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A model for relating technology, organization and employment level: A study of the impact of computerization in the Swedish insurance industry

Bengt Stymne, Jan Löwstedt and C. Patrick Fleenor

This article investigates effects of computerization in the Swedish insurance industry from 1960–1980. While the technological imperative dictates that many jobs would disappear, it was found that employment actually increased. The authors produce a model relating technology to employment levels and suggest that a range of moderating factors must be considered.

The question whether the introduction of machinery creates unemployment or not has been discussed for centuries without being resolved [1]. What is clear is that machines have been taking over tasks which used to be carried out manually. The long-term trends shown in Table 1 towards a lower share of the labour force employed in agriculture and industry can be explained to a large extent by the substitution of physical capital for human labour.

As can also be seen from Table 1 the elimination of jobs in agriculture and industry has not resulted in a corresponding increase in unemployment. Rather, the service sector has increased its share of the work force. However, there has not only been a shift of jobs between sectors but the job structure within sectors has also changed. The share of direct productive jobs has decreased and the share of administrative positions and other information handling jobs has increased. For example, the number of technical personnel per worker in Swedish industry increased ten times from 0.17 to 1.73 between 1915 and 1975 [3]. Table 2 estimates figures based on an OECD-Study [4] that more than a third of the total Swedish work-force was engaged in information-handling activities in 1975. The old debate about technology induced unemployment has flared up again because information technology may pose a threat to those already working with information tasks [5], [6] as well as eliminating the possibility of sub-

□ Bengt Stymne and Jan Löwstedt are respectively Professor of Organization Theory and Lecturer at Stockholm School of Economics. C. Patrick Fleenor is Professor of Management and Organization, Albers School of Business, Seattle University, USA.

Table 1: The distribution of the Swedish labour-force over different sectors (2)

Sector	1963 %	1968 %	1973 %	1978 %	1982 %
Agriculture	12.7	8.9	7.0	6.0	5.4
Industry	40.3	40.2	35.9	32.3	29.4
Services	45.3	48.7	54.6	59.5	62.5
Unemployed	1.7	2.2	2.5	2.2	3.1
Total	100.00	100.00	100.00	100.00	100.00

Table 2: The share of the Swedish labour force engaged in information-activities

Year	Share of labour force involved in information handling %
1960	25.6
1970	32.1
1975	34.1

Figures based on an OECD-study (4)

stituting administrative jobs for manual jobs which have become automated.

If new information technology will mean a sharp increase in the productivity level, the proportion of population employed in administrative and information-handling jobs may well start to decrease. A corresponding number of people cannot get employment in productive tasks in agriculture or industry if we assume, for a moment, that the demand for products has an upper limit. There is only so much agricultural product we are able to eat and there is only so much industrial product we are able to utilize. If so, only an increase in the demand for services can absorb the labour possibly made free by information technology. Otherwise, there is a danger of unemployment.

In fact, there are of course many reasons why the service sector should continue to grow. Our need for health care and other types of social services seems virtually unlimited. On the other hand a good portion of these services have to be financed via the tax system and there has been a good deal of public resistance in different countries against increased taxes. For example, in Sweden in the 1980s, where more than 60% of GNP is channelled through public expenditure, there has been an increased concern about tax avoidance and the emergence of an informal 'receipt-less' economy.

Will the information sector follow the same pattern as the older sectors? If so, there will be a great deal of unemployment or underemployment of massive proportions. But are there other variables to consider? Are there moderators of technological impact, and if so, what is their nature?

The present study is an attempt to clarify some issues related to those questions. The Swedish Insurance Industry was studied to determine what effects computerization has had on white collar employment from the 1950s to the present. Further, a theoretical model proposing moderating variables to the impact of technology on employment is presented. We are also presenting a brief description of how institutions and policy are related to the Swedish labour market.

Technology and employment: A theoretical model of moderating variables

The authors believe that a discussion which implicitly or explicitly assumes the existence of a technological imperative misses the opportunity to investigate intervening mechanisms that may modify or block the impacts of technology. We suggest a preliminary model as illustrated by Figure 1.

The model suggests that the effects of technological change may be buffered (or perhaps enhanced) at two levels. The first, or societal level may have both implicit and explicit regulating mechanisms directed at least partially at technological change. More subtle are social values, related to work and

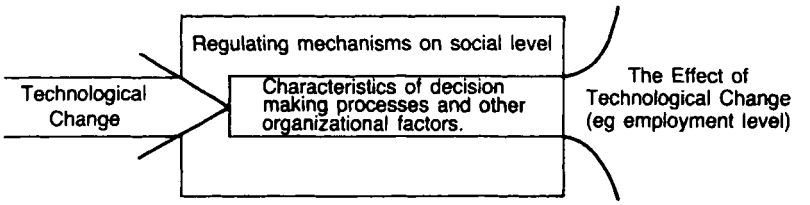


Figure 1: Theoretical Model of the Effect of Technological Change

employment levels. For example, a 5% unemployment level in Sweden would be perceived as a national disaster, while a similar level in the United States would be close to 'full' employment. This suggests that welfare societies like Sweden will more rigorously counter unemployment (technological or otherwise) than societies such as the USA. At the organizational level, propensity toward risk, resistance to change, characteristics of the decision process, and other variables may further buffer effects of technological change.

