# TOWARDS A TOTAL WORKPLACE INNOVATION CONCEPT BASED ON SOCIOTECHNICAL SYSTEMS DESIGN

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## Abstract

This article aims at developing a more comprehensive design theory for stakeholders who are involved in design processes aimed at workplace innovation, by starting from sociotechnical design and by exploring how we can broaden that perspective with other approaches, to also cover issues such as Information Technology-design and Human Resources-design. This article will focus on sociotechnical design (STS-D) theory for the design of the division of labour as developed in the Lowlands (Netherlands and Belgium). In addition to STS-D theory, other theories and practices for designing control, coordination and support systems have been developed, such as Lean Thinking, Total Productive Maintenance, Human Resource Management (HRM) theories, Relation Coordination theory, Information and Communications Technologies (ICT) theories, the practice of the New World of Work (time and place independent work) and Sociocracy for participative strategic decision making. In this article, we will outline a start for combining these approaches with STS-D theory to develop a systemic concept of Total Workplace Innovation (TWIN). As such, this article is an essayist and conceptualising approach to organizational design theory.

## Introduction

Given growing global competition and the predicted shortages in the labour market, organizations, nowadays, face the dual challenge of creating workplaces that are, on the one hand, more productive, flexible, and innovative, and on the other hand, healthy places to work. There seems to be a need for workplace innovation (WPI) to transform traditionally monolithic bureaucratic organizations into modern organizations that meet these challenges. A workplace innovation (WPI) is a developed and implemented practice or combination of practices that either structurally (through division of labour) or culturally (in terms of empowerment of staff) enable employees to participate in organizational change and renewal and, hence, improve the quality of working life and organizational performance (Oeij et al., 2015). WPI is based on

flexible instead of bureaucratic ways of organising, and, therefore, WPI-practices could help to transform bureaucratic, inflexible organizations with limited innovative capability. Bureaucratic organizations, however, are defined by and embedded in their structures, support systems, decision making systems, facilities and IT systems. Bureaucracies are, due to their focus on maximising the division of labour and central control of the work processes, designed for stable environments and mass production. Hence, they are not well-suited to respond to the need to be agile in a dynamic environment with ever changing customer demands. Therefore, to realise new ways of organising through workplace innovation, an integrated approach to systemic change in the organization is needed. We call this Total Workplace Innovation, which we define as a renewal of the organization of work with an integrated view on the division of labour, working relations and the supporting systems, with the dual aim of improving both performance and quality of working life. This definition is in line with the main starting points of STS-D theory, as will be shown later.

In this contribution, we suggest the concept of Total Workplace Innovation (TWIN) as a potential way to create common ground among researchers and practitioners interested in understanding and implementing workplace innovation (WPI). We hope to change the discussion around workplace innovation from a scattered focus on identifying one best approach to developing an integrated framework that takes the whole organization into account. Indeed, we aim at developing a more comprehensive theory for stakeholders who are involved in design processes for workplace innovation, by starting from sociotechnical design (STS-D) and by exploring how we can broaden this perspective with other approaches (see Table 1), to also cover issues such as IT-design and HR-design. We need a combination of core systems and support systems to develop a complete alternative for the bureaucratic monolithic organization.

*Table 1. Additional theoretical concepts to complete TWIN*

| | |
|---|---|
| **Lean Thinking** | *Provides guidance and tools for creating quick response (Just in time) logistics systems for the different order streams*<br>*Provides guidance and tools for continuous improvement to increase job control aimed at coping with interference and waste* |
| **Total Productive Maintenance** | *Provides guidance and tools for autonomous maintenance in whole task groups (teams)*<br>*Provides guidance and tools for improving the collaboration between operators and maintenance staff* |
| **Relational coordination theory** | *Provides guidance and tools for horizontal coordination in the control structure and job control* |
| **New World of Work** | *Provides practices and tools for designing the infrastructure of facilities regarding job demand* |
| **HRM** | *Provides guidance and tools for recruitment, rewarding and developing employees for humane and productive organizations* |
| **Archipelago ICT** | *Provides guidance for designing IT systems based on variety and job control* |
| **Sociocracy** | *Provides guidance for democratic strategic decision making to complete the design of the control structure and to increase job control possibilities* |

Although STS-D theory and WPI have much affinity, they are not the same and could mutually reinforce each other. In this article, we regard STS-D as a design approach that focuses mainly on the design of the core work process. If we add elements from other theories to this design,

then we slowly but surely broaden the STS-D design perspective in a manner that advances the goals of WPI. Therefore, we selected a number of different theoretical approaches and practices that complement STS-D in addressing the design of various support systems. Notably, this selection is based on the fact that all of these approaches take the core work processes as a starting point but add an important ingredient in terms of support systems. Moreover, they are explicitly focused on improving employee engagement, which is a core feature of WPI approaches. A focus on employee involvement remains rather implicit in the design steps of STS-D, which sees job quality as logically emerging from choices made in the design of the structure of production and the distribution of management tasks. Therefore, these additional theoretical perspectives could complement STS-D theory (Kuipers, van Amelsvoort, & Kramer, 2010).

