Strategic dialogue : in search of goal coherence

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Strategic Dialogue:

In Search of

Goal Coherence

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PROEFSCHRIFT

ter verkrijging van de graad van doctor aan de Technische Universiteit Eindhoven, op gezag van de Rector Magnificus, prof. dr. M. Rem, voor een commissie aangewezen door het College voor Promoties in het openbaar te verdedigen op donderdag 29 juni 2000 om 16.00 uur

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Marco de Haas

geboren te Alblasserdam

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Chapter 1.
INTRODUCTION & PROBLEM IDENTIFICATION

This chapter introduces the subject of our research: human performance management. In relation to this behavioral management approach based on the measurement of human performance, the two central themes of the research are introduced: the intervention of Strategic Dialogue and the construct of Goal Coherence.

1.1 IN BRIEF: PURPOSE OF THE STUDY

This monograph tells the story of people in organizations, of their goals at the organizational and group level and of the coordinated allocation of human resources in terms of time and energy to these goals; in short, this monograph tells the story of organizational effectiveness while recognizing the human factor of organization as its most valuable asset and critical factor for future success. Therefore, this monograph is about people management, about the management of human performance by its measurement, organization-wide, at multiple levels of organizational analysis and for multiple groups of organizational actors.

The purpose of our scientific journey is to produce a framework for the multilevel designing of performance measurement systems by groups in organizations. Neither the individual, nor the organization, however the group is chosen as the unit of analysis; therefore, this monograph presents a group level study of human performance management. The adverb multilevel relates to the multiple levels at which the organization can be analyzed. In the remainder of this monograph, a distinction is made between three levels of organizational analysis for revealing the organization's multiple groups. These levels correspond with the levels of aggregation in the black-box approach of systems theory (e.g. In 't Veld, 1988):

- The *macro* level. The highest level of aggregation, i.e. the macro level of organizational analysis, relates to the organizational entity as a whole, e.g. a business unit. At the macro level, the focus is on long-term or strategic innovation. The (top) management team represents the group at the macro level that is responsible for the overall or integral performance of the organization. Overall performance is indicated by the degree of common or organizational goal attainment.

- The *micro* level. The lowest level of aggregation, i.e. the micro level of organizational analysis, relates to the physical and non-physical transformations in the primary process at the organization's shop-floor. At the micro level, the focus is on day-to-day or operational execution. Manufacturing teams and sales departments, among others, represent groups at the micro level that are responsible for local performance of the organization's parts.
- The *meso* level. The macro and micro level are most easily identified: they can be thought of as the ends of a continuum. However, in many (especially larger) organizations, at least one intermediate level can be identified: the meso level of organizational analysis. This level of aggregation relates to the continuos improvement of business processes that cross the borders of local manufacturing and sales units. Logistics and quality assurance are well-known examples of such cross-functional processes. At the meso level, the focus consequently is on medium-term or tactical improvement. The adjective tactical emphasizes that the timeframe for improvement generally lies between the timeframes for strategic innovation (1 to 5 year periods) and operational execution (daily or weekly). Departments like logistical planning and quality assurance and temporary project teams or structural committees, composed of representatives from supportive and primary departments, represent groups at the meso level that focus on cross-functional performance of interacting parts.

The illusion we would like to avoid by distinguishing between the macro, meso and micro level is a classic and mechanistic view of the organization. In classic organizations, there is a clear and hierarchical distribution of long-term and short-term responsibilities, exclusively attached to a specific level of organizational analysis. Our view of the organization corresponds best with the socio-technical model of Kuipers and Van Amelsfoort (1990), which is depicted in Figure 1-1. The model shows that in modern organizations the responsibilities for innovation, improvement and execution are shared, to a certain degree, between groups at multiple levels of organizational analysis.

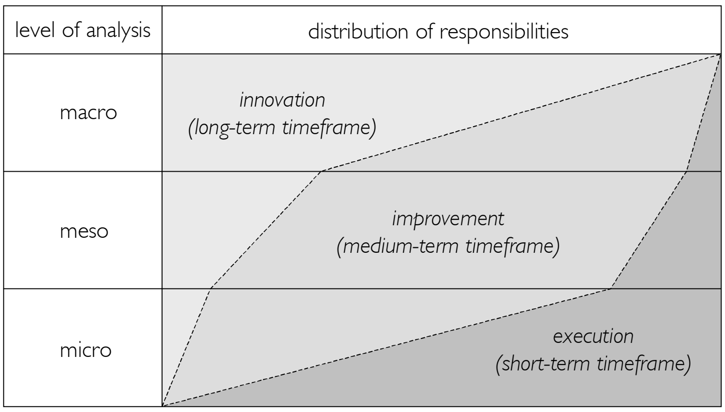

Figure 1-1: Sociotechnical model (adapted from Kuipers and Van Amelsfoort, 1990).

Since the framework for multilevel designing is prescriptive in nature, the scientific purpose really is to produce instrumental or design knowledge that professionals in the practical field (i.e. managers and consultants) can apply to construct a new or change an existing organizational reality. According to Mattessich (1995), production of instrumental tools is the *raison d'être* of applied science, which by definition is purpose-oriented.

The design knowledge presented in this monograph prescribes how to organize and facilitate the process of multilevel designing in practice; the design knowledge is not prescriptive towards the multiple products of designing, i.e. the context-specific and thus unique performance measurement systems for the organization's multiple groups, that result from the process of multilevel designing as organized and facilitated in practice. From a scientific point of view, it is the process of designing rather than the product of designing that is of interest, since the former rather than the latter can be transferred to other organizational contexts. In other words, it is the process of designing rather than the product of designing that is transferable to other practical contexts. As a consequence, we speak of a framework for multilevel designing instead of a framework for multilevel design.

Quite roughly, the design knowledge in this monograph prescribes the multilevel designing of performance measurement systems to be a highly interactive and organization-wide intervention: the process is participated by all or the majority of organizational actors who exchange and discuss their mental models of organizational effectiveness in light of the overall business strategy. This intervention is furthermore referred to as the Strategic Dialogue.

The purpose of our scientific journey is not limited to merely outlining a intervention. Moreover, effects of the Strategic Dialogue are empirically tested too. These effects regard the sharing of goal priorities within and between the organization's multiple groups, taking into account different levels of controllability by different groups through the deployment of macro level group goals into meso and micro level group goals. The degree of group consensus on goal priorities is referred to as Goal Coherence: the construct that is leading the research. The empirical question is thus whether the intervention of Strategic Dialogue contributes to enhanced degrees of Goal Coherence. Given the purpose-orientation of the research, we are simply obliged to test such effects. Since if there would be no effect, why bother practitioners in the field with the idea of a Strategic Dialogue?

The effect we would like to test is graphically depicted in the research approach of Figure 1-2. This effect is instrumental, not causal, in nature. The term research model is therefore deliberately avoided; we therefore speak of the research approach. Use of the term research model would suggest a classic research design over multiple cases with LISREL-like analysis of huge data sets aiming at causal understanding of an empirical reality. Our aim is to demonstrate the effectiveness i.e. instrumental value of an intervention that changes the empirical reality of a single case.

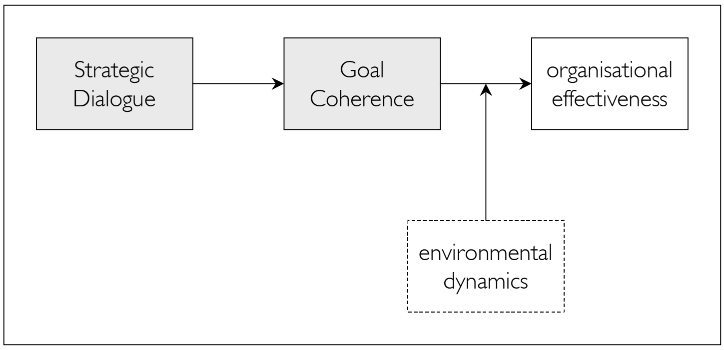

Figure 1-2: Research approach.

Another instrumental relation in Figure 1-2, the relation between Goal Coherence and organizational effectiveness, provides relevance to our attempts of empirically testing the presumed relation between Strategic Dialogue and Goal Coherence. The construct of organizational effectiveness refers to how successful the organization is in attaining its common goals. However, the effect of group consensus on goal priorities throughout the organization upon common goal attainment is not as obvious as it intuitively seems. It is plausible to suggest that the effect is moderated by environmental dynamics, which is presented in Figure 1-2 as an exogenous factor. For instance, overall performance of the entity won't benefit from shared goal priorities if the organization's major customer goes bankrupt, if a competitor introduces a breakthrough technology or if the national or global economy suffers from a financial crisis.

Therefore, no attempts are made to empirically test the validity of the relation between Goal Coherence and organizational effectiveness. In fact, there is only one hard criterion against which the effect of Goal Coherence on organizational effectiveness can be checked: the correlated performance trends of multiple groups. However, the phenomenon of environmental dynamics periodically necessitates strategic change and thus control system redesign, which frustrates empirical data gathering for this matter. There has been limited empirical research on this relation, however results are contradictory. Grinyer and Norburn (1975) and Bourgeois III (1985) examined the relationship between goal agreement among organizational members and organizational effectiveness and found no relation; Bourgeois III (1980) and Dess (1987) though found a positive relation. These contradictory findings might be explained by the disregarding of organizational dynamics as a moderating variable.

Still, we maintain the premise that it is good for the organization if organizational actors share their mental models of organizational effectiveness, resulting in a coordinated allocation of scarce human resources (i.e. time and energy). This premise is based on our principal view of the organization as a network of multiple groups that are interdependent upon each other in attaining the integral goals of the entity; this type of interdependence is therefore called goal interdependence.

Goal interdependence, defined as the degree in which people experience their individual goals to be related (Van der Vegt, Emans and Van der Vliert, 1996), is synonymous to outcome interdependence. It is conceptually distinguished from task interdependence, which is defined as a structural feature of the work relation between group members (Van der Vegt *et al.*, 1996). Task interdependence corresponds with one of Thompson's (1967) pooled, sequential or reciprocal types of interdependence. Although conceptually distinguished, outcome and task interdependence are empirically related. Van der Vegt *et al.* (1996) found that outcome interdependence moderates the effect of task interdependence on team effectiveness.

Following Van der Vegt *et al.* (1996), we extend goal interdependence from an intra-group construct defined at the individual level (relating to group or team effectiveness) to an inter-group construct defined at the group level (relating to organizational effectiveness). In contrast to these researchers, we distinguish between two aspects of group level goal interdependence:

- the structural existence of goal interdependence between groups;
- the subjective perception of goal interdependence between groups.

The first aspect expresses our principal view of the organization, which underpins the relation between Goal Coherence and organizational effectiveness as depicted in the research approach of Figure 1-2. Goal interdependence is seen as a fundamental feature of the organization. Especially given the dynamics of today's business environment, forcing customer needs to be identified and fulfilled with ever increasing delivery speed, product quality and cost reductions, goal interdependence has become a given fact of organizational life. Our view of the organization thus already seems plausible. Moreover, we will build a logical argument based on the second aspect of group level goal interdependence that further supports the plausibility of our principal view.

The second aspect of goal interdependence relates to the subjective perception of its structural existence by organizational actors. Despite its structural existence, goal interdependence between groups can be perceived alternatively, since it is quite often obscure for organizational actors in what way group goals at multiple levels of organizational analysis relate. Following the theory of cooperation (Deutsch, 1949, 1973, 1980, 1990), which identifies three alternative perceptions of goal interdependence at the individual level, we identify three alternatives at the group level:

- Perceptions of positive goal interdependence i.e. cooperation: the belief that one's group goal attainment contributes to other groups' attainment of their goals; as one group succeeds, other groups succeed;
- Perceptions of negative goal interdependence i.e. competition: the belief that one's group goal attainment precludes, or at least makes less likely, other groups' attainment of their goals; as one group succeeds, other groups lose;
- Perceptions of neutral goal interdependence i.e. independence: the belief that one's group goal attainment neither helps nor hinders other groups' attainment of their goals.

Alper, Tjosvold and Law (1998) applied the theory of cooperation for determining the effectiveness of group decision making processes. They applied the three alternative perceptions of goal interdependence at the individual level to self-managing team effectiveness. 69 teams of first-line production operators were selected and strong empirical support was found for cooperative goals to contribute to effective team performance and for competitive goals to interfere with team effectiveness. This is a very interesting finding, since a team is a special kind of group, namely a group that is characterized by goal interdependence among individual members. In other words, Alper *et al.* (1998) found at the individual level that if goal interdependence structurally exists and if it is furthermore positively perceived as such, resulting group performance i.e. team effectiveness is positively affected.

Their research findings can be extended from the micro level to the macro level of organizational analysis, relating to an entire business unit. A business unit management team can be seen as a self-managing team itself. Team effectiveness, which at this level of organizational analysis corresponds with organizational effectiveness, thus requires common goals to be cooperative. However, the unit of analysis at the macro level incorporates more than just the group of management team members; it additionally incorporates multiple groups (e.g. employees from a sales department or a manufacturing facility) acting at lower levels of organizational analysis. For the sake of organizational effectiveness, their goals, which are common goal derivatives, must be cooperative as well; not just between multiple individuals of a single group, but especially between multiple groups of a single organization.

In short, our logical argument supports our principal view of the organization. The organization as a network of multiple and goal interdependent groups underpins the premise that organizational effectiveness benefits from Goal Coherence and thus provides scientific relevance to empirically testing the effect of Strategic Dialogue on the degree of Goal Coherence throughout the organization.

This monograph will turn out to be a kaleidoscopic reading experience. In search of Goal Coherence, we make use of a variety of theories, which are listed below:

- Systems theory (Emery and Trist, 1969; Katz and Kahn, 1978);
- Cybernetic control theory (Ashby, 1958);
- Cooperation theory (Deutsch, 1949, 1973, 1980, 1990);
- Goal setting theory (Locke and Latham, 1990);
- Feedback theory (Kopelman, 1982, 1986);
- Participation theory (Miller and Monge, 1986; Vroom and Yetton, 1973);
- Resource allocation theory (Naylor, Pritchard and Ilgen, 1980);
- Agency theory (Jensen and Meckling, 1976);
- Strategy deployment theory (Akao, 1991; Zairi, 1994).

The reader will find the connection between these theories, varying from the individual level, to the group level, to the organizational level, and the practical applicability of the concepts involved, not clear beforehand. We recognize that this variety of theoretical notions complicates the readability of the monograph. In the end however, all lose ends will turn out to be connected and jointly produce design knowledge regarding the intervention of Strategic Dialogue.

1.2 SUBJECT OF RESEARCH: HUMAN PERFORMANCE MANAGEMENT

Management is often described as some sort of an art rather than a skill. Obviously, this has to do with the object of management: organizations of flesh and blood.

By flesh and blood we mean that the most distinguishing feature of the phenomenon organization is its human element. First and foremost, an organization is people: the *leitmotiv* of this monograph.

1.2.1 Organizations

What exactly is an organization? Many definitions of this phenomenon have appeared in literature on organization theory. In its most basic form, an organization can be defined as a collectivity of two or more individuals. The distinguishing feature of organization thus does not regard machines, materials, tools, money or procedures; it regards humans. This behavioral definition views the organization as a social system composed of human elements.

Organizations do not originate spontaneously, they are deliberately created for fulfilling a need in a private or public market. Therefore, organizations are goal-seeking entities. The most fundamental goal of many, especially industrial, organizations is related to financial continuity over time. By this financial goal, the common goal of the entity is meant. In addition, the organization might have other common goals, jointly pursued by all organizational actors. After all, it is people and not organizations that have goals, an early statement made by March and Simon (1958), Simon (1960) and Cyert and March (1963), connecting with the social definition of organization. Typically, common goals are proclaimed by the organization's dominant coalition, i.e. (top) management. The organization can thus be redefined as a collectivity of two or more people guided by common goals. The goal-seeking nature of organization is recognized by Etzioni (1964) and Perrow (1970) in the goal-oriented model of organization.

In order to fulfil a market need, organizations initiate the transformation of inputs into outputs. Outputs take the form of physical goods or non-physical services. During transformation, the organization adds value to the inputs consumed from the external buying market. If the organization is efficient and effective in its value adding activities, the external selling market is willing to re-consume the outputs against a premium price, structurally resulting in the attainment of common goals. The requirement of environmental interaction for common goal attainment is recognized by Emery and Trist (1969) and Katz and Kahn (1978) in the open-systems model or natural-systems model of organization, which is depicted in Figure 1-3.

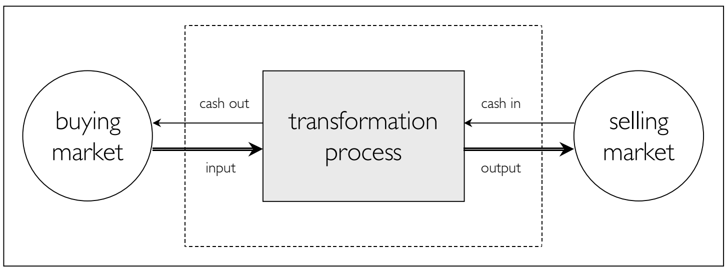

Figure 1-3: Systems theoretical model of organization.

The open-systems model of organization in Figure 1-3 which, in contrast to its closed-systems counterpart, is appropriate in today's increasingly dynamic and turbulent business environment, is founded on the previously mentioned black-box approach known from systems theory (e.g., In 't Veld, 1988). Systems theorists try to explain the working of the whole from the working of the parts. In order to understand the working of the black-box, it therefore needs to be opened and analyzed at a lower degree of aggregation. By opening the black-box, its constituting parts are revealed. Projected onto Figure 1-3, the black-box approach implies studying the phenomenon organization at multiple levels of aggregation ranging from macro to meso to micro. Each of the revealed parts i.e. groups at lower levels of analysis are responsible for one or more (sub-)sub-processes within the overall transformation process at the macro level. These groups represent organizations in themselves: collectivities of two ore more individuals such as departments, teams and work groups. These sub-organizations are termed constituencies by Pennings and Goodman (1977) and Connolly, Conlon and Deutsch (1980) in the multiple-constituency model of organization. We can thus redefine the organization as a collectivity of one or more constituencies guided by common goals.

The multiple-constituency model provides additional meaning to the goal seeking nature of organization recognized in the goal-oriented model (Etzioni, 1964; Perrow, 1970). Since a constituency is an organization in itself, it pursues own, local goals at the group level in addition to the integral goals at the organizational level[1]. In other words, constituencies are not exclusively guided by common goals (if at all!). The organization can now be redefined as a collectivity of one or more constituencies guided by group and common goals. In the remainder of this monograph, we will prefer the term constituency instead of group in order to indicate that a group pursues goals and, for its attainment, is goal interdependent upon other groups.

The systems approach that gives us the organization as a social system of multiple constituencies emphasizes the importance of goal interdependence between constituencies: goal interdependence is a major determinant of the degrees of freedom available for groups to locally contribute to the integral goals of the entity. In other words, this approach emphasizes the importance of cooperation between multiple constituencies given their mutual interdependence for attaining common goals. Due to the requirement of cooperation, common goals were previously described as supposed to be jointly pursued by all organizational members. The reason why we find systems theory helpful might be clear: the systems approach connects with our principal view of the organization.

So, we can now define the phenomenon organization more specifically as a collectivity of one or more constituencies working in mutual interdependence for the attainment of group and common goals. This social definition of organization thus incorporates a composite of the goal-oriented, the natural-systems and the multiple-constituency model of organization. In slightly different words, however with identical tenor, we can define the organization as a collectivity of multiple constituencies working in a network of multiple interdependence relations for the attainment of multiple goals. This latter definition stresses the complex nature of the organization as a social system.

1.2.2 Human behavior

The characterization of organizations as complex social systems has a fundamental repercussion for the process of management. The emphasis on the human factor of organization takes in the simple recognition that "the only way goals are going to be obtained is through the behavior of organizational actors" (Steers, 1977). Management

[1] Individual goals are ignored since this monograph is a study at the group level.

is thus about stimulating organizational behavior: i.e. decision making behavior by humans in an organizational context (Moorhead and Griffin, 1992). The essence is to fit organizational behavior to organizational goals. Such fit discourages dysfunctional behavior, which ultimately causes sub-optimization of integral performance, which in turn hampers the effectiveness of the entity. In Lawler III (1976), three types of dysfunctional behavior are distinguished:

- Bureaucratic behavior: people have the natural tendency to act rigidly in whatever way helps them 'look good on the measures' used by the control system, having dysfunctional effects if these measures are poorly designed (i.e. support faulty goal priorities or disregard relevant areas of performance);
- Production of invalid data: this behavior is typified as 'window dressing' which is also explained from the desire to look good (provision of misleading data can thus be seen as an act of bureaucratic behavior);
- Resistance to control: the deliberate ignoring of organizational controls for guiding human behavior (which might even produce functional effects in case of a poorly designed control system).

Historically, the concept of control originates from the engineering sciences, such as mechanical engineering and electrical engineering (e.g., Franklin, Powell and Emami-Naeini, 1994; Dorf and Bishop, 1995; Kuo, 1995). In contrast to engineering science, control in organization science relates to social rather than to technical systems. In both cases, control can be generally defined as the process of detecting and correcting adverse behavior (Juran, 1964). So, in order to understand the art of management, we will first have to gain understanding of human behavior in an organizational context.

Human behavior is based on a construction of reality in the human mind (Vennix, 1996). There is convincing scientific evidence (e.g. Neisser, 1967) that the human mind actively constructs external reality rather than passively stores and recalls information, which is received from the environment through the senses. The active and deliberate construction of reality takes place through processes of selective perception and selective recollection. Stated differently, the human mind is biased in information selection and recollection of past events. The construction of the external reality in the human mind is referred to as a mental model (Toffler, 1970; Gentner and Stevens, 1983; Johnson-Laird, 1983). These models are dynamic in nature and will change over time due to newly gained insights in the functioning of reality.

A mental model is an individual's cognitive representation of a system (e.g. an organization) and the individual's interaction with the system (i.e. behavior), with particular focus on how the individual's interaction with the system causes outcomes of interest (i.e. goal attainment). The notion of belief in causality is of major interest: beliefs represent the basic conceptual building blocks of mental models (Hinsz, 1995). In short, people build mental models of their environment and in turn base their behavior on these mental models, thereby creating situations which are subsequently interpreted as reality (Vennix, 1996).

Given the way human beings selectively process information, an holistic view of reality is the exception rather than the rule. A number of cognitive limitations induce people to perceive and recollect selectively and thus to focus on the parts rather than the whole:

- Limited systems thinking capability: people have difficulty in identifying interconnections and thinking in causal nets (Dörner, 1980);
- Limited information processing capacity or 'bounded rationality' (Simon, 1948): people tend to (un)consciously reduce complexity in order to prevent information overload and to reduce mental effort (Hogarth, 1987). Miller (1956) was one of the first to empirically demonstrate this phenomenon. He pointed out that in general people can only hold seven (plus or minus two) pieces of information in their short-term memory;
- Limited span of attention: "... before information can be used by the deliberative mind, however, it must proceed through the bottleneck of attention – a serial, not parallel, process whose information capacity is exceedingly small" (Simon, 1985).

Due to these cognitive limitations, people make mental models that are by definition incomplete. Since people tend to look for information which confirms their view of the world rather than to look for evidence which might refute it (Hogarth, 1987), the existing and incomplete mental models in turn feed the processes of selective perception and recollection. In addition, and perhaps far more important, people make mental models that are idiosyncratic (Hinsz, 1995). People differ due to differences in background, personality, experience, learning, etc., and will thus select differently. As a consequence, individuals interpret reality in their own unique ways. Everyday life thus presents itself to the individual as a subjective reality: there is no question of one single and objective reality perceived similarly by multiple individuals.

The point we are trying to make is that there is ample opportunity for different human beings to construct and maintain different mental models of the 'same' reality. What are the chances that people with an idiosyncratic view of the world select the same chunks of information from their environment and subsequently construct the same mental representation of the perceived reality? Quite likely, these chances are negligible. Ickes and Gonzales (1994) use the terms divergence and convergence for the degree of similarity between mental models if compared across groups of individuals. The idea of divergent mental models, symbolized by the circle and the square, is visualized in Figure 1-4.

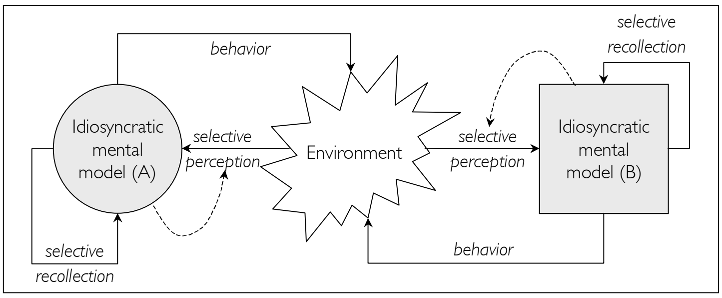

Figure 1-4: Divergence in the creation of reality (adapted from Vennix, 1996).

We would like to stress the point that is being made from a management perspective. Regarding organizational life, managers' and employees' mental models contain ideas about how group goals mutually relate and jointly contribute to organizational goals, about the common goals of the entity and the ways to attain them, about what priorities should be set between various decision alternatives and subsequent acts, and, thus, about the allocation of scarce human resources in terms of time and energy. In other words, the mental models of organizational actors contain beliefs about what is and what is not good for the organization's overall welfare. Organizational reality is even more complex due to the existence of varying positions and, consequently, of varying levels of controllability throughout the organization. Hence, means, ends and their mutual relations are multivariate in nature and interconnected at multiple levels of organizational analysis. The question is whether organizational actors grasp the complex nature of the social system of which they are part in their mental models.

All else being equal, the larger the discrepancies between managers' and/or employees' mental models, the more lack of shared vision, the more divergence in behavior and the higher the dispersion of organizational energy. According to Vennix (1996), these discrepancies will impede the effective operation of the organization, because it will induce a lack of cooperation. His remarks correspond with the previously introduced premise of our research (the Goal Coherence – organizational effectiveness relation of Figure 1-2).

Assuming that management is about coordinating individual and group efforts into organized action, the purpose of an intervention – in this case the Strategic Dialogue – is thus to share and align multiple mental models in order to foster concerted action. (Bear in mind that the purpose is not to develop a single mental model that is collectively shared by all organizational actors, since such a naive attempt would disregard the existence of varying degrees of controllability: the man who operates a machine on the factory shop-floor needs to have an entirely different mental model than the general manager.) Rather than devoting one's time to the construction of strategic plans, the focus must instead be on the process of changing mental models itself (Vennix, 1996). In the words of Checkland and Scholes (1990): "What is in short supply in organizations is an organized sharing of perceptions sufficiently intense that concerted action gets taken corporately." Striving for convergent or shared mental models, i.e. for an intersubjective perception of reality throughout the organization, seems thus essential in light of organizational effectiveness. The existence of divergent or uncomplimentary mental models within but, moreover, between the organization's multiple and goal interdependent constituencies is not to be excluded beforehand; even more so, it probably is a valid characterization of organizational life.

1.2.3 Human performance

Managing the organization is thus synonymous to managing a multitude of mental models and corresponding behaviors of organizational actors. This recognition makes managing a social system fundamentally different from managing a technical system such as a machine. A machine is managed by pushing buttons and switching levers or, in the digital variant, by programming software. In other words, managing a machine is based on a-priori and perfect knowledge of static means-end relations. A means-end relation is an instrumental relation that prescribes the means to apply in order to achieve a specified end (Ouchi, 1979; Mattessich, 1995). In case of static means-end relations, there is no need to exchange and converge beliefs regarding what does and what does not contribute to common goal attainment.

Attempts have been made in Taylor's (1911) days of scientific management to approach organizations as machines and to manage them accordingly. Not surprisingly, this type of management was developed in the early 1900's for situations of complete certainty in perfectly static business environments. Such situations required high degrees of standardization for achieving organizational efficiency (i.e. optimized resource utilization) rather than organizational effectiveness. Projection of these ideas onto the management of an organization reduced the contribution of the human factor into a pre-defined and repetitive piece of work.

Not surprisingly, strong opposition grew against Taylor's ideas, simply because his system of management had some inhumane consequences. However far more important, his management philosophy departed from a simplistic, Theory X (McGregor, 1960) approach of human beings: unintelligent with no ambition to achieve goals, not eager to learn, no ambition for self-development, not able to plan and control; in short, not capable of any cognitive input or intellectual contribution whatsoever. In fact, the machine approach to organizational control completely disregarded the human factor. However, in today's business environment where change is the only constant, the human factor is critical and its cognitive input is of far more value for the organization than its manual input. Nowadays, it is sometimes said that people get paid for their heads instead of their hands.

As a consequence of environmental and subsequent strategic change, the assumption of perfect knowledge of static means-end relations is not valid today. The ends the organization is attempting to pursue and the alternative means it applies in order to attain the ends are in a continuous state of flux. Thus, the dynamic nature of means-end relations should be the subject of continuous discussion and debate within the organization. Not only in the boardroom, but throughout the organization at the macro, meso and micro levels of organizational analysis within and between the organization's multiple constituencies. Such strategic interactions require organization-wide involvement of the human factor in the strategy process (e.g., Mintzberg and Quinn, 1991; Johnson and Scholes, 1993) and in the subsequent design of organizational controls.

This involvement justifies our behavioral approach to the study of management. In order to (self-)manage behavior, the notion of feedback is evident (Algera, 1990). This is because feedback processes per definition play a decisive role in identifying behavior and underlying mental models which cause behavior. In the words of Powers (1973: page 351): "All behavior involves strong feedback effects whether one is considering spinal reflexes or self-actualization. Feedback is such an all-pervasive and fundamental aspect of behavior that it is as invisible as the air we breathe. Quite literally it is behavior – we know nothing of our own behavior but the feedback effects of our own outputs." Feedback in organizations however is not invisible: it is deliberately created in all kinds of performance reports and as part of formal meetings and informal conversations. If feedback is viewed as the visual mirror reflection of behavior, than the contents of the feedback system (i.e. performance measurement system) should be carefully chosen since it is in fact a formalized mental model which can be exchanged and discussed among organizational members. A performance measurement system contains a set of performance indicators, an ambition level or norm value for each indicator representing a specific goal and a weight factor for each goal. Discrepancies between actual and targeted performance are periodically fed back to individuals or groups. A feedback system thus reflects what is and what is not good for the organization's overall well-being and to what extent. An interactive i.e. participatory approach to the design of performance measurement systems can therefore facilitate the changing of existing mental models.

This explains human performance management to be the subject of the research. Human performance pertains to the performance delivered by human resources, both managers and employees. Human performance management is a feedback-based intervention for managing the organization (Algera, 1990). It represents a cyclic process of defining specific measures of performance, setting concrete targets for and giving weights to identified measures, feeding back and discussing discrepancies between actuals and targets and appraising the effort for and possible achievement of negative discrepancy reduction. The notion of a discrepancy-reducing feedback loop reveals human performance management to be based on a cybernetic control model (Ashby, 1958).

The term feedback (i.e. knowledge of results) suggests that human performance exclusively deals with results, i.e. with outcomes or effects of human behavior. However, human performance is about the processes and subsequent behaviors that will cause the desired results as well. In other words, human performance includes the effort or energy that is sacrificed for the achievement of results. The relation between results and processes as two components of human performance can be illustrated with an example from sports.

In ice-hockey, it is common knowledge that the number of body-checks during the match is related to the chance of actually winning the match. Or in soccer, it is common knowledge that the amount of ball possession, especially on the competitor's playing half, is a predictor for scoring goals. What we are dealing with is a means-end relation that, if collectively believed in, prescribes what the team should do during the process of a game (i.e. body-checking or ball possession) in order to achieve a specified result (i.e. victory). But has the team performed badly if a game is lost while the number of body-checks or the amount of ball possession has been high? Not if all actors involved beforehand agreed on the strategy. The disappointing result might be an accident or just a case of bad luck. Or it might be structural, which for the team is an indication to rethink its current strategy.

So, our definition of feedback comprehends both knowledge of results and knowledge of processes. Result and process feedback, incorporating a means-end relation, interact with goal setting to enhance performance. The effects of both types of feedback may be additive according to Earley, Northcraft, Lee and Lituchy (1990), who found that the combination of specific, challenging goals and both specific process and outcome (i.e. result) feedback produced a higher level of performance than other combinations.

1.2.4 Human performance management

Human performance management consists of the following four interventions which affect human behavior and performance: 1) monitoring; 2) goal setting; 3) feedback; 4) reinforcement. Jointly applied for organizational control purposes, these interventions produce a high performing control cycle (Locke and Latham, 1990), which is depicted in Figure 1-5. In fact, the high performance cycle represents the concept of motivation, which by Naylor *et al.* (1980: p. 159) in light of their resource allocation theory is defined as "the process of allocating personal resources in the form of time and energy to various acts in such a way that the anticipated affect resulting from these acts is maximized".

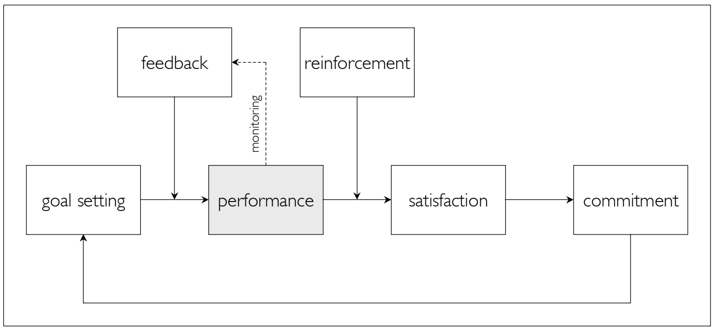

Figure 1-5: High performance cycle (adapted from Locke and Latham, 1990).

1.2.4.1 Monitoring

Monitoring refers to performance measurement. Measurement can be thought of as the backbone of human performance management: without measurement, no feedback can be provided and, thus, no specific goals can be set. A performance measurement system is defined by Simons (1995) as a diagnostic control instrument, since it facilitates diagnosing problem situations through the monitoring of key performance variables. The design of a performance measurement system encompasses the identification of a valid, complete and controllable set of performance indicators with accompanying targets and explicit weight factors per target.

A performance indicator is a formula or rule that enables quantification of performance. Quantification is the essence of measurement: the adding of symbols (i.e. figures) to phenomena (i.e. performance) through a set of prescribed rules (i.e. indicators). A set of performance indicators with accompanying indicator targets and indicator weights and with procedures for periodic data gathering and the group of organisational actors they relate to, form the elements of a performance measurement system. If used properly within a management cycle, performance measurement supports single-loop learning processes (Argyris and Schön, 1978) aiming at (continuous) improvement of business processes and resulting products.

Monitoring affects performance directly through the powerful principle of *What you measure is what you get*. This means that what the organization chooses to measure, and particularly what is both measured and fed back to organizational actors, will cause a change in what is measured (Pritchard, 1990; Eccles, 1991). Additionally, monitoring has a direct effect on performance through the well-known Hawthorne effect (e.g. Adair, 1984), which is generally defined as the modification in the subject's behavior resulting from his/her knowledge of being in an experiment or intervention. Furthermore, monitoring affects performance indirectly through subsequent goal setting interventions.

1.2.4.2 Goal setting

In the context of performance measurement, goal setting is about assigning targets to performance indicators. The assignment of indicator weights should also be seen as part of the goal setting intervention, since it results in the clarification of multiple, seemingly conflicting goals. Multiple goals should not be thought of as being in conflict, but rather that they are all important for the success of the organization. All identified goals need to be met to some degree. The real issue is to apply organizational resources to meet multiple goals in proportion to their importance. Or, in other words, the question is how much organizational effort needs to be applied to each goal so that the final combination of efforts is maximally effective for the organization (Naylor *et al.*, 1980; Pritchard, 1990).

The core premise of goal setting theory is that goals are immediate (though not sole) regulators of human action. Research on goal setting, which is reviewed in Locke and Latham (1990), resulted in two main findings regarding effects on performance. First, difficult goals lead to higher performance than easy goals. Second, specific goals lead to higher performance than vague, non-quantitative, do-your-best-goals. These findings relate to routine i.e. non-complex tasks.

There are four mechanisms which mediate (i.e. intervene) the effect of difficult and specific goals on performance. In case the attainment of goals is a non-complex activity, these mediators take the form of a universal, 'automated' task strategies in terms of directing attention, exerting effort and/or persisting through time. If goal attainment is characterized by complexity, a fourth mechanism comes into operation which concerns the development of specific strategies (Wood and Locke, 1990). Strategy development involves conscious problem solving and creative innovation and is also applied as a means of saving effort (i.e. "working smarter instead of harder").