Some trends and functions of labour market policy in Sweden

Industrial development began relatively late in Sweden, and moved very rapidly. Since 1870, Sweden's economic growth per capita, at an average of 2.5% per year, is second only to Japan's rate of 2.7% [7].

This development has not taken place without political interference. After the second world war the Labour Movement supported an economic policy aiming towards expansion of profitable companies and industries and the elimination of unprofitable ones. This policy has resulted in an expanding economy that has been able to absorb the work force from contracting industries. A policy which, like the Swedish one, has been aimed toward a rapid economic development could easily have led to pronounced inequalities in society, e.g.between mobile and less mobile labour forces. The inequalities could in turn lead to political conflicts which might eventually stall the economic progress.

However, the Swedish situation shows other mechanisms which counteract the politically dangerous secondary effects of economic development.

One such mechanism is the high degree of unionization of the Swedish labour force. Around 90% of blue collar and 70% of white collar labour are unionized [8]. Unionization does not stop at the 'proletarian' segments of the labour force but also includes highly qualified managers and specialists. Even the managers who represent their companies at the powerful Swedish Employers Confederation were unionized to 25% according to a survey made in the early 1970s. A high degree of union solidarity has been achieved in spite of status differences between union members. As an example, the majority of employees in the insurance industry have supported the members who are insurance salesmen when the employers have attempted to cut back on their sometimes huge commission incomes.

The strong position of unions has had several functions in counteracting negative effects of development. It has been possible for unions to negotiate a fair share of the fruits of economic development to labour. It has also been possible to follow a solidaric wage policy counteracting the threats from highly differentiated wages that result from differences in company profit or from shortage of certain types of labour. The level of industrial conflict has also been kept very low. The peaceful industrial relations have also been helped by the fact that the large blue collar union movement has been controlled by a social-democratic leadership at the same time as the social democrats have led the Swedish government. Since 1936, there has been only a brief interlude of conservative cabinets between 1976 and 1982.

During the rapid development after World War Two, when economic growth averaged 3.5 to 4% per year for 10 years, programs were developed to facilitate the movement of people from one region to another and for retraining people for new jobs [7].

Other social policies of the social democratic government could be seen as a mechanism buffering the impacts of social

change. The active labour force has been highly taxed and the proceeds have been transferred to disadvantaged groups, such as families with children and retired people, and for the provision of free or cheap social services like health care, child care, old-age care, education, mass transport etc.

Since 1975 the economic growth has been slow, unemployment has gone up and the economic position of the country has weakened due to an increasing foreign debt. The steel, forest and mining industries have lost their competitive advantages to other countries. The Swedish engineering industry seems to be strong still, and new industries, such as electronics, where Sweden is lagging are growing in importance. The mechanisms for adaption which have been described may well suit an expansive economy but may be of less value in a stagnating one.

However, the Social Democratic government which came into power in 1982, has attempted to increase economic activity, mainly by decreasing the real wages through depreciation of the currency and exercising restraint on union wage demands: Partly to make the resulting increased profit levels acceptable to labour, special 'wage-earner funds' have been introduced. These funds, which are governed by people from the labour movement, can buy stocks with a part of private companies' profits, which are channelled to them.

To reiterate, in discussions about the impact of technology, one main issue is if there is a technological imperative, ie that technological change determines the social system. Among the effects of a more highly developed technology the following trends could be given as examples: social stratification, lower individual autonomy, job segmentation, unsatisfactory job content, alienation and increased hierarchical control. The technological imperative could probably also be generalized to explain part of the unemployment problem: When a new, more efficient technology becomes available in an industry, workers will be laid off because of the substitution effect. If there is no demand for labour from other industries the level of unemployment in society will rise.

However, such an argument implies the assumption of a market saturation level. Of course in a theoretical analysis it is possible to assume a situation when everybody seems satisfied with his present consumption level and when there is no population increase. Empirically, periods of apparent market saturation could probably be observed. For example, the present resistance to increased taxes could be taken as a sign that a saturation level in the consumption of public services has been reached. However, such periods may also be explained as short term adjustment problems caused by market imperfections and artificial constraints, such as import/export regulations, limited distribution capacity or shortcomings of the fiscal and pricing systems, rather than 'true' saturation in demand. Therefore, we hold that the assumption of the existence of demand saturation level is so debatable that it alone makes the argument about a coupling between technology and employment level dubious. But this is not the main point we want to make in this paper, and the assumption of market saturation will not be dealt with further. Instead we want to question the technological imperative via concepts related to social regulating mechanisms and to organizational factors. Such mechanisms and factors should moderate the effects of technology on employment even if demand saturation exists. Our discussion will concentrate on the development of technology in one sector of the Swedish economy, and the employment of that industry.