We will first discuss sociotechnical systems design (STS-D) theory and its control structure as a base for the design of the core work processes, that is, the primary process. STS-D theory and practices emphasize the joint optimisation of the technical and social aspects of the organization, with a simultaneous focus on achieving improved productivity and improved quality of working life. STS-D also strives for employee participation. STS-D has a long tradition in the design of the division of labour with the aim of creating innovative and humane organizations (Pot & Dhondt, 2016). Indeed, although STS-D practices show variation across different regions of the world (Baxter & Sommerville, 2011; Mohr & van Amelsvoort, 2016; Mumford, 2006; van Eijnatten,1993), the applied basic theory regarding the division of labour remains the same, namely, creating conditions for increasing the speed in the production flow, job control or self-organization for employees, teams, units and communities of work. The overall aim is to help organizations become more agile with the help of engaged employees. However, STS-D theory only addresses the design of core work processes, whereas a systemic approach to redesigning the organization for TWIN also requires a focus on the design of support systems. Examples of support systems in organizations are ICT-systems, HR, sales & marketing, purchasing, distribution and dispatch, and maintenance.

Because the starting point for the design of an organization is its core work process, we start with STS-D. To aid our discussion on the design of the support systems we add a number of other theoretical concepts, such as: Lean Thinking (focuses on logistics and quality management); Total Productive Maintenance (stresses the integration of operations and maintenance); HRM theories (put a to focus on human resources policies); Relational Coordination theory (focuses on improving lateral communication); ICT theories (focus on the design of the information infrastructure); the concept of the New World of Work (underlines the notion of working independent of time and place and the need to create flexible facilities); Sociocracy (focuses on participative strategic decision-making and policy.

The article is structured as follows. First, we will describe STS-D theory, followed by a presentation of its design principles and the design sequence as it relates to TWIN. Second, we will discuss the complementary approaches mentioned above. Finally, we will end with some concluding thoughts.

## STS-D theory as the base for TWIN

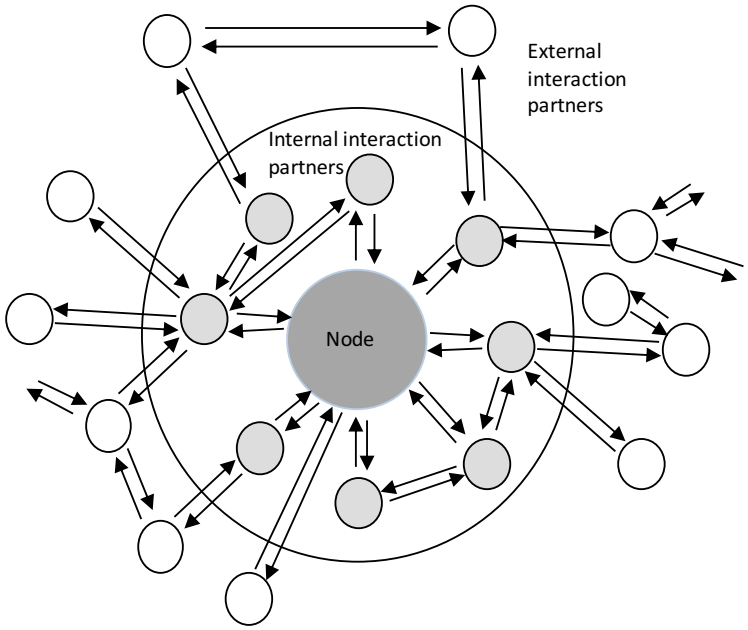
An organization's core work process is the primary process of an organization, such as, making goods or providing services. How these goods or services are produced, i.e., how the core work processes are organised, largely determines the extent to which the organization's products or services create added value for customers. Hence, orchestrating an organization's shift towards workplace innovation-related goals – performance and quality of work – typically requires a redesign of the core work process. In this respect, STS-D theory provides a valuable

framework, given that core work processes are rooted in a dynamic systems-theoretical perspective of work and organization (Kuipers, van Amelsvoort, & Kramer, 2010; de Sitter, 1994; de Sitter et. al., 1997). The design of the core work processes determines the needed degree of (central) coordination and the possibilities for (shop floor) self-organising capabilities. A maximum division of labour creates the need for central coordination and hierarchical control whereas a minimum division of labour creates conditions for self-organization and horizontal coordination (i.e., more job autonomy). Given that organizations are complex social systems, a systemic view as offered by STS-D is helpful in redesigning organizations when required by changing economic circumstances. Bureaucracies have difficulties in coping with economic changes, while flexible, flow-based organizations are better equipped to handle change and turbulence (Kuipers et al., 2010).

STS-D theory suggests that, as a result of the division of labour, the organization is an interacting network of people executing tasks and roles, using (ICT-) technological instrumentation, tools and machines. These tasks and roles are thus allocated to individuals, teams, departments and business units. STS-D makes the distinction between production and management in the following manner:

a) the structure of executing activities (the *production structure* of the core work processes—PS) and
b) the structure of control activities to manage the core work processes (the *control structure*—CS).