There is also a number of conditions which moderate (i.e. restrain) the goal-performance relation. Among task complexity, ability and situational constraints, the degree of goal commitment (or: goal acceptance) has a moderating effect on subsequent actions and performance. Goal commitment refers to the extent to which people are attached to a given goal, consider it significant or important, are determined to reach it and keep it in the face of setbacks and obstacles (Latham and Locke, 1991). Another moderator refers to feedback (see Figure 1-5).

1.2.4.3 Feedback

The issue of feedback has already been mentioned in relation to human behavior. There is evidence that people prefer specific, timely and positive feedback (e.g. Ilgen, Fisher and Taylor, 1979) and that such feedback enhances performance (e.g. Kopelman, 1982, 1986). Feedback affects performance in two ways: through cognitive and through motivational processes. Objective feedback corrects misperceptions and reduces role ambiguity, which has a cognitive effect on performance. Feedback can also increase motivation to the extent that it creates social consequences, e.g. public feedback causes competition among groups or individuals.

Evidence has repeatedly shown that the effects of feedback are limited to the specific performance for which feedback is provided. Therefore, the more specific the feedback is, the greater the effects are, since specific feedback facilitates the setting of specific goals, which have larger effects on performance than general do-your-best-goals. This point makes clear that feedback is a technical prerequisite for goal setting and that goal setting without feedback is hardly effective. Or, in the words of Locke and Latham (1990): "With respect to feedback, goals are a mediator; they are one of the key mechanisms by which feedback gets translated into action. With respect to goals, feedback is a moderator; goals regulate performance more effectively when feedback is present than when it is absent." When introducing feedback without goal setting, spontaneous goal setting can be expected to occur; when introducing goal setting without feedback, feedback seeking behavior is likely to occur.

1.2.4.4 Reinforcement

The premise of reinforcement theory is that behavior is largely a function of its consequences. As can be seen in Figure 1-5, reinforcement moderates the effect of performance on satisfaction, i.e. performance regulates satisfaction more effectively in the presence of rewards. Rewards are either internal or external. Internal, self-administered rewards include a sense of achievement based on attaining a certain level of excellence, pride in accomplishment and feelings of success and efficacy. The external rewards that are most likely to be tied to performance in relation to goals are pay, promotion and recognition (Locke and Latham, 1990). Regarding pay, expectancy theory (Vroom, 1964) states that the motivational power of pay in producing performance will be a function of the belief that high performance can be attained (expectancy), the belief that high performance will lead to outcomes (instrumentality) and the belief that those outcomes are valued (valence). As such, these beliefs can be thought of as elements of an individual's mental model.

In the remainder of this monograph, the focus is limited to the backbone of human performance management: the design of performance measurement systems. Processes of goal setting, feedback and reinforcement take place within the context of existing mental models. Our interpretation of the contents of a performance measurement system as a formalized mental model thus explains the chosen focus.

1.3 RESEARCH ON HUMAN PERFORMANCE MANAGEMENT

The study of performance measurement system design from a behavioral perspective is subject of research in two applied fields of research: Management Accounting and Organizational Psychology.

1.3.1 Management Accounting

In the Management Accounting discipline, research focuses, among a variety of other questions, on managerial decision behavior and managerial performance at the macro level of organizational analysis. Given the applied nature of the discipline, the scientific aim, amongst others, is to support the professional in the practical field with tools for enhancing managerial accountability (Kasanen, Lukka and Siitonen, 1993; Mattessich, 1995; Vosselman, 1999). Such tools fall under Anthony's category of management control (Anthony, 1988), which he distinguishes from strategic planning and task control[2]. His definition of management control relies heavily upon responsibility accounting (Anthony,

[2] We do not assume validity of Anthony's classification; we merely want to use his distinction between management control and task control to explain divergent research perspectives on the subject of performance measurement.

1965), which has lost its relevance for effective control purposes today (Johnson and Kaplan, 1987). Contemporary developments concern regaining lost relevance of the current management control practice by refocusing managerial attention towards non-financial performance indicators. This requires management control system design to be exclusively placed in a strategic context (Langfield-Smith, 1997).

Responsibility accounting stems from the early days of single transactions between independent entities. Accompanying financial reporting systems were designed for external reporting on the financial performance of the entity. These reporting systems did not support the internal controlling of the entity itself and its interdependent parts in terms of e.g. product quality and delivery reliability. In those days, this control inability was not a major problem due to the exclusive and unidimensional focus on organizational efficiency i.e. cost performance.

However, longitudinal studies of the management control practice in a number of US companies by Kaplan and Norton revealed that these unidimensional practices and the subsequent dysfunctional behavior of managers had continued until the present day, which is characterized by its multidimensional control requirements. As a consequence, dissatisfaction of managers with the quarterly and annual financial reports was witnessed. It was observed that these managers complemented their financial statements with non-financial performance information related to issues like customer satisfaction and innovation capacity. On the basis of these observations in the practical field, which Kaplan (1998) refers to as 'innovation action research', a conceptual model representing a balance between multidimensional performance indicators was developed. The resulting approach to management control system design is the well-known Balanced Scorecard (Kaplan and Norton, 1992, 1993, 1996[a], 1996[b]), which is further explained in Chapter 2.

1.3.2 Organizational Psychology

In the field of Organizational Psychology, research concentrates on operational decision behavior and operational performance at the micro level of organizational analysis. Given the applied nature of the discipline, the scientific aim, amongst others, is to support the professional in the practical field with tools for enhancing work motivation. Such tools fall under Anthony's (1988) category of task control. Contemporary developments concern involvement of the human factor in control system design. Unit personnel involvement requires a liberal management philosophy, advocating self-controlling capacity and bottom-up initiatives. One method for the participatory and bottom-up design of diagnostic controls within the organization's operational core is the Productivity Measurement and Enhancement System or ProMES (Pritchard, Jones, Roth, Steubing and Ekeberg, 1988, 1989; Pritchard, 1990, 1995), which is further explained in Chapter 2. In practice, it frequently turns out that ProMES is embedded in a broader organizational change process: the introduction of self-managing teams as the new cornerstones of the organizational structure.

1.3.3 A call for convergence

The issue of convergence has already been stressed from a practical point of view: convergent mental models of organizational actors throughout the organization will benefit the effectiveness of the entity. Until now however, convergence in mental modeling has not been addressed as a relevant research issue, since the two applied fields of research, Management Accounting and Organizational Psychology, that study performance measurement system design from a behavioral perspective, do so in isolation. Both disciplines not only have different scopes (i.e. macro goal setting vs. micro goal setting), they also focus on different issues and use different methods. For example, in Management Accounting research, qualitative studies on strategic management in field settings are a usual pattern. However, in Organizational Psychology research, many studies on the individual level in the laboratory using quantitative methods of analysis have been conducted. As a consequence, organizational psychologists generally don't attend Management Accounting conferences and, *vice versa*, management accountants generally don't attend Organizational Psychology conferences.

Since interaction between both fields is scarce, an integral perspective at the design of organizational controls is thus lacking. In the field of Management Accounting, Otley and Berry (1980) though believe that it is important to attempt to develop this integral perspective "for the control of such important artifacts as human organizations is of vital importance to the welfare of society". For the practice of Management Accounting, an integral approach to control system design would imply an extension of the discipline to one that might be termed organizational accounting (Shields, 1997; Scapens, 1998). This term expresses Shields' and Scapens' worries regarding the current and, in their view, narrow scope of the Management Accounting discipline. Their remarks connect with recent developments within the field. In different words, but with identical tenor, Otley (1994) has been advocating that "the controller is no longer embodied in the higher reaches of the organization; the control function now needs to be embedded at all levels".

The need for an integral perspective is recognized in the field of Organizational Psychology as well. Locke and Latham (1990) call for convergence between macro goal setting research (concerning business strategies) and micro goal setting research (concerning task strategies). They argue that both approaches can benefit from each other, since they are supplementary rather than competitive. In the same light of convergence, Pritchard (1990) states that "a prevailing question related to effective task strategy development concerns fitting operational controls, such as the ProMES system, with higher order organizational controls". In fact, our research is initiated as part of the ProMES research program[3] in order to answer this prevailing question.

In short, a lacuna in the existing body of scientific knowledge is detected. This lacuna represents the theoretical problem of this monograph. Concretely, the problem relates to the integral perspective on human performance management, which is lacking. By addressing the call for convergence, we aim at filling the identified lacuna with instrumental knowledge regarding the Strategic Dialogue intervention. The search for Goal Coherence, which adheres to the call for convergence, furthermore provides our research endeavor with scientific relevance from an academic point of view. The exact research question of this monograph will be dealt with in Chapter 4.

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[3] A global network of universities exist that participate in the ProMES research program, among which: Texas A&M University, US; Middle Tennessee State University, US; University of Dortmund, Germany; University of Munster, Germany; Macquarie University Sydney, Australia; University of Tilburg, The Netherlands; Eindhoven University of Technology, The Netherlands.

To give an idea of what an integral approach to the design of performance measurement systems would bring about (see Algera and De Haas, 1999), we would like to present the Performance Pyramid model of Lynch and Cross (1991). Their model is depicted in Figure 1-6. The top of the Performance Pyramid is defined as vision. Vision and the resulting overall strategy have implications for the contents of lower level performance measurement systems. For example, a low-cost milk strategy has different consequences for the contents of organizational controls than an invest strategy. In addition, three levels of performance are distinguished, which connect with the macro, meso and micro levels of organizational analysis. A further inspection of the Performance Pyramid reveals that the left hand side of the pyramid is related to external effectiveness, while the right hand side relates to internal efficiency. It should be stated here that the Performance Pyramid is not identical with the hierarchy in the organizational structure. For instance, improvement of quality performance is not only an issue for work groups at the shop floor, but also for supporting departments and for the R&D department. This conclusion underlines the goal interdependent nature of the organization's multiple constituencies.

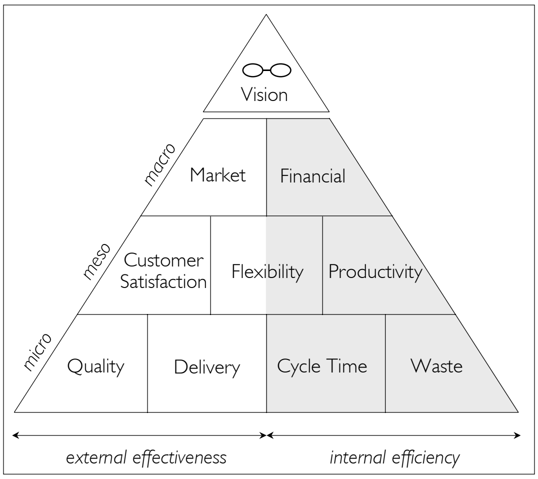

Figure 1-6: Performance Pyramid (Lynch and Cross, 1991).

Lynch and Cross (1991) present their Performance Pyramid as a multivariate and multilevel system of means-end relations: multiple performance variables are interconnected and controlled at multiple levels in the organization. This idea represents the most valuable feature of the model, since it rejects the idea of performance aggregation. The aggregation of performance would suggest controllability of the same dimensions of performance throughout the organization by all organizational actors: it would suggest a simple one-to-one translation of macro goals into micro goals. This suggestion implies the existence of a single and collectively shared mental model which, as previously stated, is a naive assumption.

Instead, the model departs from what might be called performance contribution, which suggests that different dimensions of performance are controllable at different levels of organizational analysis by different groups of organizational actors. In other words, the contents of the performance measurement system of the management team, the sales representatives, the logistical planners, the manufacturing operators, etc. will differ. This suggestion implies the existence of multiple mental models due to varying degrees of controllability, which is a more realistic assumption. In light of the organization's overall well-being, the issue is to converge existing mental models and to provide them with a common basis derived from the integral business strategy.

The Performance Pyramid is a normative blueprint for control system design. It prescribes the required contents of the products of designing: the performance measurement systems. However, the products of designing are at all times contingent upon contextual specifics and these products are thus unique: there is no "one best way of organizing". As previously put forward, the Strategic Dialogue focuses on the interactive process of designing instead of the diagnostic products of designing.

1.4 OVERVIEW OF THIS MONOGRAPH

This monograph on the intervention of Strategic Dialogue and the construct of Goal Coherence is structured along nine chapters, which are depicted in the overview of Figure 1-7.

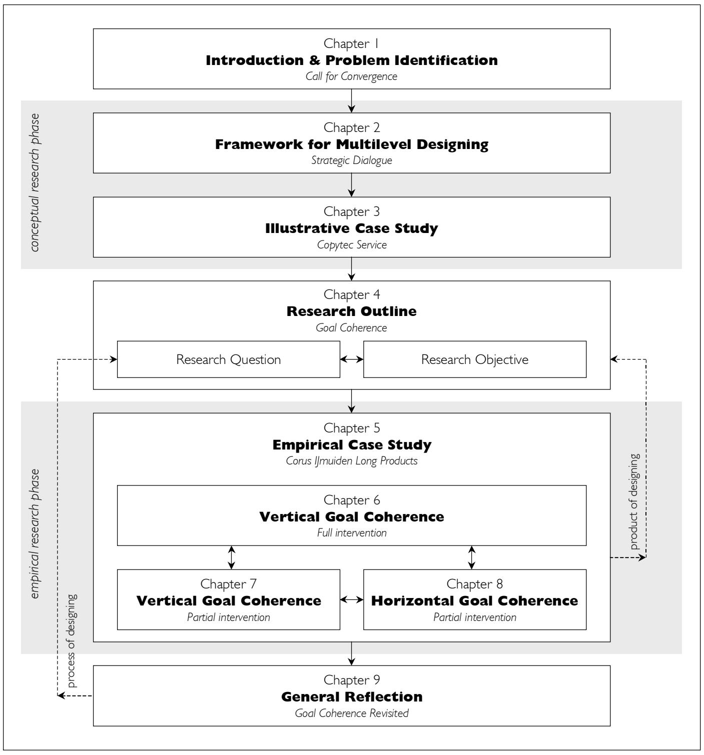

Figure 1-7: Overview of this monograph.

In order to effectively present these chapters, we will first present the overall research design as a two-case design (Yin, 1994):

- one illustrative case study during the conceptual research phase;
- one empirical case study during the empirical research phase.

The conceptual research phase is a phase of idea generation. A multitude of pre-scientific notions produce an a-priori idea of how to organize and facilitate the Strategic Dialogue in practice. This a-priori idea is next hypothetically explored in an illustrative case study. Chapters 2 and 3 relate to the illustrative case study of the conceptual research phase.

During the subsequent empirical research phase, the a-priori idea of Strategic Dialogue is empirically explored in the real-life context of an empirical case study. Within this real-life case setting, performance measurement systems and subsequent goals are actually being designed and implemented in practice. Chapters 5 through 8 relate to the empirical case study. In addition, these empirical chapters present and illustrate an intersubjective measure of association that operationalizes the Goal Coherence construct.

As part of the empirical intervention, the effect of the Strategic Dialogue on the degree of Goal Coherence is empirically tested. Within the overall research design of a preliminary, illustrative case study and a follow-up, empirical case study, we therefore have a separate design for the empirical phase of the research, which is outlined in Chapter 4.

Chapter 1, the present introductory chapter, identified a lacuna in the existing body of knowledge. This lacuna refers to an integral approach to the design of performance measurement systems. A call for convergence, advocated by leading researchers in the fields of Management Accounting and Organizational Psychology, is adhered to. The purpose of the study is to produce instrumental knowledge regarding the intervention of Strategic Dialogue.

Chapter 2 presents a definition of Goal Coherence. A distinction is made between within-constituency and between-constituency Goal Coherence. Especially the between-constituency Goal Coherence construct is of interest in search for a multilevel goal structure. In addition, the framework for the multilevel designing of performance measurement systems is presented. This framework has the status of an a-priori design theory, since its possible effect is yet to be empirically demonstrated. The framework prescribes how to organize and facilitate the Strategic Dialogue in practice during design team meetings and management approval meetings. The Strategic Dialogue refers to the interactive process of designing performance measurement systems during which existing mental models of the organization's multiple constituencies are exchanged and discussed.

Chapter 3 contains an illustrative case study, in which the application of the framework is hypothetically explored. Although based on a real-life company renamed Copytec Service, familiar with ProMES interventions from a previous research project, the Strategic Dialogue and the resulting products of designing are a conception of the researcher's mind. The purpose of the illustrative case study is to gain understanding of the Strategic Dialogue and of what it should contribute to: enhanced degrees of Goal Coherence.

After the conceptual research phase, the empirical research phase is outlined in Chapter 4 in terms of the research problem, the research design and the research methodology. The design of the empirical case concerns what we call a multiple two-group pretest-posttest design: an extended variant of Cook and Campbell's (1979) quasi-experimental one-group pretest-posttest design. To summarize our research design, it is thus constructed at two levels:

- overall design: two-case design;
- empirical design: multiple two-group pretest-posttest design.

Chapter 5 introduces the object of our empirical case study:, a business unit of the Corus corporation, the global manufacturer and supplier of steel an aluminum products which is the recent result of the merger between the British Steel corporation and the Dutch Koninklijke Hoogovens corporation in October 1999. In this practical context, the Strategic Dialogue is actually initiated, i.e. performance measurement systems are actually designed and implemented at the macro, meso and micro level of organizational analysis. For the purpose of our research, this business unit is of interest given the existence of ProMES systems in one of its operational units. Chapter 5 gives a description of the business unit's strategy, organizational structure and physical and non-physical transformation processes.

Chapter 6, Chapter 7 and Chapter 8 contain the empirical data of our study. In order to derive the required data, the Corus IJmuiden Long Products' multiple and goal interdependent constituencies participated in the multilevel designing of performance measurement systems: at the macro level by the Management constituency, at the meso level by two cross-functionally composed Quality and Logistics constituencies, and at the micro level by shop floor constituencies in the business unit's three operational units.

Shortly after the merger during the final stage of the research project, the Corporate Board of Directors decided negatively on the continuity of the Corus IJmuiden Long Products business unit within the new corporation. This necessarily caused the Strategic Dialogue to end prematurely. Hence, we have not been able to organize and facilitate the Strategic Dialogue intervention as planned in our multiple two-group pretest-posttest research design. In our report on the project, we therefore separate fully executed from partially executed interventions in three empirical chapters. Chapter 6 presents a full intervention regarding vertical Goal Coherence: the pretest and posttest operationalization of Goal Coherence within and between vertically goal interdependent constituencies, as well as the quantified effect of the Strategic Dialogue intervention on degrees of vertical Goal Coherence. Chapter 7 presents partial interventions regarding vertical Goal Coherence: the pretest operationalization of Goal Coherence within and between vertically goal interdependent constituencies, but no posttest operationalization and no quantified effect of the Strategic Dialogue intervention. Chapter 8 presents partial interventions regarding horizontal Goal Coherence: the pretest operationalization of Goal Coherence within and between horizontally goal interdependent constituencies, but also no posttest operationalization and no quantified effect.

Finally, Chapter 9 returns to the leading issue of Goal Coherence. This chapter contains the researcher's critical reflections upon the Strategic Dialogue and its consequences for organizational effectiveness. These critical reflections reveal the conditions under which the interactive process of designing is transferable to other cases. The a-priori design theory of Chapter 2 is supplemented with the conditions for effective application and consequently produces the final design theory.

Chapter 2.
FRAMEWORK FOR MULTILEVEL DESIGNING

This chapter[4] defines the construct that leads our research: Goal Coherence. It furthermore presents an a-priori framework synthesized from systems theory and cybernetics, that prescribes how to organize and facilitate the intervention of Strategic Dialogue: the interactive and multilevel designing of performance measurement systems, which aims at enhancing perceptions of positive goal interdependence within and between the organization's multiple constituencies.

2.1 INTRODUCTION

During the conceptual phase of the research, an a-priori framework for the multilevel designing of performance measurement systems is synthesized from systems theory and cybernetics. The framework incorporates a composite of the goal-oriented model, the natural-systems model and the multiple-constituency model of organization. The framework for multilevel designing is explored in Chapter 3 in an illustrative case study.

The multilevel feature of the design framework would suggest Goal Coherence to be hierarchical in nature. In line with this hierarchical flavor, Euske, Lebas and McNair (1993), among others, have addressed the vertical integration of performance measures. The term integration would suggest the design of one, overall performance measurement system and, moreover, the existence of a single mental model of organizational effectiveness shared by all organizational actors. Given our view of the organization as a network of goal interdependent constituencies, which have varying degrees of controllability regarding varying aspects of performance, we focus on coordination rather than on integration. Consequently, we leave room for the existence of multiple – though convergent – mental models of the organization's multiple constituencies.

The framework prescribes how to organize and facilitate the multilevel designing of performance measurement systems i.e. the Strategic Dialogue in practice; the framework does not present a normative blueprint that prescribes the contents of multiple performance measurement systems. The framework thus emphasizes the interactive process of designing rather than the diagnostic product of designing. As explained in Chapter 1, the product of designing is at all times context-specific and thus

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4 An adapted version of this chapter is published in De Haas and Kleingeld (1999).

unique; it is the process of designing however that is transferable to other contexts and, for that reason, is of interest for the scientific purpose of knowledge production. The distinction between the diagnostic product of designing and the interactive process of designing connects with a distinction made by Simons (1995) between:

- Diagnostic control;
- Interactive control.

Diagnostic control systems pertain to the periodic application of a discrepancy-reducing cybernetic control loop for (self-)monitoring the progress on critical performance variables. Measurement and feedback of these critical variables help to diagnose negative performance trends and, thus, to focus single loop learning processes (Argyris and Schön, 1978) i.e. improvement processes.

Interactive control on the other hand is a control approach rather than a control instrument. A manager's decision to use a specific control system – such as a diagnostic control system – interactively, implies the investment of time and energy in face-to-face meetings with superiors, subordinates and peers to review new information, which sends a clear signal to the organization about what is important and what is not. Through the dialogue and debate about underlying data, assumptions and action plans, which surround the interactive process, new strategies often emerge. As such, interactive use of performance measurement systems helps to identify new performance variables and, thus, to initiate double loop learning processes (Argyris and Schön, 1978) i.e. innovation processes. According to Simons, the interactive control variant is becoming increasingly important as a consequence of turbulence and dynamics in the organization's environment, which requires the continuous tracking, tracing and sharing of strategic uncertainties.

In fact, the need for interactive control is no novelty at all. Interactive planning was already considered of major interest by Ackoff (1970, 1974), who emphasized the process of planning over the products of planning: schedules, outcomes and targets. He describes interactive planning as: 1) continuous – it is never complete; 2) simultaneous – at several organizational levels and across departments; 3) highly participatory; and 4) comprehensive – it considers ends, means, resources, organizational redesign and implementation. However, one should bare in mind the difficulties that do exist in applying interactive control, especially in cases of high differentiation among managers that exist in diversified organizations: managers tend to emphasize tangible products rather than the process itself and become frustrated when a great deal of time is expended with no clear, tangible benefits.

We view the Strategic Dialogue as the interactive vehicle for exchanging and converging multiple mental models that exist within the organization. The hypothesized consequence would be an increased degree of Goal Coherence, which in turn benefits organizational effectiveness. This construct is the subject of Section 2.2. Before we will present our integral approach to control system design i.e. the Strategic Dialogue in Section 2.4, we will first present two partial design approaches from the Management Accounting and the Organizational Psychology domains in Section 2.3.

2.2 GOAL COHERENCE

The relevance of a call for convergence for both the practice and the study of organizational control has been previously explained in Chapter 1. In light of this call, the construct of Goal Coherence is introduced.

The construct of Goal Coherence has strong connotations with goal congruence, which is defined by Vancouver, Millsap and Peters (1994) as "the agreement among organizational employees on the importance of the goals the organization could be pursuing". According to Witt (1998), it is important to enhance goal congruence, since it lessens organizational politics i.e. goal conflict. According to the 'garbage can' model of Cohen, March and Olsen (1972), goal conflict at the macro level of organizational analysis is the rule rather than the exception. Goal congruence is operationalized by Vancouver and Schmitt (1991) in the domain of public schools as "the degree to which a teacher agreed with the school principal and with the other teachers". It is important to realize that in the definition of goal congruence only one constituency is mentioned explicitly: employees. In the operationalization of goal congruence, only two constituencies play a role: the school principal and the other teachers. Vancouver *et al.* (1994) distinguish the following constructs:

Individual level goal congruence constructs:

- Between-constituency goal congruence (supervisor-subordinate): "the degree to which an individual subordinate agrees with his or her supervisor";
- Within-constituency (e.g. the other teachers) or member-constituency goal congruence: "the degree to which an individual subordinate agrees with all the members of his or her constituency; it is a measure of fit between an individual and his or her peers".

Constituency level goal congruence constructs:

- Between-constituency goal congruence: "the degree to which all the subordinates agree with their supervisor on the goals for the organization";
- Within-constituency goal congruence: "the average agreement among fellow subordinates within a constituency on the organization's goals".

It should be noted that subjects in the Vancouver study were asked to rate the importance of several goals "for the school". The emphasis was thus directly on the common goals for the organization as a whole, which relate to the macro level of organizational analysis. The emphasis was not on the deployed goals at the meso and micro levels controllable by lower level constituencies, which indirectly contribute to common goal attainment. What is thus entirely left out in this study is the issue of different goals that are controllable by different constituencies at the macro, meso and micro levels of organizational analysis and, moreover, the interconnected nature of these goals. What we intend to demonstrate is that the available concept of goal congruence insufficiently covers the issue of multiple degrees of controllability throughout the organization that one has to take into account when coordinating goal setting processes and subsequent resource allocation decisions throughout the organization. The interest of controllability of performance indicators is discussed in Van Tuijl, Kleingeld and Algera (1995).

We define the construct of Goal Coherence as "the degree of group consensus i.e. agreement on constituency goal priorities". This definition is derived from the constituency level constructs defined by Vancouver *et al.* (1994), since our study is a group level study on human performance management. The constituency goals in our definition are not identical for all organizational constituencies, but vary from one constituency to another due to varying degrees of controllability over varying aspects of performance. Depending on the level of organizational analysis, constituency goals refer to the common goals of the entity that are 'owned' by the organization's dominant constituency i.e. top management, or constituency goals refer to deployed goals 'owned' by lower level constituencies. Determining the degree of Goal Coherence thus requires constituencies to make explicit their trade-off between multiple, seemingly conflicting goals. As explained in Chapter 1, multiple goals should not be thought of as being in conflict, but rather that they are all important for the success of the organization: the real issue is to apply organizational resources to meet multiple goals in proportion to their importance. Even more so, the application of organizational resources and, thus, the prioritizing of goals, should be coordinated between goal interdependent constituencies.

The chosen focus for the group as the unit of analysis, which makes this monograph a group level study, is not without reason. The Strategic Dialogue is put forward as an interactive instrument that fosters the open-minded and constructive discussion of opposing views regarding what is good and bad in light of common goal attainment. This corresponds with Tjosvold's (1985) idea of constructive controversy. In the same respect, Pritchard (1990) speaks of constructive disagreement as an effective means for groups to reach a consensus on performance indicator proposals. Alper *et al.* (1998) found that constructive controversy is much more useful for solving problems when conducted within a cooperative context i.e. when group members experience positive goal interdependence. With cooperative goals, people who disagree directly elaborate their views, share information, question and search each other's perspectives, exchange resources, create alternatives, use higher-quality reasoning and reach an agreement that is mutually beneficial. In case of negative goal interdependence, constructive controversy has counterproductive consequences. Experiments and field studies have documented how constructive controversy can promote decision making (Johnson, Johnson, Smith and Tjosvold, 1990; Tjosvold, 1982; Tjosvold and Deemer, 1980).

In addition to the positive goal interdependence – constructive controversy relation, Tjosvold (1986, 1989) found that processes of group goal setting, group feedback and group appraisal (i.e. human performance management at the group level) positively affect group perceptions of positive goal interdependence. In other words, the focus on the group rather than the individual creates an effective condition for constructive controversy. This constructive controversy is aimed for during the Strategic Dialogue in order to exchange and converge existing mental models of organizational actors effectively. This empirically demonstrated line of reasoning, which accounts for the group as our unit of analysis, is summarized and graphically depicted in Figure 2-1.

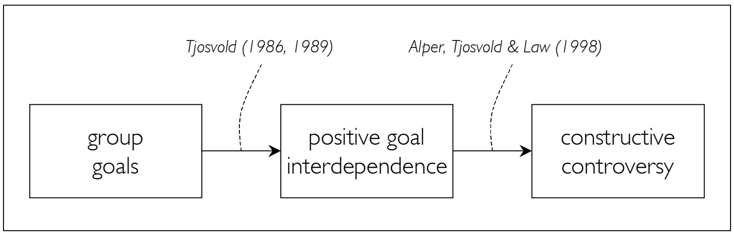

Figure 2-1: Accounting for group focus.

If we follow the causal relations of Figure 2-1 the other way round for the purpose of intervening in an empirical reality (Mattessich, 1995), we gain an enhanced understanding of the instrumental relation between the Strategic Dialogue intervention and degrees of Goal Coherence which we presented in Chapter 1 as part of our research approach. The extended version of our research approach is depicted in Figure 2-2. This figure reveals positively perceived goal interdependence within and between the organization's multiple constituencies to be the mechanism that makes Strategic Dialogue (i.e. constructive controversy) affect Goal Coherence. The Strategic Dialogue intervention thus basically aims at stimulating perceptions of the structural existence of positive goal interdependence between the organization's multiple groups.

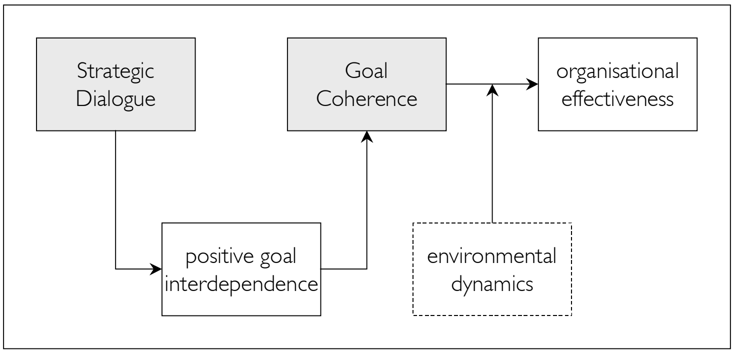

Figure 2-2: Extended research approach.

In analogy with Vancouver and his colleagues, we distinguish the between-constituency Goal Coherence construct and the within-constituency Goal Coherence construct:

- Between-constituency Goal Coherence: "the degree of inter-group consensus (i.e. between 2 groups) on constituency goal priorities".
- Within-constituency Goal Coherence: "the degree of intra-group consensus (i.e. within 1 group) on constituency goal priorities".

Given our search for a multilevel goal structure, i.e. the coordination of goals at the macro, meso and micro level of organizational analysis, the between-constituency construct is of special interest. However, both constructs are logically related in the sense that the degree of Goal Coherence between constituencies is a function of the degree of Goal Coherence within constituencies: there can be no between-constituency Goal Coherence if the within-constituency equivalent is lacking.

A final remark about our definition of Goal Coherence relates to the issue of mental modeling. The degree of Goal Coherence within or between constituencies in fact corresponds with the degree in which the mental models across the members of one single or two goal interdependent constituencies are similar. The empirical demonstration of group consensus on goal priorities thus assumes the underlying mental models of the respondents to be convergent i.e. similar. During the empirical phase of the research in Chapters 5 through 8, a measure of association will be developed which expresses such degrees of similarity, thereby operationalizing the construct of Goal Coherence.

2.3 PARTIAL DESIGN APPROACHES

The two partial design approaches from the Management Accounting and the Organizational Psychology domains that are presented here preceding the exposition on Strategic Dialogue, are better known as Balanced Scorecard and ProMES respectively.

2.3.1 Balanced Scorecard

The Balanced Scorecard (Kaplan and Norton, 1992, 1993, 1996[a], 1996[b]) is a product of the 'relevance lost' movement in the Management Accounting discipline. The elements or perspectives of the scorecard model are depicted in Figure 2-3. In fact, the Balanced Scorecard represents a normative blueprint for performance measurement system design at the macro level of organizational analysis.

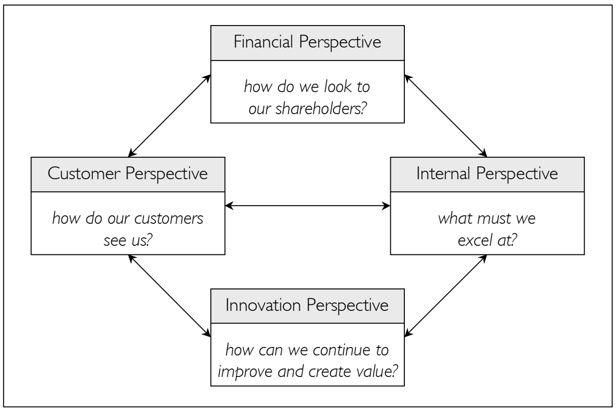

Figure 2-3: Balanced Scorecard (Kaplan and Norton, 1992).

As part of the Balanced Scorecard approach, overall business strategies are viewed as theories, as sets of hypotheses about cause-and-effect relations[5] (Kaplan and

[5] The reader might have noticed the use of both means-end relations and cause-and-effect relations in this monograph thus far as the building blocks of theory. This methodological difference is nicely

Norton, 1996). As a consequence, managers need feedback information in order to question whether their initial assumptions remain valid over time. Application of the Balanced Scorecard philosophy, which makes the strategic assumptions of management explicit, transforms periodic management reviews into events of hypothesis testing and reflection.

The ultimate effect that needs to be tested remains financial performance, which is monitored through performance indicators in the financial perspective of Figure 2-3. These indicators are identified by addressing the question: "How do we look to our shareholders?". The direct, short-term causes of financial performance are monitored through interrelated indicators in the customer perspective ("How do our customers see us?") and the internal perspective ("What must we excel at?"), while the indirect, long-term causes of financial performance are monitored through indicators in the innovation perspective ("How can we continue to improve and create value?"). The term balance thus refers to an appropriate mix of financial and non-financial performance indicators i.e. of outcome measures (or lagging indicators) and performance drivers (or leading indicators). The distinction between lagging and leading performance indicators connects with the previously made distinction between result and process feedback.

The Balanced Scorecard is deliberately called a pragmatic model and not an empirical model, since the presumed 'causal' relations between the multiple performance perspectives of Figure 2-3 have not yet been empirically tested. However, there is anecdotal evidence which suggests that the intervention is indeed effective. Especially the more popular management journals publish numerous success stories on Balanced Scorecard projects. Still nobody, especially not the consultants who sell the scorecard as some sort of a magical lamp, seems to wonder what mechanisms actually cause this instrument to be supposedly effective. The search for objective, empirical evidence thus is a challenge for the management accounting research community.

In addition to the lack of empirical evidence, we question the Balanced Scorecard's mechanical approach due to the assumption of an a-priori business strategy. Kaplan and Norton view the processes of strategy formulation (e.g., Mintzberg and Quinn, 1991; Johnson and Scholes, 1993) and control system design as sequential and linear. We far more incline to the French equivalent of the Balanced Scorecard approach, which is termed the *tableau de bord* (Lebas, 1994). This approach has been developed years

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explained by Mattessich (1995). Both types of relations are used to build theories. However, cause-and-effect relations, i.e. causal hypotheses, describe empirical (or positive) theories, while means-end relations, i.e. instrumental hypotheses, describe normative (or design) theories which have a practical application purpose.

An empirical theory contains general law statements that describe, explain or predict reality as it passively is or will develop. Description, explanation and prediction thus require a general understanding of reality over multiple research objects, enabled by in-broad research designs like extensive surveys. Causal hypotheses are subject of falsification by fundamental (or pure) scientists who search for degrees of truthfulness.

On the other hand, a design theory contains rules of thumb, heuristics, algorithms or design requirements that prescribe how to actively change an existing reality or create a new reality. Prescription thus requires a thorough understanding of single research objects, enabled by in-depth research designs like qualitative case studies. Instrumental hypotheses can not be falsified. The question is not whether an abstract representation of reality is true, but whether a concrete intervention in practice is effective: does it produce the desired consequences? Degrees of effectiveness manifest themselves in practice ("the proof of the pudding is in the eating"), which requires longitudinal studies.

Given the applied nature of our own research and the fact that processes of strategy deployment need to contribute to organizational effectiveness, we prefer to speak of means-end relations throughout the remainder of this monograph.

before the Balanced Scorecard and also stresses the importance of a balanced set of performance indicators. However, the French approach does not depart from an explicitly stated, a-priori business strategy. Moreover, strategy formulation is viewed as a learning process rather than a planning process (Mintzberg, 1990). Therefore, strategy formulation and control system design are viewed as parallel and iterative processes.