Methodology

The model presented in this paper stems from data in a broader study [9],[10],[11]. The broader study investigated investment in new technology by the Swedish insurance industry, the motives for that investment, and the effect of the new technology on employment level, organization structure, personnel practices, and work content.

The present paper deals primarily with the effect on employment level. This was accomplished through an historical analysis of the insurance industry, and case studies of a large private insurance company (Skandia), a large cooperative company (Folksam), and a smaller mutually-owned company (Valand).

Measures of business volume were derived from accounting data reported in official publications from the Insurance Inspectorate and all figures were adjusted for inflation according to a method suggested by Magnusson et al. [12]. Data for

employment levels were gathered from many different sources to compute a coherent time-series of the post-war period. Data were collected from the National Central Bureau of Statistics (SCB) as well as from files in companies and from the employers and unions.

Level of technology development (computerization) was defined as yearly costs of computer operations, including depreciation, interest, machinery leasing costs, salaries of EDP personnel, rent, telecommunication costs and paper costs.

Regression analysis and other statistical analyses were used to investigate the relationships between volume, employment level, capital, and cost of computer operations.

Technological change in information mediation

The technology of the insurance industry can best be described in terms of Thompson's mediating technology [13]. The clients' needs for risk coverage are mediated through the pooling of risks, with investment of the premium by the insurance companies. Customer requirements must be handled in as standardized fashion as possible, to achieve economy and efficiency in information handling, thus the attractiveness of computerizing as much of the information flow as possible. Insurance has, together with banking been a leader in the use of new technology in white collar work in Sweden.

Of course technological change in the offices did not start with the computer. Table 3 highlights some important technological developments in the Swedish insurance industry.

The first computer installed for a Swedish insurance company was an IBM 650 placed in Thule in 1956. The machine was primarily used for calculating charges to customers.

Table 3: Hundred years of technical-development in the Insurance Business

1879	Skandia gets its first calculating machine.
1890	Skandia gets its first copy-press, earlier all the letters were written by hand.
1894	The first typewriter and telephone arrive at Skandia.
1901	25 000 telephone calls are dispatched in Skandia.
1923	Folksam starts using punch card systems on service bureau.
1925	Thule gets its first Hollerith-machine.
1929	Rationalization through merges starts.
1930's	Standardization of letter writings and row-distances of typewriters.
1934	Skandia gets a machine for handling envelopes
1937	Thule uses punch-card in all important insurance types.
1940's	The use of adressograph starts.
1942	SPP gets its own punch-card system.
1946	Folksam gets its own punch-card system.
1947	Skandia and Hansa get own punch-card system.
1955	Folksam gets an IBM 626 calculator.
1956–58	The first computers (IBM 650) are implemented at Thule, Folksam and SPP.
1960–63	Next step in computerization: Magnetic tapes were used as input-media (IBM 1401, IBM 7070).
1964	Allmänna Brand gets their first computer. (Saab D21)
1966–68	A new step in computerization. Better memory capacity was continued (IBM 370), on-line terminal-systems were implemented.
1971–73	The development of memory capacity continues (IBM 370), on-line terminal-systems are implemented.
1972	The first display terminals are tested at Skandia.
1973–78	The other companies start using terminal-displays-systems.

Two other major insurance companies followed the Thule lead within two years. Application was broadened when memory capacity increased and input media other than punch card became available. Magnetic tape rationalized a heavy load of key-punching in the beginning of the 1960s (IBM 7070),and disk memory (IBM 360, 370) allowed for the use of display terminals in on-line systems and of database handling in the beginning of the 1970s. After the early, tentative consolidation of operations into computerized systems, the use of the machines experienced explosive growth. One company reported a fifty-fold increase in terminals during the 1970s. By 1981 the company's 3000 employees had 950 terminals at their disposal. Over half (53%) of the employees reported regular use of a terminal in their work [11]. The company was not alone in its rapid build-up of computing use. Figure 2 shows costs related to computing use for five Swedish insurance companies from 1961 through 1979.

The dramatic increase of computing costs for the sixties gives an impression of discontinuous change having taken place in the insurance industry. In the two large case-companies the computing costs grew from 0.5% of premiums in 1961 to 1.5% of premiums in 1979. The computing costs per employee were about 1000 in 1979 US-dollars. About half of the computing costs were capital costs and half salaries for system specialists and other computer personnel.

The economic development depicted in Figure 2 does of course not reflect the fact that each krona invested in 1979 could buy much more powerful hardware than in 1961 and that improved programming methods had cut down required programming time.

By the early 1980s the more advanced insurance companies in Sweden had eliminated almost all manual handling of the policy, at least in the so-called mass markets, eg auto- and home insurance. In dealing with a customer, the sales person has on-line access to a central computing system programmed with policy tariff and conditions.

