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**Complex and Diverse Ict in four Types of Organisation;
differences in stress-related risks and monotonous work?**

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Summary

In this study a research model, which has been proposed for research on the topic ict and work, is tested on its empirical tenability. Here, the model consists of the concepts ict use, a typology of organisation and their relationships with the quality of jobs. Only in interaction with organisational decision making ict can influence the quality of jobs. At least so do Batenburg et al. (2002), the original drafters of the model, state and assume, thereby principally rejecting the idea of technological determinism.

Although this research, among 1,357 employees, shows that only dependent of the type of organisation complexity and diversity of ict use have several influences on the quality of jobs, also some direct effects of ict use appear. The latter giving support to the gist of technological determinism. Therefore, extension of the original model with for instance the role of players in the technology market is recommended.

Furthermore this study supports the idea that within the socio-technical type of organisation ict use has the most favourable results on the quality of jobs, defined in terms of stress-related risks and the prevalence of short cyclical labour. As this contribution of ict use is consistent with the contribution of the management and production structure, the qualification 'Integral Organisational Innovation' is appropriate for these organisations. But the research unexpectedly showed, apart from some negative results, also some positive results for the tayloristic type of organisation as regards the quality of jobs. These appeared as jobs were characterized by a more complex ict use. Apparently also in dutch organisations, and that is in line with Van Hootegem's findings (2000) for the situation in Belgium, 'more roads lead to Rome', in this case roads to a good quality of dutch jobs.

1. Introduction

The principal aim of this paper is to examine the empirical tenability of a model proposed by Batenburg et al. (2002a; 2002b) for examining the relationship between ict (information and communication technology) and the quality of jobs. The conditions under which a relationship between ict and work 'may be possible' will be the special focus of attention. The point of departure of this research is the idea that ict can only have an influence on the quality of jobs in relationship with the

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management and production mode chosen by the organisation. After all, the management and production structure chosen by the organisation reflects either explicitly or implicitly its ideas on how work can best be organised (Benders, 1993). For when technology is implemented, the very choices made by the organisations will be decisive for the way in which jobs are designed. Batenburg et al. also reject the thought that technology has a determining influence on the quality of jobs.

Within the field of socio-scientific organisational research, technological changes in relationship to organisation and work have always been an important research theme (see for an overview: Benders, 1993). Socio-technical theory, for instance, owes its name to it.

Besides, in the past there were optimistic views of the consequences for the quality of jobs. Kern and Schumann (1984), for instance, thought they saw a return of 'craftsmanship' in the wake of the rise of new types of organisation in core sectors of German industry. But there were also more pessimistic views. Braverman (1974), for example, pointed to degradation tendencies in the quality of jobs as a result of technology and thus increased possibilities for direct control of newly created unskilled labour.

More recent research has proved that the relationship is complex and can turn out differently for varying groups (see e.g. Steijn et al., 1992; Benders, 1993; Van Hootegem, 2000).

Socio-technique as developed in The Netherlands by De Sitter (1982; 1994) in particular, offers a (re)design oriented approach together with an elaborate integral system theory. It is very feasible to conceptualise the relationships that are to be examined here with the help of its terminology. Moreover, it pays explicit attention to the quality of jobs. The object of study of this Modern Socio-technique (MST) partly overlaps, or is a reaction to the work of Taylor and his scientific management doctrine. There is also overlap with the organisational dimensions researched by Ohno that eventually resulted in the Japanese lean production concept (see for a more detailed discussion e.g. Van Hootegem, 2000).

On the basis of the theoretical framework of socio-technique it is possible to formulate a simple ideal typical organisation typology. This will be defined here in terms of the management structure and production structure of the organisation.

Now that the term organisation has been defined to a certain extent, the 'container term' ict needs to be defined too, for it is a too comprehensive one. The importance of such a specification was also apparent in previous research (Dhondt et al., 2001; Benders et al., 2002; Kraan et al., 2003; 2004). Or, as Huijgen (2002) puts it simply: "working with a cell phone is simply different from working with a particular kind of SAP" (ERP) (Huijgen, 2002). In a recent research named 'Verzonken Technologie' (['Submerged Technology'] Van Damme et al., 2005) that was done together with researchers from SCP, EUR/AIAS and TNO, we divided the great variety of technologies occurring at the shop floor into three dimensions. The dimensions of ict examined relate to the complexity, diversity and intensity of ict use. The reduction of ict use of employees in accordance with these dimensions appeared to be a procedure in which it was possible to preserve the core characteristics.

Finally, in this research the quality of jobs will be defined as the quality of the job content (see e.g. Project group Weba, 1989, Vaas et al., 1995).