2.3.2 *Productivity Measurement and Enhancement System*

In contrast to the Balanced Scorecard approach, the Productivity Measurement and Enhancement System or ProMES approach to control system design focuses on the micro level of organizational analysis. A ProMES system consists of five main elements (Pritchard, 1990):

- Products, which are the key contributions (or key result areas) of the operational group to the organization as a whole;
- Indicators, which measure how well the group is generating its products;
- Contingency functions, which show the relation between the obtained indicator values and the effectiveness of those values for the organization. Through the contingencies, the relative importance of the indicators is established; also, the possibility is created to directly compare obtained results on different indicators and to generate one overall effectiveness score, which is useful for setting specific, quantitative goals;
- Feedback reports, containing a periodic overview of the group's performance;
- Feedback meetings, which serve as a vehicle for feedback, problem solving and goal setting interventions.

The group members are heavily involved in the design of a ProMES system. Using a 'discussion until consensus' approach and aided by a facilitator, they generate detailed proposals for each of the main elements. These proposals are discussed with management in review and approval meetings. Having the group itself participate in its own system design is expected to increase acceptance, ownership and understanding of the system and reduce the likelihood that the system is ignored or sabotaged (Van Tuijl, 1997[a], 1997[b]). Additionally, using the knowledge of the group is considered beneficial for the validity and accuracy of the system. The 'discussion until consensus' approach taken is considered essential for the convergence of different perspectives that are brought into the design process into a joint perspective which is endorsed by the organizational actors involved.

One of the unique features of ProMES is the establishment of contingencies: utility functions which indicate the relation between performance indicator values and the effectiveness for the organization (Pritchard and Roth, 1991). For each performance indicator, a contingency is established. Here the basic theoretical notions from the resource allocation theory of Naylor *et al.* (1980) come into play. The total set of contingencies for a group should be used by the group to decide on how to allocate their time and energy to get a maximum total score and, consequently, a maximum contribution to organizational effectiveness. An example of such a contingency (designed by a maintenance group that diagnoses and repairs electronic equipment) is depicted in

Figure 2-4. Recall the prevailing question within the ProMES research program, which in fact relates to the exact meaning and quantification of organizational effectiveness in the construction of contingency functions.

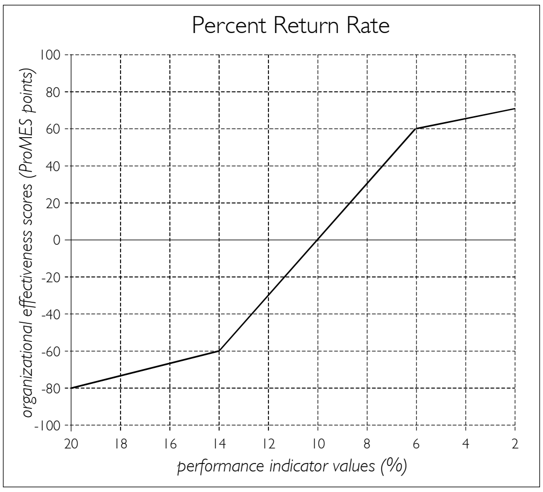

Figure 2-4: Example of a ProMES contingency function.

Approval meetings between the group and (top-)management are an essential part of the bottom-up design methodology. In these approval meetings discussions take place on the proposed products, performance indicators and contingencies. The task of management is to ensure that the products, performance indicators and contingencies for the group are the 'right' ones, considering performance improvement for the organization as a whole. This applies in particular to the contingencies. In the process of discussing contingencies, management has to judge whether the contingencies are in line with common goals at the macro level of organizational analysis. Stated otherwise, improvements on the performance indicators by the group should enhance the effectiveness of the organization as a whole. For an overview of practical experiences, the reader is referred to Pritchard (1995), Van Tuijl and Pritchard (1994) and Van Tuijl, Kleingeld, Schmidt, Kleinbeck, Pritchard and Algera (1997).

Strong, empirical support exists for the effects of ProMES interventions on the behavior of operational actors. These effects have been demonstrated for both individuals and groups of organizational actors through quasi-experimental research (Kleingeld, 1994; Pritchard *et al.*, 1989; Pritchard, 1995). In these studies, the effectiveness of ProMES systems has been based on a significant increase in performance, expressed in an overall effectiveness score (for an explanation see Pritchard, 1990). The underlying mechanism that explains the success of the ProMES method is the synergetic combination of goal setting (Locke and Latham, 1990), feedback (Kopelman, 1982, 1986) and participation (Miller and Monge, 1986; Vroom and Yetton, 1973). Thus far, a total of 26 ProMES interventions have been carried out and reported in various organizational settings in the USA, Western Europe and Australia (Pritchard, 1995: page 6). The mean effect on operational performance of these interventions (Pritchard, 1995: page 333) is approximately three times as large as the mean effect of interventions based on combined goal setting and feedback found in literature (e.g., Guzzo, Jette and Katzell, 1985).

2.4 INTEGRAL DESIGN APPROACH: STRATEGIC DIALOGUE

As outlined in the first chapter, an integral approach to control system design is lacking. The interest of an integral approach can already be recognized in the partial approaches. The Balanced Scorecard is often presented as a tool for translating strategy into operations. As part of this translation process, personal scorecards for organizational actors at lower levels in the organization are derived from the overall scorecard at the business unit level (Kaplan and Norton, 1996[b]). Albeit quite mechanistically and top-down, it can be seen as an attempt to coordinate macro and micro goal setting processes. In addition, the ProMES method explicitly incorporates a moment of coordination between the operational group and the management team during the management approval meeting (Pritchard, 1990). Much more organically and bottom-up, these approval meetings can also be explained as attempts to arrive at goal consensus at multiple levels of organizational analysis.

In addition to systems theory and cybernetics, the integral approach termed the Strategic Dialogue presented in this monograph is synthesized from the most valuable features of the partial approaches. The Balanced Scorecard feature of means-end relations between leading and lagging performance indicators is clearly recognized in the Strategic Dialogue approach, as is the ProMES feature of participation and striving for consensus during management approval meetings.

Put into practice, the Strategic Dialogue is an interactive process of exchanging visions of what is good and bad in light of common goal attainment. As explained, such visions represent existing mental models of organizational actors and thus profoundly impact human decision making behavior in organizational life. As part of this interaction, each constituency translates new knowledge or clarified insights regarding the overall business strategy into a relevant design of performance indicators (with associated indicator targets i.e. goals and indicator weights). In fact, the Strategic Dialogue is a process of explicating the relevant means-end relations from an overall business strategy perspective, which are interrelated at the macro, meso and micro level of organizational analysis. The Strategic Dialogue can thus be seen as the interactive variant of so called strategy deployment or policy deployment or target-means deployment, which are Anglo-Saxon terms for Japanese *hoshin kanri* (Akao, 1991; Zairi, 1994).

The framework for multilevel designing is prescriptive towards:

- The organization and the facilitation of the interactive process of designing: i.e. the Strategic Dialogue.
- The specification (however not the contents) of the diagnostic product of designing: i.e. the context-specific and thus unique performance measurement systems.

From the researcher's point of view, the multilevel process of designing is roughly organized along the following steps, of which the last step constitutes the participatory element of the Strategic Dialogue intervention:

- Definition of the organization's multiple constituencies. Identifying all groups of organizational actors that jointly make up the organization is a rather straightforward matter. The group as the building stone of organization is in general readily recognizable as a department, unit or team.
- Determination of goal interdependence relations between constituencies. Incorporation of goal interdependence into the design of organizational controls is a crucial matter for arriving at Goal Coherence, resulting in lower level goals to contribute to the attainment of common goals at the overall level.
- Composition of the design team for each constituency. Who is to participate in the design effort of a single constituency? Given the existence of goal interdependence relations with other constituencies, other organizational actors besides the constituency's members should participate.
- Decision on the sequence of designing. Since organizations are generally composed of multiple constituencies, the sequence of designing constitutes a point of interest. Given the purpose of the Strategic Dialogue, it seems reasonable to start designing performance indicators at the macro level and continue down to the level of operations. This should not be explained as a mechanistic management tool. Still, it is management's ultimate responsibility to decide on the organization's strategic direction and priorities, which explains the reasoning behind the preferred design sequence.
- Facilitation of interactive group processes with each design team. During design team meetings and management approval meetings, indicator proposals are agreed upon in a 'discussion until consensus' mode. These meetings constitute the actual Strategic Dialogue, during which a constructive controversy on divergent mental models is initiated.

2.4.1 Systems theory: closed-system vs. open-system approach

The basic idea of systems theory says that the working of the overall system is a function of the working of the system's parts; more exactly, system effectiveness is a function of the co-working between the system's parts. Consequently, systems theorists think and explain in terms of interdependence relations: a single element has no meaning unless it is studied in relation to interdependent elements which jointly affect the performance of the entity. This is especially true for social systems, i.e. organizations. In the organization, the multiple constituencies represent the system's parts that are goal interdependent and, thus, need to cooperate in order to avoid sub-optimization of integral performance. Therefore, goal interdependence relations between the organization's multiple constituencies should be positively perceived as such and, consequently, be explicitly incorporated into the design of performance measurement systems.

A distinction is made between two directions of goal interdependence between constituencies:

- Vertical goal interdependence between a superior- and a subordinate-constituency;
- Horizontal goal interdependence between a customer- and a supplier-constituency.

Vertical goal interdependence relates to a superior-constituency and an subordinate-constituency in a vertical 'command' chain. Superior-subordinate relations are dominant in the steep hierarchies of traditional, bureaucratic organizations as closed-systems in a stable environment. In case of a superior-subordinate relation between vertically goal interdependent constituencies, the corresponding between-constituency equivalent of Goal Coherence is referred to as vertical Goal Coherence.

Horizontal goal interdependence relates to a customer-constituency and a supplier-constituency in a horizontal supply chain. This horizontal chain of interrelated upstream and downstream business processes is generally referred to as the integral value chain (Porter, 1985) or the cross-functional order fulfillment process (Schneiderman, 1996[a], 1996[b]). Customer-supplier relations are dominant in the flat chains of modern, lean organizations as open-systems in a dynamic environment. In case of a customer-supplier relation between horizontally goal interdependent constituencies, the corresponding between-constituency equivalent of Goal Coherence is referred to as horizontal Goal Coherence.

In terms of agency theory (Jensen and Meckling, 1976), the superior- and the customer-constituency represent a principal, whereas the subordinate- and the supplier-constituency represent an agent. Our principal view of the organization as a network of goal interdependent constituencies thus corresponds with the organization as a network of vertical and horizontal principal-agent relations. Recall that the given fact of its structural existence is one thing, the perception as such by the organizational actors involved is another.

The organization as a closed system (e.g., Emery and Trist, 1969; Katz and Kahn, 1978) stems from the days of mass-production. This traditional approach models the organization as a static machine within its stable environment. Organization design from a closed-system approach results in hierarchically designed bureaucracies, focusing organizational attention on the maximization of internal efficiency. This is required by a low-cost strategy (Porter, 1980, 1985), since competition among (numerous) suppliers of standard products is price-based. The organization as a closed system emphasizes vertical goal interdependence relations between its multiple constituencies. Correspondingly, between-constituency Goal Coherence is aimed for during the interactive designing of performance measurement systems by superior- and subordinate-constituencies at hierarchically adjacent organizational levels.

For instance, the interactive designing of performance measurement systems by business unit management (the principal) and plant management (the agent), or by plant management (the principal) and a shop-floor team (the agent), should contribute to enhanced degrees of vertical Goal Coherence. Hence, the organization's formal structure, composed of all its superior-subordinate relations and described in an organization chart, is the starting-point for identifying vertical goal interdependence relations.

Due to today's environmental turbulence, the organization as a closed system is no longer appropriate. Instead, an open-system approach (e.g., Emery and Trist, 1969; Katz and Kahn, 1978) of the organization is required. Among others, Ansari (1977) used the open-system approach for integrated control system design. This more modern approach models the organization as an adaptive organism within its dynamic environment.

Organization design from an open-system approach results in market-driven, lean designed enterprises, focusing organizational attention on the maximization of external effectiveness. This is required by a differentiating strategy (Porter, 1980, 1985), since competition among (few) suppliers of batch-produced, customer-specific products is based on the creation of customer satisfaction. The organization as an open system emphasizes horizontal goal interdependence relations between its multiple constituencies. Correspondingly, between-constituency Goal Coherence is aimed for during the interactive designing of performance measurement systems by customer- and supplier-constituencies within adjacent primary and/or supportive business processes.

For instance, the interactive designing of performance measurement systems by a sales department (the principal) and a production unit (the agent), or by an assembly team (the principal) and a manufacturing team (the agent), should contribute to enhanced degrees of horizontal Goal Coherence. Hence, the organization's informal network (Snow, Miles and Coleman Jr., 1992; Snow and Miles, 1995), composed of all its internal customer-supplier relations and described in a cross-functional process-map, is the starting-point for identifying horizontal goal interdependence relations.

2.4.2 Cybernetics: feedback vs. feedforward control

From systems theory, the phenomenon organization is approached as a black box of inputs, throughputs and outputs (In 't Veld, 1988). The open-system approach emphasizes the system's outputs (since the aim is to control for external effectiveness), while the closed-system approach emphasizes the system's inputs (since the aim is to control for internal efficiency). The black-box approach is recursive in nature, in the sense that it may be applied to any level of system's analysis and, therefore, to any sub-system (e.g. a plant or department) within the overall system (e.g. a business unit). Decomposition of a system into its constituent (sub-)subsystems is common among systems theorists from the assumption that the working of the whole is explained from the (co-)working of the parts.

Considering our framework for the multilevel designing of performance measurement systems, the black-box approach connects with the existence of multiple constituencies within the organization. Each constituency is in fact responsible for the performance of a specific system, whether it concerns the overall system at the macro level, a subsystem at the meso level or a sub-subsystem at the micro level of organizational analysis. For instance, at the highest level, business unit management is responsible for overall system performance. At the next lower level, plant management is responsible for manufacturing subsystem performance, as is the sales department for sales subsystem performance. Within the manufacturing subsystem, a shop-floor team is responsible for performance of a physical transformation sub-subsystem.

Derived from the black-box approach, we propose that two types of performance indicators have to be specified. This specification connects with our definition of feedback (see Chapter 1) as both knowledge of results and knowledge of processes. A similar distinction between performance indicators is made by Imai (1986) and Hronec (1993). These indicators are termed:

- Result-oriented performance indicators, in short result indicators;
- Process-oriented performance indicators, in short process indicators.

On the one hand, result indicators relate to outputs. More tangibly, result indicators are used periodically to measure output levels. Therefore, these measures indicate 'after the fact', or *ex post*, whether output targets have been achieved or not. After the fact suggests that past performance is determined. In cybernetics (Ashby, 1958), the use of result indicators for control purposes would be termed feedback control. By definition, a feedback control loop is reactive in nature. For the purpose of feedback control, goal setting can be seen as a technical prerequisite (Locke and Latham, 1990).

Process indicators on the other hand, do not relate to outputs. Rather, they relate to throughput processes which should result in targeted output levels. More tangibly, process indicators are used periodically to measure those process parameters which have a presupposed impact on the desired levels of output. Therefore, these measures indicate whether throughput processes are executed in a way that does or does not contribute to the achievement of targets for related result indicators. In other words, these indicators should indicate 'before the fact', or *ex ante*, whether output targets will be achieved or not. Before the fact suggests that future performance is indicated. Using process indicators for control purposes might be termed feedforward control. By definition, a feedforward control loop is proactive in nature. Our model of control is depicted in Figure 2-5.

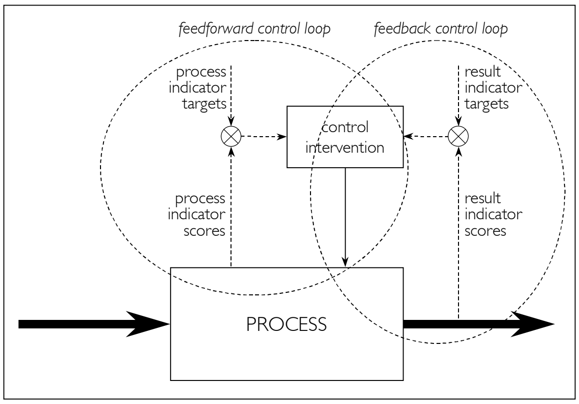

Figure 2-5: Model of control.

The right part of Figure 2-5 illustrates the feedback control loop. This reactive control loop makes use of result indicators for the periodic measurement of output levels (RI-scores), which are compared to pre-set targets. The left part of Figure 2-5 illustrates the feedforward control loop. This proactive control loop makes use of process indicators for the periodic measurement of process parameters (PI-scores), which impact future output levels. For control to be truly effective, it should be based on both control loops. Feedback control without feedforward control is termed management by exception. It is characterized by ad hoc problem solving. Control interventions can only be undertaken after problems have occurred (and damage has possibly been caused). Our model of control disregards control of inputs, since it coincides with control of a preceding system's outputs. Furthermore, the control model is recursive in nature, due to its foundation on the black-box approach of systems theory. In this sense, our conception of control corresponds with that of Otley and Berry (1980).

The principle idea behind feedforward control needs some further explanation. Feedforward suggests foreknowledge of those process variables that will cause achievement of desired output targets. Therefore, process indicators have predictive value. In this light, the identification of result and process indicators is in fact synonymous to the formulation of an instrumental hypothesis, i.e. a means-end relation. The notion of effectiveness is merely assumed by organizational actors who participate in the Strategic Dialogue. The validity of the underlying means-end relation can at best be demonstrated 'after the fact', when (non-)achievement of related result indicator targets has been demonstrated. Feedforward control is therefore risky, since invalid assumptions (i.e. invalid means-end relations) will cause anticipation of faulty performance indicators, with dysfunctional behavior and sub-optimization of integral performance as a result.

2.4.3 Design team composition

The existence of principal-agent relations between the organization's multiple constituencies has an impact on the composition of design teams in two respects.

First, with regard to vertical goal interdependence, the superior-constituency is goal interdependent upon the subordinate-constituency, in the sense that lower level subordinate-performance contributes to higher level superior-performance. Hence, members of the subordinate-constituency should not just participate in designing their own performance measurement system (in light of within-constituency Goal Coherence), but in designing their superior's performance measurement system as well (in light of between-constituency Goal Coherence). In turn, members of the superior-constituency should have a say in the approval of their subordinate's performance measurement system design.

Second, with regard to horizontal goal interdependence, the customer-constituency is goal interdependent upon the supplier-constituency, in the sense that upstream supplier-performance contributes to downstream customer-performance. Hence, members of the supplier-constituency should not just participate in designing their own performance measurement system (in light of within-constituency Goal Coherence), but in designing their customer's performance measurement system as well (in light of between-constituency Goal Coherence). In turn, members of the customer-constituency should have a say in the approval of their supplier's performance measurement system design.

In fact, the agent-constituency (i.e. the subordinate- or the supplier-constituency) acts as a hinge (Euske *et al.*, 1993) or linking-pin (Likert, 1961, 1967) during the designing of the performance measurement system of the goal interdependent principal-constituency (i.e. the superior- or the customer-constituency). By organizing the design effort as outlined above, an opportunity is created to explicitly discuss (opposing) views on what is good and bad in light of common goal attainment among the members of goal interdependent constituencies. Such a constructive controversy is expected to contribute to convergent mental models and, thus, to enhanced degrees of Goal Coherence.

2.4.4 Designing performance indicators

Analogous to the ProMES method, the process of designing is organized along two events, during which the actual Strategic Dialogue takes place:

- Design team meetings;
- Management approval meetings.

During design team meetings, each constituency prepares proposals for its own result indicators and process indicators. In order to facilitate the interactive group processes, two fundamental, interrelated questions need to be addressed:

- What to achieve?
- How to achieve?

By addressing these questions, the relevant means-end relations are made explicit. The two questions constitute the principal idea behind Japanese *hoshin kanri* (Akao, 1991; Zairi, 1994). In the Total Quality Management literature, strategy deployment or target-means deployment is presented as a tool for interactively communicating quality policy throughout the organization. The essence of deployment is transformation of the how-to-achieve question at a certain level of organizational analysis into the what-to-achieve question at the next lower level in the organization. In a similar vein, Locke and Latham (1990) conceive strategy implementation as a goal setting process whereby the means at one level of the organization become the ends at the next level, and so on. Given the levels of organizational analysis that we distinguish in our research, the process of deployment implies the means at the macro level to become the ends at the meso level and the means at the meso level to become the ends at the micro level.

Within our framework for multilevel designing, qualitative answers (so called 'products' in ProMES terms) to the what-to-achieve question need to be quantified in terms of result indicators, as do qualitative answers to the how-to-achieve question in terms of process indicators. As a result of deployment, the process indicator at a certain organizational level is presented as the relevant result indicator at the next lower level. This does not imply a mechanistic, top-down imposition of quantified answers to the what-to-achieve question upon constituencies acting at this next lower organizational level. The interactive process of designing is organized in such a way that subordinate-constituencies participate as a hinge or linking-pin in the design effort of their superior-constituencies. Consequently, the members of the subordinate-constituency have a bottom-up opportunity to critically determine the validity of their superior's performance measurement system design and to contribute to the design of process indicators (How to achieve?) which will be deployed as their result indicators (What to achieve?).

Furthermore, deployment of process indicators results in shared responsibilities for result indicators between horizontally goal interdependent constituencies at the next lower organizational level. Concretely, deployment causes the result indicators of the customer-constituency to be identical to the result indicators of the horizontally goal interdependent supplier-constituency. This co-responsibility thus forces customer- and supplier-constituencies to design process indicators from a cross-functional perspective. They are put into this joint perspective, since the interactive process of designing is organized in such a way that supplier-constituencies participate as a hinge or linking-pin in the design effort of their customer-constituencies.

The management approval meeting probably constitutes the most vital moment of constructive controversy during the Strategic Dialogue. Subordinate-constituencies present to their superior-constituency the translation of strategy (i.e. means-end relation) at the macro (or meso) level of organizational analysis into a design of performance indicators for control purposes at the meso (or micro) level of organizational analysis. Note that multiple subordinate-constituencies at a lower level correspond with horizontally goal interdependent supplier- and customer-constituencies. The proposed indicators are designed from judgements of what is and what is not beneficial for organizational effectiveness.

Ultimately, management as the dominant constituency of organization has to judge these interpretations against their own interpretations of strategic relevance. During the management approval meeting, the interacting constituencies confront each other with (divergent) mental models underlying their interpretations, thereby exchanging opinions regarding required resource allocation and, more importantly, explaining the arguments accountable for these opinions. The expected result of such an interaction between constituencies is convergence in mental modeling, resulting in the coordinated allocation of (scarce) human resources throughout the organization.

2.4.5 Conditions for designing

Beforehand, a number of basic design conditions can be identified. The conditions for designing refer to those specifics of the organizational context, which are ideally present at the start of the Strategic Dialogue. For one, an organizational culture of respect, trust and openness should be present. Furthermore, visible management commitment should be present, as well as a liberal management style that propagates the principals of empowerment, entrepreneurship, self-control and bottom-up involvement in the strategy process. In addition, we assume individuals to be willing to recognize and optimize their contribution to the organization's overall welfare and, consequently, to be willing to participate in the Strategic Dialogue. In fact, this assumption corresponds with McGregor's (1960) Theory Y.

In contrast to the Balanced Scorecard approach, the existence of an explicitly stated a-priori business strategy is not essential for the design effort. The process of designing performance indicators with the management-constituency can be used to catalyze the process of strategy formulation. As a consequence, interactive group processes with management will be time-consuming, since a consensus about strategic assumptions and priorities has to be reached as part of the Strategic Dialogue. This brings us to another condition, namely the availability of management time, which generally is a scarce resource.

2.4.6 Participation

The Strategic Dialogue intervention is a highly interactive event which requires organizational actors to participate. The issue of participation in decision making (Miller and Monge, 1986; Vroom and Yetton, 1973) needs some further elaboration, since it is not as obvious as it seems. Generally, participation may cause increases in performance (and satisfaction) through cognitive and motivational mechanisms (Locke and Schweiger, 1979). From a cognitive viewpoint, participation may result in increased information, knowledge and creativity which helps in better solving organizational problems through better communication and utilisation of knowledge. It may cause better understanding on the part of the employees who are to execute the decisions resulting from participation. With regard to motivation, participation may result in less resistance to change because of increased trust on the part of the employees and/or a greater feeling of control and reduced anxiety. Acceptance of and commitment to decisions and changes may increase through a greater degree of ego involvement or identification with the organization and through the effects of group pressures.

However, due to variance in measurability of the concepts involved (participation, performance, satisfaction) and the large number of moderating factors that exist, individual ones as well as situational ones, the effects of participation are not always clear (e.g., Andriessen and Drenth, 1984). With regard to the design of performance measurement systems, participation can be seen as a process aimed at clarifying the values and contributions of organizational actors and translating them into measurable variables. However, participation is by no means a sufficient condition for designing valid and accepted controls. Depending on the degree of value commonality resulting from participation, control systems will be accepted, complied with or rejected (Van Tuijl, 1997[a], 1997[b]).

While we accept the reservations made, participation remains an indispensable element of the Strategic Dialogue.

In the next chapter, the practical application of the Strategic Dialogue is explored in the illustrative case of Copytec Service. The illustrative case study, which concludes the conceptual phase of the research, should provide a more thorough understanding of what Goal Coherence actually is and, consequently, should provide specific clues for operationalizing this construct during the subsequent empirical research phase.

Chapter 3.
ILLUSTRATIVE CASE STUDY

The purpose of the illustrative case study, which closes the conceptual phase of the research, is purely exploratory regarding the practical applicability of our framework for multilevel designing. This chapter[6] presents the case of Copytec Service as an illustration of a resulting product of designing. Ultimately, an enhanced understanding of Goal Coherence in light of the empirical research phase is aimed for.

3.1 INTRODUCTION

The case of a service organization serves as an illustration of the a-priori framework for multilevel designing as presented in the previous chapter. As such, the case does not give a description of an empirical process in reality, but gives a description of a conceptual process in the mind of the researcher. Although it may seem organizational actors were truly reaching a consensus and making design decisions, these processes only happened in the mind of the researcher; they did not happen for real in the practical context to which they relate. The reader should be aware of the illustrative nature of this case study. We merely want to demonstrate what our theoretical intuitions, translated into an a-priori design theory, might bring about when practically applied in reality and, in addition, to further explore the nature of Goal Coherence.

The service organization is a real life company, familiar with designing ProMES systems during a former research project (see Kleingeld, 1994). Given the illustrative nature of this study, the case company is renamed Copytec. The design setting as described in Section 3.2 in terms of the company's service strategy, service structure and service process is therefore real. Our ideas regarding the multilevel designing of performance measurement systems have been projected onto this existing reality. The result of this 'mental exercise' is presented in Section 3.3. It should be noted that not all performance indicators presented as part of the case are fictitious; some of the indicators were readily available as a result of the former research project. To close the conceptual phase of the research, a reflection on the illustrative case study in light of the theoretical construct of Goal Coherence is discussed in Section 3.4.

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[6] An adapted version of this chapter is published in De Haas and Kleingeld (1999).

3.2 DESIGN SETTING

Copytec is a large supplier of office equipment, mainly photocopiers. The company does not manufacture these machines itself. Instead, Copytec buys them from leading manufacturers, sells them under its own brand-name and provides service for photocopiers sold. The company's major departments are Sales and Service. Customers range from the very small, such as private individuals and small companies, to the very large, such as multinationals, universities and local and national governments.

Copytec offers a large assortment of photocopiers, ranging from small and inexpensive copiers for infrequent use ('low volume' copiers), to large copiers with several additional features for intensive use ('high volume' copiers). Although this current assortment consists of about 15 different types, the company still provides service for approximately 75 types of copiers which have been sold in the past.

Since photocopiers require regular maintenance, service is an important part of Copytec's operations. For reasons of simplicity, the focus of this study is limited to the Service organization.

3.2.1 Service strategy

Since the 1970s, the office automation industry has moved from a product-oriented industry, via a price-oriented industry into a service-oriented industry. In such an industry, product features and prices among suppliers of photocopiers hardly vary. Hence, only those companies which are able to meet the high demands placed on service enjoy a competitive advantage. Therefore, Copytec has to position itself strategically as a high-quality service supplier, which implies a differentiation strategy (Porter, 1980, 1985).

For years, Copytec has been a leading company in the service domain by using effective and efficient maintenance procedures and sophisticated planning systems. However, to keep this competitive advantage and to secure the company's continuity in the long run, management considers high-quality and cost-effective service performance of vital importance. Quality and cost of service are seen as critical success factors in shaping Copytec's future.

Copytec's strategic mission is one of growth, which implies a build-strategy (Gupta and Govindarajan, 1984). Copytec aims at enlarging its current, leading market share by further developing service delivery as its core competence. Most promising from a growth perspective is the 'high-end' part of the service market. In formulating its strategy, management has made a distinction between premium service, quality service and standard service. 'Low-end' users are (most) easily satisfied with standard service. 'High-end' users on the other hand are much more demanding and will only be satisfied with premium service. Compared with standard and quality service, financial margins on premium service are high. Hence, a solid position in the premium service market would mean a sound, financial basis for the future. However, in the battle for premium service market share, a high-quality and cost-effective service performance is even more crucial.

3.2.2 Service structure

The structure of Copytec Service and, thus, its collection of vertical goal interdependence relations, is shown in Figure 3-1.

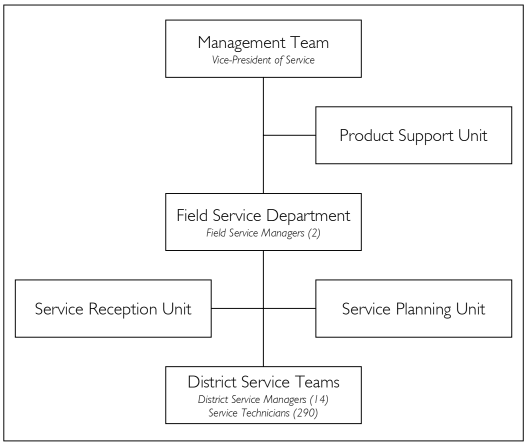

Figure 3-1: Copytec's service structure.

Responsible for the service part of the organization is the Vice-President of Service, who is a member of Copytec's Management Team. The service organization is subdivided in the Product Support unit and the Field Service organization. The Product Support unit is the expertise center of the organization. At the head of the Field Service organization are two Field Service managers. They are responsible for the Service Reception unit, the Service Planning unit and 14 District Service Teams (service delivery in the field is organized geographically).

Each district is run by a District Service manager, who supervises between 20 and 23 technicians. Depending on training and experience, the technicians service a range of 2 to 10 types of photocopiers. For these types, they possess the specific knowledge needed to carry out repairs and maintenance. About 10 percent of the technicians are senior technicians, who are specialists regarding certain types of copiers. Each technician has his own company car. In that car, he holds a stock of those spare parts which are most frequently needed during execution of the service process.

More specifically, the nature of vertical goal interdependence will be illustrated in Section 3.3.

3.2.3 Service process

The process of service delivery results in photocopier maintenance in the field. A distinction is made between preventive maintenance and corrective maintenance or repair. Preventive maintenance is carried out during repairs, which means there is no separate schedule for preventive maintenance. Copytec's service process and, thus, its collection of horizontal goal interdependence relations, is shown in Figure 3-2.

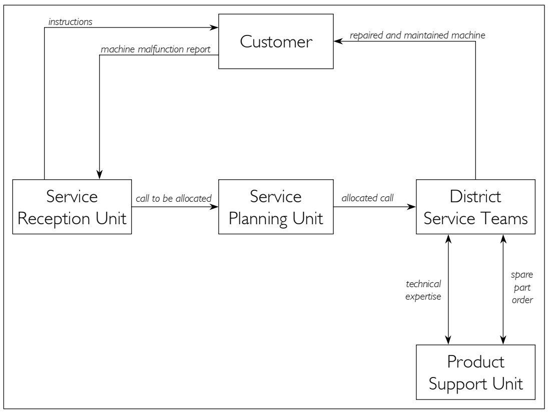

Figure 3-2: Copytec's service process.

The service process starts with a customer making a phone call to the Service Reception unit, explaining that his or her photocopier is out of order. A first attempt is made by a service receptionist to solve the problem by giving the customer instructions over the phone. If the receptionist does not succeed, the problem is transferred to the Service Planning unit. Here, all necessary service calls are scheduled. A service planner instructs a technician of the appropriate District Service Team to visit the customer, to repair the machine and to carry out preventive maintenance appropriate for the maintenance history of the machine. The technician then drives to the customer's premises, repairs the machine, follows the preventive maintenance procedures and fills in the history card which contains information about the machine's repair history.

Before leaving the customer, the technician enters data into Copytec's information system via a modem. These data include, among others: 1) the time it took to travel to the customer; 2) the time needed to repair and maintain the photocopier; 3) any use of spare parts; 4) the number of copies on the machine counter. If necessary, he also orders additional spare parts to replenish his car stock. Finally, the technician contacts his planner to receive his next job instruction.

Goal interdependence within the process of service delivery is explained first. For instance, District Service Teams are interdependent on Product Support regarding knowledge and skills. If technicians are unable to solve a technical repair problem on their own, they can ask for help from a product support specialist over the phone. If that does not solve the problem, a senior technician is called in. Other interdependencies exist between District Service Teams and Product Support. The timeliness with which the Product Support unit replenishes technicians' car stocks of spare parts, influences the number of repairs which cannot be completed because of spare part shortage. In such cases, a technician will have to return to the customer the following day. Furthermore, District Service Teams are interdependent on Service Planning. Unrealistic schedules by the service planners will cause low responsiveness of the technicians, resulting in customers having to wait a long time for a technician's arrival. In turn, for schedules to be realistic, Service Planning is interdependent on Service Reception. If the service receptionists can solve only few problems by instructing customers over the phone, the service planners will have a hard job planning all necessary visits. More specifically, the nature of horizontal goal interdependence will be illustrated in Section 3.3.

The service process gives an overview of operational responsibilities. However, not all organizational units described are solely responsible for Copytec's daily operations. The Product Support unit has both operational and strategic responsibilities, since a lot of expertise is accumulated in this part of the Service organization. This latter responsibility concerns the composition of Copytec's assortment of photocopiers. For instance, the decision to add new types of photocopiers to or remove old types from the assortment is based on research carried out by Product Support specialists. It is quite obvious that a specific composition has a long-term or strategic impact on Copytec's service performance in the field. This observation is a nice illustration of the sociotechnical (Kuipers and Van Amelsfoort, 1990) distribution of long-term and short-term responsibilities throughout the organization, as presented in Chapter 1.

3.3 DESIGN INTERVENTION

The organizational entity Copytec Service is composed of multiple constituencies that are goal interdependent within vertical and horizontal principal-agent relations. The following constituencies are identified, for each of which a performance measurement system (PMS) would have to be designed:

- Copytec Management constituency : Copytec Management PMS;
- Field Service constituency : Field Service PMS;
- Product Support constituency : Product Support PMS;
- District Service constituency : District Service PMS;
- Service Planning constituency : Service Planning PMS;
- Service Reception constituency : Service Reception PMS.

According to Copytec's service structure (see Figure 3-1), vertical goal interdependence relations exist between the following principal- and agent-constituencies:

- Copytec Management constituency and Field Service constituency;
- Copytec Management constituency and Product Support constituency;
- Field Service constituency and District Service constituency;
- Field Service constituency and Service Planning constituency;
- Field Service constituency and Service Reception constituency.

Hence, the perception of cooperation between vertically goal interdependent constituencies should be stimulated by the interactive designing of the following pairs of performance measurement systems:

- Copytec Management PMS and Field Service PMS;
- Copytec Management PMS and Product Support PMS;
- Field Service PMS and District Service PMS;
- Field Service PMS and Service Planning PMS;
- Field Service PMS and Service Reception PMS.

According to Copytec's service process (see Figure 3-2), horizontal goal interdependence relations exist between the following principal- and agent-constituencies:

- District Service constituency and Product Support constituency;
- District Service constituency and Service Planning constituency;
- Service Planning constituency and Service Reception constituency.

Hence, the perception of cooperation between horizontally goal interdependent constituencies should be stimulated by the interactive designing of the following pairs of performance measurement systems:

- District Service PMS and Product Support PMS;
- District Service PMS and Service Planning PMS;
- Service Planning PMS and Service Reception PMS.

Given the goal interdependence relations identified between Copytec's multiple constituencies, Copytec can be modeled as a system of overlapping constituencies, which is depicted in Figure 3-3. Each overlap constitutes a 'hinge' or 'linking-pin' representing vertical or horizontal goal interdependence between principal- and agent-constituencies. This figure gives a graphic representation of our principal view of the organization.

