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Dutch Socio technical systems theory – a 'third Way' in the design of work groups?

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DUTCH SOCIO TECHNICAL SYSTEMS THEORY – A 'THIRD WAY' IN THE DESIGN OF WORK GROUPS?

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INTRODUCTION

The organisation of work groups now occupies a central place in the study of employment relations. Godard and Delaney (2000) suggest this preoccupation reflects the decline of institutional bargaining systems in western economies, and the resurgence of interest in the importance of management choice in determining working arrangements. The present paper enters this discussion with a review of the importance of organisational factors in shaping work organisation. In particular it is focussed on the importance of technological arrangements on the form and nature of those arrangements. The work of the Dutch Socio Technical Systems (STS) School is used to illustrate the importance and potential of technology to shape such work arrangements.

The debate about the changes which have occurred in work organisation in the last 20 years has taken a number of paths. A dominant preoccupation in the literature is whether the changes which have taken place are part of a broader shift from Fordist work organisation to an emerging paradigm based on teamwork, multiskilling, standardisation and greater worker autonomy (Belanger , Giles & Murray 2002). More perceptive proponents of the concept of an emerging model, including Belanger, Giles and Murray, recognise that a stable pattern has not yet occurred and that there are tensions within the model. In particular, the extent to which employees have increased decision-making power is seen to vary between countries, workplaces and industries (Appelbaum & Batt 1994; Muller, Proctor & Buchanan 2000; Edwards, Geary & Sisson 2002).

A related discussion has taken place in the labour process literature. Recent work in this tradition has sought to focus on the way in which the characteristics of particular workplaces, such as the degree of unionisation, and the structure of management authority have influenced the extent of workplace authority in the workplace. The labour process literature has moved from a determinist position about increasing managerial control and deskilling of work to accepting the possibility of multiple outcomes (Muller, Proctor & Buchanan 2000; Van Der Zwaan 1999; Smith & Thompson 1998). The case study analysis of this literature provides valuable insights into the specific causes as to why particular attempts to adopt teams with enhanced employee control have had different outcomes.

Another theoretical approach, which questions the likelihood of a unitary model arising in workplaces across countries and also helps to explain the extent of enhanced worker control is the 'societal effects' literature (Sorge 1991; Van Der Zwaan 1999). The ‘societal effects’ literature draws attention to the importance of characteristics of particular labour relations and education systems in aiding or retarding the adoption of innovative work organization and delegation of responsibilities to groups. Support is offered to the impact of country differences on the delegation of responsibilities to groups in the recent EPOC study of new forms of work organization.

The Socio Technical Systems (STS) approach to work organisation had its origins in the work of Trist and Bamworth (1951), whose central argument related technology and work organisation. They argued that these two spheres could be 'optimised', so as to balance the psycho-social needs of workers with production organisation. Subsequent development of the theory, particularly in Australia gave particular attention to the psycho-social needs of workers and tended to focus on the process of introducing changes in work organisation during periods of restructuring. The Dutch approach is more explicit about the importance of attending to production systems as a basis for the adoption of work process which allow work groups to take responsibility for whole tasks. As two of the contributors to this tradition have argued (Van der Zwaan & Molleman 1998):

> …socio-technical theory takes the production structure as its starting point. It also claims that modern production structures require self-organisation and flexibility…. According to this theory the production set-up moulds the organisation of work … and so its flexibility.

Research in the Dutch school has provided a deeper understanding of the way in which production systems influence the possibility or probability of greater autonomy in the workplace (Molleman 1999).

Each of these theoretical traditions provides for a broader approach to understanding the factors influencing work organisation. Together they suggest that there are a range of factors influencing decisions about work organisation including societal, organisational and workplace characteristics. The Dutch tradition brings a renewed emphasis on the particular importance of production organisation and the realization of efficiencies in production through greater flexibility and autonomy within the workplace. The Dutch theorists have used the insights of STS to develop an organisational perspective on work organisation which offers significant advances over the lean production prescriptions now accepted throughout industry.

This paper examines some recent empirical studies of work organisation using these separate approaches as reference points. It will focus particularly on the importance of production systems.

DUTCH MST[1]

The Dutch MST approach is concerned with the redesign of organisations to achieve more efficient and focussed production flows with the devolution of control to whole task groups**.** Underlying this is a humanistic orientation to the production system. Here it is arguable that there is a significant

[1] This section presents a practical account of MST. For the underlying theory based on the German systems theorist Luhmann readers are directed to De Sitter, Hertog and Dankbaar 1997).

difference to the emphasis within lean production on technical efficiency. An understanding of the basic concepts behind MST is assisted by firstly discussing its practical antecedents.