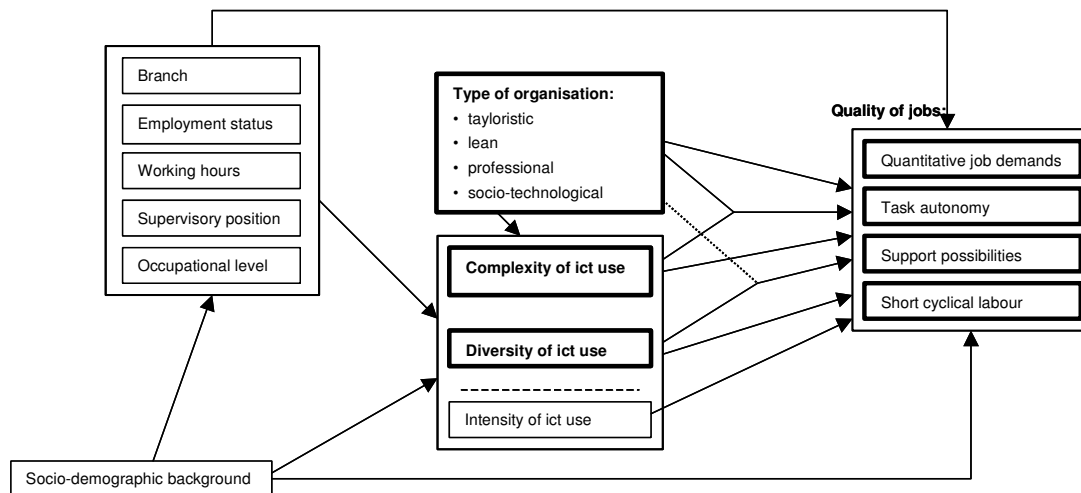
The following paragraph elaborates on the theoretical background of the research model and ends by formulating the central research question and hypotheses; these serve as a guiding principle for the empirical part of this research. In the subsequent paragraph the method, the data and the operationalisation of the concepts will be dealt

with. A discussion paragraph concerning the most important findings concludes this research.

2. Research model

In order to test the relationship between ict use and types of organisation on the one hand, and the quality of jobs on the other, it is necessary to specify a conceptual or research model. The point of departure is the model used by Batenburg et al. (2002a; 2002b). Figure 1 shows which concepts have found their way into the study presented here and which relationships are to be examined; the central concepts that will be dealt with in this paper, are printed bold. Parts from the model were also tested by us in previous research (Kraan et al., 2003; 2004).

Figure 1. Conceptual model (adaptation of the model of Batenburg et al. (2002a; 2002b)).



The model used by Batenburg et al. is, among other things, inspired by conceptual models used by Ten Have & Vissers (1987), Kommers (1991) and Benders (1993). The gist of the model used by Ten Have & Vissers is that the complexity of the environment and the technology and labour market within which the organisation functions, influence the technology used and other organisational dimensions, such as the production and management structure. These, in their turn, influence the *task pool*. Introduction of ict often entails a new or modified task pool from which jobs have to be created or adjusted. Introduction of ict, for instance, can lead to automation of certain executive tasks, but these can be replaced by other low or high skill executive tasks and/or operating and programming tasks (for examples see e.g. Benders, 1993; Van Hootegem, 2000). The final design of the ‘job structure’ in an organisation and the quality of jobs by which it is characterized, depends on the choices made by the decision makers in an organisation. At least, these are the points of departure of the model used by Batenburg et al. It is to be expected that the organisational decisions will match the management or production structure that the organisation will introduce or that it already possesses. One extreme is a ‘job structure’ that, in line with tayloristic principles, is characterized by a strict division of labour in which, among other things, regulating

and executive tasks are separated from each other and executive tasks are split up and, with the introduction of technology, reduced to a minimal span of time. At the other extreme of the continuum the complete functions designed along socio-technical principles are to be found.

It is important to bear in mind with respect to this model, that, as Batenburg et al. argued, the influence of ict on work cannot be direct, because it takes place through decisions on how to design jobs from the new or modified task pool. However, the authors also argue that it is about 'conscious or non-conscious' choices of organisational decision makers. In order to assess to what extent the starting-points behind this model work in practice, relationships that do not agree with the view emphasizing organisational choice will also have to be tested. Together with these relationships belong the direct relationships ('arrows') of ict use to the quality of jobs. If these relationships exist in the data, this may point to technological determinism. As stated, the point of departure here, following the model used by Batenburg et al., is not technologically deterministically inspired: for technology and software in particular can be set up in a flexible manner. At least in theory that is the case. But in reality certain technological systems will, on account of their complexity and the influence of technology constructors, of course, be described more frequently in terms of similar consequences for the quality of jobs, irrespective of the organisation structure chosen. Illustrations of this phenomenon are to be found in Dhondt (2000), Van Hootegem (2000) and Kraan et al. (2002). In these case studies changes in the production structure, management structure and work organisation appeared frequently after the introduction of new ict. These changes were mainly induced by technology. As a matter of fact this comes down to technological determinism. Presumably Batenburg et al. are carrying things too far in stating, in the model they propose for research into the relationship between ict and work, that this relationship cannot be direct, but is always mediated by organisational choices. These authors also referred to 'conscious or non-conscious' choices. But a non-conscious choice rather suggests that technology has 'crept inside' and can have its own determining influence.