*Figure 1. The interaction network with nodes (Kuipers et al., 2010)*




In STS-D a role or task is the work that needs to be done, which is often related to the work of other people. All these roles and tasks together constitute the whole of the core work process. In other words, all these roles and tasks together complete the whole task of, for example, a team or an organization. The notion of whole tasks implies, in theory, that there is no division of labour at all, such as for example, when a team is making a complete end-product from start to finish. This is, however, almost never the case, and therefore, roles can be seen as nodes interacting with other interdependent nodes to complete the core work process (see Figure 1). A node is a point where several inputs and outputs from different interaction partners come together to do the work.

In STS-D, as an offspring of systems theory, inputs are transformed into outputs as in the input-throughput-output model. The core work processes function in a similar vein at every level, such as, at the level of tasks, jobs, teams, departments, and the organization as a whole. At the nodes, inputs are therefore transformed into outputs or outcomes, meaning that resources are transformed into products or services. Interaction between nodes, for example, the collaboration of individuals in a team, is necessary for a number of reasons, such as, the exchange of information, knowledge creation, planning and/or coordination, and deliberation. Team members are, for example, dependent on each other's task execution. At the nodes, interactions happen with both internal and external interaction partners. In order to ensure productivity either directly or indirectly, these various interactions between nodes need to be established at the right time, between the right jobs, with the right material or information and at the right place. Otherwise, production gets delayed or mistakes become a risk. Figure 1 illustrates this point.

However, these planned interactions between nodes can suffer from interference due to variance that is not accounted for in the original planning of the production in the core work processes. For instance, in the building and construction industry, different parties have to collaborate to get the job done as they are connected in specific supply-chain models. If one of the parties withholds information or drops out of the project unexpectedly, this will interfere with the other parties' capability to get the job done. In this sense, a node has to cope with two types of variance:

a) *external variance*: such as lack of information, communication errors, changing customer demands, incomplete input, conflicting, ambiguous or competing demands;
b) *internal variance*: human errors, technical disturbance, invalid and inflexible capabilities, shortage of resources.

The key question that arises is how can organizations deal with these types of variance at the nodes in ways that do not disrupt the production process? According to STS-D, to deal with such variance, organizations should on the one hand, redesign the division of labour in such a way that the complexity of the interaction network can be reduced, and on the other hand, increase job control possibilities so that variances can be controlled at the source. In this respect, De Sitter suggested to create simple organizations but make jobs complex, meaning that jobs become rich and varied (De Sitter et al., 1997). In other words, bureaucracies create jobs that are too simple for the complex changes in the environment. TWIN and STS-D create complex jobs so that organizations can deal with that complexity in flexible ways (Mohr & van Amelsvoort, 2016).

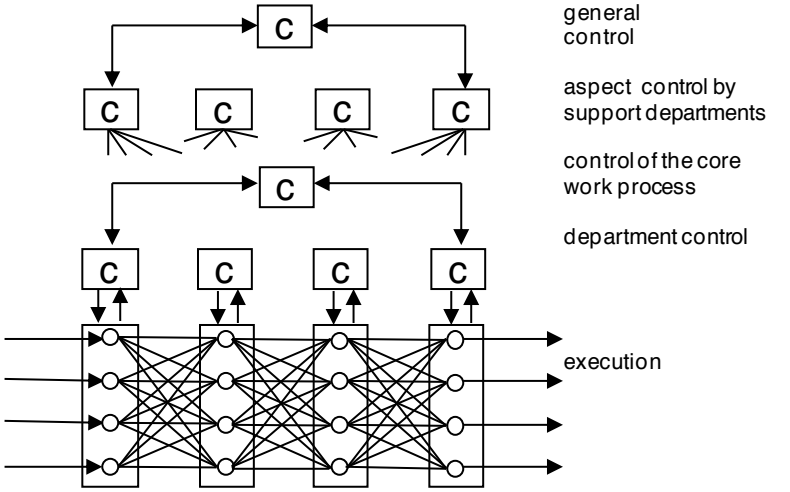
The relation between the division of labour and productivity

The productivity of an organization is related to its capability to cope with strict external demands, namely, business and customer demands for variety (product mix), and uncertainty about both short- and long-term planning. Therefore, the capability to meet these external demands, is contingent upon the needed internal variety, namely meeting requirements in relation to efficiency, quality, flexibility, and innovation. Only if organizations can internally vary how they operate, are they able to meet the external requisite variety (Ashby, 1969).