An important influence on the Dutch MST theorists was the notion of group technology, originally developed by Burbridge (1975) (De Sitter, Hertog & Dankbaar 1997). The essence of group technology was the grouping together of machines performing different functions in order to produce families of related products. Another influence was the work of Swedish management writers such as Aguren and Edgren (1980), whose work promoted the idea of focussed factories, where different product lines were constituted as 'factories within a factory'. This idea envisaged the creation of what are parallel product lines with a more strategic focus on product requirements. They also allow the integration of many support functions including quality management, planning and maintnenace, normally arranged in separate functional units, into the production cell.

Dutch production theorists used these ideas to develop an approach to the design of production structures, the technology, factory layout and routing of production, which placed autonomous work groups at the centrepiece of design. Four general design rules were proposed for creating the new system (De Sitter et. al. 1997; Eijnatten & Van der Zwan, 1998) .

The first rule proposes a redesign and simplification of the production structure beginning with an identification of product families. This principle allows, in their argument, production to be aligned more directly with market (internal or external) requirements. This realignment, or 'streamlining'was undertaken through an extensive analysis of all the company's products and services, and the operations required to produce them. A detailed matrix of products by the range of operations required to produce them is then used to develop logically grouped product families. This phase of design was referred to as the 'top-down implementation process, in that it involved a view from the strategic level of the organisation.

The second design rule involved a redesign of control systems starting at the workplace level. This rule proposes the involvement of workgroups in redefining the division of labour within the workplace around whole group tasks congruent with the definition of product cells. This process provides the distinctive socio-technical team arrangement. It may be noted in passing that this process is likely to be influenced considerably by industrial relations, and in particular the definition of occupations' contractual conditions. Training and education is also clearly of importance in the achievement of the desired rearrangement of work tasks.

The third design rule relates to the support functions, which regulate the production process. It proposes the relocation of support functions to the work group as part of their overall task. Planning

production flows, for instance, could be largely done locally in the team replacing the need for centralised specialist planning units or complex computer systems. It also requires changes to accounting systems, and by implication to reward systems to encourage a focus on a whole task at the work group level. Other support functions such as maintenance, human resources and quality control, would also be located in the team. Overall control and co-ordination of teams, development of new markets and products remain appropriately at higher more strategically located levels of the organization.

De Sitter et al. (1997) concluded that any socio-technical analysis had to proceed in this way, that is to simplify the production structure into parallel flows before attending to the redesign of tasks into whole group tasks. They argued that attempts to redesign work without first attending to production structure would lead to an inappropriate fit between a team and the organization. Team members would be frustrated by not having appropriate control capacity, that is the ability to undertake the range of control activities demanded by the complexity of the production arrangements. The essence of the design rules was to create an organization, in which there were simpler control needs while at the level of the team there was a balance between the ability of employees to control the functions related to their production tasks and the level of control required in the production system. This organisational design, they argue is more stable and efficient than a traditional system requiring high levels of external control.

These design rules can be seen as an expert approach to production organisation. However the Dutch school does propose use of participative design processes, which they acknowledge to have been a particular strength of Australian variants of STS (Van Eijnatten & Van der Zwan 1998, p. 290). The Dutch theorists also propose that organizational members should be provided with the skills and knowledge required to undertake their own systems redesign. They argued that just allowing participative job redesign was not enough. Implementation of MST has given rise to ten principles for whole task groups derived from the design rules (Haak 1994). They are useful assessing the extent to which fully functioning whole task groups have been created (see Appendix 1 for the principles).

The relevance of production structure

The question of the fit between production structures and the degree of local autonomy of work groups over production has been subject to comment by a range of authors (Cutcher-Gersenfeld et al 1994; Edwards et al 2002). Van der Zwaan and Molleman (1998) have analysed the limitations of the applicability of self-managing whole task groups in different types of production systems.

Their production typology reproduced below, proceeds from an analysis of production systems along two critical dimensions, the complexity of the system itself, the capacity complexity, the continuity of production and its material complexity.