These themes lead to the following central research question:

- *What is the relationship between information and communication technology and quality of jobs and what role is played here by the types of organisation?*

The research question is accompanied by the following hypotheses:

- *H.1: The use of complex and diverse ict only influences the quality of jobs when depending on the management- and production structure.*

Hypothesis 2 follows from H1 naturally:

- *H.2: Use of complex and diverse ict has the most favourable effects on the quality of jobs within organisations with a decentralized management structure applying group work.*

Ict has been isolated as a separate organisational dimension here. For, from the point of view of the postulated research model, the very effect on jobs produced by ict together with - the design principles behind - the management and production structure is interesting.

The production structure and the management structure of the organisation are relevant to the quality of a job or the work-related risks, because the production structure indicates how 'something' is going to be made in the organisation, how the work will be prepared and supported. The management structure has to do with the way problems at work are solved. At job level the production structure influences the scope and content of the tasks. The management structure influences the possibilities

of carrying out the set tasks in a job, the so called regulating possibilities (Vaas et al., 1995). Special attention will be paid to the effects on both stress-related risks in jobs and learning and developing opportunities offered by the job. These will be operationalized with the help of work load, task autonomy, support possibilities in the job and the degree to which monotonous, short cycle labour occurs.

Naturally, the type of organisation is expected to be a determining factor in relation to these four indicators of the quality of jobs and this influence is expected to be reinforced both by the complexity and the diversity of ict use (interaction with the intensity will not be taken into consideration on account of its limited effect; see Van Damme et al., 2005). Thus the effect of ict use on the quality of jobs in tayloristic organisations is more likely to go together with an automation strategy resulting in a clustering of monotonous (remaining) tasks in jobs without regulating tasks (see e.g. Steijn, 2001).

Furthermore, although there won't be given much attention to this in the discussion of the results, the following relationships are expected to be found. The tayloristic type of organisation will, as a result of the strict division of work envisioned, be characterized by functions with limited autonomy, limited support possibilities, strongly boosted task requirements and short cycle tasks. For the socio-technical concept the very opposite applies. In the lean type of organisation, which is also characterized by teamwork, the support possibilities in the jobs can also be expected to be relatively prevalent, but the jobs will, in spite of the 'autonomy' of the employees in this concept to make proposals for improvements, also as a result of this 'autonomation' be characterized by limited task autonomy and short cyclical labour. The autonomy in the fourth concept of the typology – the 'professional' type of organisation (Steijn, 2001) – is presumably greatest because the autonomy does not have to 'suffer' from team autonomy, as may be the case in socio-technical teamwork. But, due to the absence of teamwork, the support possibilities within the professional type of organisation will be relatively limited. It is harder to predict the influence on the other dimensions of the quality of jobs in this 'mixed' concept, which lacks a theoretical foundation.

The influence on the employment relationships will not be taken into consideration here (see for this aspect Van Hootegem, 2000). Nor will the quantitative structure of employment and the relationships maintained between organisations (see Dhondt, 2000 and Van Hootegem, 2000) and other influences by the organisation environment, with the exception of sector influences, be dealt with in this research. Finally, the ultimate consequences of good or poor quality of jobs for the outcomes of employees, such as health and RSI complaints and, in traditional terminology, 'alienation' will not be examined here. For there is a lot of factual evidence about those relationships based on earlier research.

3. Method

Data

In 2002 TNO Work and Employment carried out an extensive survey of 'Work in the Information Society' among employers and their employees. For the collection of data among employers the NIPO Business Monitor was employed. This is a continuous telephonic collection of data by a panel of employers in Dutch profit sectors. We chose to select only employers with ten or more employees. We included the question whether the respondent was prepared to distribute questionnaires among a number of his employees. If the employer was prepared to do so, a set of

questionnaires with instructions on how to distribute these were mailed. Businesses with ten to thirty employees were required to give questionnaires to all employees. Businesses with more than thirty employees were requested to distribute thirty questionnaires at random among their employees. Out of 1,020 employers 539 (53%) responded positively to the question as to whether they were prepared to distribute the questionnaires. The actual employee response of 1,357 questionnaires comes from 241 businesses (24% of the total number of businesses in the random sample). Sample bias, for example, towards educational level or ict use is adjusted for in the analyses.

In the employee questionnaire, which was carried out in 'paper and pencil', we had a good opportunity to formulate questions about, among other things, ict applications, type of organisation and the quality of jobs. This paragraph proceeds to discuss the operationalisation of these concepts.