Bureaucratic organizations are based on the principle of maximum division of labour, which, in turn, leads to complexity and rigidity (Achterbergh & Vriens, 2009). This maximum division of labour can be counterproductive for a number of reasons. First, bureaucratic organizations (see Figure 2) tend to be characterized by 1) simple jobs, i.e., the formation of silos between functional departments, each pursuing fragmented goals and interests, and 2) complex

interactions, i.e., long hierarchical communication lines, central decision-making, and a large number of rules and meetings. Bureaucracies have many nodes, and are therefore exposed to the risk of much interference in the core work processes when the work cannot be performed as initially planned. Figure 2 indicates that the performance of the core work processes requires several dependencies in terms of control (c) and execution.

*Figure 2. The bureaucratic regime (Kuipers et al., 2010)*




Hence, if external pressures on the organization that threaten the planned process increase, the bureaucratic organizational design will rapidly lead to productivity problems. These problems can be manifested for instance as (Kuipers & Van Amelsvoort, 1990; de Sitter, 1994):

- unreliable and long lead times due to poorly harmonized processes;
- slow response times;
- difficulty in quality assurance due to insufficiently managed processes and poor communication;
- poor cost control because actual (hidden) costs cannot be monitored and (too) much interference occurs;
- slow and blind decision-making;
- expensive coordination and control mechanisms;
- lack of employee involvement;
- lack of innovative capability due to poor communication between the business functions, and a lack of initiative.

In general, the traditional, bureaucratic response to these problems is to tighten control (centralisation) and implement more stringent rules and procedures. These measures are counterproductive, because the root cause of these dysfunctions is, in fact, deepened. In contrast, STS-D aims to reduce complexity by minimising the division of labour (see the section on STS-D principles below).

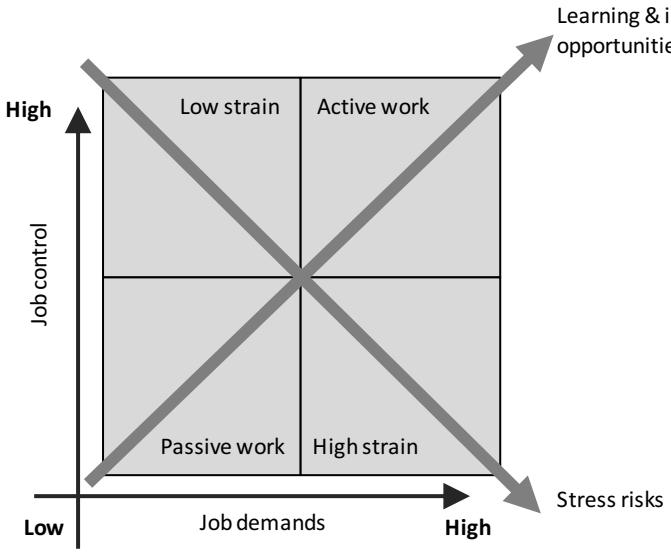
The relation between the division of labour and employee involvement

The division of labour does not only affect productivity but also the quality of working life. For instance, Karasek's *Job Demand-Control* model (Karasek, 1979; Karasek & Theorell 1990) (see Figure 3)[1] suggests that work organization, specifically, high control (autonomy) in performing

[1] The Job Demand-Job Control model has affinity with the Job Demands-Resources model (Bakker & Demerouti, 2007; Demerouti et al., 2001). However, we see resources as an element of job control, namely in the way that job design should include the possibility to deploy one's resources. For example, the degree of decision latitude determines whether

tasks is crucial in transforming job demands from risks and stress drivers into learning opportunities.

*Figure 3. The Job Demand Job Control model of Karasek (1979; 1990)*




In this model, job demands are seen as stressors such as work overload, unpredictable demands, time pressure, role ambiguity, interference, as well as emotional and physical demands. Job control is the combination of autonomy, decision latitude, instrumental support from colleagues, constructive performance feedback, craftsmanship, flexible resources, leaders' appreciation and support, accurate information, and communication. In this respect, there is evidence that high job demands and low job control are important predictors of psychological stress and illness. In addition, De Sitter (1994) claims that job control leads to involvement and motivation, which translates into positive effects on indicators such as absenteeism, turnover and stress. Moreover, there is evidence that a combination of high job demands and high job control in the form of active work is a predictor of an innovative organization (De Sitter, 1994).