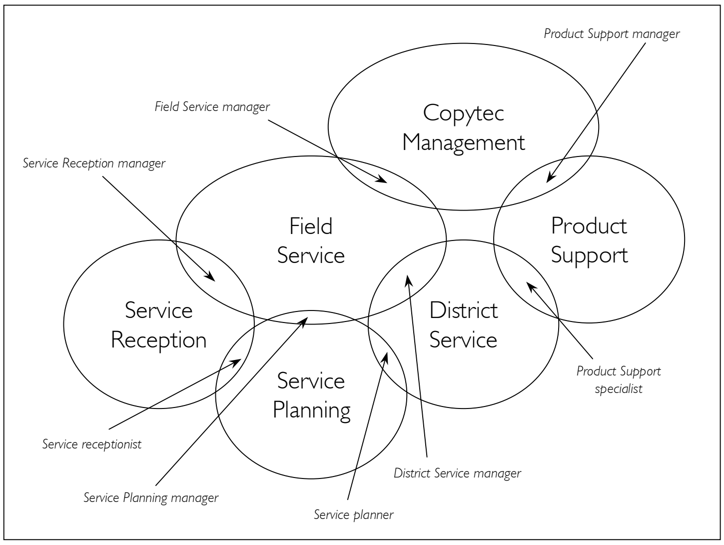

Figure 3-3: Goal interdependent constituencies and connecting 'hinges'.

Composition of design teams for each of Copytec's constituencies is based on Figure 3-3. Concretely, design teams would be composed of the participants presented in Table 3-1. Design teams are listed in the preferred sequence of designing. Given this sequence, each hinge participates in the design effort of his principal- or customer-constituency, prior to his own constituency's design effort.

Table 3-1: Design team composition.

Design of	Participation by (* = 'hinge')
Copytec Management PMS	Vice-president of Service Field Service managers * Product Support manager *
Field Service PMS	Field Service managers District Service managers * Service Planning manager * Service Reception manager *
District Service PMS	District Service managers Service technicians Product Support specialists * Service planners *
Product Support PMS	Product Support manager Product Support specialists
Service Planning PMS	Service Planning manager Service planners Service receptionists *
Service Reception PMS	Service Reception manager Service receptionists

In the remainder of this section, 3 PMS designs will be described in more detail. The PMS designs are solely described in terms of performance indicators; accompanying indicator targets and indicator weights are not dealt with. For the purpose of this chapter, it would be inappropriate to deal with the specifics of each and every PMS design. Therefore, we opted for the Field Service PMS (superior-constituency) and the District Service PMS (subordinate-constituency) to illustrate vertical goal interdependence and for the District Service PMS (customer-constituency) and the Product Support PMS (supplier-constituency) to illustrate horizontal goal interdependence in Subsection 3.3.2 and Subsection 3.3.3 respectively. First, we will present an overview of all PMS designs in Subsection 3.3.1.

3.3.1 Overview of PMS designs

Copytec's multilevel design of performance measurement systems, which could have been the result of an interactive and organization-wide Strategic Dialogue intervention, is shown in Figure 3-4. This figure presents a multilevel goal structure in which goal interdependence relations between principal- and agent-constituencies, both in vertical and horizontal direction, have been explicitly incorporated. The indicated goal interdependence relations in Figure 3-4 are the subject of the subsequent subsections.

Please remind that the case of Copytec Service is a conception of the research's mind, an experimental line of thought, albeit that some real-life elements have been incorporated. For the ease of writing, we will pretend as if design interventions have literally taken place. The reader should be aware of this style of writing.

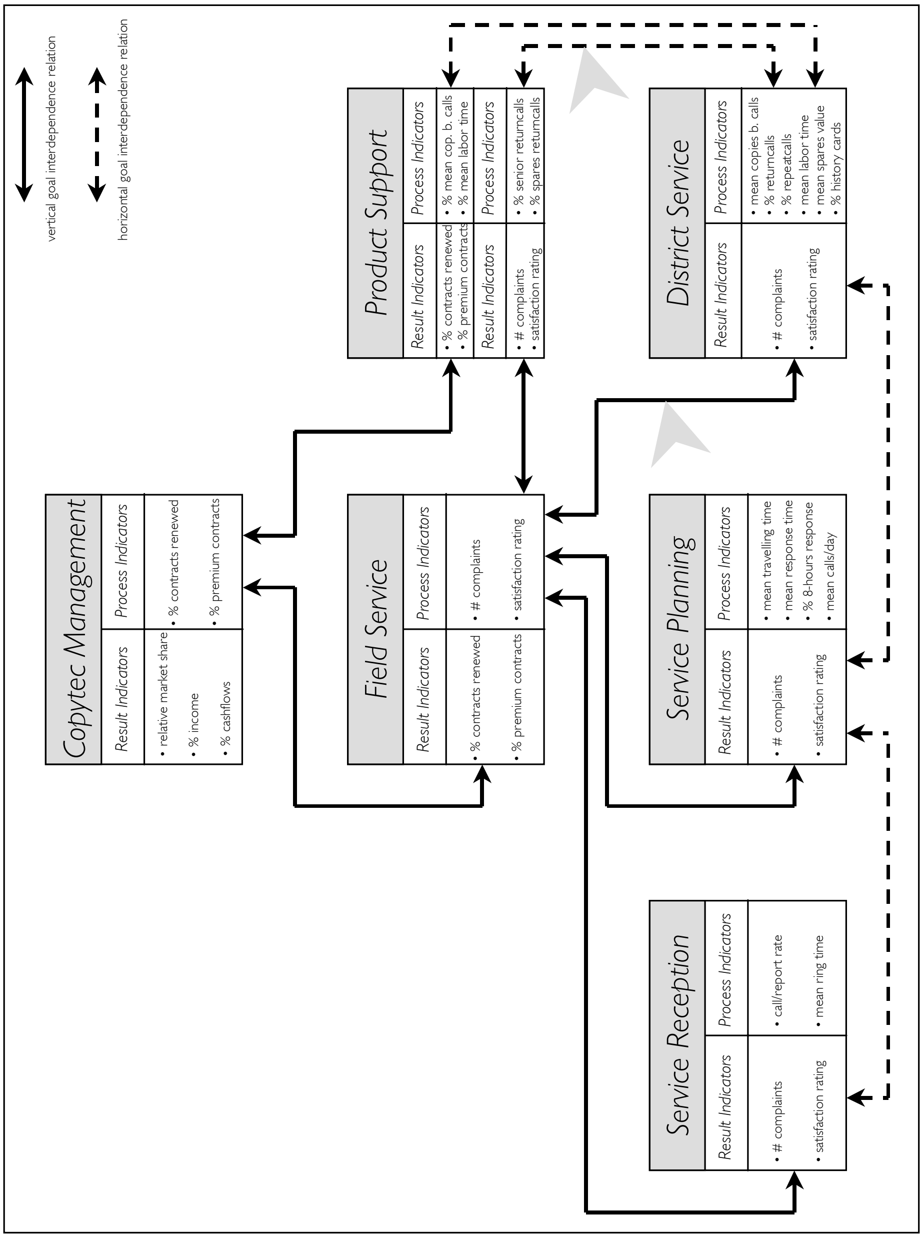

Figure 3-4: Multilevel design of performance measurement systems.

3.3.2 Vertical goal interdependence: Field Service & District Service constituency

During the design of the Copytec Management PMS (see Figure 3-4) in which the Field Service managers and the Product Support manager had participated as 'hinges' during design team meetings, the Management Team reached a consensus on the relevant result indicators – indicating what to achieve i.e. organizational goals – and on the relevant process indicators – indicating how to achieve i.e. critical success factors – at the macro level of organizational analysis. Relevance should be interpreted in terms of controllability of indicator performance by the Management Team members and validity of the assumed relation between underlying means and ends which, at the macro level, relate to the Copytec Service entity as a whole and thus to the overall business strategy. The process indicators were defined as:

- % Contracts renewed: the percentage of service contracts renewed;
- % Premium contracts: the fraction of premium service contracts.

Deployment of the process indicators of the Copytec Management PMS resulted in these indicators to become the result indicators of both the Field Service PMS and the Product Support PMS at the meso level of organizational analysis (see Figure 3-4). Since participation by the agent-constituencies was previously asked for, these result indicators were not imposed top-down on the Field Service constituency, nor were they on the Product Support constituency. As a consequence of this deployment procedure, the means of the principal-constituency at the macro level equaled the ends of the agent-constituencies at the meso level. By doing so, the vertical goal interdependent nature of principals and agents was made explicit in the PMS designs.

In relation to the result indicators mentioned above, a valid set of controllable process indicators was defined at the meso level as part of the Field Service PMS. The District Service managers, the Service Planning manager and the Service Reception manager participated as 'hinges' in the design team meetings of the Field Service managers. This is because the means of the principal-constituency at the meso level would ultimately have to equal the relevant ends of the agent-constituencies at the micro level. The Field Service managers reached a consensus on (few) customer complaints and (high) customer satisfaction ratings as the determinants of future result indicator scores. Hence, the relevant process indicators were identified in terms of:

- # Complaints: the number of complaints made by customers;
- Satisfaction rating: subjective judgements regarding customer satisfaction.

One should note that only those customer complaints and satisfaction ratings that were related to the District Service teams were included in the Field Service PMS. By doing so, satisfactory controllability of the indicators was ensured. The contents of the Field service PMS is summarized in Figure 3-5.

Field Service	
Result Indicators	*Process Indicators*
• % contracts renewed	• # complaints
• % premium contracts	• satisfaction rating

Figure 3-5: Indicators of the Field Service PMS.

The difference between feedback and feedforward control, as introduced in Chapter 2, can now be explained more tangibly. Exclusive reliance on the result indicators would only give the Field Service managers the opportunity to look back at past performance. This could cause risky situations. If these managers have no information available about the (possibly) increasing number of customer complaints or about the (possibly) decreasing rates of customer satisfaction, they might draw the wrong conclusions. This is because the percentage of service contracts renewed and the fraction of premium service contracts may not indicate any deterioration at all, at least not in the short run. However, these result indicators are most likely to deteriorate in the long run. By then, it may be too late and only ad hoc problem solving 'after the fact' can be executed. The process indicators described create the opportunity to look ahead and anticipate future problems, provided the validity of the assumed relation between means (i.e. process indicator scores) and ends (i.e. result indicator scores).

The process indicators of the Field Service PMS were then deployed to the micro level of organizational analysis, where the daily execution of the operational service process takes place. This caused the result indicators of the District Service PMS, among other PMS designs for the Service Planning unit, the Service Reception unit and the Product Support unit (see Figure 3-4), to become:

- # Complaints: the number of complaints made by customers;
- Satisfaction rating: subjective judgements regarding customer satisfaction.

In relation to these result indicators, a relevant set of process indicators was defined. The Product Support specialists and the Service Planners participated as 'hinges' in the design team meetings of the District Service teams. This is because the District Service teams (customer-constituency at the micro level) are horizontally goal interdependent upon the upstream Service Planning and Product Support units (supplier-constituencies at the micro level). In light of the new strategy, the District Service managers and their service technicians decided that a service performance of low quality and/or high cost would result in many customer complaints and low satisfaction ratings. In other words, the process indicators of the Service Team PMS would have to indicate whether service was delivered in a high-quality and low-cost way.

It was decided that quality of service could be measured by the number of copies made between two successive service calls, by the number of repeat-calls and by the number of return-calls. A repeat-call is necessary if a photocopier starts malfunctioning within five working days after the last service call. A return-call is necessary if a technician does not have sufficient time to fix the problem, if a technician does not have sufficient spare parts in his car, or if a senior technician has to be called in. Hence, relevant process indicators of the Service Team PMS became:

- Mean copies between calls: the mean number of copies between two successive calls;
- % Repeat-calls: the number of repeat-calls, expressed as a percentage of the total number of service calls;
- % Return-calls: the number of return-calls, expressed as a percentage of the total number of service calls.

In addition to the quality indicators described, a relevant set of process indicators which could measure the cost of service was defined. These indicators pertained to the repair and maintenance duration and the number of spare parts used during a service call. Cost of service was also believed to be influenced by the number of history cards filled out correctly. In case these cards are filled out incorrectly, the repair and maintenance history of the machine will be partly unknown during the next service call. This may cause the maintenance carried out and/or the machine parts replaced during that visit to be incorrect. Thus, the following process indicators were added:

- Mean labor time: the mean labor time of a service call;
- Mean spares value: the mean value of spare parts used per call;
- % History cards: the percentage of history cards correctly filled out.

The contents of the Field service PMS is summarized in Figure 3-6.

District Service	
Result Indicators	*Process Indicators*
• # complaints • satisfaction rating	• mean copies b. calls • % returncalls • % repeatcalls • mean labor time • mean spares value • % history cards

Figure 3-6: Indicators of the District Service PMS.

3.3.3 Horizontal goal interdependence: District Service & Product Support constituency

We have already presented the result indicators and the process indicators of the District Service PMS in the previous subsection. As a consequence of the deployment of the relevant means at the meso level into the relevant ends at the micro level, the result indicators of the Product Support unit equaled the result indicators of the District

Service teams. These two constituencies are goal interdependent in the horizontal chain of customer-supplier relations at the micro level. Horizontal goal interdependence was made explicit in the PMS designs of the customer-constituency i.e. the District Service teams and the supplier-constituency i.e. the Product Support unit due to the deployment procedure.

Therefore, just as had been the case during the design of the District Service PMS, the Product Support PMS also contained 'Customer complaints' and 'Satisfaction rating' as the relevant result indicators, which were deployed from the Field Service PMS. Note that there is no vertical goal interdependence relation regarding operational service activities between the Field Service managers and the Product Support manager (see Figure 3-1). This can be explained as an inconsistency in Copytec's service structure. Because of this structural inconsistency, the Product Support manager did not participate in the design team meetings of the Field Service PMS.

The Product Support manager and his subordinates reached a consensus on two relevant process indicators. Given the horizontal goal interdependence relation with the District Service teams, the service technicians participated as a 'hinge' in the design team meetings of the Product Support unit.

Service technicians contact the Product Support unit, whenever they are confronted with complex problems. If a product support specialist can transfer his technical expertise to technicians in the field, the number of return-calls carried out by senior technicians will be minimized. Furthermore, if the Product Support unit replenishes technicians' car stocks in time, the number of return-calls due to spare part shortage will also be minimized. Good performance in these areas is assumed to result in good performance of the service technicians downstream the value chain.

Hence, the relevant process indicators of the Product Support PMS were identified in terms of:

- % Senior return-calls: the number of return-calls by senior technicians, expressed as a percentage of the total number of return-calls;
- % Spares return-calls: the number of return-calls due to spare part shortage, expressed as a percentage of the total number of return-calls.

As previously described, the Product Support unit not only has short-term responsibilities related to the daily service process, but also has responsibilities which indirectly impact Copytec's service performance in the field in the longer run. In addition, process indicators of the Copytec Management PMS were deployed. It meant that the Product Support PMS consisted of two parts: one part that focused at the daily execution of the service process at the micro level and one part that focused on the continuous improvement of the service performance at the meso level.

For this latter part of the Product Support PMS, '% Contracts renewed' and '% Premium contracts' were deployed from the Copytec PMS as the relevant result indicators. The Product Support manager and his specialists defined a relevant set of process indicators in relation to these result indicators. It was agreed upon that the maximum service level which technicians in the field are able to deliver is a function of the particular composition of the assortment of photocopiers. Therefore, if the Product Support unit allows photocopiers of a poor quality into Copytec's assortment, the resulting service performance in the field will in the long run be poor as well. Such poor service performance will manifest itself in the mean number of copies between two successive calls and in the mean labor time of a service call: two relevant process indicators of the service technicians.

Adding new and qualitatively superior types of photocopiers to and removing old and qualitatively inferior types from Copytec's assortment should over time result in improved performance on both service technicians' process indicators. Ultimately, this should contribute to an improved integral service performance and, thus, in an increased number of (premium) service contracts renewed. Hence, the following process indicators were added to the Product Support PMS:

- % Mean copies between calls: improvement rate in mean number of copies between two successive calls;
- % Mean labor time: improvement rate in mean labor time of a service call.

The contents of the Product Support PMS is summarized in Figure 3-7.

Product Support	
Result Indicators	*Process Indicators*
• % contracts renewed • % premium contracts	• % mean cop. b. calls • % mean labor time
Result Indicators	*Process Indicators*
• # complaints • satisfaction rating	• % senior returncalls • % spares returncalls

Figure 3-7: Indicators of the Product Support PMS.

3.4 REFLECTION

What can we learn from this 'mental exercise', this conceptual illustration in light of our search for Goal Coherence, which we intend to empirically demonstrate during the next phase of the research?

Suppose that Copytec had been a real-life case instead of an illustrative case. It is expected that the process of designing (and application) of the performance measurement systems of Figure 3-4 would have stimulated perceptions of positive goal interdependence and would thus have contributed to enhanced degrees of Goal Coherence throughout the Copytec organization. As part of the intervention, the organization's multiple constituencies do not independently discuss performance indicator proposals, targets for resulting indicators and priorities for resulting goals; rather, goal interdependent constituency members do so face-to-face in mutual consultation, thereby confronting each other with their mental models of organizational effectiveness. This is made possible since the Strategic Dialogue prescribes goal interdependent constituencies to share the same performance indicators: between vertically goal interdependent principals and agents, the relevant means as identified by the principal-constituency correspond with the relevant ends as identified by the agent-constituency; between horizontally interdependent constituencies, the relevant ends as identified by the principal-constituency correspond with the relevant ends as identified by the agent-constituency.

The expected consequence is the existing mental models of organizational actors to converge within and between constituencies. In order to empirically demonstrate this phenomenon, we first need to operationalize the constructs of between-constituency and within-constituency Goal Coherence. These constructs have been previously defined in terms of inter-group and intra-group consensus on constituency goal priorities respectively. We can now identify that these constituency goal priorities should relate to those performance indicators which principal- and agent-constituencies jointly share.

This is a valuable clue for the operationalization of our leading research construct. The details are presented in the subsequent methodological Chapter 4, which presents our main research questions. As a result of the reflections on the illustrative Copytec case, we are now able to concretely define these research questions, which had already been rudimentary sketched in the introductory chapter. These questions will lead the intervention in the empirical case study of the Corus IJmuiden Long Products business unit, which is covered in Chapters 5 through 8.

Chapter 4.
RESEARCH OUTLINE

This methodological chapter defines the research problem and outlines the empirical phase of the research in terms of the research design and the underlying research methodology.

4.1 INTRODUCTION

The problem of this research has been roughly identified in terms of a call for convergence in the previous chapters. In the current chapter, the exact research problem is explicitly dealt with. The research problem is stated in terms of the practical research objective and the theoretical research question in Section 4.2.

The research design is presented in Section 4.3. Mind that the research design presented relates to the empirical case study of the empirical research phase. The design is called a multiple two-group pretest-posttest design. The empirical case study concerns the Corus IJmuiden Long Products business unit. As part of the research design, the method for empirical data gathering at an ordinal level of measurement is dealt with, as is the statistical technique termed categorical principal component analysis – as implemented in the program CATPCA in SPSS Categories 10.0 (Meulman and Heiser, 1999) – for operationalizing the Goal Coherence construct. The type of research that is conducted within the research design contains elements of participatory action research (Whyte, 1991) and reflection-in-action (Schön, 1983; 1987).

Finally, the underlying research methodology is dealt with in Section 4.4. Given the purpose-orientation of the research, recognized in the practical research objective, the research is methodologically founded on the design cycle (Rozenburg and Eekels, 1991). Since we are guided by a theoretical research question, the research methodology additionally contains elements of another ground model, the empirical cycle (De Groot, 1961).

4.2 RESEARCH PROBLEM

The problem of our research has both a practical and a theoretical equivalent. Following De Leeuw (1996) and Verschuren and Doorewaard (1995), we distinguish between:

- The research objective, which addresses the practical problem;
- The research question, which addresses the theoretical problem.

A practical problem is generally defined as an undesirable discrepancy between the actual and the desired state of a system in a real-life, practical context. Practical problem solving aims at eliminating undesirable discrepancies in real-life systems. In our research, such real-life systems pertain to organizations that are in a state of lacking Goal Coherence between goal interdependent constituencies. The practical problem is addressed by the research objective. Pursuing the research objective is obvious from the purpose-orientation of our research.

We have access to an organization that values the idea of coherent goal setting between its goal interdependent constituencies. This organization, presented in Chapter 5, is called Corus IJmuiden Long Products and is one of the business units of the Corus corporation. The business unit serves as the object of research during the empirical research phase. In this real-life context, a state of lacking Goal Coherence throughout the organization is experienced as a consequence of a strategic redirection, which has been enforced upon the organization due to environmental change.

We are the opinion that research in the practical field is unworthy of the predicate scientific – i.e. has no academic relevance – in case it is limited to practical problem solving: the practicing of science would be synonymous to the practicing of consulting. Our scientific ambition is to learn from practical problem solving processes in the field by critically reflecting upon these processes in their specific organizational context, in order to derive design rules that are transferable, under certain conditions, to other, unique contexts.

In our research, design knowledge concerns prescriptions regarding the multilevel and interactive designing of performance indicators and subsequent goals. Design knowledge thus relates to the process of designing i.e. the Strategic Dialogue; it does not relate to the resulting product of designing. The search for a general product of designing presupposes the existence of a universally applicable design blueprint that prescribes, for each and every situation, the same contents of multiple performance measurement systems. In the words of Galbraith (1973), this would suggest a 'one best way of organizing' contingent upon various and unique situations. In Chapters 1 and 2, we have presented the Performance Pyramid (Lynch and Cross, 1991) and the Balanced Scorecard (Kaplan and Norton, 1992, 1993, 1996[a], 1996[b]) respectively as design blueprints.

However, we do not believe in the existence of general knowledge regarding the product of designing. Instead, we do believe in the existence of a general process of designing, universally applicable in various organizational contexts, albeit resulting in unique products of designing as a consequence of the uniqueness of various organizational contexts. Uncovering the general process of designing in one empirical case requires continuous reflections of the researcher upon real-life design interventions in order to reveal the conditions for effective application. Effective application should in our study be interpreted in terms of the demonstrated contribution to enhanced degrees of Goal Coherence.

As illustrated in Chapter 1 by the call for convergence by leading researchers in the applied disciplines of Management Accounting and Organizational Psychology, the design knowledge we are looking for represents a lacuna in the existing body of knowledge. Such a lacuna is generally defined as a theoretical problem. Theoretical problem solving thus aims at filling the scientific database with lacking knowledge products.

The theoretical problem is addressed by the research question. The research question is generally translated into a hypothesis. The construction of hypotheses is common within the empirical research cycle (De Groot, 1961): hypotheses are tested in order to demonstrate induced causality. Given the applied nature of our research, our research question is translated into what is called an instrumental hypothesis (Mattessich, 1995). An instrumental hypothesis concerning means and ends, in contrast to a causal hypothesis concerning causes and effects, is tested in order to demonstrate the presumed effectiveness of an intervention. The instrumental hypothesis of our research has already been introduced in Chapter 1 as part of our research approach and pertains to the instrumental relation between the Strategic Dialogue intervention and the Goal Coherence construct. We will return to this subject in Section 4.4

The purpose-oriented research objective, which emphasizes the unique product of designing in terms of the context-specific performance measurement systems, and the knowledge-oriented research question, which emphasizes the general process of designing in terms of the transferable Strategic Dialogue, thus jointly define the research problem. Both are interrelated in the sense that achieving the practical objective contributes to answering the theoretical question and, *vice versa*, the contents of the theoretical question in turn is leading the research intervention in practice. Both are made explicit in the following subsections.

4.2.1 Research objective

The research objective relates to the product of designing in terms of context-specific and thus unique performance measurement systems and reads as follows:

"To initiate and facilitate the Strategic Dialogue at the macro, meso and micro level of the Corus IJmuiden Long Products organization from the perspective of the enforced strategic redirection, and to deliver, as a result of this intervention, multiple performance measurement systems."

4.2.2 Research question

The research question relates to the process of designing in terms of a, under certain conditions, transferable Strategic Dialogue intervention and reads as follows:

"Does the intervention of Strategic Dialogue positively affect degrees of Goal Coherence within and between Corus IJmuiden Long Products' multiple and goal interdependent constituencies?"

From this main question, three sub-questions are derived that regard the measurement of a theoretical construct, the testing of an instrumental hypothesis and the transferring of a unique finding:

1. "How can we operationalize the Goal Coherence construct?";
2. "How can we empirically demonstrate the effect of the Strategic Dialogue intervention on degrees of within-constituency and between-constituency Goal Coherence?";

3. "Under what conditions can the empirical findings of our unique case be transferred to other cases?" or, in other words, "What general design rules regarding the interactive process of designing can be derived from the empirical findings?"

Recall from Chapter 1 the ultimate purpose of our study: to produce prescriptions i.e. design knowledge regarding the Strategic Dialogue intervention that professionals in the practical field can apply to change an existing or create a new organizational reality (which means an organizational reality that is characterized by enhanced degrees of Goal Coherence). Especially the last of the three sub-questions is connected with the purpose of our scientific endeavor.

4.3 RESEARCH DESIGN

The design of the empirical study of the Corus IJmuiden Long Products case is called a multiple two-group pretest-posttest design. As part of this research design, the method for empirical data collection at an ordinal level of measurement, the categorical principal component analysis for analyzing these data in light of the Goal Coherence construct and the specifics of the conducted type of research are subsequently dealt with.

4.3.1 Multiple two-group pretest-posttest design

The multiple two-group pretest-posttest design is an extended variant of Cook and Campbell's (1979) one-group pretest-posttest design. This quasi-experimental design is one of the more frequently used research designs in the social sciences. It constitutes the recording of pretest observations O_1 on a single group of individuals, who later receive a treatment X, after which posttest observations O_2 are made. This design is diagrammed in Figure 4-1.

$$O_1 \longrightarrow X \longrightarrow O_2$$

Figure 4-1: One-group pretest-posttest design.

In our research, the treatment concerns the intervention of Strategic Dialogue, in which organizational actors participate during design team meetings and management approval meetings. The pretest and posttest observations relate to the empirical measurement of the degree of Goal Coherence before and after these interactive moments of dialogue.

In our research, we do not record observations on a single group of individuals, but on multiple groups of individuals, namely the Corus IJmuiden Long Products' multiple constituencies at the macro, meso and micro level of organizational analysis. Yin (1994) would speak of an embedded case study, since we have multiple units of analysis in our study. Moreover, observations are recorded on two groups a time, regarding a principal-constituency and an agent-constituency being vertically or horizontally goal interdependent. Therefore, we speak of a multiple two-group pretest-posttest design.

Concretely, the research design consists of the 19 constituencies mentioned below, which correspond with 90 individuals. For reasons of clarity, we need to mention in anticipation of Chapter 5 that the business unit's production organization consists of 3 operational units (i.e. production plants), namely the Steelworks, the Rolling-mill and the Finishing-center, which operate in a 5-shift, a 3-shift and a 5-shift system respectively. The 2 constituencies at the meso level are cross-functionally composed of staff members from the business unit's 3 operational units and of staff members from the business unit's Sales, Logistical Planning and Quality Assurance departments. At the micro level, the Steelworks, the Rolling-mill and the Finishing-center constituencies are composed of a plant manager and his shift managers; each of the 13 Shift constituencies are composed of a shift manager and a delegation of his first-line operators.

- Macro level: 1 Management constituency (7 members);
- Meso level: 1 Quality constituency (8 members);
  1 Logistics constituency (7 members);
- Micro level: 1 Steelworks constituency (6 members);
  5 Steelworks Shift constituencies (2x7, 2x8 and 9 members);
  1 Rolling-mill constituency (4 members);
  3 Rolling-mill Shift constituencies (4, 5 and 5 members);
  1 Finishing-center constituency (6 members);
  5 Finishing-center Shift constituencies (5x3 members).

At each level of organizational analysis, the relevant means-end relations are made explicit in terms of result-oriented performance indicators with associated indicator targets (addressing the what-to-achieve question) and process-oriented performance indicators with associated indicator targets (addressing the how-to-achieve question) during design team meetings of the Strategic Dialogue.

Recall from the conceptual research phase that we have defined the construct of Goal Coherence in terms of intra- and inter-group consensus on constituency goal priorities. Reflections on the illustrative case study resulted in a refinement of this definition: constituency goal priorities relate to those performance indicators that goal interdependent principal- and agent-constituencies jointly share.

In order to operationalize the constructs of between-constituency and within-constituency Goal Coherence, we thus need goal interdependent constituencies to prioritize those performance indicators – and associated goals – which they jointly share. This contributes to a coordinated trade-off between multiple, seemingly conflicting goals, that all need to be met to a certain extend. In case of vertical goal interdependence between principal- and agent-constituencies, e.g. between the Management constituency as the superior-constituency and the Quality constituency as the subordinate-constituency, the prioritizing relates to the process indicators of the Management constituency, which correspond with the result indicators of the Quality constituency. In case of horizontal goal interdependence between principal- and agent-constituencies, e.g. between the Rolling-mill constituency as the customer-constituency and the Steelworks constituency as the supplier-constituency, the prioritizing relates to the result indicators of the Rolling-mill constituency, which correspond with the result indicators of the Steelworks constituency.

The prioritizing of performance indicators and associated targets is enabled by a simple scaling procedure, which constitutes an ordinal level of measurement and consequently produces categorical i.e. ranking data. Goal interdependent constituencies, with an identical instruction, have to order the performance indicators and subsequent goals that they jointly share in light of common goal attainment. Part of the instruction is that constituency members do so individually, i.e. the ranking exercise is not part of the interactive group processes during the design team meetings and the management approval meetings. The reason for this is to avoid the chance of mock-consensus. Given the pretest-posttest feature of the research design, goal interdependent constituencies have to order the performance indicators twice: before and after the management approval meeting of the Strategic Dialogue. This meeting constitutes a vital moment of constructive controversy (Tjosvold, 1985) between principal- and agent-constituencies. The ranking exercise is in fact a goal setting intervention which aims at the clarification of multiple, seemingly conflicting goals.

The two-group pretest-posttest design of our research, which is applied multiple times, is diagrammed in Figure 4-2, with X_p and X_a the design team meeting(s) of the principal constituency and the design team meeting(s) of the agent constituency respectively, $O_{1,p}$ and $O_{1,a}$ the pretest measurement of shared goal priorities among principal constituency members and among agent constituency members respectively, X_{p+a} the management approval meeting(s) and $O_{2,p}$ and $O_{2,a}$ the posttest measurement of shared goal priorities among principal constituency members and among agent constituency members respectively.

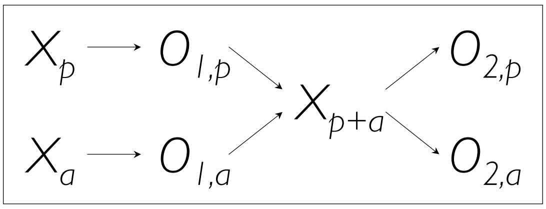

Figure 4-2: Two-group pretest-posttest design.

By making constituency members prioritize their performance indicators and associated goals, their underlying mental models of organizational effectiveness are made explicit. We previously assumed the empirical demonstration of group consensus on goal priorities to be underpinned by the existence of convergent mental models. In other words, the existence of convergent mental models will manifest itself through the empirical demonstration of Goal Coherence. The ranking i.e. categorical data per respondent in fact make explicit a one-dimensional mental model: the indicators/goals can be thought of to be positioned equidistantly along a straight line. The degree in which these one-dimensional mental models over multiple respondents are similar can be established through the application of a categorical principal component analysis.

4.3.2 Data collection and analysis: categorical principal component analysis

To analyze the categorical data, we have chosen for a categorical principal[7] components analysis, as implemented in the program CATPCA[8] in SPSS Categories 10.0

[7] The term principal in categorical principal component analysis is not related to term principal in principal-agency theory.

(Meulman and Heiser, 1999). CATPCA stands for CATegorical Principal Components Analysis with optimal scaling. The technique can be thought of as a method of dimension reduction: it simultaneously quantifies categorical (i.e. qualitative) variables while reducing the dimensionality of the data with minimal loss of information found in the original variables i.e. with minimal loss of variance accounted for (VAF). Stated differently, the technique reduces a set of categorical variables into a smaller set of uncorrelated principal components. The technique is most useful when an extreme number of variables prohibits effective interpretation of the relations between objects. The reader should be aware of the fact that CATPCA is an innovative technique for organization research.

By reducing the dimensionality of the data, i.e. by reducing the number of sources of variance in the data, interpretation can be restricted to a few principal components rather than a large number of variables. Principal components, common sources of variance and reduced dimensions are thus terms with a similar meaning. Ultimately, dimension reduction (the number of dimensions in the original data set equals the minimum of the number of variables and the number of options minus one) reveals those few dimensions that represent the major sources of variance of the original data. In other words, dimension reduction reveals the common sources of variance that the categorical variables share. The transformation of the original, categorical variables into metric variables is underpinned by monotonically increasing transformation functions. The theory of CATPCA is described, among others, in Gifi (1990), Meulman (1992), Krzanowski and Marriott (1994) and Heiser and Meulman (1994, 1995).

Since the size of constituencies in terms of the number of subjects in our study is small – e.g. the Management constituency consists of 7 members – the statistical techniques appropriate for large populations of subjects as applied by Vancouver and Schmitt (1991) and Vancouver *et al*. (1994) for operationalizing their goal congruence constructs (see Chapter 2), are not appropriate in our study. The few respondents per constituency in our study is one of the main reasons why we have chosen for a categorical principal component analysis. In Appendix A, the analysis technique is illustrated with an uncomplicated example.

Principal components (or factor) analysis is usually defined as the analysis of a correlation matrix. In the analysis of the correlation matrix, there is no representation of the units of observation (the rows of the data matrix). In the analysis of ranking data, we analyze the full data matrix (and not the correlation matrix) to obtain loadings for the variables and scores for the units.

In a traditional principal component analysis, the subjects (here: constituency members) are considered as the units and the options (here: constituency goals) as the variables which order or classify the units. In the analysis of ranking data, where the respondents have ordered the options, the reversed data matrix should be analyzed, with subjects as variables and options as units (Cronbach and Gleser, 1953). In case of such a subject-oriented multivariate analysis, resulting measures of correlation should be interpreted as intersubjective measures of association. Measures of intersubjectivity are commonly applied in social science research due to lacking measures of objectivity. In particularly, Q-methodology (Stephenson, 1953; Brown, 1986; McKeown and Thomas,

[8] Like other SPSS Categories applications, the technique is mainly exploratory rather than confirmatory in nature. There is much more emphasis on visually discovering possible relations between variables in a multidimensional space than on hypothesis testing.

1988) has evolved as a science of the subjective. A common measure of association is represented by Cohen's Kappa (Cohen, 1960). The application of CATPCA in our study produces a new measure of association that operationalizes the Goal Coherence construct, as will be demonstrated in Chapter 6, Chapter 7 and Chapter 8.

The principal component loadings are correlations between the variables and the principal components, and they give coordinates to represent the variables as vectors in the principal components space. The squared principal component loading gives the variance accounted for (VAF) by each dimension, and the sum over variables gives the total variance accounted for, which is equal to the eigenvalue associated with each principal component. The eigenvalues are related to Cronbach's α, where $\alpha = m(\lambda-1)/(m-1)\lambda$, with λ the eigenvalue and m the number of variables (Heiser and Meulman, 1994).

The results of a principal component analysis can be represented in a graphical display. Each variable (i.e. constituency member) is represented by a vector, extending from the origin. The squared distance of the vector tip to the origin corresponds to the percentage of variance accounted for. If the VAF for two variables is decent, a small angle between the two vectors in the space indicates a large correlation between the two variables. In the present study, this indicates a large association between two respondents.

The options (i.e. constituency goals) are represented as points in the same graph as the variables. The perpendicular projection of the options onto the vectors gives a metric approximation of the ranking data: the higher the projection in the direction of the vector, the larger the rank number. Options projecting close to the origin are judged as average, and options with a projection on the extension of the vector in the opposite direction imply a very low rank number.

The particular representation is called the vector model, and is due to Tucker (1960); Gabriel (1971) invented the name biplot. The vector model was successfully applied to preference data by Carroll (1972). For more details in the principal component analysis context, see Heiser and Meulman (1983).

Ranking data require a so-called non-metric analysis, where initially only the order of the options is taken into account, and where the distances between options are optimally determined by the technique during the analysis. Standard principal component analysis shows how much of the average proportion of variance of the original variables is accounted for by the principal components. Optimal scaling in CATPCA implies that the total proportion of VAF is as large as possible (given the ordinal information), and thus also that Cronbach's α is maximized (Heiser and Meulman, 1994).

Similar approaches to principal component analysis are described in Kruskal and Shepard (1974), Young, Takane and De Leeuw (1978), Winsberg and Ramsay (1983) and Ramsay (1989). Application of CATPCA in psychology are to be found, among others, in Vlek and Stallen (1981), Wagenaar (1988), Kerkhof, Van der Wal and Hengeveld (1988) and Van der Ham, Meulman, Van Strien and Van Engeland (1997). A similar application in anthropology is described in Gower and Meulman (1993).