Operationalisations

Three aspects of ict use

The questionnaire contains a module of 25 ict applications, developed by Tijdens et al. (2002), for which the respondent was requested to indicate which of these he applied professionally.

As mentioned above, with researchers of SCP, EUR and AIAS the 'container term' ict use was conceptualised into three aspects, i.e. complexity, diversity and intensity. As far as we know this itemization is an innovation in the research into the use of ict, organisation and work.

Complexity of ict use

The typology of the complexity of ict use will be illustrated in most detail here, as this requires some explanation in contrast to the diversity and intensity of the ict use. The TNO-employee questionnaire 'Work in the Information Society 2002' contained questions about the level of difficulty of the main tasks of the job. We selected the users who work with one of the soft- or hardware applications four hours or more a day and examined the complexity of their jobs.

The relation between, on the one hand, the use of soft- and hardware and, on the other hand, the complexity of the functions, had a high face validity.

On the basis of the results we categorized the soft- and hardware applications as follows:

- simple applications: EDI (electronic data interchange); automatic cash register; scanning equipment; digital measuring equipment and controls;
- basic applications: computer – either connected to network or mainframe; laptop; palmtop; PDA (personal digital assistant); working with MS Office-like applications (software for word processing; spreadsheets; presentations; databases); Inter-, intranet; electronic calendar; e-mail programme; newsgroups/ mailing lists;
- complex applications: DTP-programme; statistical software (e.g. SPSS); Enterprise Resource Planning software (e.g. SAP, Baan); workflow software; robot; computer operated machines (NC/CNC).

Subsequently we included employees who did not work with soft- or hardware or less than four hours a day. Of course this can lead to combinations. For example in the case of an employee working both with a simple application and a basic application. In such a case we hierarchically assigned the score 'basic' use. As appears from the above mentioned list of ict applications, in the typology we do not make an explicit

distinction between soft- and hardware use; we have assigned the complexity scores of soft- and hardware use a determining function in the division. The construct complexity of ict use obviously still has the value of non-use. By the way, few respondents belong to that category. In following steps finally we examined the further validity of the typology that thus emerged, for instance by crossing it with the type of profession (see Van Damme et al., 2005). The results of these exercises rose to our expectations.

Diversity of ict use

Making the diversity of ict use operational was a straightforward process. For each ict application the respondent was asked to indicate whether or not he uses this application. We made the diversity of the use operational as the number of information and communication technologies ticked off.

Intensity of ict use

In order to determine the intensity a question was included concerning the average number of hours a day the respondent works with a mouse, key-board or other input device for the computer (e.g. trackball, joystick, touch-screen, etc.).

Type of organisation

On the basis of a combination of the control and production structure, a distinction was made into four ideal types of organisations.

Firstly, in the tayloristic organisation type, for example, our definition involves a centralised management of employees: employees have little to no influence on the decisions of their department; they cannot call in people from other departments when problems arise and do not discuss division of tasks and task planning among themselves. In short, the regulating tasks at group level are limited to absent. The extent to which the functions contain these 'organizing tasks' was measured with four items (Cronbachs alpha = .62) and this scale was subsequently split at the median. Secondly, the way in which the production structure was developed was measured with a question in which team-based work is central, i.e. whether 'the employee performs the work in an semi-autonomous task group/self controlling team (note: consisting of more than eight people who divide the work among themselves and, among other things, monitor quality)'. A production process not characterized by group work is the second characteristic of the tayloristic type of organisation in our definition. In the case of team based production but a centralized management structure we defined the type of organisation as lean group work. However, if the group work is characterized by a lot of regulating tasks at group level, the type of organisation is called socio-technical. If, in line with with the tayloristic type of organisation, there is not a production structure consisting of semi-autonomous task groups/self managing teams, but if the directing of the production takes place in a decentralized way, we have, what Steijn (2001) calls, a professional type of organisation.

The quality of jobs

The quality of jobs, or more specific job content, is determined here by means of a selection of modules from the NOVA-WEBA questionnaire, originally developed by Dhondt et al. (1992). This instrument lists various aspects of the quality of job content and has its theoretical background in predominantly the work of Karasek (1979), De Sitter (1982) and Hacker (1983). The quality of a job is defined in terms of risks in

the job for the well being of employees. Of a risk for one's well being can be spoken in the next cases:

- Firstly, when people are overloaded mentally by work. In that case work leads to (permanent) stress reactions and burnout.
- The second important health risk is formed by work offering people insufficient opportunities to learn in and through their work and to develop further.

In this research the quality of jobs has been measured with the following indicators:

- quantitative job demands: measured by five items about the quantitative workload, time pressures and work pace (Cronbachs alpha = .79);
- task autonomy: the extent to which the job has independent regulating possibilities with regard to work pace, order and method (Cronbachs alpha = .69);
- support possibilities: the second regulating task to meet the job demands; measured here by means of the item "colleagues help in getting the job done, if necessary".
- short cyclical labour: measured with the item "Do the same short lasting tasks recur all the time in your job?"

