pay slips attached to invoices, based on optical character reading or other types of automated treatment). Handling of cash would decline. One constraining factor may be that banks would not want to lose their identity vis-à-vis the customer to an extent so that the customer does not know with which bank he is communicating.

This alternative would make possible a reduction of perhaps more than 50% of the personnel employed at present.

Offering Personnel Services

Banks all over the world advertise the services of their competent employees: "Our personnel is our utmost resource". This type of banking service would offer the highest degree of quality in banking. This alternative might possibly also come about because of employment regulation acts, e.g. not permitting lay-offs of personnel. The banks would then have to employ their personnel in the most useful or meaningful ways. This alternative would mean no change in employment.

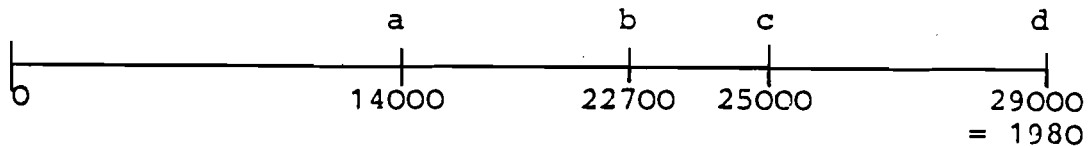
The Economizing Bank

The economizing bank will, given the investment for growth made during the 1970's and given the (over-) capacity available, be hesitant to incur further fixed cost. It would either keep its computing equipment longer than intended or go for leasing instead of buying. It would, in principle, be trying to cut its

investments as well as costs as much as possible. It would also reduce its training activities for personnel. It is, in principle, a passive strategy.

Comparison of the Alternatives' Employment Effects

The net effects (present personnel minus personnel savings plus new jobs created = new employment) are plotted along a line on which a scale implying full time equivalents is used. The following picture would appear for the five scenarios:



Banking Sector Employment (Full Time Equivalents)

a = Automated Bank; b = Financial Boutique"; c = Depositor Culture, and Economizing Bank; d = Personnel as Resource.

As announced before, the Swedish study gives the reader to understand that automation is not something which is "given from the outside", but that it depends on the general views but also the policies adopted both in society and, of course, within the banks and amongst the unions, what "philosophy" is selected for bank automation. Also Henize confronts the options of the technically feasible with the economically feasible. Hedberg/Mehlmann introduce beyond this the market-wise feasible, the socially feasible and the politically feasible.

To Select a Future

The five alternatives were put before a number of groups of relevant decision makers and experts, as well as union representatives.

The outcome of this feed-back process resulted in a conclusion saying that two alternatives should be developed, one based on the principle of the option "personnel as a resource", the other on the "economizing bank". However, both of them should also integrate features from the other options.

The employment consequences in brief would be for the Alpha option approx. 24,000 FTEs, for the Beta scenario between 25,500 and 27,000.

Implementation

In the concluding chapters strategies are being developed to the implementation of future options.

Further, the qualifications of the banking personnel of 1990 according to the alternatives are being specified and broken down into a substantial number of categories. A training strategy is being devised. It is based on the expected

development of various professional categories.

The estimated development (decline) of employment in banks is compared with recently published forecasts from France, (Nora & Minc 1979) and an Australian investigation. Both forecasts are approximately in line with the forecast by Hedberg/Mehlmann¹⁾. International comparisons are not always quite valid, since the banking sector in most cases is regulated in one way or the other. A comparison of the Swedish banking sector with its equivalents in other countries is further constrained because of the quite substantive differences in the levels of automation and even integration. As indicated above, e.g. the "intensity" of accounts held in the broad population is probably much higher in Sweden than in other countries. The same is true when it comes to dispersion of cash cards or credit cards to broad masses. Also the availability of on-line connected ATMs, which are not bank-specific is quite unique. This even implies that a substantive share of the Swedish population is acquainted with ATMs, has accepted this stage of development of automation and most likely is prepared to accept further steps in that direction, compared with the average citizen in other (European) countries.

This development also implies that many of the early failures and mistakes in the process of automation, have been overcome, a learning process which obviously is unavoidable. As an indication of the trust in the fool-proofness and technical reliability it may be mentioned that the first ATM network in Germany, which at present is in an advanced test phase, permits payments of up to DM 300.-, whereas the well run in country-wide inter-bank on-line ATM system in Sweden permits payments of up to DM 800.- (Skr. 2,000.-) at a time. The next steps in the technological development affecting the banking sector most likely will be the extension of the utilization of cash cards to at least larger retail outlets but also towards the introduction of the "electronic vallet", i.e. the microprocessor-equipped plastic card, which may be "charged" with "electronic cash". It may be used instead of cash in paying for telephone calls, petrol at non-manned petrol stations, public transportation, at retail stores of many different kinds, etc.

The advantage of the electronic vallet is that it may be operated without access to on-line networks, thus permitting its dispersion to a wider range of points of sales, even to those where the frequency of utilization would not motivate on-line connections around the clock.

Henize's assumption that people in general would be prepared to allot approximately the same slice of time or of money to certain activities is disregarded when it comes to assume continuity of money handling/manipulating behaviour.

1) Cf., however, Schmidt, K.D. 1980, who estimates employment in banking in the Federal Republic of Germany to increase by 80,000 between 1980 and 1990.

Once people have experienced how much more convenient it is to avoid queuing at bank tellers but also not having to carry around cash, they seem to be more and more prepared to take advantage of a new technology, in particular as that technology does not imply cost increases worthwhile talking about.