4.3.3 Research type: participatory action research and reflection-in-action

In order to explain our specific research type, we return to the interrelated nature of our practical research objective and our theoretical research question: in order to gain theoretical insights, we engage in practical problem solving; in order to research a construct, we actively intervene in an empirical reality. This type of research is defined by Lewin (1951) as action research: it consists of an iterative and parallel process of taking action and doing research. As Lewin propagates: "one can only learn to understand social reality by changing it".

Since the Strategic Dialogue aims at the organization-wide involvement of the human factor in the process of change, our research design is better typified in terms of participatory action research (Whyte, 1991). The element of participation not only relates to the organizational members of the Corus IJmuiden Long Products business unit who participate in the Strategic Dialogue; it also relates to the researcher who facilitates the process of change. Participatory action research enables the researcher's reflection-in action (Schön, 1983; 1987): it provides ample opportunity for critical reflections upon the interactive process of designing in order to derive the rules for effective application of the Strategic Dialogue prescriptions. Moreover, the process of reflection aims at detecting the conditions for designing that make the transfer of prescriptive knowledge outside the boundaries of the initial case plausible.

The reason behind a single, empirical case study concerns the fundamental and thus time-consuming nature of participatory action research: not only regarding the participating organizational actors, who need to rethink, discuss and make explicit their contribution to the organization's overall effectiveness, but regarding the participatory action researcher as well. The participatory action researcher is not just collecting empirical data; he is facilitating an organization-wide change process and, as part of this, he is deriving the data from his empirical case that help him to answer the theoretical questions by which he is guided.

The participatory action researcher facilitates the intervention of Strategic Dialogue on the basis of the framework for multilevel designing that has been presented in Chapter 2. This framework, explored in the illustrative case of Copytec Service (see Chapter 3), serves as a guide for the initiation and organization of real-life design interventions in the empirical case of Corus IJmuiden Long Products. Before facilitating the process of change, the participatory action researcher first needs to gain thorough understanding of the unique specifics of his research object: the business strategy, the organizational structure and the physical and non-physical transformation processes of the Corus IJmuiden Long Products business unit. The framework for multilevel designing then helps the participatory action researcher to identify Corus IJmuiden Long Products' multiple constituencies that are goal interdependent within principal-agent relations (both vertically and horizontally) and to initiate and facilitate the design team meetings and management approval meetings during which the constructive controversy (Tjosvold, 1985) in light of common goal attainment is catalyzed.

4.4 RESEARCH METHODOLOGY

The research outline is closed by two core research models of which we make use for methodologically underpinning our study. The design cycle is discussed in Subsection 4.4.1 and the empirical cycle is discussed in Subsection 4.4.2.

4.4.1 Design cycle

Given the applied nature of our research, it is methodologically positioned within the design cycle (Roozenburg and Eekels, 1991). Application of the design cycle aims at actively changing an existing reality and creating a new i.e. 'better' one by solving a practical problem (ranging from a somewhat general societal problem to a very concrete organizational problem). A practical problem has previously been defined as an undesirable discrepancy between the actual and the desired state of a real-life system. The design cycle is a well-known research model in applied research. In Dutch applied research, the design cycle is referred to as the regulative cycle (Van Strien, 1986). In accounting research, the design cycle is known as the constructive approach (Kasanan *et al.*, 1993). The design cycle is depicted in Figure 4-3. The basic idea of this research cycle concerns a partial approach and a subsequent integral approach: first the practical problem is analyzed from the parts, then the integral solution is synthesized for the whole of the parts. Typically, a design process consists of (Roozenburg and Eekels, 1991):

- analysis;
- synthesis;
- simulation (application);
- evaluation;
- decision.

During the analytical phase, the researcher forms an idea of the practical problem within its unique context in connection with the product to be designed. The analytical proceeding decomposes the problem into its constituting parts. The resulting diagnosis produces a set of required properties for the product to be designed. Given these properties, application of the product to be designed to the real-life system to which it relates is expected to reduce the encountered discrepancy between the actual and the desired state of the (organizational) system. As part of the analysis, the constraints posed by the unique context are also taken into account.

During the synthetic phase, the researcher synthesizes a provisional design. This design represents an integral solution for the practical problem, which implies that the design incorporates all the expected properties identified during the analysis. As a consequence, this phase of the design cycle is essentially a creative activity, all the more since the solution that is produced cannot be derived from available knowledge by deduction.

During the simulation phase, the expected behavior and properties of the provisionally designed product are judged before practical application, using reasoning or model tests. The simulation should result in expectations regarding the actual properties of the product. It is sometimes said from applied research that "the proof of the pudding is in the eating": through repetitive application by professionals in the practical field, trust in rather than proof of design knowledge is empirically developed (Vosselman, 1996). This would imply that the expected properties of design products can only be properly judged during – and thus not before – actual application in practice. The judging of design products implies the element of subjectivity. The purpose-orientation of applied research is recognized by Mattessich (1995), who therefore pleas for explicitly incorporating subjective value judgements by professionals in the practical field into the evaluation of design products.

During the evaluative phase, the required properties of the product to be designed, which were identified during the analysis, are confronted with the expected or observed properties of the simulated or applied design. Based on this confrontation, the effectiveness of the design is (subjectively) judged: design effectiveness is positively judged if it is believed that application of the design will (further) solve the initial, practical problem. "Does it work?" is thus the basic, instrumental question that is addressed during the evaluative phase. Design effectiveness has multiple aspects, namely relevancy, simplicity and acceptance.

Finally, during the decision phase, it is either decided to implement the simulated or applied design in case of a positive judgement of design effectiveness, or to postpone implementation in case of a negative judgement and subsequently generate a better i.e. more effective design. There are two alternatives for such a design iteration: 1) to reanalyze the practical problem in order to identify additional or new properties; 2) to synthesize a revised or new version of the provisional design from the same required properties.

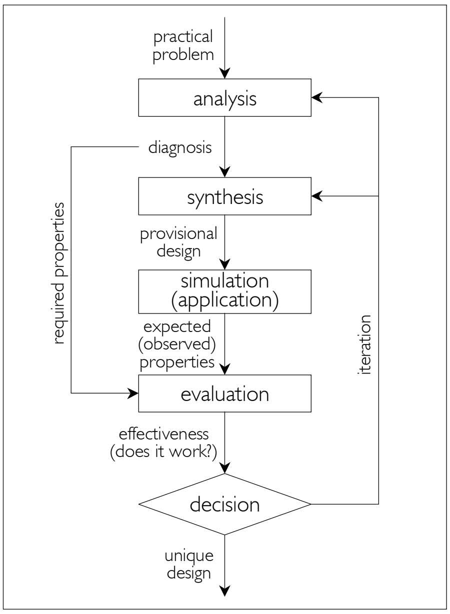

Figure 4-3: Design cycle.

Although design methodology originates from the engineering sciences such as Mechanical Engineering and Electrical Engineering, its use is appropriate for the design of 'products' in the broadest sense of the term. The design cycle is thus appropriate for researching the design of control instruments in the applied fields of Management Accounting and Organizational Psychology. Projection of the design cycle onto the ProMES-like design of performance measurement systems in our research implies the so called design team meetings to incorporate the design cycle phases of analyzing, synthesizing and simulating, while the so called management approval meetings incorporate the design cycle phases of evaluating and deciding. Note the multiple application of the design cycle during the empirical phase of our research as a consequence of the research design presented in Subsection 4.3.1. Moreover, note that the organizational actors of the Corus IJmuiden Long Products business unit go through the design cycle as a consequence of the participatory action research type (Whyte, 1991). They are joint by the researcher for the purpose of his reflection-in-action (Schön, 1983; 1987).

By critically reflecting upon the process of designing, the relevant circumstantial factors and, hence, the underlying, universal mechanisms are revealed that account for observed success or failure of the unique design product. During the process of reflection which is incorporated into the subsequent phases of the design cycle, Van Aken (1994) speaks of a reflective cycle, the basic question "Why does it work?" is thus addressed by the researcher. From the insights gained, restrictive conditions are derived regarding the transferring of design knowledge to other unique contexts.

Design knowledge concerns knowledge of means-end relations: it concerns prescriptions regarding an intervention in practice. According to Mattessich (1995), knowledge of means-end relations is essentially different from knowledge of cause-and-effect relations. For the purpose of causal knowledge production, the empirical cycle (De Groot, 1961) is appropriate. While the scientific purpose of the application of the design cycle is to actively change or create an endogenous reality, the application of the empirical cycle is to passively understand the way an exogenous reality is or develops. Despite the purpose-orientation of our research which is recognized in the practical research objective, we additionally make use of elements of the empirical cycle since we are guided by a theoretical research question.

4.4.2 Empirical cycle

Research in e.g. Physics, Medicine or Economics concerns the detection of general law statements. In these disciplines, the empirical cycle (De Groot, 1961) is a well-known research model. Its application aims at passively representing reality as it is or will be by solving a theoretical or 'knowledge' problem. A theoretical problem has previously been defined as a lacuna in the existing body of scientific knowledge. The empirical cycle is depicted in Figure 4-4. The basic idea of this research cycle concerns an inductive approach (from the particular to the general) and a subsequent deductive approach (*vice versa*: from the general to the particular). Typically, an empirical research process consists of (De Groot, 1961):

- observation;
- induction;
- deduction;
- testing;
- evaluation.

The researcher first induces general law statements in terms of causal hypotheses from particular facts (i.e. observed empirical phenomena), next deduces particular facts (i.e. verifiable predictions) from induced laws, then confronts the deduced facts with new, empirically observed facts and finally evaluates the degree of truthfulness of the induced hypotheses. The basic, causal question that is addressed by the researcher during evaluation thus concerns the "Is it true?" question. The objective criteria for answering this question relate to internal and external validity, accuracy and reliability. Since subjectivity in terms of value judgements would harm the making of generalizations, it is excluded from the evaluative phase. If the "Is it true?" question is not answered satisfactorily, a research iteration is required by deriving new facts from the empiricism or by inducing new hypotheses.

Within the empirical cycle, the process of falsification (Popper, 1972) is the scientific vehicle for knowledge production: the idea is to search for objective facts that refute the induced causality. Since resulting knowledge concerns knowledge of cause-and-effect relations, it is descriptive, explanatory or predictive in nature.

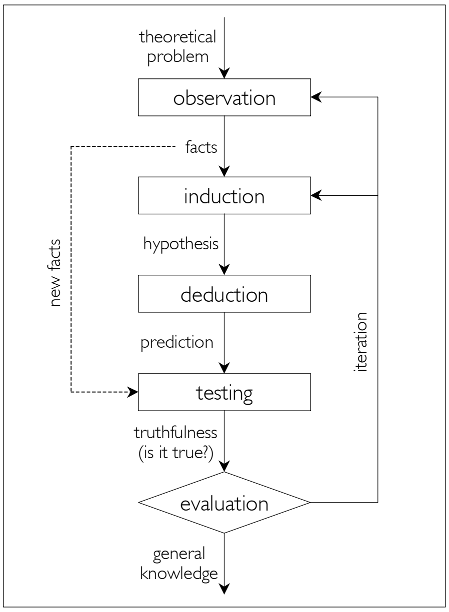

Figure 4-4: Empirical cycle.

After the discussion on the design cycle and the empirical cycle, features of both are summarized in Table 4-1. We will now explain more precisely why we additionally position our research within the empirical cycle, despite the fact that our research is essentially applied in nature. For one thing, our research is part of the ProMES research program. As mentioned before, a prevailing question of this program is how operational control systems fit with higher order control systems such as the management control system. This question has a history in numerous ProMES projects through the years. It is witnessed by ProMES researchers that during management approval meetings in practice, management often has difficulty judging the validity of performance measurement system designs presented by operating staff. That is, management has difficulty judging the contents of these systems in terms of the proposed set of performance indicators, the associated goals that are made explicit by the indicator targets, and the relative weights or priorities of these goals as made explicit in the contingency functions. What is observed are processes of ad hoc strategy formulation: managers whispering with each other during approval meetings about goal priorities and, in certain cases, managers even interrupting approval meetings in order to mutually discuss behind the scenes the (implicit) business strategy and its implications for the daily operations at the shop floor. What is apparently lacking in these cases is a multilevel consensus on goal priorities: i.e. Goal Coherence. These observations are empirical facts that have put an empirical research cycle in motion, of which this research makes part.

Table 4-1: Design cycle and empirical cycle.

	Design cycle	Empirical cycle
Problem	practical	theoretical
Purpose	change endogenous reality	understand exogenous reality
Knowledge	means-end relations • prescription	cause-and-effect relations • description • prediction • explanation
Scientific criterion	effectiveness • relevancy • simplicity • acceptance	truthfulness • validity (internal and external) • accuracy • reliability
Scientific vehicle	reflection • "Why does it work?"	falsification • "Is it true?"
Evaluation	subjective	objective
Researcher	actively involved	passively involved

Another link to the empirical cycle refers to the presumed relation between the Strategic Dialogue intervention and the degree of Goal Coherence. This relation is a-priori hypothesized and quoted as the research question in Subsection 4.2.2. The induction of an hypothesis, albeit an instrumental rather than a causal one, is typical for the empirical cycle. In order to test the validity of the hypothesized relation between Strategic Dialogue and Goal Coherence, we need to derive new facts from the empiricism. Concretely, we need to find follow-up cases where we can initiate the Strategic Dialogue. Given the time-consuming nature of the intervention as explained before, a series of cases implies an entire research program which is behind the scope of the current Ph.D. research project. We will return to this issue in Chapter 9 where we will present the suggestions for future research. In the next chapter, we will present the specifics of the first case in the required series of cases: the Corus IJmuiden Long Products business unit.

Chapter 5.
EMPIRICAL CASE STUDY

This chapter presents the object of research during the empirical research phase: the Corus IJmuiden Long Products business unit. In this real-life case, we have been able to study the Strategic Dialogue in practice and to measure degrees of Goal Coherence.

5.1 INTRODUCTION

Corus IJmuiden Long Products is one of the business units of the Corus corporation. This global supplier of steel and aluminum products is the result of the corporate merger in October 1999 between British Steel and Koninklijke Hoogovens.

Koninklijke Hoogovens was founded in the Netherlands in 1918 with the purpose to provide the Dutch market with iron and steel. Koninklijke Hoogovens is a so called integrated steel company: in addition to its facilities at the 'back side' of the company to produce and process steel (e.g. steelworks and cold and hot rolling-mills), it has its own facilities at the 'front side' to produce hot metal from iron ore and pit coal (e.g. coking plants and blast-furnaces). Only after WWII, Koninklijke Hoogovens expanded its activities beyond the domestic market. In addition, activities were further expanded in the 60s with the production of aluminum products. The key ratios of the Koninklijke Hoogovens corporation are presented in Table 5-1.

Table 5-1: Key ratios of Koninklijke Hoogovens.

Year	1995	1996	1997	1998
Steel production (in thousand tons)	6149	6171	6674	6725
Turnover (in million €)	3675	3600	4536	4906
Net result (in million €)	230	148	226	188
Employees	19387	18300	22731	21942

Our business unit is a former Koninklijke Hoogovens business unit, called Hoogovens Steel Long Products. In the remainder of this monograph though, we will speak of Corus IJmuiden Long Products, which is the business unit's new name after the corporate merger with British Steel. As its name reveals, our business unit produces and sells steel products of long dimensions. Long products are referred to as billets (square section) or bars (round section). Billets and bars are semifinished products that are further processed elsewhere, e.g. by forging companies downstream the automotive supply chain. Our business unit thus operates in a business-to-business market. The key ratios of the Corus IJmuiden Long Products business unit are presented in Table 5-2.

Table 5-2: Key ratios of Corus IJmuiden Long Products.

Year	1995	1996	1997	1998
Steel production (in thousand tons)	1160	1240	1180	1090
Turnover (in million €)	267	257	297	303
Operational result (in million €)	21	-4	14	6
Employees	718	732	750	677

The specifics of Corus IJmuiden Long Products are outlined in terms of the business strategy in Section 5.2, the business unit structure in Section 5.3 and the cross-functional business process in Section 5.4 successively. Preparing for the empirical intervention, our business unit is finally presented as a network of goal interdependent constituencies in Section 5.5.

5.2 BUSINESS STRATEGY

Before the business strategy of Corus IJmuiden Long Products is explained, the corporate strategy is explained first. By corporate strategy we mean the strategy of Koninklijke Hoogovens, since the major part of our research activities have been conducted before the merger. Furthermore, the unique position of the business unit in the corporate structure is explained, which will clarify the strategic context of our research case.

In a nutshell, corporate strategy is to deliver an increased added value, which implies an emphatic focus on (further) developing positions in markets for specialty products. A specialty is a non-standard, high-tech steel specification for critical application purposes in industry, which therefore represents a highly added value for customers. Based on technological knowledge, accumulated over a period of more than 80 years, the mission is thus to find new, high-end markets for new, high-tech products. Focussing on higher market segments simultaneously implies withdrawal from markets for commodity products. A commodity is a standard product that is mass-produced by numerous competitors. Since a commodity is standardized and globally produced, financial turnover is dependent on merchant prices, which tend to fluctuate with economic developments. Basically, the idea is to become less cyclical by leaving the 'price-fight' markets of commodity products. This strategic shift requires a rationalization and upgrade of the productmix.

Cyclical fluctuations are typical for any basic industry. To further reduce dependence on the steel industry's cyclical nature, corporate strategy is to move up in the industrial column in order to get closer to the end customer. This implies the integration of transformation processes downstream the supply chain. In this light, extending the 'back-side' of the company with e.g. galvanizing and coating production lines is explained. By integrating subsequent processes, a better insight in the actual demand information of the final customer in the supply chain is attained. In other words, demand information is more transparent and less distorted by traders, wholesalers and distributors using up their stocks in cases of demand decline, which causes huge bullwhip effects upstream the supply chain (for an explanation, see Simchi-Levi, Kaminski and Simchi-Levi, 2000). Furthermore, the mentioned price fluctuations tend to contribute to bullwhip effects. This fact provides an additional argument for withdrawing from commodity markets.

Since the corporate reorganization of 1995 (our business unit served an exemplary purpose two years earlier), Koninklijke Hoogovens is composed of decentralized, autonomous business units. Before that year, the functionally and centralistically organized corporation was nearly brought to the edge of the abyss (net loss of € 106 million in 1993). This disastrous situation had given rise to the reconsidering of corporate strategy, as described in the previous paragraphs. As part of this strategic reconsideration, a business unit structure was considered to better fit the corporate strategy of finding new markets for new products. A business unit is a profit center and thus bottom-line responsible for an integral business process (sales, manufacturing, logistics and distribution, quality assurance, product development). The Corporate Board of Directors thus delegated each business unit the responsibility of rationalizing and upgrading its own productmix.

Regarding our business unit, its management team identified the relevant combinations of products to produce and markets to supply as part of a process of strategy formulation with external consultants during 1995/1996. The resulting strategic portfolio contained the following product/market combinations, ordered in sequence of decreasing importance:

- Forging Steel / Automotive;
- Quality Steel / DLL;
- Quality Steel / Wire-Profile;
- Rebar Steel / Construction;
- Merchant Steel / Export.

Forging Steel is a broad-ranged family of high-value added, low-volume specialties produced for the automotive industry. Forging Steel represents numerous highly alloyed steel specifications, which ultimately have to meet the most stringent strength and safety requirements. These high-quality products, ordered in small quantities, are completely customer-specific regarding metallurgical composition and length. This implies an engineer-to-order production situation with the CODP i.e. the customer order decoupling point (Bertrand, Wortman and Wijngaard, 1997) situated in the 'stock' of accepted customer orders. Forging Steel is supplied to forging companies in square billets and round bars of 25 different sections. To simultaneously attain this diversity in sections and the required strength characteristics, Forging Steel is rolled. Forging companies in turn supply the big car companies with critical automotive parts, such as crankshafts and wheel suspensions. There are nine Forging Steel producers in the automotive market.

Quality Steel is a broad-ranged family of high-value added, low-volume specialties produced for the wire industry. Just as Forging Steel, Quality Steel represents numerous highly alloyed steel specifications. These high-quality products, ordered in small quantities, are also completely customer-specific regarding metallurgical composition and length (engineer-to-order production situation). Quality Steel is supplied in non-rolled billets of nine different sections to wirerod and wiredrawing companies. Ultimately, products such as screws, bolds, nuts and nails but also cables and paperclips are produced from wire. Quality Steel is also supplied to producers of profiled construction beams. DLL is a major wire customer which therefore is identified as a specific product/market combination. There are five Quality Steel producers in the wire and profile market.

Rebar Steel is a narrow-ranged family of low-value added, high-volume commodities produced for the construction industry. Rebar is the abbreviation of reinforcing bar: profiled bars that reinforce concrete building constructions. Rebar Steel is a highly standardized product: it represents a limited number of low-quality steel specifications, ordered in large quantities and produced from Merchant Steel billets. These billets are rolled, however not for reinforcing bars to attain strength characteristics but to attain a profiled surface in ten different sections. As a standard product, Rebar Steel can be produced to stock in anticipation of a customer order, which implies a make-to-stock production situation with the CODP situated in the stock of finished products. Rebar Steel is not further physically transformed but directly processed in commercial and industrial building. There are numerous Rebar Steel producers in the construction market, especially since the falling down of the Iron Curtain.

Merchant Steel is the most basic commodity in the market of long steel products: everyone who starts a steelworks can make it since no profound technological knowledge is required to be able to produce this standard product. Hence, there are numerous Merchant Steel producers. Typically, it is produced in large shipments for export purposes. As a matter of fact, this is not a product/market combination at all, but merely a necessary closing entry that balances the periodic hot metal supply from the blast-furnaces. This phenomenon, which is a direct consequence of Koninklijke Hoogovens being an integrated steel company, will be explained hereafter.

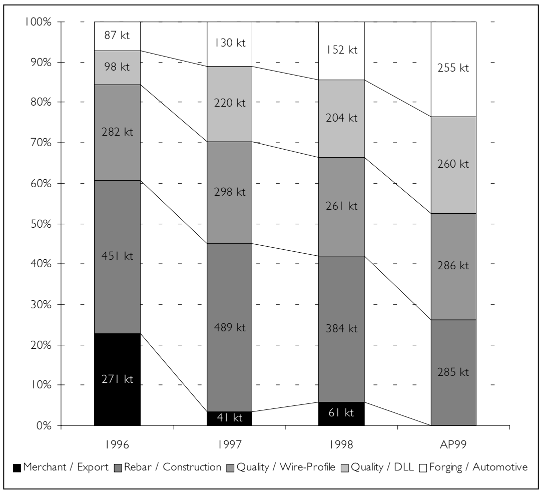

Figure 5-1: Strategic business portfolio.

The business strategy of rationalizing and upgrading the mix of long products is graphically illustrated in Figure 5-1. This figure shows the absolute and relative share of each product/market combination in the business unit's annual steel supply (actuals for 1996, 1997 and 1998 and Annual Plan targets for 1999). Clearly, the share of specialties is increasing at the expense of the commodities' share: from 40% in 1996 (actual) to 75% in 1999 (targeted).

Concretely, the intended business strategy is to withdraw completely from the export market and to use Rebar Steel as the necessary closing entry. In the longer run, the business strategy is to completely withdraw from the construction market as well and to use the least added value qualities of Quality Steel as the necessary closing entry. Ideally, Corus IJmuiden Long Products would only produce Forging Steel and the top qualities of Quality Steel, such as cold heading qualities.

Our business unit has a subordinate position within the Koninklijke Hoogovens corporation, which limits the strategic intentions of Corus IJmuiden Long Products. At Koninklijke Hoogovens, the major part of the physical output takes the form of flat slabs of steel rather than long billets of steel. Slabs of steel are physically transformed in plates and thin sheets of steel for the automotive industry (e.g. car bodies), the packaging industry (e.g. canning of food and drinks), the construction industry (e.g. facade sheeting), the tube and vessel industry, the shipbuilding industry and the machine building industry. Since the profitability of flat products is much better than that of long products due to both larger sales and productivity potentials, the tendency is to produce the former rather than the latter. Koninklijke Hoogovens is therefore indicated as a 'flat' plant.

This phenomenon applies for many other integrated steel companies as well. However, in many of these companies, the production capacity of the 'front side' (i.e. the hot metal supply) exceeds the production capacity of the 'back side' (i.e. the hot metal consumption). As a consequence, a part of the hot metal supply cannot be consumed by the 'flat' production routing, moreover since hot metal of nearly 1500 degrees Celsius cannot be stocked. It is no alternative to adjust a blast-furnace's output volume in order to match production capacities, since this intervention would harm the qualitative composition of the hot metal. It is no alternative to enhance the hot metal consumption either, at least not in the short run, since this would require huge investments in the downstream 'flat' production facilities. In the long run however, it might be a valid alternative if the financial position of the company allows such investments. Given these circumstances, the most attractive alternative from an economic point of view is to invest in a 'long' production routing, which requires much less financial resources. This explains the origination of a 'long' business unit within a predominantly 'flat' corporation. The resulting, subordinate position should not at all be explained as a negative rationale of existence: if the business turns out to be highly profitable, the Corporate Board of Directors would surely think twice to withdraw from the 'long' market.

At Koninklijke Hoogovens, roughly five sixth of the annual hot metal supply is allocated to the 'flat' production routing and the remaining one sixth to the 'long' production routing. The function of our business unit is thus to process the hot metal surplus as profitable as possible for the long product market. Each year, the exact hot metal supply is laid down in a contract with the blast-furnaces. Corus IJmuiden Long Products not only has the right but also the obligation to purchase the contracted amount. Preferably, the contracted amount of hot metal is physically transformed in high-quality, specialty steel (i.e. Forging Steel and Quality Steel). Since existing, technological barriers prevent our business unit from doing so, a portfolio of product/market combinations is required that additionally contains low-quality commodity steel (i.e. Rebar Steel and Merchant Steel). In light of the obligation to purchase hot metal and the technological barriers in the 'long' production routing, these commodities are a necessary closing entry that periodically balance the contracted hot metal supply.

Within the annual contracts, Corus IJmuiden Long Products periodically encounters both quantitative and qualitative fluctuations in the hot metal supply. If there is an installation disturbance in the slab producing steelworks in the predominant 'flat' production routing, the billet producing steelworks in the subordinate 'long' production routing is temporarily encountered with a hot metal surplus, which it is obliged to consume. Since the qualitative composition of hot metal is not constant but variable (e.g. due to blast-furnace process disturbances or due to low-quality iron ore), the billet producing steelworks in the 'long' production routing is temporarily encountered with low-quality hot metal (e.g. with a high sulfur degree), which it is obliged to consume. Since the 'flat' production routing is predominant, the slab producing business units get the qualitatively best hot metal. These quantitative and qualitative obligations thus require a commodity outlet for Corus IJmuiden Long Products, since specialty steel is customer-specific which cannot be produced to stock and it is a high-quality product which cannot be made from poor hot metal quality.

Given the restrictions previously sketched, one aspect of the business strategy is indisputable: to enlarge the share of the Forging Steel product/market combination in the business unit's annual steel supply. Forging Steel represents the spearhead of the business strategy; it is the mainstay of the business. Therefore, we have chosen to limit the Strategic Dialogue at Corus IJmuiden Long Products to this specific aspect.

5.3 BUSINESS UNIT STRUCTURE

The organizational structure of Corus IJmuiden Long Products is depicted in Figure 5-2. This organization chart presents an overview of vertical goal interdependence relations between the Managing Director, who is ultimately held accountable for overall business performance by the Corporate Board of Directors, and several primary and supportive departments represented by functional managers. These managers jointly make up the business unit's management team, which represents the organization's most dominant constituency. We relate this constituency to the macro level of organizational analysis and call it the Management constituency.

Corus IJmuiden Long Products is mainly a production unit, since nearly 550 of the total 590 organizational members belong to the Production department. The other, primary departments are the two Sales departments: one for Forging Steel and Quality Steel and one for Rebar Steel. The remaining departments are supportive. The Quality & Logistics department consists of three smaller departments: Quality Assurance, Engineering and Logistical Planning.

Figure 5-2 furthermore illustrates vertical goal interdependence relations within the production organization between the Management constituency represented by the Production manager and four operational units represented by four plant managers. These operational units are the Steelworks (300 people), the Rolling-mill (60 people), the Finishing-center (110 people) and the Rebar-mill (80 people). Within each operational unit, a Process Control department technically supports the daily operations. Given the exclusive choice for the Forging Steel product/market combination, as accounted for in Section 5.2, the Rebar-mill, and thus also the Rebar Sales department, are furthermore disregarded in our study.

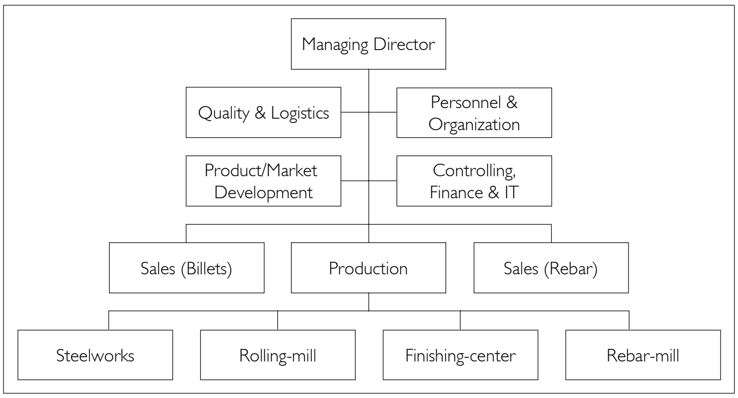

Figure 5-2: Business unit structure.

Operational units at Corus IJmuiden Long Products operate in a 3- or 5-shift system. Each plant manager therefore makes up a local management team with his shift managers. In contrast to the general management team at the macro level (i.e. the Management constituency), we relate these local management teams to the micro level of organizational analysis and call them the Steelworks constituency, the Rolling-mill constituency and the Finishing-center constituency respectively.

Vertical goal interdependence relations furthermore exist at the micro level within each operational unit between the local management teams and the corresponding operational shifts composed of a shift manager and his first-line operators. Consequently, we identified five Steelworks Shift constituencies, three Rolling-mill Shift constituencies and five Finishing-center Shift constituencies.

The business unit's ProMES systems, which make the business unit of interest for the purpose of our research, relate to the Steelworks: these systems have in the past been designed and implemented by the Steelworks Shift constituencies. Given the strategic redirection sketched in the previous section, the validity of these ProMES systems is clearly questioned.

In order to identify the constituencies at the meso level of organizational analysis that connect the macro level and micro level constituencies, we analyzed the cross-functional business process, which is described in the next section.

5.4 BUSINESS PROCESS

The cross-functional business process of Corus IJmuiden Long Products is depicted in Figure 5-3. This process map presents an overview of horizontal goal interdependence relations between the organization's primary and supportive departments. These departments represent successive stages in the business unit's order fulfillment process, which starts with a customer order and ends with the delivery of the physical goods ordered. Given the focus on a single product/market combination, physical goods refer to Forging Steel.

As part of the order fulfillment process, the three operational units, supported by the Quality Assurance department, execute the physical transformation process, during which a released work order is transformed into Forging Steel billets or bars. The Sales department, the Engineering department and the Logistical Planning department execute the preceding, non-physical transformation process, during which a customer order is accepted and transformed into one or more work orders that are to be released for production in due time.

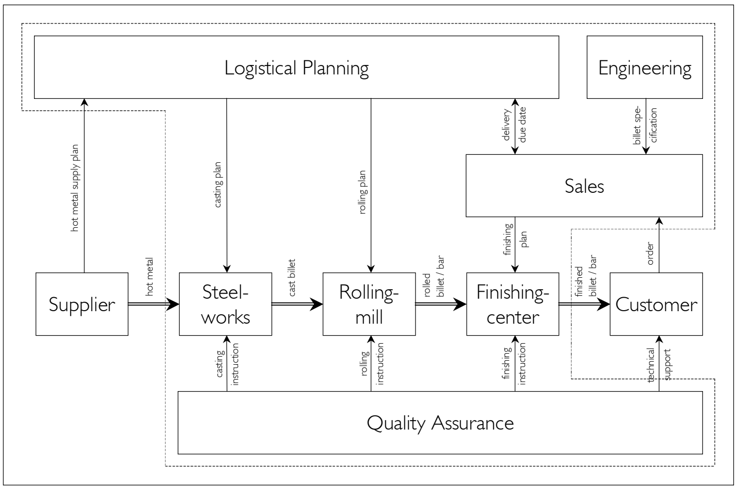

Figure 5-3: Business process map.

The order fulfillment process starts at the Sales department with a customer requesting a specified quality, section, length and amount of Forging Steel billets or bars. A customer order request either is a repeat request as part of an annual contract, or a once-only request by a new or existing customer. A repeat request relates to an existing steel specification which has been produced before; a once-only request either relates to an existing or to a new steel specification which has never been produced before. In this stage of the order fulfillment process, we specifically speak of a customer order request, which only becomes a customer order after explicit acceptance both by the customer and by Sales.

In order to accept a customer order request, it is checked against two criteria: technical feasibility and logistical feasibility. For assessing the technical feasibility of the request, the Sales department is supported by the Engineering department. Based on known production limitations, Engineering determines whether the requested steel quality can be produced or not. In cases of an existing steel specification, this assessment is a formality; in cases of a new steel specification which has to be engineered first, assessing the technical feasibility is a more profound matter. In the latter case, Engineering might advice not to accept a customer order request.

For assessing the logistical feasibility of the request, the Sales department is supported by the Logistical Planning department. Based on the cumulative allocation of production capacity per week to previously accepted customer orders, Logistical Planning roughly executes a capacity check, especially regarding the capacity of the Rolling-mill due to its fixed, 3-week rolling cycle (two weeks square billets from large to small sections and one week round bars from large to small sections). As a result of this capacity check, a delivery due date i.e. delivery due week is proposed to Sales. A request is logistically feasible if Sales can promise the standard order fulfillment lead time of six weeks.

If the requested steel specification is decided to be technically feasible, Sales communicates the proposed delivery due date to the customer. In cases of a new customer and/or a new steel specification, a price is offered as well. If the customer accepts the delivery term and, if applicable, the offered price and payment conditions, the customer next officially orders the requested quality, section, length and amount of Forging Steel billets or bars.

The Sales department takes care of the order entry, which means making the customer order identifiable by a unique order number in the sales module of the organization's SAP enterprise resource planning system. For the purpose of order entry, the order information provided by the customer is checked for completeness. After order entry by Sales, the customer order can only be scheduled for production by Logistical Planning after it has been accorded by Engineering. A customer order is accorded if the technical product prescription (i.e. the chemical analysis or composition as defined in the steel code) is available. The steel code is the technical translation of the customer's steel specification. Steel codes are maintained in a specific SAP module by Engineering. Formally, according means that a customer order number in the sales module of SAP is one-to-one linked to a steel code. If the steel code is not yet available, it needs to be engineered first. Based on the steel code and the derived inspection code, Quality Assurance writes the technical process prescription in terms of the casting, the rolling and the finishing instruction.

After a customer order has been accorded, its acceptance is only then officially confirmed to the customer by Sales. It might turn out that after a lengthy engineering effort, the previously proposed delivery due date by Logistical Planning is no longer feasible. In these cases, Logistical Planning has to recheck the availability of production capacity in the coming weeks and has to propose a new date which Sales has to renegotiate with the customer.

Only customer order numbers that are formally accorded are periodically written from SAP to the planning system of Logistical Planning. Once an (external) customer order has appeared in the planning system, it is transformed by Logistical Planning in one or more (internal) work orders, depending on the total number of tons ordered. A work order, which at Corus IJmuiden Long Products is referred to as a loading, represents approximately 100 tons of steel. This amount is determined by the size of the vessels in the Steelworks, which can maximally handle the indicated amount of liquid steel at one time. Each work order has a unique number, derived form the customer order to which it belongs.

Based on the agreed upon delivery due date with the customer, Logistical Planning provides each work order with a casting week and a rolling week. The casting week indicates the week in which the work order will be released for production in the Steelworks; the rolling week indicates when this will successively happen in the Rolling-mill. At the end of each week, Logistical Planning draws up the production schedules for the coming week for the Steelworks and the Rolling-mill. These weekly production schedules are composed of all work orders with a casting or rolling week that corresponds with the week to come. The Steelworks schedule i.e. the casting plan is drawn up to enable large batch sizes at the casting installation (continuous casting of identical or alike steel specifications), while the Rolling-mill schedule i.e. the rolling plan is drawn up to enable rolling from large to small sections.