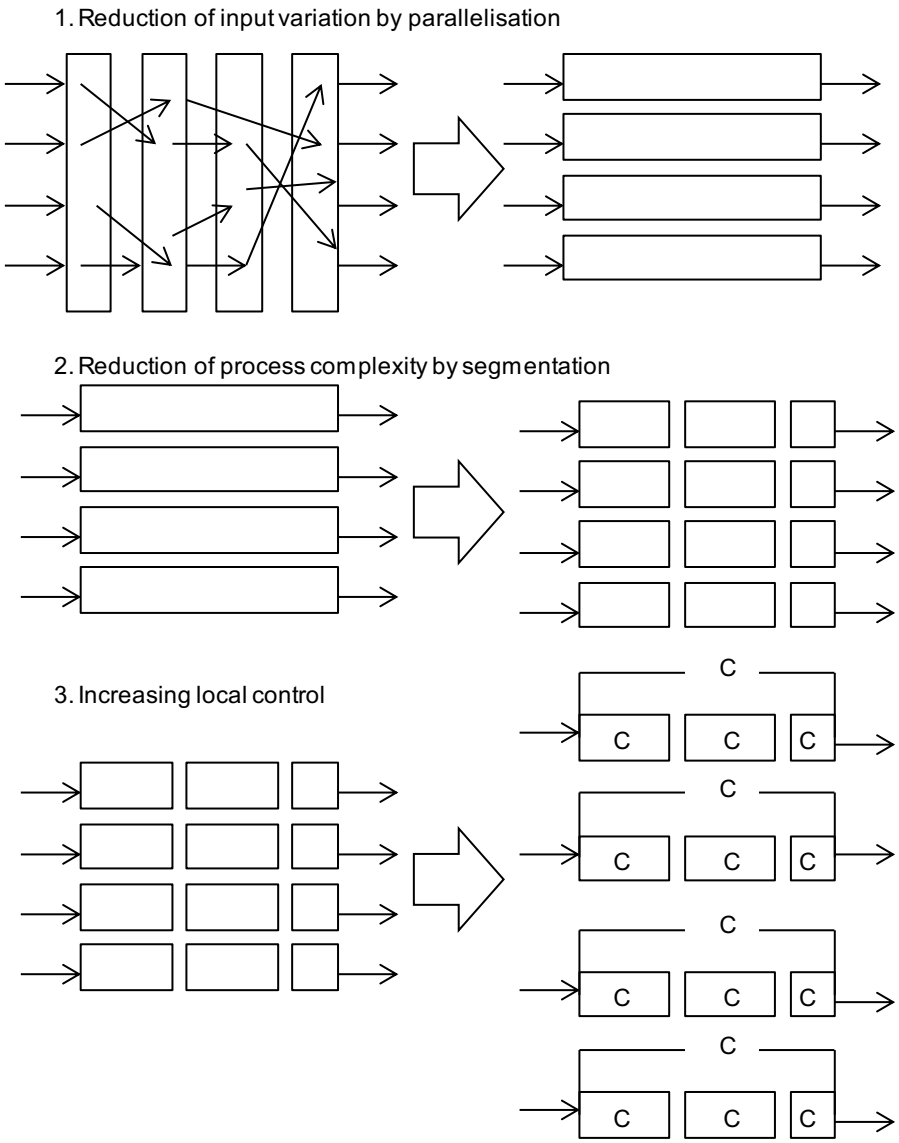
In sum, job control is an important predictor for employee involvement and, as such, a precursor to workplace innovation. Indeed, STS-D proposes that, by increasing job control, employees are stimulated to learn, better equipped to deal with interference and, thereby, better prepared to respond to challenges arising from job demands. This increased level of job control does not only affect employee involvement but also serves the organization by affording the possibility to better mobilise the use and development of human talent (De Sitter, 1994), and thereby enable the goals of workplace innovation.

## STS-D design principles

As previously stated, we take the STS-D perspective as a base for designing the structure of an organization for TWIN (see Figure 4). To reduce the shortcoming of bureaucracies, De Sitter (1986, 1994) developed a three-step design sequence for reorganising the core work processes. First, one designs the production structure, second the control structure, and third the information structure.

persons can apply their knowledge and talents to solve problems. De Sitter (1994) has pointed out that employees do not get stress from problems in their work, but from the limited autonomy to solve these problems within their designed jobs.

*Figure 4. The design sequence of STS-D (Kuipers et al., 2010)*




Within STS-D, there is a specific design sequence for the design of organizations (De Sitter et al, 1986).

1. *The design of the production structure, or how an organization produces its goods or services*: If we assume that strategic positioning, such as the need for flexibility, innovation and healthy work, has been carried out, one needs to first design the core work process. This is done by focusing on the overall picture and then on the details (i.e., first on the whole, then on the parts). Based on the different customer families (see principle 1 in the upcoming robust organization design section), this means that one starts with creating the different (business) units, then the different departments within these units, and finally, ends with the design of the work teams and jobs.
2. *The design of the control structure, or how the core work process and supporting processes are managed*. The second step is a redistribution of control capabilities through the design of the management structure. This control structure is designed in reverse order, in other words, from the parts to the whole (i.e., bottom-up and not top-down). That is, first one determines what can be controlled at the (lowest organizational) local level (i.e., team and

job level), subsequently what can be organized at the level of a larger organizational operating unit (above that level), and finally what needs to be controlled at the (highest) organizational level. Next, the consultation and decision-making structure can be further elaborated in detail. The principle here is that emerging problems require autonomy to solve them at the level where those problems occur. This implies that the task of managing the core work processes should as much as possible migrate to the lowest organizational level.

3. *The design of the information structure (and other support systems), or how information streams support production and management*. Thirdly, the various (technical and support) systems are embedded in the new organizational architecture (see next paragraph). These systems include IT and support systems. Here the rule is that these systems should support and not control the production and control structure, hence, this information structure should not be designed too soon, and never before step 1 and 2.