When the customer has made his decision the sales clerk enters the request into the system, which prints out a policy and bill which is mailed to the customer. The customer sends the bill to the post office, where his bank-account is automatically debited. The post-office computer electronically notifies the insurance company's computer that a payment has been made. If the insurance

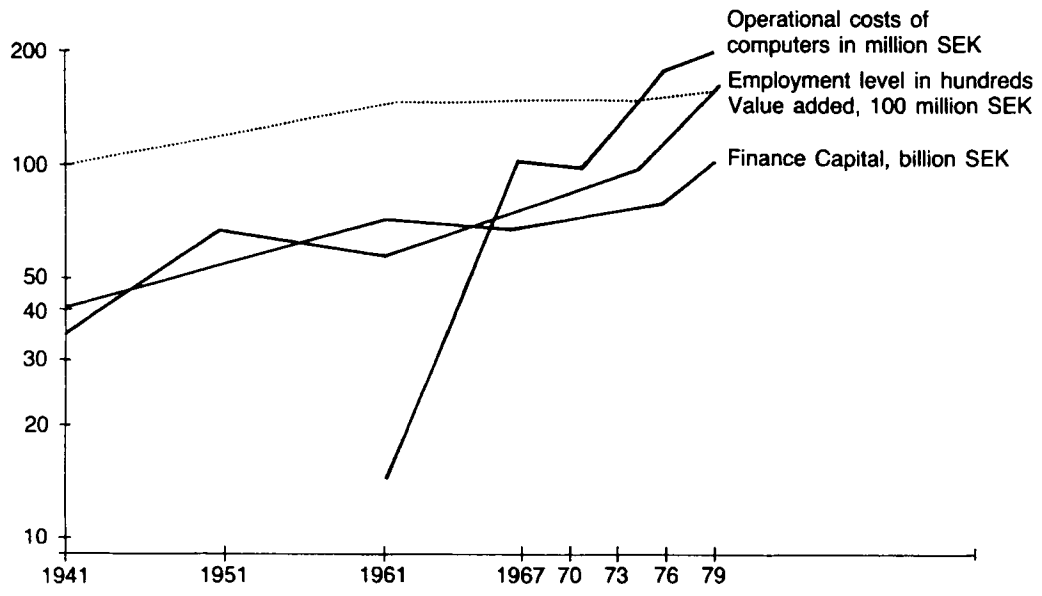


Figure 2: Employment level, Value added, Finance capital and Operational costs of computers for five leading Swedish insurance companies (semi-logarithmic scale)

thus underwritten is for a motor-car, the insurance company's computer will electronically inform the computerized files of the government authority responsible for the car register that the customer's car is now covered by the insurance required by law.

Figure 3 shows major activities and interactions in the development and delivery of insurance. The standardization and computerization reduced the need of internal handling of the policy. Thus the computerization of the insurance business has resulted in a decrease in the number of people working with the handling or filing of policies. People are, however, still needed for developing new tariffs and other insurance services. Also salesmen and salesclerks responsible for the interface between the company and the customers are vital for the functioning of the business. The percentage of employees engaged in this interface has increased in the companies included in this study.

In conclusion it can be said that in a sense computers do not represent anything entirely novel in the insurance industry, but can be seen as a continuation of a drive towards more standardization. Therefore, computerization may not lead to revolutionary effects.

On the other hand, since computerization started around 1960, any specific changes and discontinuities due to computer technology should be able to be detected by comparing trends before 1960 with trends after 1960. This is the task of the remainder of this paper.