Thus far reaches the non-physical routing of a customer order. Next, it is waiting for the week to come in which the first or only work order belonging to that customer order is due to be released in the Steelworks. The moment this work order is actually taken into production as indicated in the casting plan, the first loading of hot metal that enters the Steelworks at the Hot Metal Pit is assigned the corresponding work order number. In this operational unit, loadings of hot metal (liquid) are physically transformed into loadings of cast billets of steel (solid). The feature of the customer ordered product that is determined in the Steelworks refers to its chemical analysis. The operational activities per installation are prescribed in the casting instruction by Quality Assurance.

Hot metal is supplied from the blast-furnaces in specially designed wagons that contain two or four loadings of hot metal. At the Hot Metal Pit, one loading of hot metal a time is pored from the wagon into a so called hot metal ladle. The work order is next transported to the Desulfurizing Stand, where the proportion of sulfur in the hot metal is reduced and the blast-furnace slag floating on top of the hot metal is removed.

After this process step, the work order is transported to one of two Converter Installations. Here, the contents of the hot metal ladle is emptied in a converter, which in fact is a large reactor vessel. Before that, the converter vessel has first been filled with scrap steel for recycling purposes. Pure oxygen is blast into the hot metal in the converter vessel, which therefore is referred to as the oxysteel process. The chemical reaction that is caused produces carbon monoxide and consequently reduces the carbon proportion of the hot metal, which becomes steel when the proportion has dropped below a certain limit. This chemical reaction thus is a combustion process. In this light, the scrap steel has another purpose: to prevent overheating. In addition to the oxygen, all kinds of alloys and materials are added during the conversion from hot metal into steel, which cause additional, chemical reactions. Two process parameters are constantly monitored: the analysis (i.e. the chemical composition) and the temperature of the loading of steel. Determining the chemical analysis requires which requires sample taking and laboratory analysis by Quality Assurance. These parameters should be at their targeted values, as prescribed in the casting instruction, at the most critical moment in the Steelworks: the moment the casting of a loading of steel starts at the downstream Casting Installation.

First however, the contents of the converter vessel, except for the oxysteel slag floating on top of the steel, is emptied in a so called steel ladle and transported to the Ladle Furnace Installation. Here, the steel analysis and temperature are fine-tuned and again monitored. The final amounts of alloys and materials are exactly dosed and the temperature is brought to the optimal casting temperature by three electrodes. In addition, the loading of steel is homogenized. Then, if the preceding work order is nearly cast, the steel ladle is transported to one of two Casting Installations to enable batch production i.e. continuous casting.

The steel ladle, which has a tap hole in the bottom, is put on top of the Casting Installation. At the right moment, the tap hole opens and the steel floats in the tundish: a division bin that distributes the steel over six casting molds. In these molds, the steel congeals and turns from liquid into solid. The strings of solid steel that are extracted from the molds have a square section and are cut into billets, which are marked with the corresponding work order number. Billets of one batch that incorporate the transition to the subsequent loading of another steel quality are rejected and recycled. After the billets have cooled down, the work order is transported to the stock of cast products in front of the subsequent operational unit: the Rolling-mill. Here, the work order is waiting for the rolling week to come. Only those cast loadings that are technically released after inspection i.e. 'free for rolling', are to be logistically released for downstream rolling in due time. To decide on the so called first choice status of a loading of cast billets, Quality Assurance closely cooperates with the Steelworks' Process Control department.

The feature of the customer ordered product that is determined in the Rolling-mill refers to its square or round section and to its strength characteristics. The operational activities per installation are prescribed in the rolling instruction by Quality Assurance. If the rolling week has come and, dependent on the rolling plan, the work order is actually taken into production, the loading of cast billets is first heated up at the Pit Furnace Installation. When the billets are at the right temperature, they are transported to the line up of eight Rolling Installations: two for the pretreatment and six for the final treatment. The billets of the loading are processed one at a time by each Rolling Installation. During the pretreatment, a billet is surface rolled in two steps, thereby reducing its square section; during the final treatment, a billet is caliber rolled in two, four or six steps, thereby further reducing its square section or changing it into a round section. The set up of the Rolling Street is prescribed in the rolling instruction.

As a consequence of rolling, the length of a billet proportionally increases with the reduction of its section. These long billets are indicated as poles, which are cut after the last rolling step into smaller pieces which are called billets again, or bars. By rolling, billets and bars not only attain their final section, but also their strength characteristics. For this purpose, samples are taken from rolled billets and bars which are laboratory analyzed by Quality Assurance. In addition, the loading is inspected on surface defects and on length, section and straightness dimensions being out of tolerance.

The work order is next transported to the Cooling Bed. If cooled down, it is transported to the stock of rolled products which is situated at the shop floor of the subsequent operational unit: the Finishing-center. Only those rolled loadings that are technically released after inspection i.e. 'free for finishing', are to be logistically released for downstream finishing in due time. To decide on the so called first choice status of a loading of rolled billets or bars, Quality Assurance closely cooperates with the Rolling-mill's Process Control department.

A work order that is 'free for finishing' is not waiting for a predetermined finishing week to come. In contrast to the upstream operational units, there is no weekly finishing schedule for the Finishing-center drawn up by Logistical Planning. Daily practice is that Sales releases the most urgent work orders for finishing. Hence, logistical control is decoupled in the stock of rolled products.

The feature of the customer ordered product that is determined in the Finishing-center refers to the billet or bar length and to the packing up of the loading for shipment. The operational activities per installation are prescribed in the finishing instruction by Quality Assurance.

The moment the loading of rolled billets or bars is logistically released again by Sales, it is transported to the IRUS Installation. IRUS stands for Infra-Red Ultra-Sonic inspection. Here, one billet or bar a time is inspected on internal i.e. structure defects and external i.e. surface defects; detected flaws are marked on a billet's or bar's surface. Dependent on the steel quality, the thoroughness of the IRUS inspection is prescribed in the finishing instruction. In the past when this installation was not yet invested in, there was a Viewing Stand where inspection was executed by the human eye.

Moreover, the IRUS Installation reports the reparability of possibly detected flaws. This regards external flaws, since internal flaws can not be repaired. If internal and/or external flaws are too severe, the loading is rejected. The decision to reject a loading is made by Quality Assurance in close cooperation with the Finishing-center's Process Control department. If reparable, the loading is transported to the Grinding Table. Here, marked flaws are manually repaired with hand grinders, which thus is a labor-intensive operation.

Next, the work order is transported to the Sawing Installation. Here, the billets or bars are exactly sawn at the specified length. Finally, the work order is made ready for shipment. Each customer has own preferences regarding the bundling, color marking and labeling of finished billets or bars. If bundled, color marked and labeled, the loading is transported to the stock of finished products, which is situated outside the Finishing-center. Only those finished loadings that are technically released after inspection i.e. 'free for sending', are logistically released for shipment to the customer. Quality Assurance, in close cooperation with Process Control, decides on the 'free for sending' status of the work order, which is next reported to Sales. Unless the customer order has to be completed first with other work orders, Sales sends an invoice to the customer notifying that the ordered goods have been sent out.

Based on the analysis of the cross-functional business process, we identified two constituencies at the meso level of organizational analysis that connect the Management constituency at macro level with the Steelworks, the Rolling-mill and the Finishing-center constituencies at the micro level. We call these constituencies the Quality constituency and the Logistics constituency; the former focuses on qualitative i.e. technical aspects of integral performance, while the latter focuses on logistical aspects of integral performance and its consequences for local performance in the operational units. The Quality constituency is cross-functionally composed of metallurgists of the Quality Assurance department and of process controllers of the Steelworks', the Rolling-mill's and the Finishing-center's Process Control departments. The Logistics constituency is composed of central planners of the Logistical Planning department, sales representatives of the Sales department, a local planner of the Steelworks and the plant managers of the Rolling-mill and the Finishing-center. In Chapter 6, the arguments for the identification of these two meso level constituencies will be explained in light of the integral performance indicators proposed by the Management constituency.

5.5 GOAL INTERDEPENDENT CONSTITUENCIES

In Figure 5-4, we present an overview of Corus IJmuiden Long Products' multiple constituencies, which are vertically and horizontally goal interdependent (cf. Figure 3-3 in Chapter 3). It is difficult to depict all constituencies in one display, since both meso level constituencies are composed of representatives of the same operational units.

Figure 5-4 demonstrates the Management constituency at the macro level, in the person of the Managing Director, to be ultimately responsible for business unit performance. The Management constituency is linked to the Quality constituency through the Quality & Logistics manager, who runs the Quality Assurance department, and through the Production manager, who is in loading of the business unit's operational units. The Management constituency is linked to the Logistics constituency through the same

Production manager, through the same Quality & Logistics manager who also runs the Logistical Planning department and through the Sales manager who is in loading of the Sales department.

Figure 5-4 furthermore shows the members of the meso level constituencies. Metallurgists of the Quality Assurance department and process controllers of the operational units make up the Quality constituency. The Logistics constituency is made up of central planners of the Logistical Planning department, sales representatives of the Sales department, a local planner of the Steelworks and the plant managers of the other operational units.

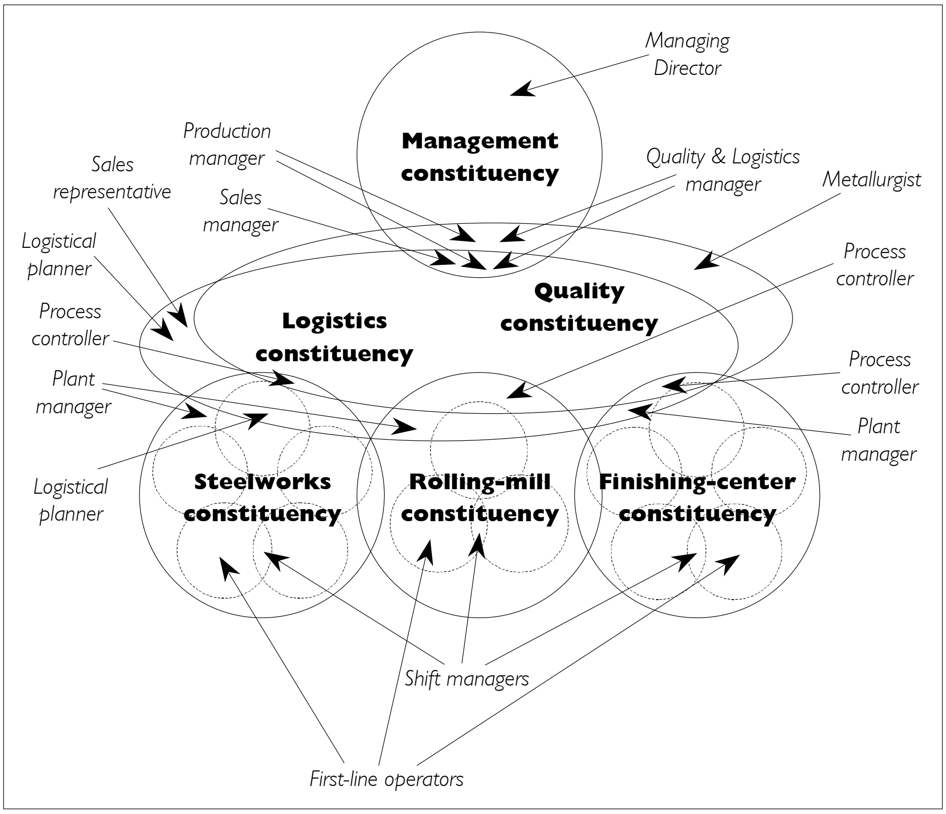

Figure 5-4: Goal interdependent constituencies.

The Quality constituency at the meso level is linked to the Steelworks constituency, the Rolling-mill constituency and the Finishing-center constituency at the micro level through the process controllers. The Logistics constituency is linked to these micro level constituencies through a local planner and two plant managers respectively.

Figure 5-4 furthermore shows the micro level constituencies to be composed of a local management team composed of the plant manager and his shift managers. Within each operational unit, additional constituencies are composed of the shift manager and his first-line operators.

Chapter 6. VERTICAL GOAL COHERENCE

FULL INTERVENTION

This chapter[9] covers the intervention of Strategic Dialogue between the Management constituency and the Quality constituency: two vertically goal interdependent constituencies at the macro and meso level of the Corus IJmuiden Long Products organization. Vertical Goal Coherence refers to the degree of intra- and inter-group consensus on shared goal priorities between a superior- and a subordinate-constituency.

6.1 INTRODUCTION

The Strategic Dialogue at Corus IJmuiden Long Products regarding the product/market combination Forging Steel / Automotive was initiated at the macro level of organizational analysis by the Management constituency. As a result of the participation by the Management constituency in the Strategic Dialogue, the common goals of the entity and the underlying critical success factors for common goal attainment were identified and made explicit during design team meetings. What is referred to are the long-term or strategic means-end relations for the organization as a whole and its operationalization into Strategic Result Indicators (indicating "What to achieve?" from a macro perspective) and Strategic Process Indicators (indicating "How to achieve?" from a macro perspective). The intervention at the macro level is the subject of Section 6.2.

The dialogue about what is and what is not good for the organization's overall effectiveness was extended to the meso level of organizational analysis. At this level of analysis, two cross-functional constituencies were identified by opening the organizational black-box: the Quality constituency and the Logistics constituency (the latter constituency's participation in the Strategic Dialogue is covered in Chapter 7). The Strategic Process Indicators identified by the Management constituency were deployed to the meso level and served as the integral and thus cross-functional input for design team meetings with the Quality constituency. As a result, the medium-term or tactical means-end relations for the organization as a system of multiple and interacting parts was identified and operationalized in terms of Tactical Result Indicators (indicating "What to achieve?" from a meso perspective) and Tactical Process Indicators (indicating "How to

[9] An adapted version of this chapter is published in De Haas, Algera, Van Tuijl & Meulman (2000).

achieve?" from a meso perspective). The design intervention at the meso level is covered in Section 6.3.

In addition to the design team meetings of the Management constituency and the Quality constituency, the management approval meetings between these two vertically goal interdependent constituencies are covered in Section 6.3. Before and after these moments of constructive controversy (Tjosvold, 1985), we collected empirical data in order to operationalize within-constituency and between-constituency Goal Coherence. These operationalizations, enabled by a specific measure of association based on the application of the CATPCA technique, are presented in Section 6.4. The operationalizations of pretest and posttest degrees of vertical Goal Coherence allowed us to quantify the effect of the Strategic Dialogue. Section 6.5 reports a positive effect, which thus supports the instrumental hypothesis of our research. The full intervention covered in this chapter is diagrammed in Figure 6-1, where M stands for Management constituency and Q for Quality constituency (cf. Figure 4-2 in Chapter 4).

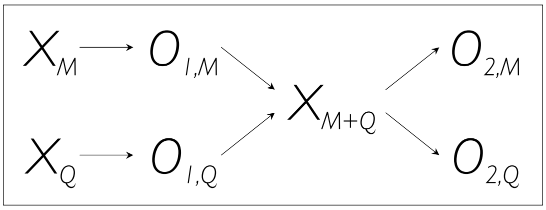

Figure 6-1: Full design: Management and Quality constituency.

Before the process of multilevel designing by Corus IJmuiden Long Products' multiple and goal interdependent constituencies is more thoroughly dealt with, the resulting multilevel product of designing is presented first in Figure 6-2 (cf. Figure 3-4 in Chapter 3). In the current Chapter 6 and subsequently in Chapter 7 and Chapter 8, the exact meaning of the result indicators and process indicators, interconnected by means-end relations at the macro, meso and micro level of organizational analysis, will be clarified. By delivering the multilevel design of performance measurement systems, the practical research objective (see Chapter 4) is achieved, albeit partially due to the premature ending of the Strategic Dialogue, as indicated by the white spots in the overview of Figure 6-2.

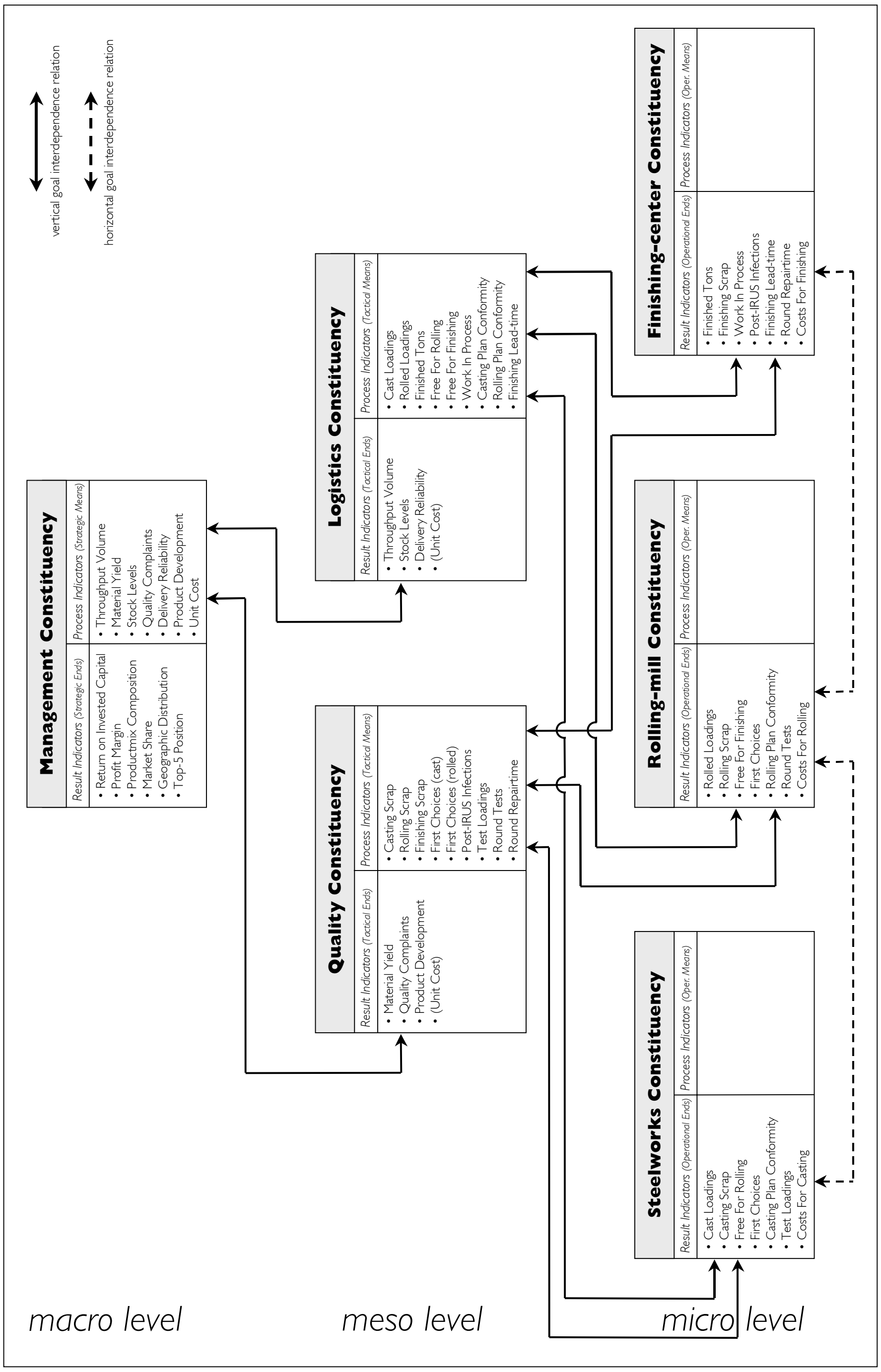

Figure 6-2: Multilevel design of performance measurement systems.

6.2 STRATEGIC DIALOGUE AT THE MACRO LEVEL: THE MANAGEMENT CONSTITUENCY

The Strategic Dialogue was initiated at the macro level during design team meetings of the Management constituency, which consisted of seven managers. As a result, the common goals of the entity were identified in relation to the underlying critical success factors for common goal attainment. The long-term or strategic means-end relations for the organization as a whole were operationalized into Strategic Result Indicators and Strategic Process Indicators.

6.2.1 Design team meetings X_M

Following a process of strategy formulation with external consultants during 1995 and 1996, the operationalization of the overall business strategy regarding the product/market combination Forging Steel / Automotive into a set of shared performance indicators took the Management constituency an additional year during 1997 (see Woltring, 1998). The adjective shared emphasizes that overall performance indicators with ditto indicator targets were pursued that would appeal to the collective responsibility of the entire management team in order to stimulate perceptions of positive goal interdependence: indicator proposals reflecting individual responsibilities of the functional managers were deliberately left out. Positive goal interdependence (Alper *et al.*, 1998) is the mechanism by which Strategic Dialogue is presumed to affect Goal Coherence (recall the extended research approach presented in Chapter 2), at this level among individual management team members. As predicted by Kotter (1982), indeed it turned out to be a difficult feat to get a group of executives to commit to a single set of goals. This was because the Strategic Dialogue was participated by a highly differentiated management team of a functionally organized business unit. Differentiation is defined by Lawrence and Lorsch (1967) as "the difference in cognitive and emotional orientation among managers in different functional departments". Given the lacking sense of a shared purpose within the management team, the interactive process of designing overall performance indicators was in fact a process of organizational development.

Difference in cognitive and emotional orientation corresponds with divergence in mental models. The existence of divergent mental models among individual managers supports the perception of negative goal interdependence. In our view, this condition was present at Corus IJmuiden Long Products and caused the design intervention to become a laborious, calendar time consuming event. As part of the Strategic Dialogue, we had to prepare the management team for a constructive controversy about organizational effectiveness. Hence, it was no alternative to start with plenary design team meetings. Given the perception of negative goal interdependence, such meetings would only have given rise to defensive attitudes, avoidance of direct and open-minded discussion and, when compelled to discussion, imposition of own positions on each other, which frustrates productivity, intensifies stress and lowers morale (Alper *et al.*, 1998). As a matter of fact, this situation sketch gives a fairly good description of the meeting style at that moment. As a consequence, we had to organize individual conversations and subgroup meetings with 2 to 3 managers at a time in order to bring the managers to heel and to carefully prepare useful input for plenary meetings. For that matter, we even had to conduct an external survey (see Van de Meulengraaf, 1997), as part of which we asked customers to indicate what they valued of a good steel supplier. The results of this survey provided objective input for the how-to-achieve question from a macro perspective.

In addition, it turned out that during these conversations and meetings, the managers expected the researchers to be equal partners in the strategic discussion about long-term means and ends for their organization. It was insufficient for us to just facilitate the process; moreover, it was expected that we became experts on the business strategy. As an expert, we had to come up with relevant indicator proposals ourselves during the preparatory meetings in order to get the process going (as if we were the responsible managers!). Clearly, managers were hesitant in openly giving their opinion on what they believed was good and bad for the organization's overall welfare.

Jointly, the required care in preparing and organizing design team meetings and the required expert role during these preliminary meetings accounted for the relatively long lead time of the design intervention at the macro level. The underlying cause of negative goal interdependence among the management team members can be explained from the business unit's historic evolution.

As part of the corporate reorganization program which was initiated in 1992, the Corus IJmuiden Long Products business unit had to reduce its number of employees from 1.250 to currently 590. This caused the organization to become (extremely) lean. As a result of employee reduction, hierarchical layers were minimized, which flattened the organization. Consequently, the management team was composed of the relatively large number of seven managers, who were mainly occupied with everyday matters of an operational nature. For instance, the Production Manager, as a member of the business unit management team, simultaneously managed the physical operations of the Steelworks. In addition to this operational focus, a functional mindset of individual managers prevailed, as explained before. This was an inheritance of the early, centralistic regime. In these days, the primary functions of sales and production were completely separated, even in a geographical sense; sales was located at headquarters, physically outside the fence of the production site. Interactions were regulated at the very top within the Corporate Board of Directors. As a consequence, managers (as well as staff) had been raised, through the years, within the closed boundaries of the functional domains to which they belonged. Therefore, organizational actors had learned to mentally model reality through their functionally determined frames of reference, which hindered the perception of positive goal interdependence upon other functional domains.

The new business unit structure gave no rise to challenge management's functional mentality: after corporate, functional domains had been split into smaller, organizational parts, these parts were rejoined in bottom-line responsible business units, which were, albeit on a smaller scale, functionally organized as well. Moreover, functional contrasts were stressed by the specific management style of the first Managing Director of Corus IJmuiden Long Products. This manager, who was assigned by the Corporate Board to minimize losses within a period of two years time, primarily managed his business unit functionally. In light of the business unit's productmix which, at that time, mainly consisted of high-volume, standard products (i.e. Rebar Steel and Merchant Steel), this even was a well-considered choice, since the selling and manufacturing of a standard i.e. simple product required no complex interactions between organizational actors of different functional domains. Each functional manager was individually called to account for functional performance in terms of cost performance, since competitiveness in a commodity market required low cost performance and thus an emphasis on internal efficiency. Even more so, conflicts within the management team as a means to maximize the pressure at achieving the required low-cost performance were not discouraged, which further stressed functional contrasts. The introduction of conflicts in case of positive goal interdependence is an effective intervention since it stimulates constructive controversy. However, it has counterproductive effects when perceptions of negative goal interdependence exist (Alper *et al.*, 1998). Conflicts than stimulate blaming behavior, defensive attitudes and a culture of disrespect and distrust. Briefly, in the perception of the managers of Corus IJmuiden Long Products, there was no room for collective responsibilities. Given this feature of the design context, the difficult process of designing at the macro level can be better understood.

Still, since 1998, the resulting products of designing in terms of Strategic Result Indicators and Strategic Process Indicators have been given structure to the Corus IJmuiden Long Products business plan which needs to be written annually. This fact provides evidence of the value that is attributed to the resulting product of designing at the macro level. Strategic progress is subsequently reported to and discussed with the Corporate Board of Directors against the Annual Plan during quarterly forecast meetings. In addition to this, we collected anecdotal evidence which indicates that the Strategic Dialogue indeed contributed to a less differentiated management team that is becoming aware of its joint responsibility for the integral business performance. This evidence is illustrated by the following quotations:

- *"We now have a tool in our hands that periodically helps us to assess whether our overall business strategy is still appropriate or whether it should be considered for adjustment."* (Managing Director);
- *"Discussing these strategic performance indicators stimulates consensus building among management team members about shared visions of the future."* (Product/Market Development Manager);
- *"The quarterly forecast meetings provide a formal moment, during which priorities for decision making within the functional domains of our individual responsibility are coordinated."* (Controller);
- *"Finally, we can start learning to talk the same language and to understand each others professions for which we individually carry functional responsibility."* (Quality and Logistics Manager);
- *"From now on, no more finger pointing; rather, we will have to look each other straight in the eyes and address issues that affect us all."* (Sales Manager);
- *"I was always wondering whether optimizing cost performance of my plant would benefit the business unit as a whole. I truly believe that we can make better money if we learn to collectively manage by these strategic indicators."* (Production Manager).

6.2.2 *Design of Strategic Result Indicators*

The strategic ends for the organization as a whole concerning the product/market combination Forging Steel / Automotive were identified by the Management constituency in terms of:

- Profitability;
- Growth.

This is the qualitative answer to the what-to-achieve question from a macro perspective. In order to arrive at the quantitative answer to this question, the strategic ends of profitability and growth were operationalized into the six Strategic Result Indicators of Table 6-1. Each of the Strategic Result Indicators is explained and graphically illustrated in Appendix B.

Table 6-1: Strategic Result Indicators.

What to achieve from a macro perspective: strategic ends	
Profitability	• Return on Invested Capital (ROIC) • Profit Margin • Productmix Composition
Growth	• Market Share • Geographic Distribution • Top-5 Position

Concretely, the strategic ends of profitability and growth concerning the product/market combination Forging Steel / Automotive implied for the organization as a whole in 1999 to simultaneously achieve the following, overall goals, which are formally communicated to the Corporate Board of Directors through the Annual Plan 1999:

- achieve a more than average ROIC of 22½%;
- minimize the negative trend in Profit Margin from € 41 to € 28;
- (further) upgrade the Productmix Composition from a 10% to a 20% share of Rounds and SBQ's;
- increase Market Share in Germany from 8% to 12% and in the UK from 3½% to 7½%;
- increase Geographic Distribution of sales in other than the main, German market from 27% to 31%;
- increase supplier positions at the top-5 forgers in the market (Top-5 Position).

6.2.3 *Design of Strategic Process Indicators*

In relation to the strategic ends of profitability and growth, the Management constituency identified the strategic means for the organization as a whole concerning the product/market combination Forging Steel / Automotive in terms of:

- Production Capacity;
- Customer Satisfaction;
- Low Cost.

This is the qualitative answer to the how-to-achieve question from a macro perspective. In order to arrive at the quantitative answer to this question, the strategic means of Production Capacity, Customer Satisfaction and Low Cost was operationalized into the seven Strategic Process Indicators of Table 6-2. Each of the Strategic Process Indicators is explained and graphically illustrated in Appendix C.

The identified means represents management's vision of what the organization should be good at for achieving its strategic ends of profitability and growth. The relation between the means and the ends at the macro level of organizational analysis is in fact a assumption made by the Management constituency. Provided that this assumption is valid, management should pursue other constituencies to allocate their resources to the strategic means of Production Capacity, Customer Satisfaction and Low Cost.

Table 6-2: Strategic Process Indicators.

How to achieve from a macro perspective: strategic means	
Production Capacity	• Throughput Volume • Material Yield • Stock Levels
Customer Satisfaction	• Quality Complaints • Delivery Reliability • Product Development
Low Cost	• Unit Cost

Concretely, the strategic means of Production Capacity, Customer Satisfaction and Low Cost concerning the product/market combination Forging Steel / Automotive implied for the organization as a whole in 1999 to simultaneously achieve the following, overall goals, which are also formally communicated to the Corporate Board of Directors through the Annual Plan 1999:

- increase Throughput Volume from 2,6 to 4,2 tons per week;
- increase Material Yield from 80,8% to 81,7%;
- decrease Stock Levels from 29,2 to 28 kilotons;
- decrease Quality Complaints from 56 to 50 complaints (i.e. from 0,43 to 0,22 complaints per kiloton);
- increase Delivery Reliability from 70% to 90%;
- increase Product Development from 15 to 40 kilotons Rounds;
- decrease Unit Cost from € 308 to € 292.

These Strategic Process Indicators, together with the accompanying macro goals, served as the input for the Strategic Dialogue at the meso level. The continuation of the Strategic Dialogue at this level of organizational analysis is the subject of Section 6.3.

6.3 Strategic Dialogue at the meso level: the Quality constituency

The Management constituency is goal interdependent upon lower level constituencies within vertical principal-agent relations for common goal attainment. According to our framework for multilevel designing, which has been presented in Chapter 3, agent-constituencies at the meso level of organizational analysis therefore have to participate in the design team meetings of the principal-constituency at the macro level in order to arrive at a coordinated goal setting and, subsequently, at a coordinated allocation of human resources i.e. time and effort.

In the case of Corus IJmuiden Long Products, participation of the meso level constituencies in explicating the long-term or strategic means-end relations for the organization as a whole was organized afterwards. This was due to the existence of divergent mental models within the highly differentiated Management constituency. As explained, the design effort at the macro level already was a laborious event. Introduction of additional, divergent mental models of meso level constituency members during the design team meetings of the Management constituency would probably have caused an even more time-consuming design effort.

After pragmatic considerations, the Management constituency therefore designed a provisional set of strategic performance indicators without participation of lower level constituencies first. The preliminary design was justified by management's argument that it had to gradually learn to manage by collective, cross-functional performance indicators anyway. This justification was reinforced by management's conviction that its control system design would be provisional by definition given environmental dynamics and uncertainty, which would periodically necessitate a strategic redirection and subsequent redesign of organizational controls.

As a consequence of this pragmatic decision, agent-constituencies at the meso level would have to question the validity of the long-term or strategic means-end relations for the organization as a whole during own design team meetings. Validity of a performance measurement system in general concerns the validity of the performance indicators (is the set of indicators complete and controllable?), the validity of the indicator targets (are goals achievable?) and the validity of the indicator weights (do goal priorities sufficiently reflect organizational effectiveness tradeoffs?).

According to our framework for multilevel designing, addressing the interrelated what-to-achieve and how-to-achieve questions from a meso perspective explicitly departs from the provided answer to the how-to-achieve question from a macro perspective. In our case, the ends for the agent-constituencies at the meso level thus needed to be stated in Production Capacity, Customer Satisfaction and Low Cost terms. If not, the agent-constituencies might possibly identify medium-term or tactical means-end relations that are irrelevant and consequently allocate (scarce) resources to faulty performance variables, thereby stimulating dysfunctional behavior and ultimately contributing to sub-optimization of integral performance i.e. organizational ineffectiveness. Therefore, questioning the validity of the strategic means-end relations was restricted to the Strategic Process Indicators of Table 6-2. These indicators, describing the strategic means at the macro level, were deployed as the tactical ends at the meso level, thereby becoming Tactical Result Indicators. Consequently, the accompanying goals were shared by vertically goal interdependent constituencies.

Given the operationalizations of the strategic means by the Management constituency, a distinction was made between qualitative or technical performance in terms of Material Yield, Quality Complaints and Product Development (vs. cost performance in terms of Unit Cost) on the one hand and logistical performance in terms of Throughput Volume, Stock Levels and Delivery Reliability (again vs. cost performance in terms of Unit Cost) on the other hand. The distinction between qualitative and logistical performance connects with the distinction between two meso level constituencies: the Quality constituency and the Logistics constituency, which were both cross-functionally composed for the purpose of Strategic Dialogue. Participation in the Strategic Dialogue by the latter constituency is discussed in Chapter 7.

6.3.1 Design team meetings X_Q

The Quality constituency was cross-functionally composed of representatives from existing, formal constituencies. As the cross-functional process map of Figure 6-3 indicates, these formal constituencies refer to the Steelworks, the Rolling-mill, the Finishing-center and the Quality Assurance department.

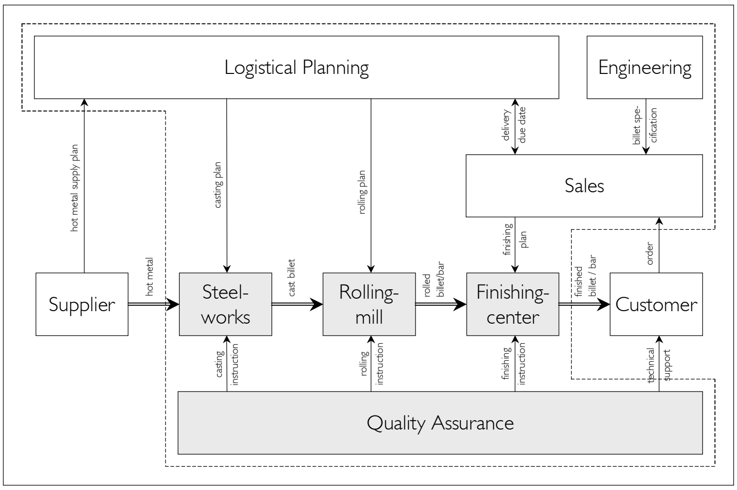

Figure 6-3: Composition of the Quality constituency.

Concretely, the Quality constituency was composed of three Steelworks process controllers, one Rolling-mill process controller, one Finishing-center process controller and three metallurgists of the Quality Assurance department. Given the metallurgic profession of these technical engineers, they have a natural tendency to mentally model qualitative aspects of performance (in this case in terms of Quality Complaints, Material Yield and Product Development) as being of interest for organizational effectiveness. The cross-functional composition of the Quality constituency aims at stimulating perceptions of positive goal interdependence regarding qualitative performance among constituency members, who formally belong to constituencies at the micro level of daily operations. As Figure 6-3 illustrates, these formal constituencies are goal interdependent within a supply chain of horizontal principal-agent relations.

After the Management constituency had explicated the long-term means-end relations for the organization as a whole during 1997, the Quality constituency started to explicate derived means-end relations at the meso level by the end of 1998. Again, the interactive group process, organized during several design team meetings which had been preceded by preliminary, individual interviews, was facilitated by addressing the two interrelated questions of "what to achieve" and "how to achieve", however from a meso perspective. The operationalization of the qualitative answers into quantitative parameters, i.e. the design of Tactical Result Indicators and Tactical Process Indicators, would ultimately form the input of the management approval meeting.

6.3.2 Design of Tactical Result Indicators: collecting pretest data $O_{1,M}$ and $O_{1,Q}$

As explained before, designing the Tactical Result Indicators by the Quality constituency corresponded with assessing the validity of the Strategic Process Indicators of Table 6-2 as provisionally designed by the Management constituency. Completeness and controllability of these overall indicators, as well as the feasibility of the accompanying indicator targets for the organization were subject of an open-minded discussion. It turned out that the relevance of the common goals was clearly recognized and understood by the group of process controllers and metallurgists.