We now turn from the sequence of steps to the design rules. Here, again we touch upon the design of the production structure, control structure and information structure, but now in more detail, as the design goes from a crude design to a fine-grained design. This consists of four steps, namely parallelisation, segmentation, local control, and support systems (Figure 4).

The STS-D approach avoids the shortcoming of bureaucracies because it results in a far more flexible design that enables a proper response to change and turbulence. We discuss this design approach in the following from both a strategic and an operational point of view.

## Design as a strategic issue

Now that we have explained the general design sequence of STS-D, we address its strategic relevance first. In the next section, we discuss how these strategic choices can result in an operationally robust design. Robust means that interferences in the core work process are minimised. According to the open-system principle, the design of organizations needs to be strategic and should include *all* stakeholder perspectives. This is in stark contrast to the focus on shareholder value alone often witnessed in traditional organizations (Achterbergh & Vriens, 2009). From an STS-D perspective, in line with the open-system principle, diagnosing, designing and changing organizations needs to be done by taking into account environmental conditions and strategic business choices. These strategic choices, in turn, impose requirements on the organization, the “burning platform”, and dictate the desired direction (see also Adler & Docherty, 1998). Moreover, it is highly recommended that the design is drafted in co-creation with the different stakeholders. Indeed, the best guarantee for success is to *fetch the whole system into the room* (Weisbord, 2004). This points to the importance of employee involvement, a hallmark of workplace innovation.

## Robust organization design

Apart from strategic choices, we need robust organizations which can cope with the demands of flexibility and innovation in a dynamic world. Hence, from the STS-D perspective, robust organization design is based on the following three principles (see Figure 4; van Amelsvoort, 2000):

1. *Reduce complexity in the division of labour in the core work processes (PS) by focusing on customer order families*. Reducing complexity can be achieved by the introduction of parallel processing (i.e., factory in a factory). Parallel processes a) afford a better business focus, and (b) create the conditions for decentralized control (see also principle 2). Parallelisation is defined as creating parallel streams of orders based on different customer families (e.g., markets, type of product). According to this principle, the design of the core

work processes is based on the *type* of customers and their orders. This implies identifying customer families (orders) that show homogeneity in terms of business demands, and, therefore, impose identical constraints on the manner in which the production process must be carried out. Identifying these customer families involves finding criteria to divide customers into relatively homogeneous subsets with different strategic demands. For example, a construction company builds tangible products. However, renovating a house or building a hospital represents completely different core work processes with different strategic demands. Hence, a miniature organization can be formed around these subsets of customer orders (i.e., one for house renovations and another one for commercial buildings) that each complete the process from a to z for this group of customer orders. In other words, the whole task is performed by a relatively self-organising group (i.e., autonomous work teams). We refer to the process as *parallelisation* (Figure 4). In other words, parallel order streams are created, with each being maximally interdependent within the stream, but minimally dependent across streams. This implies the design of whole tasks and the creation of self-organising groups, units and communities of work which are smaller in scale. *Segmentation* (Figure 4) of the core work processes can help to reduce process complexity and create teams of 8-10 people. Segmentation is defined as cutting the flows of orders into parts, in such a way that a whole task of activities with high interdependency is created (i.e., De Sitter's complex jobs at team level).

2. *Increase the local (job and team) control capability by decentralization: self-organization and a healthy control structure* (Figure 4). In an effective hierarchy designed to deal with turbulence, the different levels of control (i.e., layers of the organization) have added value in terms of operational and strategic control. That is, flexible and innovative organizations are structured in such a way that they can react fast both at an operational and at a strategic level. To achieve operational control, work teams are self-organised at the operational level. Operational control is the combination of internal control (job autonomy, decision-making authority, technological variation possibilities, flexible access to means) and external control (coordination, team members' support, recognition, feedback, and influence). According to Ashby's law of requisite variety, control capability at a node (in this case, the self-organised team) is necessary in order to resolve interference at the place where it occurs and to prevent or reduce quality problems, delivery time deviations, or productivity losses (Ashby, 1969). To achieve strategic control, different (business) units are set in place. Strategic control is necessary to reduce frequent interference among self-organising units and to explore innovations. Moreover, in dynamic situations, both operational and strategic control imply learning. The preconditions for control and learning are: participation in goal setting and purpose definition as well as effective feedback mechanisms for inspiration and learning, as in the JDJC-model (but now on the level of a team for example).
3. *Congruent infrastructure (technology and facilities) and HR systems: minimum critical specification (Cherns, 1987).* Because the units in the organization have different business demands they will also have different support demands (Figure 4). A supporting HR system, for example, should differ between teams of technically-skilled employees operating on the shop floor and administrative teams skilled in financial issues working in the office. Therefore, the design of the different support systems and technology should follow the first two principles mentioned above. Moreover, their design should be based on diversity instead of 'one size fits all' and should be focused on providing support instead of controlling. (See the next paragraph for a discussion of support systems).