Capacity complexity refers to the complexity of decisions involving allocation of workers, throughput times, quality requirements and other logistic aspects of production. In traditional production structures, such as the 'job shop', production is machine centred with a multiplicity of machines producing components, which are further machined or assembled at other points in the plant. This situation creates considerable demands for coordination, quality control and the management of part and product flows between workstations. The Dutch MST theorists argue that this is inherently inefficient with resources being diverted to such logistic and control tasks. They propose that a more efficient production arrangement is one in which work is grouped into product centred 'factories within factories', or production cells. Cells reduce the demand for coordination and logistical controls to movements between cells or between cells and final assembly, leaving the whole task of a component production under the control of a cellular work group. The principle of work group autonomy thus serves the purpose of improving overall efficiency in the production system. The redesign of production systems thus facilitates a more efficient work process based around whole tasks, which can be undertaken by specific workgroups. For instance, the National Nederlands insurance company integrated processing of different insurance types and reconfigured them for service delivery at regional level by teams segmented initially by acceptance of insurance risk and assessment of claims (Den Hertog 1995).

The other critical dimension of production described by Van der Zwan and Molleman (1998) is that of material complexity. This refers to the nature of materials, markets or other external factors shaping production. They argue that such factors can limit the opportunities to redesign production systems because of the level of demand or the nature of raw materials and the process used.

Figure 1: Production systems typology

		Material Complexity		
		LOW		HIGH
	LOW	Continuous flow production		Mass production & large batches
Capacity complexity			Large assortment of midsize batches	
	HIGH	Unit production & small batches		Projects and very complex installations

From Van der Swan & Molleman 1998, p. 310.

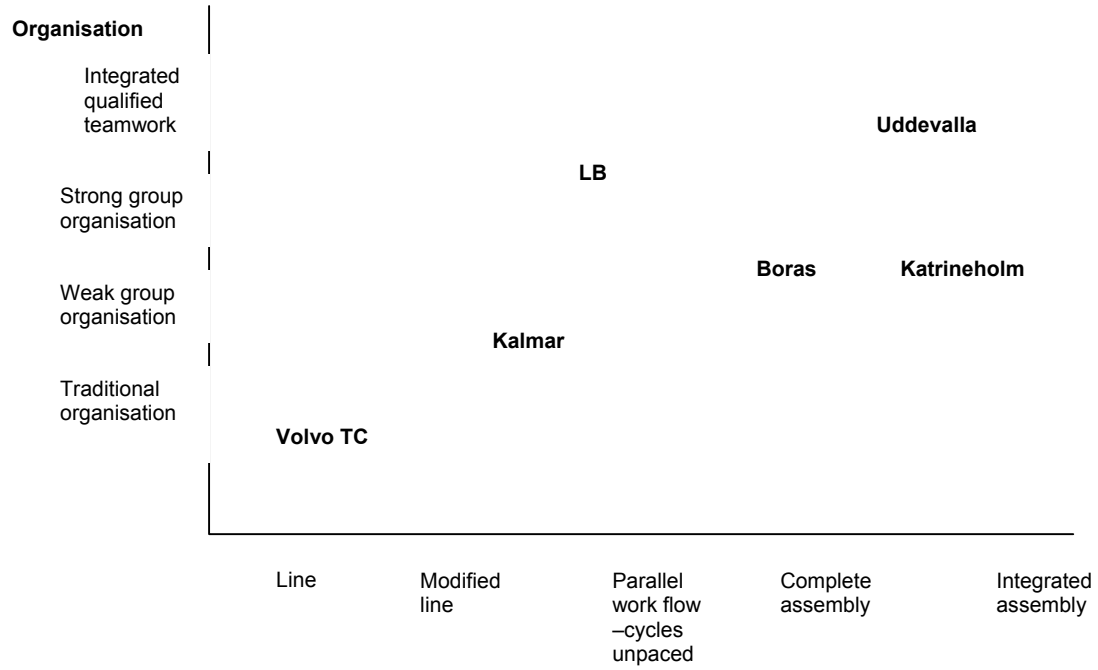
In the cell described as mass production and large batches, where the production process is characterised by mass production of a small variety of products and the processes are tightly coupled without buffers so that employees are highly interdependent, it is difficult to identify the potential for whole task groups. Final assembly of cars on conveyer belt lines are an obvious example. Work in such processes is also highly standardised and such an assembly process would seem to be more suitable for lean production approaches with standardised multi-tasked jobs and low inventories with no buffers. Large clerical processing areas with simplified task development such as telephone call centres would also fit this category.

With projects and very complex installations, where the variety of task is high and repetitiveness is low, each individual has the control capacity to undertake transformation of information, materials and parts to meet customer needs. In such situations whole task groups are not appropriate.