Conducted analyses

For answering the central research question and the testing of the hypotheses, analyses were conducted using software for linear structural equation modelling (LISREL).

All associations are adjusted for the background variables of the model, such as branch, socio-demographic factors and the job characteristics employment status, supervisory position, occupational level and the number of working hours. Because of the often found combined influences of the type of organisation and ict use on the quality of job content (last columns in table #1) a lot of attention will be paid to these influences².

4. Research findings

Below per indicator of the quality of jobs, firstly the main effects of the types of organisation and ict use will be dealt with. Secondly, their combined influences - the interaction effects - are dealt with. Table #1 shows a summary of the results. In table 2 in the appendix presents the exact coefficients and the coefficients of the other relationships in the model.

² In this text only effects greater or equal to .10 will be highlighted.

The interaction effects have to be visualized by means of figures. The four types of organisation are represented by the direction and strength of a significant relation (with $\beta \geq .10$) between an aspect of ict use on the one hand and an aspect of the quality of labour on the other hand. The lines are based on the unstandardised regression coefficients. In each figure the line per group reads as follows: the middle of the line corresponds to the mean of the variable on the x-axis and the mean of the variable on the y-axis. The length of the line measures two standard deviations of the group.

Table 1. Overview of the results: quality of jobs influenced by the type of organisation, complexity and diversity of ict use and the type of organisation, complexity and diversity of ict use together (interaction effects).

| Quality of jobs: | Type of organisation: | | | | Ict use: | | Interaction of the types of organisation and ict use: | |
|--------------------------|-----------------------|-----------------|--------------|-------------|------------|-----------|---|-----------|
| | lean | socio-technical | professional | tayloristic | Complexity | Diversity | Complexity | Diversity |
| Quantitative job demands | 0 | 0 | 0 | 0 | 0 | + | ja | ja |
| Task autonomy | - | 0 | + | - | 0 | + | nee | nee |
| Support possibilities | 0 | + | + | 0 | + | - | ja | ja |
| Short cyclical labour | + | 0 | - | + | 0 | 0 | ja | ja |

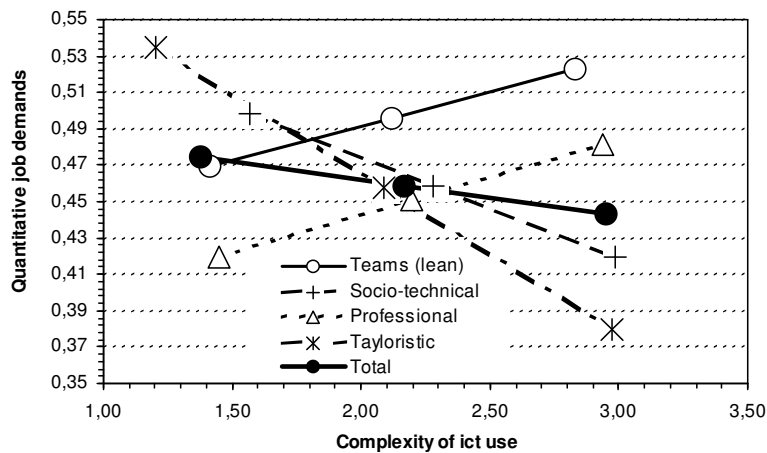
Note: the symbols + (more), - (less) en 0 (no effect) indicate the direction of the association. All associations are adjusted for the background variables of the research model.

Quantitative job demands

The analyses do not indicate differences in the height of quantitative job demands between the types of organisation (see also table 1).

However, the diversity of ict use does appear to have influence on the quantitative task requirements: use of more diverse kinds of ict goes together with a greater amount of work the employer has to carry out. The analyses do not show a connection between the other dimensions of ict use – the complexity and intensity of ict use – and the quantitative task requirements.

Figure 2. Job demands influenced by complexity of ict use and type of organisation (interaction effect).



But the complexity of ict use and the type of organisation do have an interaction effect on the quantitative task requirements of jobs. As also illustrated in figure 2, more complex ict use within lean and professional organisations goes together with an increase of quantitative task requirements in jobs, whereas increase of the complexity of ict use within tayloristic and socio-technical organisations by contrast goes together with a decrease of the quantitative task requirements within jobs. This could be accounted for by the fact that employees in lean organisations, for instance as a consequence of ‘autonomation’, lose ground if more complex ict is applied, for example with the introduction of workflow and ERP systems. Task requirements will increase further. In socio-technical organisations a workflow system would actually cause a decrease of task requirements through its standardized and routinizing character. It comes out that the same holds true for jobs in tayloristic organisations.

This might be a consequence of a reduction in the volume of *manual* machine paced work that has to be done for, by now, it can be taken over by the software.