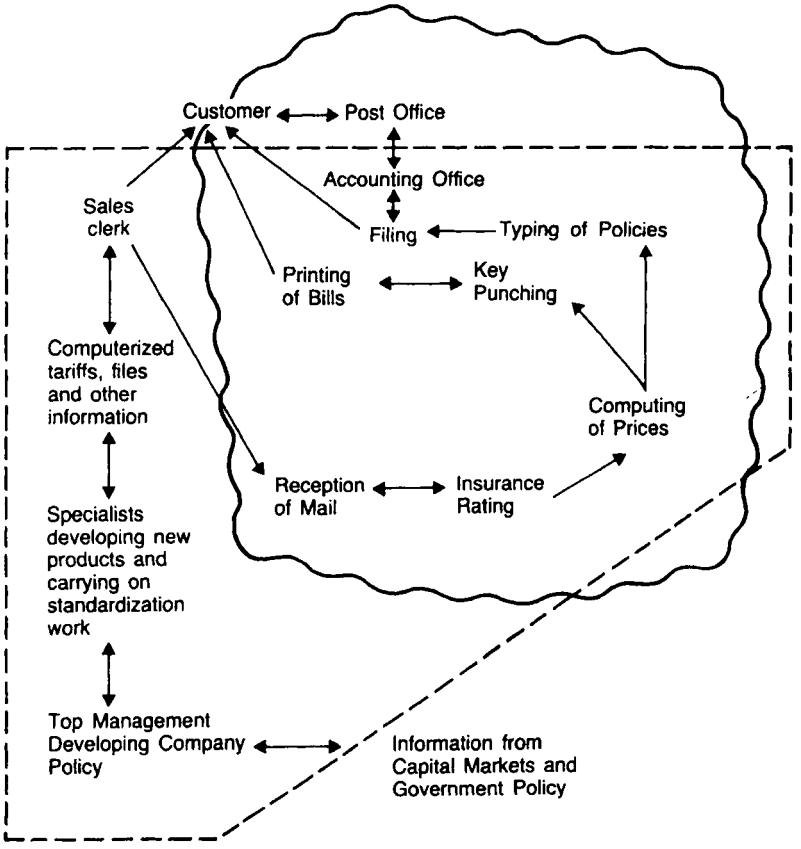


*Figure 3: Development and delivery of Insurance**

**Enclosed area denotes activities where computer had greatest effect. Dashed line denotes organizational boundary.*

Employment trends in the Swedish insurance industry

Whatever effects computerization may have had, decreasing over all employment was not one of them. In fact, employment in the industry actually increased above + 11% between 1961 and 1979 (Table 4).

The reader will note that the greatest increase was in part-time employees. Full time employees increased until 1970, and then decreased slightly, while the number of field sales people declined until 1970 and then increased slightly. The increasing employment level contradicts the idea that computerization in an industry necessarily leads to unemployment. The contradiction between expected and realized employment level changes can be illustrated by one of the cases [10]. In 1967 the company forecasted a reduction of the work-force from 4000 employees to about 2800, exclusively from the expected productivity increase due to computerization. The same study suggested that additional measures could bring the work-force down to 2500. In fact, by 1973, the work force was close to 5000. The forecast was not a hastily written staff paper but the result of a careful personnel planning exercise involving the responsible line managers. Trying to understand why the forecast failed gave us some insights incorporated in our theoretical model.

Another sector experiencing rapid computerization, the banking industry, has reported a similar experience of increased employment level [14]. The same is true of the white-collar sector in the manufacturing industry, according to official Swedish statistics.

Why has employment continued to rise in the face of rapid computerization? Before we develop our theoretical model further we will make some observations of how the quality or composition of the work-force has changed during the computerization period.

Internal labour market change

As was observed before, the number of part-time workers has increased. It is primarily women who work part-time, but the number of men working part-time is increasing fast. The larger number of part-time workers is not necessarily a sign of a limited availability of full-time positions but rather an out-come of legislation and fiscal policy which will be treated below as social regulating mechanisms.

Although the employment level has been affected little by the use of new technology, the industry and its employees have been affected by other types of change. During the last two decades the demographic characteristics of the work-force have changed as well as the structure of the internal labour market.

Turning first to demographics, the industry today is less dominated by women (58% of the employees) than it was earlier. The proportion of very young women, under 20 years of age, has diminished most. In the late fifties more than one out of ten employees belonged to this category, while in 1979 they were not more than one out of two hundred. In some respects, this change is explained by changes in the education-system, but the change in the proportion of young women is greater in the insurance

Table 4: Employment Trends in the Swedish Insurance Industry, 1961–1979

	Office Workers			*Salesmen*	
Year	*Full-time*	*Part-time*	*Total*	*Total*	*Total*
1961	11 400	630	12 030	2 701	14 731
1967	11 700	905	12 675	2 276	14 951
1970	11 941	1 041	12982	2 095	15 077
1973	11 542	1 501	13 073	2 097	15 170
1976	11 720	2 022	13 742	2 071	15 813
1979	11 211	2 944	14 155	2 177	16 332

Source: Lowstedt, Ringh and Stymne, 1981

industry than in white-collar jobs in manufacturing industries.

During the last two decades the proportion of employees in five characteristic job categories was also studied (sales clerk, EDP-personnel, claims-adjuster, tariff-rater, professional salesmen). The proportion of these more professionally skilled groups has increased from less than 30% (1961) of the total work force to 60% (1979). This increase has taken place at the expense of less skilled, nonprofessional work.

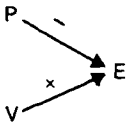
In Sweden all white-collar employees have been classified according to a nomenclature developed jointly by the unions and the employees' federation. Among other things, each job is classified according to its degree of difficulty or routinization. The proportion of employees classified by this system as having a routinized job has decreased from more than 60% in 1941, to 30% in 1979. The most rapid decrease of routine work took place during the beginning of the seventies, parallel to the increased use of display terminals.