What does Dutch STS say about some well known examples of work organisation reform?

The Case of Volvo in Sweden provides an example that enables us to look at socio-technical relationships. Berggren (1992) developed a model of forms of work organisation and production systems across Volvo. This is reproduced in figure 2. Berggren's analysis suggests that the Dutch approach needs to take into account other factors influencing production organisation. The strength of Swedish unions, labour market problems and enlightened management in Volvo and the development of appropriate logistics and training made this possible (Berggren 1992).

Figure 2: Production design and work organisation



Source: Berggren (1992)

Another area where the Dutch model may need modification with regard to the fit between technology and work, relates to recent developments in advanced manufacturing centres. Such technology integrates machining processes, which were functionally separated in batch production workplaces. For employees to control such machines requires extended training. This high cost of training and employee learning ability associated with controlling several machines renders it difficult for employees to rotate.

Molleman and Slomp (2001) in a fifteen year longitudinal study of a Dutch plant found that it moved from functional layout to parallel flows. It then adopted advanced multi-function machining centres in the mid 1990's.The number of teams were reduced and a double shift system was adopted because of the need to use expensive machines. Teams were maintained in a modified form and employees working on one machine showed high levels of skill use and job satisfaction.

Dutch Modern Socio-Technical Theory (MST) has been subject to criticism within the Netherlands on several counts (Van Der Zwaan 1993 and 1999). Firstly, the theory has been seen as focussing on the reorganisation of production and not engaging in employee relations and issues of power which have a major impact on redesign processes. The response from MST writers such as Van Der Zwaan (1999) is to argue that the increased control capacity inherent in MST redesign of organisations shifts power from middle managers and support staff to employees. This is, indeed, a potential strength of MST, but any change process still has to deal with the actual social and power relations at work,

captured by the labour process literature. The case study of Philips semi-conductors, discussed below, captures some of these dilemmas.

The use of the MST redesign process has also to be put in the context of the Dutch labour relations and training system. The Dutch experience is based upon the so-called 'Polder' model of cooperative employee relations (Visser & Hemerijck 1997). This model includes mandatory works councils with consultation rights on change issues and codetermination rights on HRM matters. These are set in a social structure characterized by high levels of consultation between government, employers and unions. This model has remained in the 1990s despite employers being in a stronger bargaining position (Visser 1998). In terms of the issues identified by the 'societal effects' theorists in terms of training, work organization, job demarcations and organizational structures the Netherlands can be seen as about half way between the French and German models (Van Der Zwaan 1999). MST has also been promoted since the late 1980s, under Dutch Health and Safety law, as the preferred method of ensuring stress free job design (Van Der Zwaan 1999). These contextual factors predispose the Netherlands to be more receptive to innovation required in the MST model than Anglo Saxon countries. Evidence of this has emerged in the recent EPOC study of new forms of work organization. This study shows that Sweden and the Netherlands have the highest level of delegation of responsibilities to groups (EPOC Research Group 1997).

However, Dutch case studies indicate that a range of problems arise in the implementation process. One expected problem is that middle managers and staff specialists resent loss of status and power and supervisory managers fail to cope with their new role of coaching and coordinating self-managing groups (Van Der Zwaan 1999). De Sitter et al (1997) recognise that the actual course of redesign projects does not follow a sequential pattern inherent in the design rules set out above. The character of group members and group dynamics also present problems in the implementation process (Van Der Zwaan 1999). An extensive evaluation by Haak (1994) at Philips semi-conductors illustrates some of these problems.

Haak's (1994) evaluation of the use of MST at Philips shows that changing production structures and attempting to give control to whole task groups runs into a range of problems, which show similarities to those identified by Edwards et al (2002). In a survey of employees, supervisors and managers Haak (1994) shows that the paper exercise of creating self-managing task groups was translated into reality to a lesser or greater extent depending upon the group. Haak (1994) derived six criteria from the implementation principles to assess the extent of implementation of MST. Firstly, with regard to autonomy of each group lack of sufficient investment forced groups to share equipment and sometimes personnel. Secondly, the integration of indirect task such as production planning into groups was only partially achieved in some groups but more fully in others. Thirdly, group leadership

was divided between an external and internal leader due to a multiple shift system constricting group decision making. Fourthly, rewards systems were not altered to reflect group performance but remained age and seniority based. The fifth and sixth criteria , namely team development and information and communication showed the greatest development. Generally stable groups with stable technical processes were identified as having more closely met the MST model of whole task groups.