Task autonomy

As expected, autonomy is most favourable within organisations with a professional type of organisation; employees in tayloristic and lean organisations have relatively little task autonomy, while organisations with a socio-technical type of organisation have a half way position.

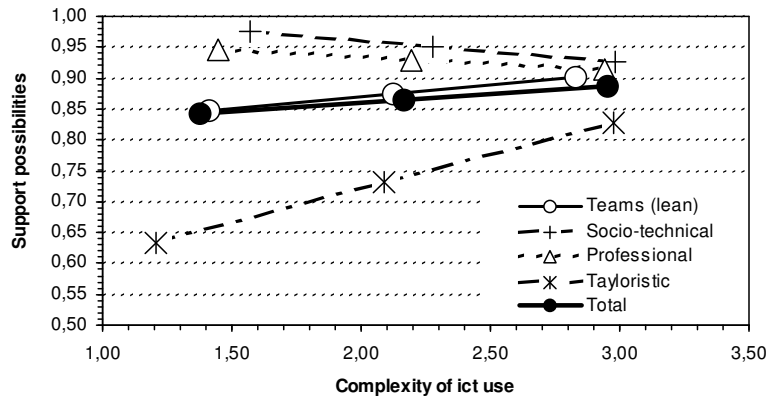
Also more diverse ict use goes together with a greater degree of task autonomy in the job. However, greater intensity or complexity of ict use does not go together with greater task autonomy. The analyses do not show combined influences of ict use and type of organisation.

Support possibilities

There are substantial differences between types of organisation and to what extent employees support each other, if necessary. The support possibilities are greatest in socio-technical and professional organisations. In tayloristic organisations support possibilities are relatively unfavourable. Lean organisations score in between the two. Employees working with more complex ict have somewhat more favourable support possibilities when performing tasks. The opposite applies to diversity of ict use: a more diverse ict use goes together with fewer support possibilities in the function. But the effects are weak.

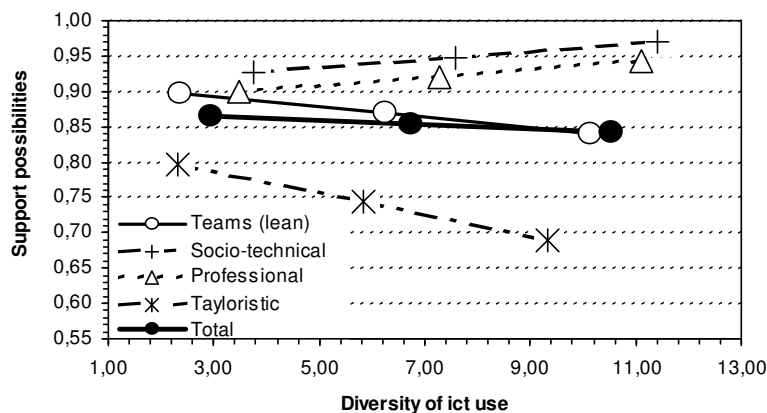
Besides, the type of organisation, together with the complexity and diversity of ict use, influences the support possibilities of jobs. Jobs within tayloristic organisations are characterized by more favourable support possibilities the higher the complexity of ict use is (figure 3). On the other hand, this relationship is absent in the other types of organisation. That appears to be an unexpected result, but as figure #3 shows, the support possibilities within these types of organisation were already favourable. Therefore, it is only an indication of a reduction of the lag of development of tayloristic organisations, as a result of using complex ict. It could point to deconcentration of support services towards executive departments within tayloristic organisations. Examples of this phenomenon are to be found in the case studies presented by Van Hootegeem in 'De draaglijke traagheid van het management' ([‘The bearable slowness of management’], 2000). Although many organisations cling to the traditional line organisation which is typical of work at the conveyor belt, there is sometimes decentralization under the influence of technology. Apart from this decentralization, however, defunctionalization of preparation and support were hardly under discussion. But the fact that the preparatory and support jobs, such as planners and maintenance engineers or helpdesk assistants respectively, have now come more closely to the operational level, may explain the increased support possibilities.

Figure 3. Support possibilities influenced by complexity of ict use and type of organisation (interaction effect).



In contrast with the complexity of ict use, more diverse ict use within tayloristic organisations goes together with less favourable support possibilities (figure 4). In the other three types of organisation this relationship between diversity of ict use and support possibilities is absent. It is plausible that this is due to the emergence of some specialist jobs within the tayloristic type of organisation; these jobs are characterized by a relatively favourable quality of jobs. Van Hootegem also found several examples of this in his case studies.