If at all explained as a consensus, it certainly was subjectively found. In search of within-constituency and between-constituency Goal Coherence, we needed to know whether there was a consensus on goal priorities i.e. a consensus on the allocation of scarce (human) resources to the multiple goals which had been found relevant. Concretely, the establishment of goal priorities required the explicit weighing of Tactical Result Indicators by the Quality constituency members.

Therefore, we asked each process controller and metallurgist to individually arrange the goals related to the seven Tactical Result Indicators in order of interest for the organization's overall wellbeing on a 7-point scale; the score of 7 represented the highest interest, whereas the score of 1 represented the lowest interest. Concretely, we asked the Quality constituency members to pretend as if they were in the position of the business unit's Managing Director. By doing so, a strategic mindset rather than a functional or departmental mindset was stimulated during the design team meetings. For the purpose of measuring between-constituency Goal Coherence, we asked each of the Management constituency members to individually rank the same goals related to the seven Strategic Process Indicators. Mind that the seven goals are conflicting in nature. E.g., an exclusive focus on increasing Throughput Volume will most certainly produce an increase in Stock Levels and probably in Quality Complaints. Or an exclusive focus on increasing Product Development will most certainly produce a decrease in Throughput Volume and thus an increase in Unit Cost.

The categorical data sets obtained are depicted in Table 6-3 for the Management constituency and in Table 6-4 for the Quality constituency. These data represent the pretest data $O_{1,M}$ and $O_{1,Q}$ collected before the most vital part of the Strategic Dialogue: the constructive controversy between vertically goal interdependent constituencies during the management approval meeting. The pretest feature of the data is highlighted in both tables by the figure 1 extension of the abbreviated constituency member names.

Table 6-3: Categorical data $O_{1,M}$: pretest of the Management constituency.

	STRI	DORTI	GEERI	BROEI	WOUDI	BREEI	SCHII
increase Throughput Volume (TV)	2	2	5	7	4	5	5
increase Delivery Reliability (DR)	3	5	3	4	6	6	4
decrease Stock Levels (SL)	4	3	2	2	5	3	2
decrease Quality Complaints (QC)	5	6	4	5	7	7	7
decrease Unit Cost (UC)	7	7	7	6	2	7	6
increase Material Yield (MY)	6	4	6	1	1	7	3
increase Product Development (PD)	1	1	1	3	3	4	1

Table 6-4: Categorical data $O_{1,Q}$: pretest of the Quality constituency.

	VRIEI	DBIEI	HAMOI	EIJDI	OVERI	MENSI	JONKI	TEMMI
increase Throughput Volume (TV)	4	2	1	5	6	7	3	5
increase Delivery Reliability (DR)	3	5	1	7	1	2	5	5
decrease Stock Levels (SL)	2	2	1	1	1	1	1	4
decrease Quality Complaints (QC)	6	7	7	7	7	6	7	6
decrease Unit Cost (UC)	1	6	7	7	6	3	6	4
increase Material Yield (MY)	5	6	7	4	6	5	2	7
increase Product Development (PD)	7	6	7	3	5	4	4	6

6.3.3 Management approval meeting X_{M+Q}: collecting posttest data $O_{2,M}$ and $O_{2,Q}$

As part of the Strategic Dialogue, the Management constituency had to approve of the Tactical Result Indicator design – especially of the associated goal priorities – of the lower level Quality constituency in relation to its own design at the macro level of organizational analysis. In other words, management had to judge the expected contribution of intended resource allocation by process controllers and metallurgists to common goal attainment.

The management approval meeting is a decisive moment of constructive controversy during the Strategic Dialogue. During this meeting at Corus IJmuiden Long Products, the interacting Management and Quality constituencies exchanged their opposing views regarding required resource allocation. Very importantly, they did so in a sphere of openness, allowing for a discussion in real arguments (e.g. why exactly is a low Unit Cost more or less important than a high Delivery Reliability?) that account for specific opinions, in order to reveal divergent mental models of organizational actors.

Since both constituencies indeed had rather opposing views on goal priorities, a second management approval meeting was arranged by management for all arguments to be heard. Management was seriously worried about the fact that the group of process controllers and metallurgists found the goal of decreasing Unit Cost of relatively low importance for the organization's overall good. Management argued strongly that despite the added value and customer specificity of forging steel, the product still is and will always be a steel product which by definition is a commodity product. In any commodity market, a low cost performance is of vital importance.

In addition, management was worried about the fact that the goal of increasing Product Development was found of relatively high importance. In general, developing new products is of interest, however not for Corus IJmuiden Long Products, simply due to lacking financial resources. In the current situation, it would be unwise to engage in an unbridled product development. In management's opinion, these activities would have to be restricted to a few, previously defined 'runners': fast moving forging steel products that produce a high turnover.

After this second meeting, we asked the process controllers and metallurgists as well as the managers to individually rearrange their priorities. The categorical data sets obtained are depicted in Table 6-5 for the Management constituency and in Table 6-6 for the Quality constituency. These data represent the posttest data $O_{2,M}$ and $O_{2,Q}$: collected after the management approval meeting. The posttest feature of the data is highlighted in both tables by the figure 2 extension of the abbreviated constituency member names.

Table 6-5: Categorical data $O_{2,M}$: posttest of the Management constituency.

	STRI2	DORT2	GEER2	BROE2	WOUD2	BREE2	SCHI2
increase Throughput Volume (TV)	4	2	3	1	4	7	5
increase Delivery Reliability (DR)	3	5	5	3	6	5	3
decrease Stock Levels (SL)	2	3	2	2	1	3	2
decrease Quality Complaints (QC)	5	6	6	6	7	6	6
decrease Unit Cost (UC)	7	7	7	7	5	7	7
increase Material Yield (MY)	6	4	4	5	3	7	4
increase Product Development (PD)	1	1	1	4	2	4	1

Table 6-6: Categorical data $O_{2,Q}$: posttest of the Quality constituency[10].

	VRIE2	DBIE2	HAMO2	OVER2	MENS2	JONK2	TEMM2
increase Throughput Volume (TV)	3	3	1	3	2	4	1
increase Delivery Reliability (DR)	2	4	5	4	4	5	5
decrease Stock Levels (SL)	1	1	2	1	1	4	4
decrease Quality Complaints (QC)	6	6	6	6	6	7	6
decrease Unit Cost (UC)	7	7	7	7	7	6	7
increase Material Yield (MY)	5	5	4	5	5	4	3
increase Product Development (PD)	4	2	3	2	3	4	2

6.3.4 Design of Tactical Process Indicators

During the design team meetings, the Quality constituency did not just focus on assessing the relative importance of the common goals identified at the macro level, that were deployed to the meso level for the purpose of Strategic Dialogue. Moreover, the what-to-achieve question was followed up by the interrelated how-to-achieve question in order to identify the medium-term means-end relations that are of relevance for the organization. At the meso level, the organization is represented as a system of multiple parts, interacting within horizontal principal-agent relations, as is depicted in the

[10] In the meantime, process controller EIJD had found employ in another Corus business unit.

cross-functional process map of Figure 6-3. In contrast to the Tactical Result Indicators, which integrally applied to the organizational system as a whole, the interrelated Tactical Process Indicators therefore locally applied to the organization's parts. Since the Quality constituency was composed in reaction to the qualitative aspect of the strategic means (as was the Logistics constituency in reaction to the logistical aspect), Tactical Process Indicators were provisionally designed by the process controllers and metallurgists in relation to:

- Production Capacity in terms of Material Yield;
- Customer Satisfaction in terms of Quality Complaints and Product Development.

The provisionally designed Tactical Process Indicators will ultimately be deployed as the operational ends for identifying the relevant short-term means-end relations at the micro level of organizational analysis. Since the Strategic Dialogue at the micro level will be limited to the physical transformation processes at the factory shop floor, we will only present the Tactical Process Indicators as proposed by the Quality constituency that relate to the Steelworks, the Rolling-mill and the Finishing-center. The resulting nine indicator proposals, which had also been presented and discussed during the management approval meeting, are shown in Table 6-7. These indicators are further explained in Appendix D. As a consequence of the lacking reference to Low Cost performance, this table leads one to suspect as if cost considerations played no role at all during the design team meetings of the Quality constituency. Such suspicions are unjust, since these considerations were indeed taken into account; they have only been made explicit by a performance indicator afterwards during the Strategic Dialogue at the micro level.

Table 6-7: Tactical Process Indicator proposal by the Quality constituency.

		Steelworks	Rolling-mill	Finishing-center
Production Capacity	(Material Yield)	• Casting Scrap	• Rolling Scrap	• Finishing Scrap
Customer Satisfaction	(Quality Complaints)	• First Choices	• First Choices	• Post-IRUS Infections
	(Product Development)	• Test Loadings	• Round Tests	• Round Repairtime

6.4 OPERATIONALIZATIONS OF VERTICAL GOAL COHERENCE

On the basis of the categorical pretest and posttest data sets, it is hard to judge whether the Strategic Dialogue intervention had an effect on the degree Goal Coherence within and, moreover, between the Management constituency and the Quality constituency. In order to operationalize the Goal Coherence construct, the CATPCA technique, as previously presented in Chapter 4, is therefore applied to the categorical data sets obtained.

By applying a categorical principal component analysis, the original, high-dimensional set of ordinal data (six dimensions in the data of the Management constituency and seven dimensions in the data of the Quality constituency, i.e. the minimum of the number of variables and the number of options minus one) is optimally reduced to a 2-dimensional set of metric data through monotonically increasing transformation functions. The number of dimensions in the CATPCA procedure is optional: in our analyses, the number of dimensions could be set at a default value of 2, which consequently allowed for graphic representations of these data. The reduction to 2 dimensions was allowed for since the sum of VAF, which is a measure of model fit, was largely sufficient in all our analyses.

6.4.1 Pretest association

Results of the dimension reduction of the pretest data in terms of vector coordinates (representing the subjects i.e. respondents in the analysis and, moreover, their loadings upon the reduced dimensions) and point coordinates (representing the options i.e. goals in the analysis, that define the reduced dimensions) are presented in Table 6-8 for the Management constituency and in Table 6-9 for the Quality constituency. Concretely, Table 6-8 shows the non-metric transformation of Table 6-3 for determining the degree of pretest within-constituency Goal Coherence of the Management constituency, whereas Table 6-9 shows the non-metric transformation of Table 6-4 for determining the degree of pretest within-constituency Goal Coherence of the Quality constituency. Incorporating managers as supplementary variables into the analysis of the process controllers and metallurgists and *vice versa* will be explained later on in light of the operationalization of between-constituency Goal Coherence.

Table 6-8: Dimension loadings and scores: pretest of the Management constituency.

Active variable (Management)	DIM1 loading	DIM2 loading	Supplementary variable (Quality)	DIM1 loading	DIM2 loading
STRI1	.942	-.245	VRIE1	-.600	-.122
DORT1	.900	.302	DBIE1	.512	-.165
GEER1	.933	-.025	HAMO1	.500	-.283
BROE1	.112	.968	EIJD1	.611	.645
WOUD1	-.546	.790	OVER1	.671	.114
BREE1	.908	-.167	MENS1	-.073	.448
SCHI1	.666	.685	JONK1	.517	.622
			TEMM1	.255	-.861
eigenvalue	4.147	2.210	eigenvalue	2.032	1.879
Cronbach's α	.885	.639	Cronbach's α	.580	.535
VAF (Σ=.908)	.592	.316	VAF (Σ=.489)	.254	.235
association	**.507**	.290	association	**.163**	.019

Unit (i.e. option)	DIM1 score	DIM2 score
Throughput Volume (TV)	-.516	.924
Delivery Reliability (DR)	-.382	.509
Stock Levels (SL)	-.834	-.453
Quality Complaints (QC)	.587	.931
Unit Cost (UC)	1.803	.478
Material Yield (MY)	.691	-2.125
Product Development (PD)	-1.348	-.264

Table 6-9: Dimension loadings and scores: pretest of the Quality constituency.

Active variable (Quality)	DIM1 loading	DIM2 loading	Supplementary variable (Management)	DIM1 loading	DIM2 loading
VRIE1	.779	-.536	STRI1	-.005	.553
DBIE1	.930	.223	DORT1	.336	.841
HAMO1	.809	-.070	GEER1	.127	.504
EIJD1	.252	.922	BROE1	.166	.691
OVER1	.912	.167	WOUD1	.499	.497
MENS1	.799	-.224	BREE1	.709	.336
JONK1	.717	.683	SCHI1	.654	.673
TEMM1	.756	-.567			
eigenvalue	4.745	2.056	eigenvalue	1.335	2.558
Cronbach's α	.902	.587	Cronbach's α	.293	.710
VAF (Σ=.850)	.593	.257	VAF (Σ=.556)	.191	.365
association	**.593**	.091	association	**.191**	*.365*

Unit (i.e. option)	DIM1 score	DIM2 score
Throughput Volume (TV)	-.394	-.388
Delivery Reliability (DR)	-.851	.814
Stock Levels (SL)	-1.558	-.185
Quality Complaints (QC)	1.779	.881
Unit Cost (UC)	.001	1.441
Material Yield (MY)	.538	-1.364
Product Development (PD)	.486	-1.199

Due to the reduction to 2 dimensions and the optimal scaling of the categorical data, the data of Table 6-3 and Table 6-4 can be represented graphically, which is depicted in Figure 6-4 and Figure 6-5, visualizing pretest degrees of within-constituency Goal Coherence. In these graphs, the options (i.e. the goals) are represented by points, whereas the subjects (i.e. the managers and the process controllers and metallurgists) are represented by vectors. The graphical interface of CATPCA allows for visual detection of relations between variables. As such, these representations fulfill a comprehensive feedback purpose during the interactive group processes.

First, the contents of Table 6-3 and Table 6-4 and the meaning of Figure 6-4 and Figure 6-5 are further explained. A vector coordinate corresponds with the correlation between a subject and a dimension. The calculation of correlations is actually possible after the transformation of categorical data into metric data. In factor analysis (or principal component analysis) terms, the correlation between a subject and a dimension is interpreted as the loading of a subject upon a dimension: the higher a specific subject loads upon a specific dimension, the more the specific ordering of options by that subject is explained by that specific dimension. E.g., STRI1 in Table 6-8 has a high loading (.942) upon the first of two dimensions (DIM1) that resulted from the CATPCA analysis of the pretest data. So, the specific ordering of goals by STRI1 is largely explained by DIM1. If we look at the original ranking data of Table 6-3, STRI1 ranks decreasing Unit Cost as the most important goal for the organization in light of profitable growth, then increasing Material Yield, then decreasing Quality Complaints, etc. Indeed, these ordering preferences are largely explained by DIM1 if we look at Figure 6-4. In the direction of the vector tip of STRI1, DIM1 gives the highest priority to the goal of decreasing Unit Cost, the next highest priority to increasing Material Yield, the next highest priority to decreasing Quality Complaints, etc. The original ranking preferences of STRI1 are not entirely explained by DIM1, since STRI1 also loads upon DIM2 (-.245).

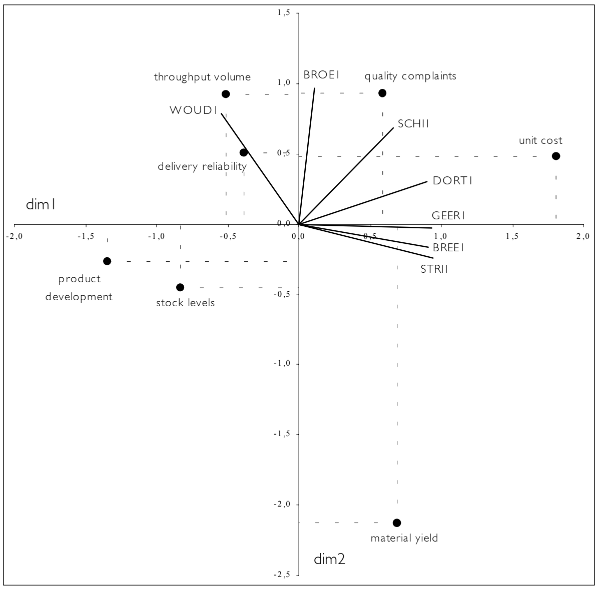

Figure 6-4: Pretest of the Management constituency.

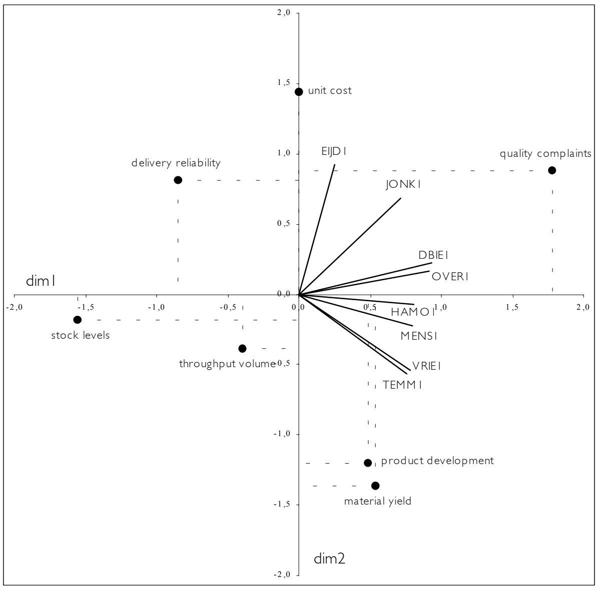

Figure 6-5: Pretest of the Quality constituency.

Of major importance is the interpretation of dimensions. What do these dimensions represent? In general, the dimensions that result from reduction with the CATPCA procedure are anonymous: they merely define a multi-dimensional space.

However, since we apply the procedure to transposed data matrices in which the subjects are the variables, the dimensions attain a specific meaning. Clearly, the perpendicular projection of the options onto either dimension in Figure 6-4 and Figure 6-5, indicated by the dotted lines, produces a metric approximation of the ordinal goal priorities found in Table 6-3 and Table 6-4. In other words, DIM1 and DIM2 each represent a one-dimensional mental model of indicators/goals arranged along a straight line, albeit it no longer equidistantly due to the non-metric transformation that is part of the CATPCA analysis. Now recall our definition of Goal Coherence: inter-group and intra-group consensus on goal priorities. Group consensus in terms of CATPCA can thus be identified by the subjects in the analysis to load highly (i.e. loadings nearby +1 or -1) upon the same dimension. In graphic representation, group consensus will consequently result in all vectors lying in the same direction on or near this shared dimension. But how to identify the dimension that is mostly shared among group members? For this purpose, we calculate the variance accounted for (VAF) by each dimension.

The eigenvalues in Table 6-8 and Table 6-9 represent a measure of how much variance is accounted for by the dimensions that resulted from dimension reduction. The eigenvalue per dimension is calculated as the SSQ (i.e. sum of squares) of the loadings. In order to determine how much variance is accounted for by the reduced dimensions, the calculated eigenvalues after dimension reduction are divided by the sum of eigenvalues in the original data sets. In the original data set, the sum of eigenvalues equals the number of dimensions: seven in the pretest data of the Management constituency and eight in the pretest data of the Quality constituency. E.g., the VAF of .592 for DIM1 in Table 6-8 equals the eigenvalue of 4.147 of that dimension divided by the initial sum of eigenvalues of 7; the VAF of .316 for DIM2 is calculated likewise. Note that the sum of VAF over the dimensions (.908 in Table 6-8 and .850 in Table 6-9) is a measure of how much information (i.e. variance) found in the transformed data set is accounted for after dimension reduction. As previously stated, the sum of VAF is a measure of model fit: if no information is lost and consequently VAF equals 1, the fit is said to be perfect. In case of high fit, i.e. if most variance is accounted for by the reduced dimensions, the length of vectors in the graphic representation will accordingly approximate the value of 1. If the amount of fit is found to be too low, an additional third or possibly fourth dimension has to be incorporated into the CATPCA analysis.

Since the VAF per dimension is calculated as the SSQ of loadings upon that dimension, the dimension that is dominant in terms of the highest VAF corresponds with the dimension upon which all subjects on average load most strongly. In other words, the dominant dimension represents a specific order of goals that is mostly shared among subjects. If we take a closer look at Table 6-8, we see that of the reduced dimensions, DIM1 (VAF of .592) is dominant over DIM2 (VAF of .316). This means that individual Management constituency members correlate most strongly with DIM1 (especially DORT1, GEER1, BREE1 and STRI11, however not BROE1), which therefore corresponds with the specific prioritizing of goals that is mostly shared within the management team. Some managers also correlate quite strongly with DIM2 (especially BROE1, but also WOUD1 and SCHI1), which therefore corresponds with a second order of goals that is shared among management team members, however to a lesser degree. By definition, the CATPCA procedure names the dominant dimension DIM1, the second dominant dimension DIM2, etc.

From the interpretation of a dimension as the metric equivalent of ordinal goal priorities and the interpretation of the dominant dimension as the specific order of goals that is mostly shared among constituency members, we can now calculate the intersubjective measure of association that operationalizes the within-constituency Goal Coherence construct. This measure corresponds with the calculation of VAF for the dominant dimension, corrected for opposite loading signs. E.g., if we look at Figure 6-4, we see that WOUD1 correlates in opposite direction with DIM1 compared to the other managers. For the calculation of VAF, this is no problem; for the calculation of association as the intersubjective measure of group consensus, it is a problem. Therefore, we need to make a correction for opposite signs. Association is hence calculated as the difference between the SSQ of positive loadings and the SSQ of negative loadings on the dominant dimension, divided by m (with m being the number of variables i.e. subjects in the analysis, which corresponds with the initial number of dimensions in the original data). The numerator of this quotient is by definition positive (or at least zero), since the CATPCA procedure attributes positive signs to the majority of alike directed loadings. Hence, degrees of within-constituency Goal Coherence vary between 0 and 1. In formula notation:

$$association = \frac{SSQ(loading_{pos}) - SSQ(loading_{neg})}{m}$$

For the Management constituency, the degree of pretest within-constituency Goal Coherence consequently equals .507, as is shown by the measure of association in Table 6-8. This measure is also calculated for the second dimension in the analysis, since it is theoretically possible in case of strong but opposite loadings that the dominant dimension does not account for the highest degree of association. A similar calculation is made for the Quality constituency in Table 6-9, resulting in pretest within-constituency Goal Coherence of .593.

After the operationalization of within-constituency Goal Coherence, we will now turn to its between-constituency equivalent. As the within-constituency Goal Coherence construct relates to goal priorities that are shared among members of a single constituency (which might not be shared among members of other, goal interdependent constituencies), the between-constituency Goal Coherence construct relates to goal priorities that are shared among members of multiple goal interdependent constituencies. Thus, the degree of similarity of within-constituency Goal Coherence between goal interdependent constituencies is a measure of between-constituency Goal Coherence.

Regarding the vertically goal interdependent Management constituency and Quality constituency, we interpret between-constituency Goal Coherence as the degree in which the Management constituency members share the goal priorities that are mostly shared among the Quality constituency members and, *vice versa*, the degree in which the Quality constituency members share the goal priorities that are mostly shared among the Management constituency members. Thus, in CATPCA terms, between-constituency Goal Coherence is measured by the loadings of the managers upon the dimension with the highest eigenvalue in the analysis of the process controllers and metallurgists and, *vice versa*, by the loadings of the process controllers and metallurgists upon the dimension with the highest eigenvalue in the analysis of the managers. These loadings can be obtained by adding managers as supplementary variables to the analysis of the process controllers and metallurgists and, *vice versa*, by adding process controllers and metallurgists as supplementary variables to the analysis of the managers. Supplementary variables are passively involved in the CATPCA dimension reduction procedure, i.e. these variables do not define the dominant dimensions: these dimensions are defined by the active variables. The resulting loadings from these supplementary analyses are presented in Table 6-3 and Table 6-4. In Table 6-3, the Management constituency members represent the active variables, while the Quality constituency members have been passively added as supplementary variables. In Table 6-4, the Quality constituency members represent the active variables, while the Management constituency members have been passively added as supplementary variables. The loadings of the supplementary variables of Table 6-4 and Table 6-3 are graphically depicted in Figure 6-6 and Figure 6-7, visualizing pretest degrees of between-constituency Goal Coherence. Verify that the coordinates for the options in Figure 6-6 correspond exactly with those in Figure 6-5 and that the coordinates in Figure 6-7 correspond exactly with those in Figure 6-4.

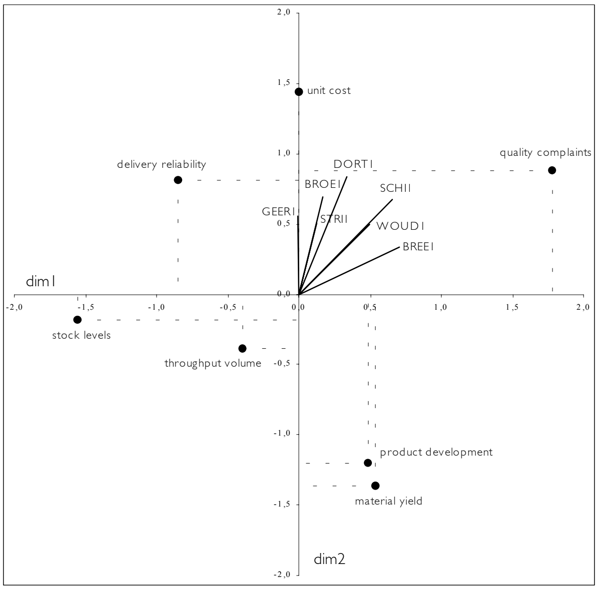

Figure 6-6: Supplementary pretest of the Management constituency.

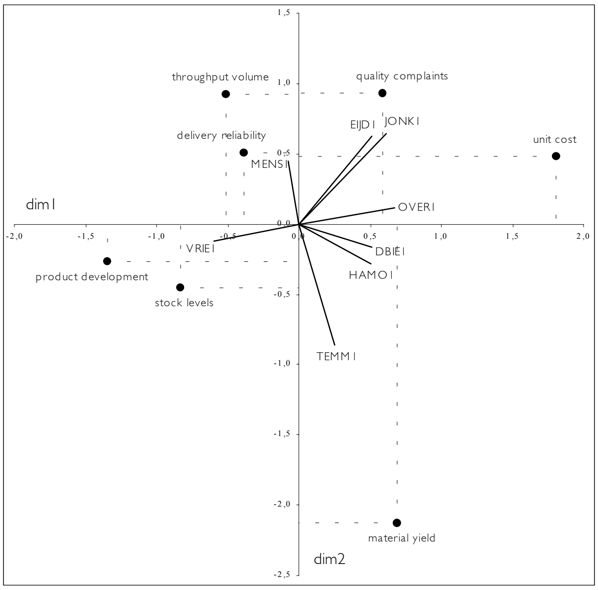

Figure 6-7: Supplementary pretest of the Quality constituency.

In a similar vein, we can calculate the measure of association with the previously presented formula for operationalizing the degree of Goal Coherence between the Management and the Quality constituency. The degree of pretest between-constituency Goal Coherence is only .191 according to the calculation of association in Table 6-9. Note that in this case the numerator of the association quotient does not have a positive sign by definition. In a supplementary analysis, the CATPCA procedure cannot attribute positive signs to the majority of alike directed loadings of the supplementary and thus passive variables, since the dimensions are defined and thus fixed by the active variables. Hence, degrees of between-constituency Goal Coherence vary between -1 and +1.

If we take a closer look at Table 6-9, the loadings of the managers upon the dimension that is dominant for the process controllers and metallurgists are relatively small: DIM1 only accounts for .191 of the variance in the ranking preferences of the managers, which corresponds with an equal degree of association (the opposite loading sign of STRI1 has a negligible impact). Even more so, managers correlate quite strongly with DIM2 (VAF of .365), which for the Quality constituency represents an ordering of goals that is shared to a far lesser degree. The bad fit of the supplementary pretest analysis (the sum of VAF equals .556) is also displayed in Figure 6-6 by the relatively small vector lengths, especially of STRI1 and GEER1. If we take a closer look at Table 6-8, and moreover at the dispersed vector angles in Figure 6-7, the low degree of pretest between-constituency Goal Coherence of only .163 is instantaneously clear.

6.4.2 *Posttest association*

The same exercise is executed regarding the posttest data of Table 6-5 and Table 6-6. Results of the CATPCA analyses in terms of dimension loadings of the subjects and dimension scores of the options are presented in Table 6-10 for the Management constituency and in Table 6-11 for the Quality constituency.

Table 6-10: Dimension loadings and scores: posttest of the Management constituency.

Active variable (Management)	DIM1 loading	DIM2 loading	Supplementary variable (Quality)	DIM1 loading	DIM2 loading
STRI2	.902	-.050	VRIE2	.949	-.283
DORT2	.949	-.279	DBIE2	.974	.197
GEER2	.968	-.211	HAMO2	.941	-.282
BROE2	.949	-.283	OVER2	.974	.197
WOUD2	.637	.761	MENS2	.949	-.283
BREE2	.627	.776	JONK2	.796	-.093
SCHI2	.968	-.195	TEMM2	.939	-.290
eigenvalue	5.290	1.424	eigenvalue	6.099	.410
Cronbach's α	.946	.348	Cronbach's α	.975	-1.682
VAF (Σ=.959)	.756	.203	VAF (Σ=.930)	.871	.059
association	**.756**	.134	association	**.871**	.036
Unit (i.e. option)	DIM1 score	DIM2 score			
Throughput Volume (TV)	-.270	1.054			
Delivery Reliability (DR)	-.250	.796			
Stock Levels (SL)	-1.133	-1.964			
Quality Complaints (QC)	.627	.184			
Unit Cost (UC)	2.064	-.865			
Material Yield (MY)	-.080	.784			
Product Development (PD)	-.960	.009			

Table 6-11: Dimension loadings and scores: posttest of the Quality constituency.

Active variable (Quality)	DIM1 loading	DIM2 loading	Supplementary variable (Management)	DIM1 loading	DIM2 loading
VRIE2	.990	-.143	STRI2	.825	-.388
DBIE2	.990	-.143	DORT2	.996	.073
HAMO2	.996	.074	GEER2	.996	.069
OVER2	.990	-.143	BROE2	.990	-.143
MENS2	.990	-.143	WOUD2	.561	.737
JONK2	.780	.626	BREE2	.349	-.542
TEMM2	.997	.003	SCHI2	.978	-.127
eigenvalue	6.512	.478	eigenvalue	5.039	1.034
Cronbach's α	.987	-1.273	Cronbach's α	.935	.039
VAF (Σ=.999)	.930	.068	VAF (Σ=.868)	.720	.148
association	**.930**	.045	association	**.720**	.010
Unit (i.e. option)	DIM1 score	DIM2 score			
Throughput Volume (TV)	-.718	-.500			
Delivery Reliability (DR)	-.329	2.035			
Stock Levels (SL)	-.693	-.495			
Quality Complaints (QC)	.746	.973			
Unit Cost (UC)	2.155	-.690			
Material Yield (MY)	-.471	-.840			
Product Development (PD)	-.690	-.483			

Concretely, Table 6-10 shows the non-metric transformation of Table 6-5 for determining the degree of posttest within-constituency Goal Coherence of the Management constituency (association of .756) and the degree of posttest between-constituency Goal Coherence with the Quality constituency (association of .871), whereas Table 6-11 shows the non-metric transformation of Table 6-6 for determining the degree of posttest within-constituency Goal Coherence of the Quality constituency (association of .930) and the degree of posttest between-constituency Goal Coherence with the Management constituency (association of .720).

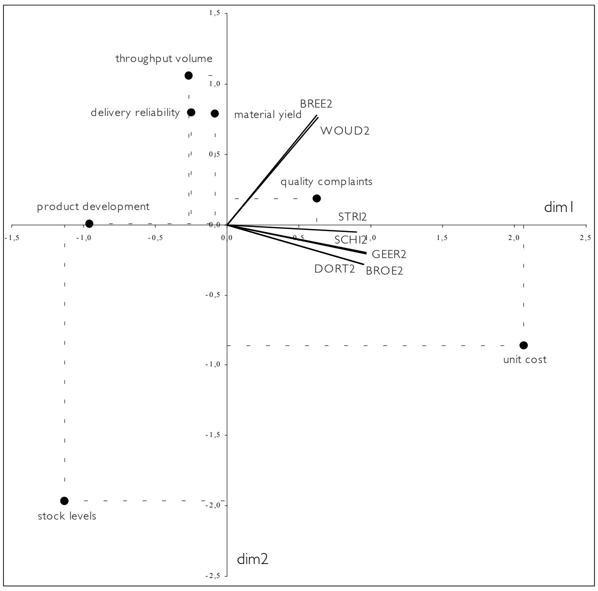

Figure 6-8: Posttest of the Management constituency.

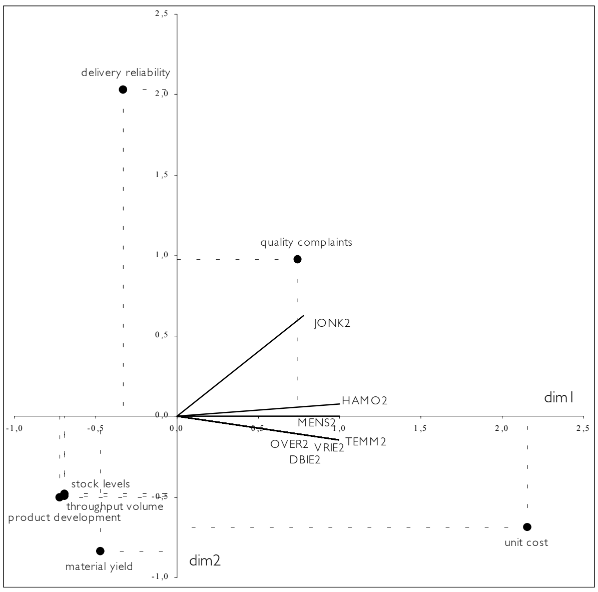

Figure 6-9: Posttest of the Quality constituency.

The data of Table 6-10 and Table 6-11 regarding the active variables in the CATPCA analyses are graphically depicted in Figure 6-8 and Figure 6-9, visualizing posttest degrees of within-constituency Goal Coherence. Compared to Figure 6-4 and Figure 6-5 that visualize pretest degrees of within-constituency Goal Coherence, Figure 6-8 and Figure 6-9 clearly reveal an enhanced convergence with the dominant dimension, although within the Management constituency BREE2 and WOUD2 still load quite strongly upon a second dimension (loadings of .776 and .761 respectively) and within the Quality constituency JONK2 still loads quite strongly upon another dimension (loading of .626).

In addition, the data of Table 6-10 and Table 6-11 regarding the supplementary variables in the CATPCA analyses are graphically depicted in Figure 6-10 and Figure 6-11, visualizing posttest degrees of between-constituency Goal Coherence. Compared to Figure 6-8 and Figure 6-9 that visualize pretest degrees of between-constituency Goal Coherence, Figure 6-10 and Figure 6-11 clearly reveal an enhanced convergence with the dominant dimension of the goal interdependent constituency, which is especially true for the Quality constituency. Within the Management constituency, BREE2 and WOUD2 still load quite strongly upon a second dimension which is found of minor interest by the Quality constituency (loadings of -.542 and .737 respectively).

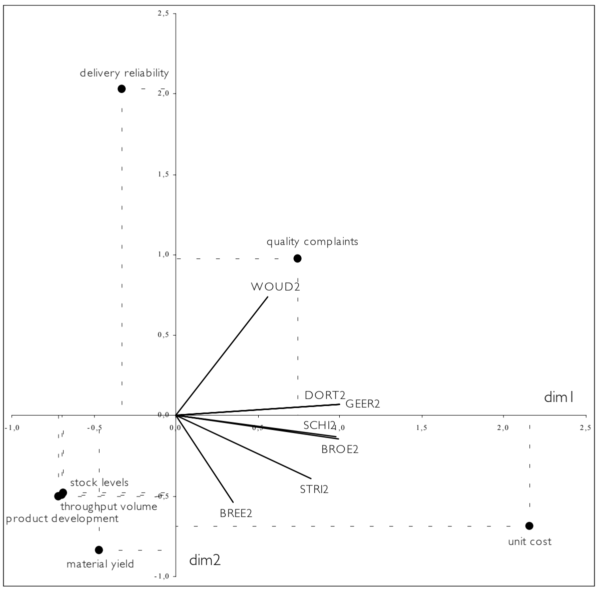

Figure 6-10: Supplementary posttest of the Management constituency.