## Complementary approaches to STS-D for TWIN

So far, the STS-D approach has focussed mainly on the design of the production structure and control structure, i.e., the division of work into tasks and roles for TWIN (i.e., how to produce and how to manage). However, a systemic approach to redesigning the organization for TWIN also requires the design of support systems (i.e., the information structure). Below, we will discuss each of these different approaches as they relate to TWIN (see also Table 1).

### Lean Thinking

Lean Thinking and its associated toolbox mainly focus on the reduction of waste. Similar to STS-D, it takes into account the whole core work process, starting with product development and ending with the delivery and subsequent support of a product to the customer (Womack, Jones, & Roos, 1990). Lean Thinking's contribution to TWIN is twofold: the principle of Just in Time (JIT), more recently reframed as Quick Time Response (Suri, 1998; 2010), and the concept of continuous improvement. Specifically, we propose that the Lean JIT principle can be used to design the logistics systems for TWIN. The continuous improvement element of the Lean toolbox focuses on eliminating all forms of waste. We argue that continuous improvement is an excellent way to enhance job control if applied at the level of individual employees, which in turn, would enable employees to cope with interference, stimulate learning and enhance employee involvement.

### Total Productive Maintenance (TPM)

The TPM approach primarily deals with the organization of equipment maintenance in the production industry. Specifically, TPM focuses on the optimal cooperation between the production and maintenance department, which is in line with the aim of TWIN to increase employee job control possibilities. In TPM an important objective is involving all maintenance employees as well as having the operation teams implement practical solutions for further improvement (Nakijama, 1988). TPM has added value to STS-D for achieving TWIN, because it increases job enrichment with the focus on the task of autonomous maintenance, i.e., maintenance by operators.

### Relational Coordination theory

In large organizations and networks there is a need for horizontal coordination between teams, units and communities of work. In this respect, *Relational Coordination* theory, developed by Gittell (2003), can complement the TWIN model. The theory has been used to examine what sets productive complex organizations, like airlines and hospitals, apart from their less productive competitors. The results suggest that it is the horizontal, informal relationships between employees that make the difference (Gittell, 2003). In practice, effective organizations seem to employ a variety of interventions to safeguard the coordination of their internal relationships. However, there are some common characteristics across these interventions. First, these organizations are characterised by a diversity of roles as well as wide-ranging, overlapping roles within order streams. Moreover, they tend to have developed wide-ranging organization-wide mobility policies where employees can be regularly transferred to another stream or branch. This will facilitate cross-pollination of knowledge regarding customers and operations and will help increase employee job control. Importantly, the time span for organising these coordinated relationships can differ significantly. For example, employees may rotate in their tasks several times within one working day. Security officers in Scandinavian airports (Gittell, 2003) are rotating almost constantly, enabling employees to keep an eye on travellers from several different observation points.

### The New World of Work

The New World of Work is a combination of practices that focuses on the flexible design of workplace facilities based on time and place independent work (Bijl & Gray, 2011). The New World of Work approach complements the STS-D approach to achieve TWIN, by providing tools for designing the infrastructure of the workplace as well as tools for virtual collaboration. Indeed, re-designing an organization has far-reaching implications for its infrastructural requirements. A flexible organization, with for instance, project teams working in different time-zones with a dynamic need for deliberations, would need flexible working facilities as well as supporting ICT systems that allow for virtual collaboration.

### Human Resources Management (HRM)

STS-D theory informs us on how to design tasks and roles that mobilise human talent (de Sitter, 1994), however, it does not provide any answers regarding employee selection, training and development or reward systems. To this end, Human Resources Management (HRM) approaches can be used to complement STS-D in designing a TWIN model. In this respect, we focus on two schools of thought in HRM named after the American Business Schools where they were developed, namely the Michigan (Fombrun, Tichy & Devanna, 1984) and the Harvard models (Beer, Spector, Lawrence, Mills, & Walton, 1984). The Michigan approach, generally seen as the "hard" version of HRM, focuses on high performance aligning personnel management with the organization's strategy. Therefore, the HRM instruments are tailored to ensure that employees add value to the organization and the focus is on ensuring high employee performance. In contrast, the Harvard model, or the "soft" approach to HRM, focuses on the internal coordination of the expectations and interests of both the business and the employees. Employee involvement is central and the assumption is that it can only be achieved if people are confronted with challenging work. Moreover, it assumes that employee involvement will result in higher productivity, quality and efficiency. Both HRM models assume a balance between management (Michigan) and employee value (Harvard) and they both see HRM as an integral part of the enterprise strategy. STS-D theory claims to balance business demands and employee interests, therefore, for TWIN the combination of both models seems logical.