Theoretical model

The employment level (E) is determined by productivity (P), the average production of an individual, and the volume (V) of business. Productivity can be expressed as the ratio of employees to volume:

$$(1) \quad P = \frac{V}{E}$$

(2) Thus, $E = \frac{V}{P}$ or as a graph:

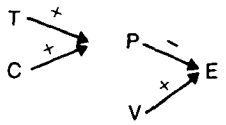


Individual production depends of course on the tools and other means of production available, generally expressed as capital. Here we will distinguish between T, which is capital invested in equipment and other types of technology, and C, which is the financial capital of an insurance company. We then use C and T to differentiate between amounts of technological and financial capital per employee.

$$(3) \quad P = f(T, C)$$

Graphically the relationships might be shown as:

(4)

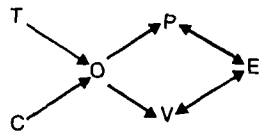


However, according to our thinking T and C are not directly linked to productivity, but mediated through organizational activity. Organization (O) can generally be interpreted to mean how human, technical and financial factors are combined and managed.

A precise mathematical formulation of the impact of O upon P is not possible, but we suggest that O will moderate the effects of T and C in significant ways. For example, we propose that the mere existence of organisation will create a time-lag before change in T or C will have an impact upon P. The time lag can be a function of organizational inertia, of a conscious planning mechanism, or both.

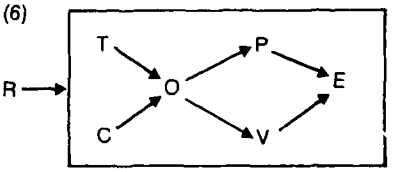
We must also acknowledge that O may also affect volume (V). An effective management can increase V by discovering new market segments for existing products, and by developing new products for existing markets. Similarly, ineffective management or inefficient organization can work to suppress V. When we consider the effect of O, the model now becomes:

(5)



Of course we must also take into account the regulating mechanisms of society (R). Our complete model then assumes the form:

(6)



where

- E = Employment level
- T = Technology
- P = Productivity
- O = Organizational Factors
- C = Financial Capital
- V = Volume
- R = Social Regulating Factors

We briefly discussed technology earlier. We now turn our attention to the remaining variables.

Productivity (P)

According to our model, one reason why employment has not gone down in spite of rapid technological change could be that no increase in productivity took place. However, Table 5 shows that there actually was a productivity increase and that employment rose in spite of such an increase. The relationship shown in Table 4 holds also on the individual company level. Four companies out of five showed an increase in productivity in the period following computerization.

Both premiums and value added have been adjusted for inflation before calculating productivity changes. Valued added is defined as premiums and interest received during a year by the company minus premiums paid for reinsurance, and money paid for claims settlement. The value added is the amount which remains at the end of the year for immediate or future distributions between the stakeholders, ie the owners, the policy-holders and the employees. The value added could be said to be the money the policyholders are willing to forego in order to be insured. The value added could therefore be interpreted as the consumers' estimation of the value of product provided by the insurance industry.

Assuming constant volume, an annual increase in productivity of 3% would halve the labour requirement in 20 years; and if productivity had risen at the upper limit of the predicted effects of technological change computerization would have led to massive lay-offs.

Though the productivity figures shown here are substantial, they are probably lower than what the critics of technological development have feared and what rationalization-experts have hoped for. One reason for overestimation of productivity gains is that considerable gains can be observed in the areas most affected by a new technology and that these changes are then generalized to functions less affected by technological change. We have actually been able to observe yearly personnel reductions of about 6% in some production departments during the period of computerization. At the same time the number of employees in some customer-oriented units and especially in the units dealing with systems development have increased.

It should be noted that there were yearly productivity gains even before computerization. This may indicate that, at least for the insurance industry, productivity increase is a function of ongoing standardization rather than just a discontinuous outcome of computerization. If this is true it is likely that there are mechanisms of coping with undesirable effects of productivity increases and that those mechanisms long since have been developed in and around the insurance industry.

Volume (V)

Figure 2 shows that there has been a considerable yearly increase in the volume of insurance business. The main reason for this is of course that households and companies have an ever increasing capital to insure. But volume is also affected by management action. The largest company has for example become successful in international markets. Also government regulations may increase volume, eg by stipulating stricter responsibility for the products and services that businesses and local authorities deliver to consumers.

Volume is not necessarily the same as the number of insurance policies sold. Companies are also trying to expand business by improving quality of services and to sell new, more complicated policies.

The general conclusion that observations on volume support, is that no predictions can be made about the impact of technology on employment without making assumptions about future business volume.

The impact of financial capital (C)

Figure 2 shows that financial capital has increased steadily for the industry. However, we have not been able to find any relationship beween increase in financial capital and increase in premiums per employee. Thus changes in financial capital cannot explain the productivity increases in terms of premiums which we observed after the introduction of computers. On the other hand there is a clear relationship between increases in value added per employee (see Figure 4). One could even dare to hypo-

Table 5: Productivity increase in the Swedish insurance industry before and after computerization

Volume measured in:	Yearly productivity increase before computerization (1941–1961) %	Yearly productivity increase after computerization (1967–1979) %	Net change in productivity %
Premiums	1.7	4.6	+ 2.9
Value added	1.3	7.0	+ 5.7

thesize that increase in productivity measured as value added is mainly an outcome of changes related to the financial capital.