Attitudes Towards Changing Jobs

The experience banks and their customers have made during a gradual transition to higher degrees of automation seems, against the background of the Swedish experience, to be quite positive. The tendency has been that not only businessmen and accounting officers in industry and business have tended to integrate banking routines into business routines or, in the private case, to prepare their banking business at home. It has also led to that more and more banking services are handled in an impersonal way, e.g. by mail, by means of prepared documents and optical character-reading prepared stationary. This trend may continue if e.g. teletext is being adopted more generally (which assumes a wider utilization than only that in connection with bank business). Several tendencies obviously amplify the trend towards a lessening need to make personal calls at bank offices. At the same time, however, the greater ease in communicating with banks may have induced the general public to make use of bank services to a greater extent than before. So there may have been a counter-trend implying that people use banks more than before. Part of this is done by means of automation or distant handling, part of it, however, also has led to more frequent calls, for different more sophisticated services and consequently personal calls with a different content, requesting a different, "higher" competence from the bank clerks' side.

The personnel at most banks, thus, have been subject to fairly drastic changes in their working conditions and will experience further changes still to come. In the Hedberg/Mehlmann report an older study, in which Hedberg and others participated, is summarized. It reflects the attitudes of banking personnel to the changes which came as a consequence of the computerization during the 1960's and 1970's up to the mid-1970's. An excerpt of this is given overleaf.

The results of the attitude study show that the effect of the introduction of computers is by no means uniform. One can observe, when it comes to variation of work, that two thirds experience a greater variation of tasks, as a consequence of computerization (at the same time 25% say the work has become more uniform). But also the character of work has become more repetitive for many (58%) whereas for a minority repetitiveness has declined.

Quick discovery of errors seems to be a uniformly and positively experienced consequence, but also the obviously drastically reduced discovery of mistakes made through colleagues (the computer indicates to the clerk/operator that he is just about to commit an error. He can correct himself instead of being corrected by colleagues).

Table 4: Effects of Computerization on Work Roles and Organization of Work, as Experienced by Bank Clerks

	increased	unchanged	declined
Variation			
of tasks	67		25
of equipment, forms			
machinery	52	36	12
repetitive work	58	25	17
Goals, Controls, Feedback			
mistakes discovered			
quick error notification	92		92
Workpace, Working time			
workpace	33	19	37
self control of workpace		32	56
constant work	32	28	40
convenient working hours	32	54	14
Supervision			
freedom from detailed			
supervision	23	73	
superordinates' knowledge			
of work		39	57
Self Control			
choice of methods		44	48
choice of working sequence		54	40
decision responsibility	33	63	
Knowledge and Training			
chances to learn on the job	80	20	
use of knowledge base	44	35	
Interesting Job	76	24	

The workspace has changed or increased at approximately equal shares whereas the self-control of the workspace has declined for many (the computer controls the work now). For many the workspace is unchanged or it has become more even, but two fifths feel it has become more regulated. Quite a few have had to complain about negative consequences as to working hours as a consequence of the introduction of computers.

Banking is a task of minute detail. The computer, of course, brings little change, nevertheless, 23% experience less detailed supervision, most likely from supervisors. The computer is supervising them now, so they can detect errors themselves. This means that the role of supervision obviously is changing. Indeed, it is changing quite drastically, so three fifths feel that the supervisor no longer is competent to control the entire set of tasks. Programmers and systems' designers have been intruding into the supervisory sphere.

One would have expected that the computer is putting fetters upon self-control of the bank clerks' working conditions. Indeed, the choice of working methods obviously is today much more constrained for many. The same is true to a slightly lesser extent when it comes to the choice of the working sequence. No one, however, seems to have lost responsibility for decisions taken. One third have experienced increased responsibility in decision situations.

Contrary to a great deal of prejudice, the introduction of computers gives people a chance to learn on-the-job, but also to use the knowledge base they have acquired over a life-time, and in summary, to three quarters the job has become more interesting.

On the average, then, the first quite difficult phase of computer introduction into banking seems to have rendered more positive than negative attitudes. This may be a surprise, at least to some observers.

The at least moderately positive climate thus created may provide a positive attitudinal base for further automation, even if the next generation of automata to be introduced may imply higher degrees of intrusion into traditional clerical jobs in banks and, thus, be looked forward to with mixed feelings.

Strategies for Bankers, Banking Personnel, Unions, as well as Government Agencies, to Prepare for and Meet the Future

Because of the taskforce mission given, the Swedish report concludes with a section containing recommendations to or options for the interested parties to adapt to further automation in the banking sector. As this topic falls outside of the aims of this chapter, it may suffice having mentioned the title of the concluding chapter of the Swedish study.

Concluding Remarks

This short summary of tendencies and potentials for flexible automation in service industries is by no means exhaustive and complete. In the sources quoted much deeper treatments of the topic are contained than possibly could be reflected here. In order to stimulate the thinking process - rather than taking recourse to an enumeration, which in any case could not be complete and perfect - two recent reports on the banking sector have been used as examples of how one can approach the matter of assessment of possibilities and potential effects of flexible automation in service industries. The chosen examples from the banking sector, although showing considerable overlap when it comes to methods of estimating the employment consequences of automation in the banking sector, at the same time demonstrate widely different views and, consequently, angles of approach. The approach by Hedberg and Mehlmann is not nearly as detailed and approaching perfection as that of Henize. At the same time it, however, introduces major social and societal points of view, which obviously are of equal importance to the decision makers in the banking sector, amongst the unions, and also in the political sector of a country, when it comes to assessing the consequences of automation in non-industrial sectors.

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