The implementation of a successful MST project would thus seem to depend upon not only a social partnership approach to industrial relations, but also more industry and company specific factors identified by the labour process literature such as:

- the commitment of management to delegate to groups
- the coherence of management change initiative
- the economic pressures confronting the firm
- the expectations and engagement of employees
- the strength of unions and their ability to negotiate the changes
- the level of skills of employees affected by the changes (low skill employees may accept weak levels of delegation whereas skilled employees with discretion may be sceptical of changes
- the significance of job security as part of change (Edwards et al 2002).

The concept that innovative job design is a zero sum game in which employees are inevitably exploited is a justified criticism of some changes to work organisation, but recent reviews of the relevant case studies indicates that change to team work can also grant greater discretion to employees (Muller, Proctor & Buchanan 2000; Edwards et al 2002. Hence, regarding the issue of power, it is apparent that the application of MST is a necessary but not sufficient condition for delegation to groups. The labour process literature enriches understanding of the change process.

The second criticism is that MST does not deal effectively with the process of change (Van Der Zwaan 1999). The redesign process according to De Sitter et al (1997) involves structural exploration, which includes mapping of existing shortcomings in the production system and deciding whether they are structural or not. This is akin to examining the technical system in traditional STS. The outcome is to document internal performance criteria as an input to the next step, which is on the job training for Self Design. During this employees learn how to analyse their own work organization and relate to other functions and subsystems. It helps to mobilise people as they learn skills, interact with one another and see that that the change process is serious. Functional barriers are broken down and they learn to speak the same language**.** The design principles discussed above are then implemented using

the internal performance criteria developed in the structural exploration stage.The response has been to recognise the need for much greater involvement of employees unions and work councils, learning from Swedish and other examples of developed methodologies for involvement.

Conclusions

Dutch MST represents an approach to the redesign of work in which the definitions of work group control over whole work tasks is seen as the basis of productive efficiency. This approach to the design of production systems differs considerably from conventional approaches to production design by according priority to self-management as distinct from bureaucratic approaches to control. The approach also differs from lean production principles which treat work group autonomy as an instrument for providing greater flexibility and an array of skills utilisation at the work place, without according any significant degree of control over the whole tasks. Indeed in some uses of the lean production concept standardised tasks are the basis of group activities. In that situation groups share routinised work processes, in contrast to the situation proposed by the Dutch theorists in which groups share responsibility for a whole task which incorporates significant control dimensions.

Dutch STS differs from the mainstream of earlier STS theory in the way it treats the relationship between work systems and production structures. Their emphasis is on building better work organisation on the basis of changes in technology and factory layout, which together constitute the production system. Thus Dutch MST provides a third way for production organisation. However it has its limitations. Its limitations include an admission that the concepts seem to relate to a limited array of production options. The opportunity to redesign work group arrangements appears to be limited by material and markets in particular.

A further limitation relates to the importance of societal factors. Though only explored briefly above, it is evident that national systems of education and industrial relations can exert considerable influence on the possibility of developing autonomous group working. This has been documented in Swedish cases, and in the Dutch case the existence of legislative imperatives requiring employers to attend to work organisation .

The Dutch MST attempts to unite a well informed production systems perspective with the humanistic orientation of STS theory. It has in recent works also acknowledged the contribution of Australian STS practitioners in the processes of intervention in systems restructuring (Van der Zwan & Molleman, 1998). They remain critical, however, of the limited perspective brought to the production systems in many Australian uses of STS.

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Appendix 1

1. The group should be relatively independent and complete
2. Physical task boundaries should, preferably, be clearly definable.
3. The group needs to be large enough to be able to perform with sufficient redundancy the scale of functions needed for the group task. The group needs to be small enough to allow direct mutual attuning and to enable maintaining personal contact
4. Within the group there needs to be complementary tasks-required interdependence.
5. The group needs autonomy, authority, information, and feedback to control its own affairs, to solve its own problems, and to discuss its own strategies.
6. External reward and control need to be matched with an observable and measurable input-output ratio of the group.
7. The group should have appropriate production systems, control systems, support systems, and information systems at its disposal.
8. The internal individual status and reward need to be matched with the scope of availability.
9. The status differences within the group should not handicap the internal mobility.
10. The internal and external leadership is in principle a function of the group which, depending on the importance of the leadership role, is documented in a well-described role for the group coordinator, if necessary rotating among particular group members