If, as we have indicated here, the effective handling of capital is the *real* business of the insurance industry, value added should be a better basis for productivity estimates than premiums. Computers may well add to better financial management but a host of other factors is also important. What is significant is that increases in value added may be used to increase employment in future periods, thus reducing traditional pressure for rationalization. If increased surpluses are going to be used for employment it is of course partially a matter of union strength and political considerations and partially a question whether management thinks that a high staffing level will enhance the companies' competence in information mediation.

In this connection it is worth noting that the economic result of the insurance business is very much dependent on the financial return of its capital. A variation in return on capital of two percent is equal to all labour costs in the industry.

As noted above the *real* task of the insurance industry may be to obtain as good as possible investment alternatives for the premiums paid by the customers. Since the value of the funds which the industry deals with is so much higher than the costs of transactions in relation to the insurance policy, it could be hypothesized that improvement in the financial performance of a company will carry more weight for that company's future development than

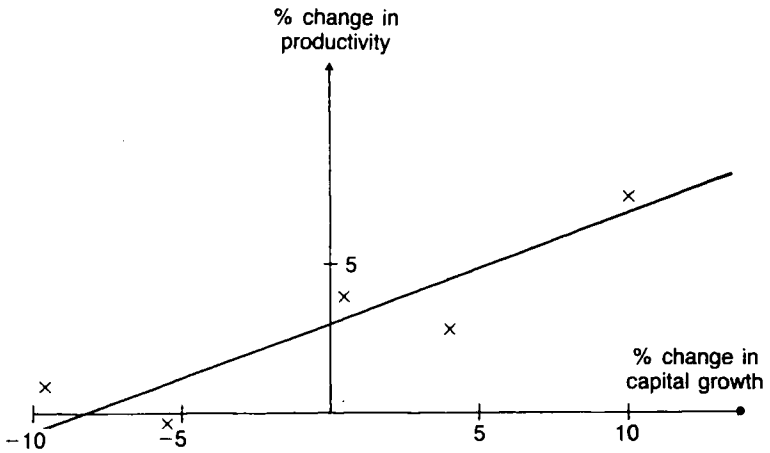


Figure 4: Relationship between increase in productivity (value added per employee) and increase in rate of growth in financial capital (per employee). The observations were taken from five especially studied companies. Their yearly rates of change after computerization (1967–79) were substracted from their yearly rates of change before computerization (1941–1961)

changes in the efficiency in handling office work.

Perhaps that hypothesis can be generalized to mediating technologies at large. The volume of business which is being demanded from an organization engaged in the mediation of information is related to the value of the information mediated and not mainly to the cost of mediation.

Even if we did not study the handling of financial capital in a systematic way, casual observations lead us to think that management of capital has been paid much more attention lately than earlier in the insurance industry. A professional finance analyst has become chief executive officer of the largest insurance company and companies are looking for ways to substitute low yielding-assets for assets with a higher rate of return. Attempts are also made to convince authorities to give the industry a free-hand in financial placement policy.

Organizational factors (O)

There are many reasons why organizational factors have to be taken into account when the effects of technology are contemplated. Our argument builds on the conception of the firm as an information handling and decision-making system as suggested by March and Simon [15].

According to this line of reasoning, environmental changes do not affect an organization in a direct and mechanical way. Instead information about technological change has to be perceived and digested by members of the organization. In order to decide about buying a new technology, time consuming–decision making processes have to take place, followed by a lengthy process of adaptation and organizational learning. In addition, all these organizational processes are liable to misinterpretion, cognitive limitations and human error. This means that the adaption process will take time. The existence of a considerable time gap between technological change and the mastering of a new technology by an organization means that there is only a loose coupling between technology and effects [16]. So many other things will have time to affect and disturb the organization that it will be very hard to isolate effects of one type of outside change, such as technology.

Our argument also means that adapting to a new technology is resource consuming. Therefore, at least for some time, employment may increase during the change process: new specialists are needed to handle the new technology, people are needed for making studies and sitting in meetings, political infighting consumes resources, trainers are needed to teach the old employees the new system, alternates are needed to run the business when ordinary jobholders are away for training, and additional labour may even be needed to clear up the mess created by the switch-over. If the lag time and the temporary need for more people are combined with an assumption of technical and environmental changes happening fairly regularly, we have built a case where technological change actually could result in lower productivity and higher employment levels than under stable conditions. The corollary of this is of course that a moratorium on technological change may actually increase productivity levels and lower employment levels.