### Archipelago ICT thinking

Although information technology (ICT) systems play an important role in organizations, ICT has never played a major role in designing organizations from a STS-D perspective. However, ICT systems profoundly determine organizational design choices, as they create the technical context within which many organizations are operating and, hence, they also affect the social work system (Bednar & Welch, 2016). In fact, in many cases, ICT is the context within which work takes place. In STS-D, ICT systems are regarded as support systems, hence, in the design sequence, this implies: 'first organise, then automate'. The introduction of traditional enterprise ICT systems, for example, such as enterprise resource planning (ERP), has had negative effects on organizational agility, productivity and organizational and employee health (Govers, 2003). This is largely due to the fact that they aim for standardisation and take a 'one size fits all' approach, whereby, all business functions are integrated into one core work process. However, in most organizations, a number of simultaneous processes take place that vary in terms of inputs/outputs and process steps. Moreover, due to this attempt at standardisation, ERPs can lead to a neglect of customer demands as well as decreased job control.

Contrary to this practice, the STS-D principles suggest that archipelago enterprise

computerization, when taking into account the necessary variety in work processes, is more suitable for workplaces aiming at TWIN goals (organizational performance and quality of work). Archipelago enterprise computerization is analogous to islands being connected under the water line, while being disconnected above the water line in an archipelago (Govers & Sudmeier, 2016). An archipelago enterprise system can consist of various parallel, independent enterprise systems instead of a single organization-wide one. This would imply that the organization identifies independent parallel market or production flows (streams) and ideally would provide each stream with its own computerization to deal with the variety and dynamics of that stream. The general information for all streams is the underwater connection. A light version of an archipelago system can be, for instance, a menu card structure. Like in a cafeteria, a menu of an enterprise system is built around clear-cut, varied processes. The archipelago design of IT systems can create the opportunity to provide specific production flow information to the employees and increase job control. This means that you do not have to provide more information than needed, which results in limited complexity for employees.

Sociocracy or the circular organization

Democratic values are important to create innovative and humane organizations. To this end Sociocracy (Lekkerkerk, 2016) provides the philosophy and tools to improve strategic decision-making, given that it focuses on participative strategic decision-making. Participative and democratic strategic decision-making enforces strategic job control possibilities, enables employee involvement and serves as an important tool for improving local labour relations.

Sociocracy was developed in The Netherlands in the 1970s (Endenburg, 1998; Lekkerkerk, 2016), and although the philosophy has spread, it has not been implemented on a large scale. Its more recent US adaptation, that has gained some ground recently, is called Holacracy (Roberson, 2015). Sociocracy is a consistent approach to involve employees (including managers) across different hierarchical levels in making non-operational decisions, for instance about strategic choices, including innovation and change (Endenburg, 1998). Sociocracy proposes the creation of circles, each consisting of a group of people at the shop or office floor. Depending on the size of the organization and the operational division of labour, there will be a hierarchy of circles (e.g., operational circle, business unit circle, top circle). The members of a circle elect one of them (the manager excluded) to represent them and their views in a higher-level circle, which is linking related lower-level circles. Thus, a number of layers may be formed until the top-circle is reached at top-management team level. Hence, a ‘circle-organization’ not only has a normal chain of command hierarchy for operational matters, but also a parallel structure of ‘circles’ for strategic or policy decision-making, that also serves as a bottom-up feedback channel, increasing the information processing capacity of the organization.

## Conclusion

STS-D theory and practices have played an important role in designing the structure of humane and innovative workplaces. However, for workplace innovation, simply restructuring units, departments, tasks and roles is not enough. In traditional, bureaucratic organizations, support systems have hidden conservation mechanism to keep the bureaucracy in place. Moreover, for workplace innovation, support and coordination systems as well as democratic strategic decision-making should be included in designing the workplace.

In this article, we aimed at developing a more comprehensive design theory for stakeholders who are involved in design processes aimed at workplace innovation, by starting from sociotechnical design and by exploring how we can broaden that perspective with other approaches, to also cover issues such as IT-design and HR-design. Specifically, we focused on

the following approaches as potential additional perspectives to STS-D in developing a concept of Total Workplace Innovation:

- The Lean Thinking approach for quick time response (JIT) control systems and for continuous improvement;
- The relational coordination theory for supporting horizontal coordination;
- HRM-theories and practices for supporting HR-policies;
- TPM to support the collaboration between maintenance and operation;
- ICT systems design to create effective information support systems, based on variety instead off one size fits all;
- Sociocracy for participative decision-making and democratic involvement on strategic issues.

It is to be noted, that the TWIN concept we presented in this contribution needs to be further elaborated upon. In addition, we admit that we have left several questions unanswered due to limited space, such as, how can these approaches be integrated, how will they affect one another, and what will be the consequences in terms of design steps. Therefore, we suggest a joint journey of practitioners and academic researchers to develop a more profound model and practices for Total Workplace Innovation.

To conclude, the added value of this approach to workplace innovation practices is the understanding of workplace design as a fundamental precondition for the joint optimisation of quality of working life and productivity. The TWIN model starts from a structural design perspective (STS-D), however, to realise TWIN we need to integrate the design perspective with behavioural aspects and specific types of leadership (see Oeij et al., 2015). Realising TWIN in practise, hence, is a simultaneous design and organizational development process.

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