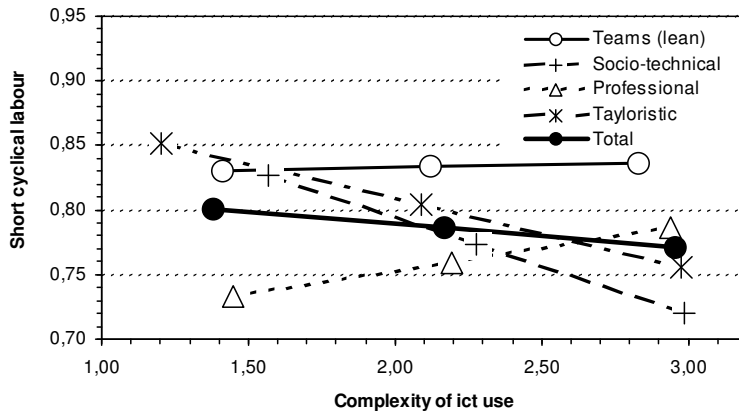
Figure 4. Support possibilities influenced by diversity of ict use and type of organisation (interaction effect).



Short cyclical labour

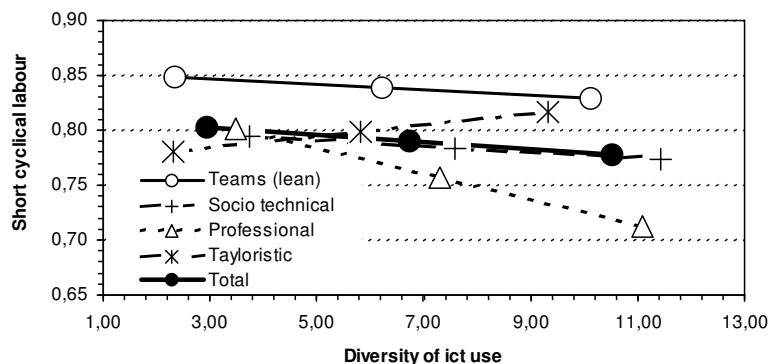
In lean production organisations short cyclical labour is most prevalent. As compared with especially professional organisations, work in these organisations consists, to a greater extent, of the same short lasting activities all the time. The analyses do not show a direct connection between ict use and the extent to which short cyclical labour occurs in jobs. In combination with the type of organisation, however, ict does have influence on the quality of jobs.

Figure 5. Short cyclical labour influenced by complexity of ict use and type of organisation (interaction effect).



As illustrated in figure 5, increase of the complexity of ict use goes together with a decrease of short cyclical labour in tayloristic and socio-technical organisations, whereas this connection does not exist within the two other types of organisation. This is probably due to differences between types of organisation in the kind of ict used. In professional and lean organisations more frequently, relatively speaking, more complex ict in the form of ERP, workflow software and CAD/CAM equipment are used (Kraan et al., 2004). These forms of ict standardize the work process, also in professional organisations, leading to an increase of short cyclical labour. On the other hand it can be observed that the more diverse ict use becomes, the less short cyclical labour professional organisations have (figure 6). That also applies, though to a lesser degree, to lean and socio-technical organisations. In tayloristic organisations, however, diverse ict use often goes together with a more short cyclical job.

Figure 6. Short cyclical labour influenced by diversity of ict use and type of organisation (interaction effect).



Discussion

The research has shown that, in order to assess the relationship between ict use and quality of jobs properly, it is necessary to broaden the scope of research into explanatory factors within the organisation. That was most apparent in the analysis of

the relationship between ict use and short cyclical labour. For diversity and complexity of ict use only have influence in combination with a certain constellation of the production and management structure; here called the type of organisation. But that does not mean the rejection of hypothesis 1 (H1): the various dimensions of ict use do have direct influence on the other three dimensions of the quality of jobs examined: quantitative task requirements, task autonomy and support possibilities in the job. This assessment implies that H1 will, after all, have to be rejected. However, there are some objections. For instance, the number of explanatory (organisational) factors will always have to remain somewhat limited in quantitative empirical research, and research into effects should preferably be longitudinal. But, also as regards content, it is plausible that the hypothesis did not prove to be tenable. A critical note concerning the research model on which this research is based was formulated earlier in this paper. According to the authors of the research model, the relationship between ict use and ict implementations on the one hand, and the quality of jobs on the other, always involved the 'conscious or non-conscious' intervention role of decision makers in organisations. The model thus makes itself immune from the determining influence technology may have on the quality of jobs. For the research presented here showed that it is certainly plausible that ict use is related to the quality of jobs irrespective of the existing organisational structures. Of course, the use made by employees depends on the technology present in an organisation. As it is expensive to develop hard- and software or custom-tailored solutions on one's own, organisations are often dependent on the technology market and, often, on external consultants who supervised implementation. This is how a system was able to develop with its own specific features and influence independent from the existing organisational structure and which could actually be conflicting with that structure. The following example may illustrate this point. As regards the occurrence of work pressure, it is interesting to realize that in 1997, with the first generation of workflow software systems, a proportional division of the workload was not really feasible. Only the division along 'roles' such as sales, was possible with these systems (Van de Berg et al., 1997). An extension of the research model used by Batenburg et al. (2002a; 2002b) with determining factors in the technology market might therefore be a useful addition (see also the model of Ten Have and Vissers, 1987).