In our study companies we made a number of observations indicating that the theoretical reasoning above was mirrored by the following developments:

1. *Personnel policies agreed upon by management and unions:*
   For example, education of current employees instead of lay-off.
2. *Decision-making process takes time:*
   Different interests are consulted in the decision- and implementing process. The unions have a right to negotiate formally with management before a decision is made.
3. *Resistance to change:*
   For example, managers resist any loss of importance of their function. Active behaviour from groups of employees or unions may focus upon the new technology and slow down the adaption process. They therefore search for new functions to perform.
4. *Learning takes time:*
   It takes time to leave an old task or job and learn a new one.
5. *Emphasis on quality:*
   For example a shift towards more quality in the product or service may require more labour.
6. *Changes generate employment themselves:*
   A change from one administrative system to another may create temporary double staffing, both for back-up and to correct unpredicted short comings.

These factors and possibly others as well

extend the response time for an organization's reaction to technological change.

During the adjustment interval, new changes may hit the industry from the outside and require yet more adjustments which tend to temporarily increase the employment level. To what extent these organizational factors are valid is due to cultural differences determined at the societal level.

Social regulating mechanisms (R)

The impact of social regulating mechanisms was emphasized earlier in this paper. The authors believe this aspect to be one of the most overlooked in the question of technological development. At the most basic level are unwritten social values toward the value of work in people's lives. At the more visible level are specific governmental policies (presumably reflecting societal desires) toward work and employment.

Sweden has historically been very active in employment legislation. Management's right to manage has been slowly eroded in favour of granting more influence to labour in questions of working life. Legislation at the end of the 1970s established the norm of 5-week vacations for most workers. This of course subtly redefines the concept of 'full employment'. Rights for parents to stay home with their children combined with economic compensation for those who do so have contributed to women's tendency to work part-time. Sharply progressive taxation also makes part-time work more attractive. The Security of Employment Act, which imposes certain restrictions on the employer's right to freely employ, lay off, give notice and dismiss employees, was established in 1974. The Co-determination Act (Medbestämmandelagen) of 1977 gave labour much more power in decisions affecting work. The wage earners' funds which started their operations in 1984, will eventually increase union control over strategic decisions. The implications are obvious in terms of a company's flexibility in questions of employment levels.

Of course other rules and regulations may also intervene in the effect of technological change. Some of them were mentioned in the previous section on the Swedish labour market.

It has not been the aim of this paper to develop the ideas of how these regulating mechanisms work, more to focus on their existence. The authors believe that there are not only buffers or absorbers in the process, but also that it is possible to imagine motivators or multipliers. These expanding or contradicting forces always affect the employment-level to some extent. When these mechanisms are taken into account the question of technology and employment may be less frightening.

Conclusions

The empirical study underlying this discussion presented convincing evidence that dramatic technological change in the Swedish insurance industry was *not* accompanied by reduced employment, but in fact the opposite [17]. This result is in conflict with the conventional wisdom that technological advancement will result in unemployment. The authors accept the idea that new technology *can* result in unemployment, but argue that there are moderators to that effect. We have proposed a theoretical model describing such moderators, and have included aspects of individual productivity, business volume, and capital structure but focused also upon organizational factors and social regulation mechanisms.

We point out that these factors and regulating mechanisms are empirically based on the Swedish case and corresponds to our knowledge of organizational theory and political science. The suggested model is a way not only for scholars but also for politicians and other actors of the society, to dig deeper into the dilemma of technological change and employment. The model presents the general proposition that effects of technological change always will be mediated and regulated by organizations and society. Factors and mechanisms will be different in different cultures, but patterns may be common. In this article we have focused upon absorbers and inertia in the adaptation process. By that we do not imply that those are the only intervening factors around. There are not only buffers or absorbers but perhaps motivators or multipliers as well, although such factors are not discussed in any detail in this case. To some extent this could be explained by the fact that this paper is based on an historical study in a period of growth in Sweden. The same power of resistance to change may not be developed in other industries or even in the future in the insurance industry. That is why our paper cannot be generalized to predict

future employment levels in Sweden or elsewhere. However, we are convinced that there always has to be a discussion of social regulating mechanisms to understand technological change and its effects on the society.

The technological change we have concentrated on is large scale introduction of VDUs with on-line access to central computers and databases. Of course it can be argued that another technology, for example micro-computers, may have so much greater potential for productivity increases that our results cannot be used to hypothesize further changes in employment levels. Though our results cannot be used for prediction, we hold that effects of any technology cannot be understood without reference to demand, organizational pecularities and social regulating mechanisms.

Clearly the model must be developed by further research. That can be done by comparing organizations in different industries, vis-à-vis their response to technological change.

Preferably however, this could be done cross-culturally, to assess the effect of social regulating mechanisms at the societal level. Comparing results of technological change and coping mechanisms in an advanced welfare economy such as Sweden with an advanced capitalist economy such as that of the USA would be instructive.

In proposing this preliminary model, the authors ask the reader to examine the premises of the technological imperative. We believe the reader will, like the authors, find those premises to be inadequate for a complex world.

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