The results at hypothesis 2 link up with the findings above almost seamlessly. The constellation of ict and the organisation typology used here did not always effect the indicators of the quality of jobs examined in the direction expected. But the research results give (a lot of) support to hypothesis 2. This hypothesis suggests that ict use has the most favourable results on the quality of jobs within organisations with decentralized management that have group work at operational level. This is the socio-technical type of organisation.

The aim of both a good quality of jobs and of the organisation is an important and distinguishing feature of the socio-technical theory. In the organisations mentioned in this research that were designed along socio-technical principles, the design of ict use actually contributes to a good quality of jobs. As this contribution is consistent with the contribution of the management and production structure, the qualification 'Integral Organisational Innovation' is appropriate for these organisations; the term preferred by socio-technologists in the Netherlands to the term socio-technique. But in addition to the results that were anticipated for the socio-technical type of organisation, the research unexpectedly showed, apart from some negative results, also some positive results for the tayloristic type of organisation as regards the quality

of jobs. These appeared as jobs were characterized by a more complex ict use. Apparently also in dutch organisations, and that is in line with Van Hootegeem's findings (2000) for Belgium, 'more roads lead to Rome', in this case roads to a good quality of jobs.

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Appendix. Lisrel results.

Table 2. The four indicators of the quality of jobs influenced by type of organisation, complexity and diversity ict use (direct effects) and the interaction of type of organisation, complexity and diversity of ict use (interaction effects) (analysis adjusted for the model's background variables) ^a.

| Dependent: | working hours | education level | supervisory position | temporary employment status | female | education level | age | socio-technical | professional | tayloristic | manufacturing | retail & wholesale | commercial & financial services |
|-----------------------------|---------------|-----------------|----------------------|-----------------------------|---------|-----------------|---------|-----------------|--------------|-------------|---------------|--------------------|---------------------------------|
| working hours | | | .12** | | -.57*** | .01 | -.11*** | | | | | | |
| occupational level | | | | | -.09*** | .73*** | .06** | | | | | | |
| supervisory position | | | | -.09** | -.23*** | .10*** | .17*** | | | | | | |
| temporary employment status | | | | | .05 | -.02 | -.21*** | | | | | | |
| complexity of ict use | .07 | .08 | .03 | .01 | .01 | .15*** | -.04 | .04 | .00 | -.01 | .19*** | .06 | .11* |
| diversity of ict use | .13*** | .14*** | .01 | -.06* | -.05 | .23*** | .00 | .05 | .03 | -.08 | .06 | .03 | .10* |
| intensity of ict use | .15*** | .06 | -.05 | -.01 | .27*** | .12** | -.12*** | .04 | .00 | -.01 | .08 | .09 | .22*** |
| quantitative job demands | .10** | .04 | .11 | -.03 | -.03 | -.02 | .12*** | -.01 | -.06 | -.04 | -.02 | .00 | -.07 |
| task autonomy | .09* | .09* | .11*** | | .04 | -.01 | .00 | .08 | .14** | .00 | .04 | -.04 | -.04 |
| support possibilities | .03 | .05 | .08* | .07** | .08* | -.12** | -.20*** | .23*** | .20*** | -.21*** | .02 | .11** | .15*** |
| short cyclical labour | .02 | -.16*** | .02 | -.03 | .23*** | -.10* | .07* | -.09* | -.15** | -.07 | .12** | .20*** | .12** |

Table #2 (continued)

| Dependent: | complexity of ict use | diversity of ict use | Intensity of ict use | socio.* compl. ict | prof.* compl. ict | tayl.* compl. ict | socio.* div. ict | prof.* div. ict | tayl.* div. ict |
|--------------------------|-----------------------|----------------------|----------------------|--------------------|-------------------|-------------------|------------------|-----------------|-----------------|
| quantitative job demands | -.04 | .12** | .05 | -.03 | .02 | -.11 | -.01 | -.02 | .06 |
| task autonomy | -.05 | .23*** | .01 | -.01 | .06 | -.01 | -.01 | -.05 | .08 |
| support possibilities | .10** | -.10* | -.08** | -.14** | -.15** | .07 | .08 | .11* | -.05 |
| short cyclical labour | -.07 | .01 | .03 | -.07 | .03 | -.06 | .03 | -.02 | .09 |

* p < .05; p < .01; p < .001.

^a Note: the standardised coefficients are presented. The variable type of organisation has the lean type of organisation as its reference category; the variable branch has as its reference category the construction branch. Chi-kwadraat (73) = 342.27 (p < 0.001), RMSEA = 0.062, CFI = 0.97.