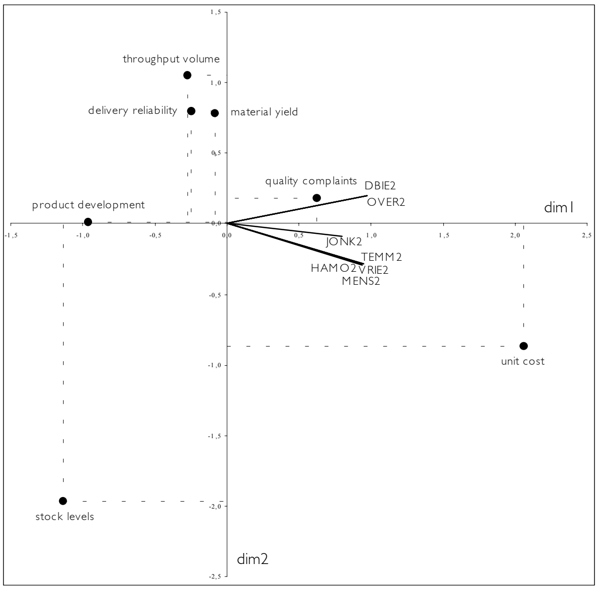

Figure 6-11: Supplementary posttest of the Quality constituency.

6.5 EFFECTS ON VERTICAL GOAL COHERENCE

The calculations in Section 6.4 of pretest and posttest degrees of Goal Coherence within and between the Management constituency and the Quality constituency are summarized in Table 6-12. An effect is calculated as the difference between posttest and pretest association. Regarding within-constituency Goal Coherence, which varies between 0 and +1, effects vary between –1 and +1; regarding between-constituency Goal Coherence, which varies on a larger scale between –1 and +1, effects vary between –2 and +2.

Table 6-12: Summary of operationalizations and effects.

	Management constituency		Quality constituency	
Goal Coherence (i.e. association)	pretest	posttest	pretest	posttest
within-constituency	.507	.756	.593	.930
effect		**.249**		**.337**
between-constituency	.191	.720	.163	.871
effect		**.529**		**.708**

Given demonstrated effects larger than zero, we can conclude that the Strategic Dialogue positively affected degrees of Goal Coherence within and between the vertically goal interdependent Management constituency and Quality constituency. As can be seen, this applies all the more to between-constituency Goal Coherence: effects of .529 for the Management constituency and even .708 for the Quality constituency resulting from the supplementary analyses. This is a promising finding since especially the between-constituency equivalent of Goal Coherence, as previously explained, is of major interest in search for a multilevel goal structure. These observations thus support the instrumental hypothesis of our research, previously presented in Chapter 4.

The strong and positive effect on between-constituency Goal Coherence is further illustrated in Figure 6-12. This figure shows the dominant dimensions that resulted from the CATPCA analyses of the pretest and posttest ranking data of the Management constituency and the Quality constituency. These dimensions represent a metric approximation of ordinal goal priorities, found by the perpendicular projection of the options upon the dominant dimension in the 2-dimensional, graphic representation. Moreover, since these dimensions are dominant, they represent the metric approximation of ordinal goal priorities that is mostly shared within the group of managers and within the group of process controllers and metallurgists. With regard to the latter group, note that Figure 6-12 nicely illustrates the natural tendency of these technical engineers, as mentioned before, to mentally model qualitative aspects of performance as of major interest (pretest priorities of the Quality constituency).

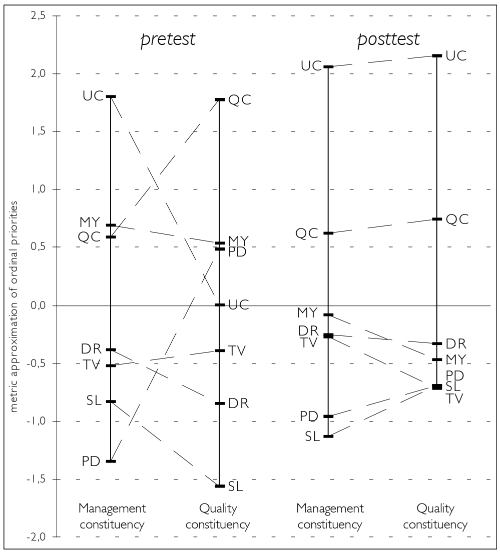

Figure 6-12: Similarity of dominant dimensions.

Recall that the degree of between-constituency Goal Coherence in fact corresponds with the degree of similarity of within-constituency Goal Coherence between goal interdependent constituencies. The similarity in ordering preferences within separate constituencies is graphically illustrated in Figure 6-12 by the dotted connection-lines between equal goals. Clearly, the preferred sequence of ordering by the Management constituency and the Quality constituency, especially with regard to the goal of decreasing Unit Cost (UC), decreasing Quality Complaints (QC) and increasing Product Development (PD), is more similar after than before the constructive controversy of the management approval meeting. Figure 6-12 reveals instantaneously which development has taken place in the minds of the interacting organizational actors. In case of the process controllers and metallurgists, the most dramatic change relates to the perceived interest of Unit Cost improvements. Clearly, the cost arguments of management have been convincing, as were the arguments for a limited product development: the goal of increasing Product Development has been put into perspective. Another and interesting observation relates to the goal of increasing Material Yield. Apparently, the strategic interaction made both constituencies decide analogously on a decreased impact of this goal on the organization's overall effectiveness. This observation confirms our statement made in Chapter 2 that the Strategic Dialogue is not a mechanistic instrument imposed top-down by the dominant organizational coalition, i.e. management, but an organic instrument that produces relevant bottom-up input for the strategy process.

Next, Chapter 7 deals with vertical Goal Coherence as well. In contrast to the full intervention of the current chapter, the Strategic Dialogue intervention of Chapter 7 between vertically goal interdependent constituencies could only be partially facilitated.

Chapter 7.
VERTICAL GOAL COHERENCE
PARTIAL INTERVENTION

This chapter covers the intervention of Strategic Dialogue between the Management constituency and the Logistics constituency: two vertically goal interdependent constituencies at the macro and meso level of the Corus IJmuiden Long Products organization. Furthermore, this chapter covers the intervention of Strategic Dialogue between the Management constituency and three micro level constituencies: the Steelworks, the Rolling-mill and the Finishing-center constituency.

7.1 INTRODUCTION

Compared to the previous chapter, the Strategic Dialogue interventions presented in this chapter have only been partly implemented. As a consequence of the negative decision by the Corporate Board on the continuity of the Corus IJmuiden Long Products business unit within the new corporation, we had to deviate from our initial research plans. The findings reported here thus provide less convincing support for the intervention's effect on vertical Goal Coherence.

Following the Quality constituency, the Strategic Process Indicators identified by the Management constituency (indicating "How to achieve?" from a macro perspective) were also deployed to the Logistics constituency at the meso level. These performance indicators served as the integral input for design team meetings with the cross-functionally composed Logistics constituency. As a result, the medium-term or tactical means-end relations for the organization as a system of multiple and interacting parts was identified by this constituency in logistical terms. Subsequently, these relations were operationalized into Tactical Result Indicators (indicating "What to achieve?" from a meso perspective) and Tactical Process Indicators (indicating "How to achieve?" from a meso perspective). This design intervention at the meso level is covered in Section 7.2.

In contrast to the vertically goal interdependent Management constituency and Quality constituency, we were not able to organize and facilitate a true moment of constructive controversy (Tjosvold, 1985) on goal priorities between the Management constituency and the Logistics constituency. At the time of the management approval meeting, it was two more weeks before a possibly dramatic decision was to be made about the business unit's future by the Corporate Board of Directors: is Corus IJmuiden Long Products, in light of the corporate strategy of Corus, allowed to continue its activities or forced to cease its activities? This decision had in the past been postponed several times by the Corporate Board of the former Dutch Koninklijke Hoogovens corporation, but was to be made definitively by the new Corporate Board after the recent merger with the British Steel corporation. As the sword of Damocles, this decision was hanging over the heads of the organizational actors participating in the management approval meeting, which naturally undermined the relevancy of the strategic discussion on long-term priorities for the business unit: a long-term that might not even exist anymore within two weeks time. Due to this pseudo management approval meeting, we speak of a partial intervention, which is diagrammed in Figure 7-1, where M stands for Management constituency and L for Logistics constituency (cf. Figure 4-2 in Chapter 4).

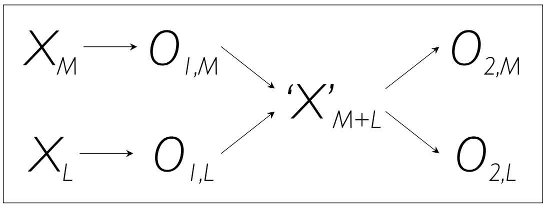

Figure 7-1: Partial design: Management and Logistics constituency.

Before and after the pseudo management approval meeting, indicated by the quotation marks in Figure 7-1, we collected empirical data in order to operationalize within-constituency and between-constituency Goal Coherence. Based on these operationalizations, we demonstrated a neutral effect of the Strategic Dialogue on degrees of vertical Goal Coherence. Compared to the effects reported on the full intervention in Chapter 6, the effects reported here should be interpreted with great care, given the particular circumstances.

Finally, the Strategic Dialogue was initiated at the micro level of organizational analysis. At this level, the Steelworks constituency, the Rolling-mill constituency and the Finishing-center constituency participated in the multilevel goal setting process. Each of these three micro level constituencies represented a local management team composed of the plant manager and his shift managers. The Tactical Process Indicators, proposed separately for each of the three operational units by the Quality constituency regarding technical performance and by the Logistics constituency regarding logistical performance, were deployed to the micro level. These indicators served as the input for design team meetings of shop floor constituencies. The idea was to locally identify the short-term or operational means-end relations for each of the organization's parts and to subsequently operationalize these relations into Operational Result Indicators (indicating "What to achieve?" from a micro perspective) and Operational Process Indicators (indicating "How to achieve?" from a micro perspective). The design intervention at the micro level is presented in Section 7.3.

By the time we had arranged preliminary design team meetings with each of the three micro level constituencies, as part of which we collected pretest data on the mutual interest of the Operational Result Indicators, the Corporate Board of Directors decided negatively on the future of Corus IJmuiden Long Products: from the beginning of

2000 on, the business unit would have to be closed down within 1½ years time. As a consequence of this corporate decision, the relevance of the Strategic Dialogue had instantaneously disappeared. Therefore, the operationalization of Operational Process Indicators had to fall beyond the scope of our study. Moreover, there was no reason left to organize management approval meetings between the Management constituency and the Steelworks, the Rolling-mill and the Finishing-center constituencies. Due to lacking posttest data, the effect of the Strategic Dialogue on degrees of vertical Goal Coherence between these constituencies could thus not be determined. The partial intervention at the micro level is diagrammed in Figure 7-2, where M stands for Management constituency and S, R and F for Steelworks, Rolling-mill and Finishing-center constituency respectively (cf. Figure 4-2 in Chapter 4).

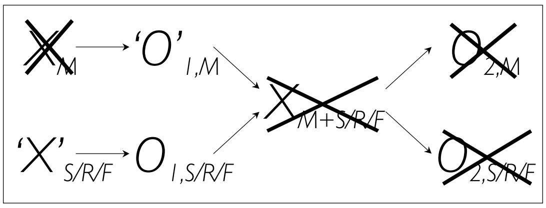

Figure 7-2: Partial design: Management and Steelworks/Rolling-mill/Finishing-center constituency.

We did not have the opportunity to make the Management constituency directly rank the Operational Result Indicators of the micro level constituencies during follow-up design team meetings. In order to measure pretest between-constituency Goal Coherence, we assumed consistent ranking preferences by the Management constituency members. Based on this assumption, we indirectly derived pretest data from the Management constituency, which is indicated by the quotation marks ('$O'_{1,M}$') in Figure 7-2. The other quotation marks in Figure 7-2 ('$X'_{S/R/F}$') indicate the preliminary status of the design team meetings of the micro level constituencies.

Despite the partial nature of the intervention, we clearly demonstrated a situation of lacking consensus on goal priorities between general management of the business unit and local management of the operational units. It is all the more a pity that we did not have the opportunity to continue the Strategic Dialogue, since this pretest situation offered a promising basis for demonstrating additional effects and finding further support for the instrumental hypothesis that is leading our research.

7.2 Strategic Dialogue at the meso level: the Logistics constituency

As previously explained, participation of the meso level constituencies in explicating the long-term or strategic means-end relations for the organization as a whole was organized afterwards at Corus IJmuiden Long Products. This was due to the existence of divergent mental models within the highly differentiated Management constituency. The Logistics constituency therefore did not directly take part in the design team meetings of the Management constituency, but assessed the validity of the provisionally designed

Strategic Process Indicators during own design team meetings. For the preceding design team meetings X_M of the Management constituency, the reader is referred to Chapter 6.

7.2.1 *Design team meetings X_L*

The Logistics constituency was cross-functionally composed of representatives from existing, formal constituencies, as was the Quality constituency. As the Corus IJmuiden Long Products process map of Figure 7-3 indicates, these formal constituencies refer to the Steelworks, the Rolling-mill, the Finishing-center, the Logistical Planning department and the Sales department.

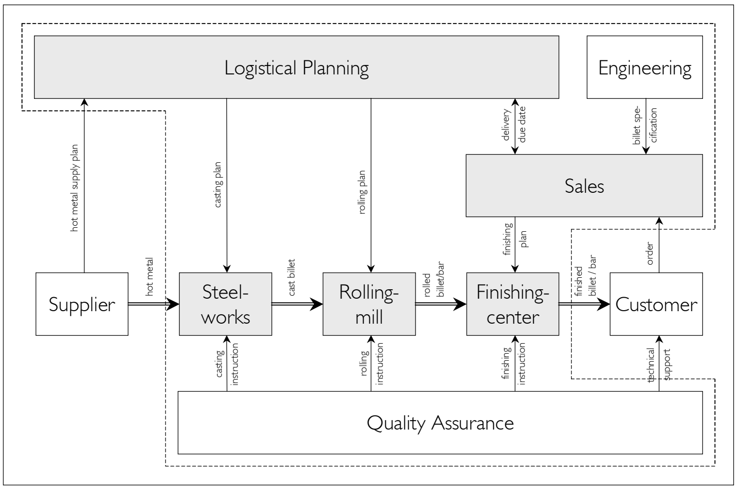

Figure 7-3: Composition of the Logistics constituency.

Concretely, the Logistics constituency was composed of two central planners of the Logistical Planning department, one local planner of the Steelworks, two plant managers (one of the Rolling-mill and one of the Finishing-center) and two sales representatives of the Sales department. In contrast to the Quality constituency, the focal point related to logistical performance (in terms of Delivery Reliability, Throughput Volume and Stock Levels) rather than to qualitative performance. The cross-functional composition of the Logistics constituency aims at stimulating perceptions of positive goal interdependence regarding logistical performance among constituency members, who formally belong to constituencies at the micro level of daily operations. As Figure 7-3 illustrates, these formal constituencies are goal interdependent within a supply chain of horizontal principal-agent relations.

By the middle of 1999, the Logistics constituency started to explicate medium-term means-end relations derived from the long-term means-end relations as identified by the Management constituency. Again, the interactive group process, organized during several design team meetings which had been preceded by preliminary, individual interviews, was facilitated by addressing the two interrelated questions of "what to achieve" and "how to achieve" from a meso perspective. The operationalization of the qualitative answers into quantitative parameters, i.e. the design of Tactical Result Indicators and Tactical Process Indicators, would ultimately form the input of the management approval meeting.

Concretely, the design team meetings were facilitated by a redesign assignment of the integral logistical control structure of the Corus IJmuiden Long Products business unit (see Van Buren, 1999). In contrast to knowledge of technical performance, knowledge of logistical performance was clearly underdeveloped within the organization. As a consequence, the business unit had a long history of negative and laborious discussions about the subject of logistics. Every member of the organization that had involved him- or herself in the logistical discussion held an own and strong opinion and, moreover, every opinion was right due to a lacking common factor. Regarding the subject, opposite positions were taken by organizational actors: logistics had become a political issue. Perceptions of positive goal interdependence were not at all present. Therefore, it would have been insufficient – perhaps even dangerous – to start straightaway with addressing the interrelated what-to-achieve and how-to-achieve questions. At the first design team meeting, one of the constituency members literally said: "For the umpteenth time, here we go again!"

In order to create a shared vision on logistical issues, we therefore made the fundamental decision to prepare a redesign of the integral logistical control structure during 6 design team meetings of the Logistics constituency, with the intended purpose to arrive at relevant logistical performance indicators. As the facilitators of the interactive group process, we had to bring in the required logistical knowledge ourselves. Ultimately, the Logistics constituency proposed a new logistical control structure that was based on the principles of Flow Production, Workload Control and Available-to-Promise (Bertrand *et al.*, 1997). The course of the design team meetings and the specifics of the resulting control structure are explained in detail in Appendix E.

7.2.2 Design of Tactical Result Indicators: collecting pretest data $O_{1,M}$ and $O_{1,L}$

As was the case for the Quality constituency, design of the Tactical Result Indicators by the Logistics constituency corresponded with assessing the validity of the Strategic Process Indicators as provisionally designed by the Management constituency. Completeness and controllability of these overall indicators, as well as the feasibility of the accompanying indicator targets for the organization were discussed during the design team meetings. For the purpose of measuring degrees of within-constituency and between-constituency Goal Coherence, we asked each Logistics constituency member to individually rank the goals related to the seven Tactical Result Indicators with the same ranking instruction for the Quality constituency as described in Chapter 6. We used the posttest ranking data of the Management constituency in the previous analysis of the Quality constituency as the pretest ranking data in the current analysis of the Logistics constituency. The reader is referred to Appendix F for the categorical data sets $O_{1,M}$ and $O_{1,L}$.

7.2.3 Management approval meeting 'X'$_{M+L}$: collecting posttest data $O_{2,M}$ and $O_{2,L}$

It turned out that the management approval meeting was not so much a moment of constructive controversy on goal priorities between two goal interdependent constituencies. Probably, this had to do with the innovative feature of the new logistical control structure as presented by the Logistics constituency. It took time to convince the skeptical Management constituency of the interest of saying no, under certain circumstances, to forging steel customers and of a restricted release of work orders, being a single decision for the entire value chain of Corus IJmuiden Long Products made by the Logistical Planning department (at the expense of the current power positions of Production and Sales). Clearly, management recognized that the application of the principles of Flow Production, Workload Control and Available-to-Promise implied a way of interacting and communicating internally between departments and operational units as well as externally towards customers that was completely at odds with current practices.

Since the discussion was so much focused on the contents and the implications of the new logistical control structure, the discussion about goal priorities and underlying mental models of organizational effectiveness was only of marginal importance. However, there was another, much more fundamental reason causing this discussion to be of minor interest, as explained in the introduction of this chapter: the uncertainty caused by the corporate decision on the business unit's future being at hand.

Still, we asked the managers as well as the Logistics constituency members to individually rearrange their priorities after the meeting. There was only one manager that we could not get to reorder his preferences due to the existing uncertainty. The reader is referred to Appendix F for the categorical data sets $O_{2,M}$ and $O_{2,L}$. In addition, Appendix F contains the results of the CATPCA analysis of the pretest and posttest data, the quantification of pretest and posttest degrees of Goal Coherence within and between the vertically goal interdependent Management and Logistics constituencies, and the graphic representations of vector and point coordinates that visualize degrees of vertical Goal Coherence.

7.2.4 Design of Tactical Process Indicators

During the design team meetings, the Logistics constituency did not just focus on assessing the relative importance of the common goals identified at the macro level, that were deployed to the meso level for the purpose of Strategic Dialogue. Moreover, the what-to-achieve question was followed up by the interrelated how-to-achieve question in order to identify the medium-term means-end relations that are of relevance for the organization as a system of interacting parts. Since the Logistics constituency was composed in reaction to the logistical aspect of the strategic means (as was the Quality constituency in reaction to the qualitative aspect), Tactical Process Indicators were provisionally designed in relation to:

- Production Capacity in terms of Throughput Volume and Stock Levels;
- Customer Satisfaction in terms of Delivery Reliability.

Since the Strategic Dialogue at the micro level will be limited to the physical transformation processes at the factory shop floor, we will only present the Tactical Process Indicators as proposed by the Logistics constituency that relate to the Steelworks, the Rolling-mill and the Finishing-center. The resulting nine indicator proposals, which had been presented during the management approval meeting, are shown in Table 7-1. These indicators are further explained in Appendix G. As a consequence of the lacking reference to Low Cost performance, this table again leads one to suspect as if cost considerations played no role at all during the design team meetings of the Logistics constituency. These suspicions are as unjust as they were against the Quality constituency.

The indicators of Table 7-1, in addition to the indicators proposed by the Quality constituency, are deployed in the following Section 7.3 as the operational ends for identifying the relevant short-term means-end relations at the micro level of organizational analysis.

Table 7-1: Tactical Process Indicator proposal by the Logistics constituency.

		Steelworks	Rolling-mill	Finishing-center
Production Capacity	(Throughput Volume)	• Cast Loadings	• Rolled Loadings	• Finished Tons
	(Stock Levels)	• Free For Rolling	• Free For Finishing	• Work In Process
Customer Satisfaction	(Delivery Reliability)	• Casting Plan Conformity	• Rolling Plan Conformity	• Finishing Lead-time

7.2.5 *Operationalizations of and effects on vertical Goal Coherence*

The calculations in Appendix F of pretest and posttest degrees of Goal Coherence are summarized in Table 7-2. Compared to the positive effects reported in Chapter 6 regarding the previous analysis of the vertically goal interdependent Management and Quality constituencies, the effects reported here on the current analysis of the vertically goal interdependent Management and Logistics constituencies are mainly negative. The only positive effect of .120 relates to the development of within-constituency Goal Coherence of the Logistics constituency: all other effects are negative.

Table 7-2: Summary of operationalizations and effects.

	Management constituency		Logistics constituency	
Goal Coherence (i.e. association)	pretest	posttest	pretest	posttest
within-constituency	.756	.348	.481	.601
effect		**-.408**		**.120**
between-constituency	.329	.132	.454	.086
effect		**-.197**		**-.368**

Especially, the negative effects on between-constituency Goal Coherence are striking. This phenomenon is furthermore illustrated by Figure 7-4. The figure instantaneously reveals that the dominant mental models of the two goal interdependent constituencies have diverged rather than converged after the pseudo management approval meeting.

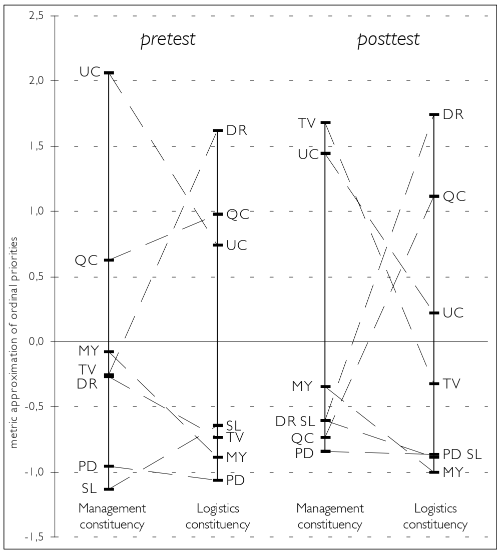

Figure 7-4: Similarity of dominant dimensions.

The pseudo management approval meeting indicates that a true constructive controversy between the Management constituency and the Logistics constituency – although unintentionally – did not happen. Hence, the Strategic Dialogue intervention was not fully but only marginally implemented. Compared to the full intervention between the Management constituency and the Quality constituency, we might consider these constituencies to represent a treated experimental group, while we might consider the Management constituency and the Logistics constituency to represent an untreated control group. We are not pretending as if we designed an experiment according to the exact rules of Cook and Campbell (1979), since we simply did not. We merely want to use the analogy of an experiment to make any sense of our findings. From an experimental perspective, Table 7-2 would provide compelling support to the instrumental hypothesis of our research.

However, we do not trust the posttest ranking data of the Management constituency. Most striking in Table 7-2 is the negative development of within-constituency Goal Coherence of the Management constituency (effect of -.408), which gives rise to our doubts. Apparently, the highest responsible constituency of the business unit had got confused in anticipation of the corporate decision, resulting in a profound decline of consensus on goal priorities. In an attempt to rule out the impact of the specific situation on the demonstration of effects, we pretended in a follow-up analysis as if the Management constituency had maintained its ordering preferences after the management approval meeting. For this purpose, we used the pretest ranking data for posttest purposes as well. The resulting CATPCA data and measures of association are presented in Appendix F.

On the basis of these data, the 'non-crisis' equivalent of Table 7-2 is presented in Table 7-3. Obviously, the effect on within-constituency Goal Coherence of the Management constituency is zero given identical pretest and posttest data; the effect on within-constituency Goal Coherence of the Logistics constituency remains unchanged.

However, degrees of between-constituency Goal Coherence are improved by ruling out the impact of the corporate threat of closing down the business unit: effects of -.029 (in contrast to the previous -.197) and -.008 (in contrast to the previous -.368) in the supplementary analyses of the Management constituency and the Logistics constituency respectively.

Table 7-3: 'Non-crisis' equivalent of Table 7-2: Summary of operationalizations and effects.

	Management constituency		Logistics constituency	
Goal Coherence (i.e. association)	pretest	posttest	pretest	posttest
within-constituency	.756	.756	.481	.601
effect		**.000**		**.120**
between-constituency	.329	.300	.454	.446
effect		**-.029**		**-.008**

Compared to the strong and negative effects of Table 7-2, the neutral effects of approximately zero in Table 7-3 provide more credible support to the instrumental hypothesis of our research. We must exercise the greatest care though in the interpretation of this support from an experimental perspective, since there has been no matter of an experiment in the true sense of the word whatsoever.

7.3 STRATEGIC DIALOGUE AT THE MICRO LEVEL: THE STEELWORKS, THE ROLLING-MILL AND THE FINISHING-CENTER CONSTITUENCIES

The combined indicator proposals by the Quality constituency (see Appendix D) and the Logistics constituency (see Appendix G) were finally deployed as the relevant, operational ends to be discussed during the 'Strategic Dialogue' at the micro level. Unfortunately, we had no opportunity to facilitate the interrelated how-to-achieve question at this level of organizational analysis in order to identify and make explicit the relevant, operational means in light of common goal attainment. This was due to the decision by the Corporate Board of Directors of Corus to cease all activities related to the manufacturing and selling of long steel products at the site in IJmuiden in due time.

Abundantly clear, there were no further grounds to continue the Strategic Dialogue by the time we were planning design team meetings for the Steelworks, the Rolling-mill and the Finishing-center. However, we had arranged preliminary design team meetings in order to question the validity of the Tactical Process Indicators identified at the meso level that were to be deployed as the Operational Result Indicators at the micro level. These preliminary meetings provided us with pretest ranking data of the participating Steelworks constituency (see Subsection 7.3.1), Rolling-mill constituency (see Subsection 7.3.3) and Finishing-center constituency (see Subsection 7.3.5) for the purpose of measuring degrees of pretest within-constituency and between-constituency Goal Coherence. Due to the lost relevance of the Strategic Dialogue, no management approval meetings were organized. Hence, the posttest data collection as well as the measurement of posttest Goal Coherence and the testing of effects had to be cancelled.

7.3.1 The Steelworks constituency

In the Steelworks, liquid steel is produced from hot metal and subsequently cast into solid, square forging steel billets within a five-shift production system. Each shift operates during three successive day parts (i.e. the morning, the afternoon or the night) and is next two days off. As a consequence of the five-shift system, the Steelworks is operated twenty-four hours a day and seven days a week. Clearly, the five production shifts are mutually interdependent for achieving the Steelworks' goals.

For the purpose of Strategic Dialogue, the Steelworks constituency was composed as a local management team consisting of the plant manager and five shift managers. The specific composition of the Steelworks constituency aimed at stimulating perceptions of positive goal interdependence.

7.3.2 Design of Operational Result Indicators: collecting pretest data 'O'$_{1,M}$ and $O_{1,S}$

To get the dialogue on strategic priorities started, we asked each local manager individually to arrange the Operational Result Indicators of the Steelworks, listed in Table 7-4, in order of interest for the business unit's overall well-being during a preliminary design team meeting 'X'$_S$. At the suggestion of the plant manager, an Operational Result Indicator was added in order to measure the Steelworks' contribution to low cost performance. This indicator, termed Costs For Casting, was measured as what was internally called the 'phase costs' of the Steelworks. These 'phase costs' incorporate the variable costs and allocated fixed costs for the production phase of casting billets. Expressed per loading, Costs For Casting thus represent the (partial) Unit Cost for a cast loading of forging steel billets.

Table 7-4: Operational Result Indicators of the Steelworks.

What to achieve from a micro perspective: operational ends		
Production Capacity	(Throughput Volume)	• Cast Loadings
	(Material Yield)	• Casting Scrap
	(Stock Levels)	• Free For Rolling
Customer Satisfaction	(Quality Complaints)	• First Choices
	(Delivery Reliability)	• Casting Plan Conformity
	(Product Development)	• Test Loadings
Low Cost	(Unit Cost)	• Costs For Casting

The overall means of Production Capacity, Customer Satisfaction and Low Cost concerning the product/market combination Forging Steel/Automotive, thus implied for the Steelworks as part of the business unit to simultaneously pursue the following, local goals:

- increase the number of Cast Loadings;
- decrease the percentage of Casting Scrap;
- increase the number of loadings Free For Rolling;
- increase the number of First Choices;
- increase the degree of Casting Plan Conformity;
- increase the number of Test Loadings;
- decrease the average Costs For Casting.

Mind that these local goals are conflicting in nature. E.g., an exclusive focus on decreasing the percentage of Casting Scrap will most certainly produce a decrease in the degree of Casting Plan Conformity, or an exclusive focus on increasing the number of Cast Loadings will leave no room for increasing the number of Test Loadings.

Despite the lacking design team meeting X_M of the Management constituency on the micro goals of the Steelworks, we were able to measure pretest degrees of between-constituency Goal Coherence. For this purpose, we assumed consistent ordering preferences by the Management constituency. In Table 7-4, the macro level performance indicators of the Management constituency are indicated between brackets. From these indicators, the micro level performance indicators of the Steelworks constituency were deployed by the Quality and by the Logistics constituency at the meso level. Concretely, we assume that if the Management constituency would highly value e.g. business unit performance on Unit Cost, it will consistently value Steelworks performance on Costs For Casting. The assumption of consistent ordering preferences allows for the substitution of general management's micro goal ordering preferences, in this case regarding the Steelworks, by general management's macro goal ordering preferences regarding the organization as a whole. Concretely, ranking data '$O'_{I,M}$ is substituted by the posttest data in the analysis of the Quality constituency (recall that the posttest ranking data in the analysis of the Logistics constituency was not representative due to the corporate threat at the time). The same assumption is applied in Subsection 7.3.3 regarding the micro goals of the Rolling-mill and in Subsection 7.3.5 regarding the micro goals of the Finishing-center.

Appendix H contains the categorical data sets '$O'_{I,M}$ and $O_{I,S}$, the results of the CATPCA analyses, the quantification of pretest degrees of Goal Coherence within and between the Management constituency and the Steelworks constituency by the measure of association, and the graphic representations of vector and point coordinates, visualizing degrees of Goal Coherence.

7.3.3 The Rolling-mill constituency

In the Rolling-mill, the cast billets supplied by the Steelworks are rolled into square forging steel billets with smaller sections or into round forging steel bars within a three-shift production system. Each shift operates during five successive day parts (i.e. the morning, the afternoon or the night) and is next two days off. Clearly, the three production shifts are mutually interdependent for achieving the Rolling-mill's goals.

For the purpose of Strategic Dialogue, the Rolling-mill constituency was composed as a local management team consisting of the plant manager and three shift managers. Hence, the specific composition of the Rolling-mill constituency aimed at stimulating perceptions of positive goal interdependence.

7.3.4 Design of Operational Result Indicators: collecting pretest data '$O'_{I,M}$' and $O_{I,R}$

Identical to the Steelworks constituency, we asked each local manager individually to arrange the Operational Result Indicators of the Rolling-mill, listed in Table 7-5, in order of interest for the business unit's overall well-being during a preliminary design team meeting 'X'_R'. At the suggestion of the plant manager, an Operational Result Indicator was added in order to measure the Rolling-mill's contribution to low cost performance. This indicator, termed Costs For Rolling, was also measured in terms of 'phase costs'. These 'phase costs' incorporate the variable costs and allocated fixed costs for the production phase of rolling square billets and round bars. Expressed per loading, Costs For Rolling thus represent the (partial) Unit Cost of a rolled loading of forging steel billets/bars.

Table 7-5: Operational Result Indicators of the Rolling-mill.

What to achieve from a micro perspective: operational ends		
Production Capacity	(Throughput Volume) (Material Yield) (Stock Levels)	• Rolled Loadings • Rolling Scrap • Free For Finishing
Customer Satisfaction	(Quality Complaints) (Delivery Reliability) (Product Development)	• First Choices • Rolling Plan Conformity • Round Tests
Low Cost	(Unit Cost)	• Costs For Rolling

The overall means of Production Capacity, Customer Satisfaction and Low Cost concerning the product/market combination Forging Steel/Automotive, thus implied for the Rolling-mill as part of the business unit to simultaneously pursue the following, local goals:

- increase the number of Rolled Loadings;
- decrease the percentage of Rolling Scrap;
- increase the number of loadings Free For Finishing;
- increase the number of First Choices;
- increase the degree of Rolling Plan Conformity;
- increase the number of Round Tests;
- decrease the average Costs For Rolling.

Mind that these local goals are conflicting in nature. E.g., an exclusive focus on increasing the number of Rolled Loadings will most certainly produce a decrease in the degree of Rolling Plan Conformity (as a consequence of the fixed rolling cycle). The reader is referred to Appendix I for the categorical data sets '$O'_{I,M}$' and $O_{I,R}$. In addition, Appendix I contains the results of the CATPCA analyses, the measures of association that quantify pretest degrees of Goal Coherence within and between the Management constituency and the Rolling-mill constituency, and the graphic representations of vector and point coordinates, visualizing degrees of Goal Coherence.

7.3.5 The Finishing-center constituency

In the Finishing-center, square forging steel billets and round forging steel bars supplied by the Rolling-mill are finished and made ready for shipment to the customer within a five-shift production system. Each shift operates during three successive day parts (i.e. the morning, the afternoon or the night) and is next two days off. Just as the Steelworks, the Finishing-center is hence operated twenty-four hours a day and seven days a week. Clearly, the five production shifts are mutually interdependent for achieving the Finishing-center's goals.

For the purpose of Strategic Dialogue, the Finishing-center constituency was composed as a local management team consisting of the plant manager and 5 shift managers. Hence, the specific composition of the Finishing-center constituency aimed at stimulating perceptions of positive goal interdependence.

7.3.6 Design of Operational Result Indicators: collecting pretest data ‘$O'_{I,M}$’ and $O_{I,F}$

We asked each local manager individually to arrange the Operational Result Indicators of the Finishing-center, listed in Table 7-6, in order of interest for the business unit's overall well-being during a preliminary design team meeting ‘X'_F’. At the suggestion of the plant manager, an Operational Result Indicator was added in order to measure the Finishing-center's contribution to low cost performance. This indicator, termed Costs For Finishing, was also measured in terms of ‘phase costs’. These ‘phase costs’ incorporate the variable costs and allocated fixed costs for the production phase of finishing square billets and round bars. Expressed per loading, Costs For Finishing thus represent the (partial) Unit Cost of a finished loading of forging steel billets/bars.

Table 7-6: Operational Result Indicators of the Finishing-center.

What to achieve from a micro perspective: operational ends		
Production Capacity	(Throughput Volume)	• Finished Tons
	(Material Yield)	• Finishing Scrap
	(Stock Levels)	• Work In Process
Customer Satisfaction	(Quality Complaints)	• Post-IRUS Infections
	(Delivery Reliability)	• Finishing Lead-time
	(Product Development)	• Round Repairtime
Low Cost	(Unit Cost)	• Costs For Finishing

The overall means of Production Capacity, Customer Satisfaction and Low Cost concerning the Forging Steel product/market combination, implied for the Finishing-center as part of the business unit to simultaneously pursue the following, local goals:

- increase the amount of Finished Tons;
- decrease the percentage of Finishing Scrap;
- decrease the amount of Work In Process;
- decrease the number of Post-IRUS Infections;
- decrease the Finishing Lead-time;
- decrease the Round Repairtime;
- decrease the average Costs For Finishing.

Mind that these local goals are conflicting in nature. E.g., decreasing the amount of Work In Process will probably increase the number of Post-IRUS Infections, or decreasing the Finishing Lead-time will probably result in an increase in Finishing Scrap. The reader is referred to Appendix J for the categorical data sets '$O'_{I,M}$ and $O_{I,F}$. In addition, Appendix J contains the results of the CATPCA analyses, the measures of association that quantify pretest degrees of Goal Coherence within and between the Management constituency and the Finishing-center constituency, and the graphic representations of vector and point coordinates, visualizing degrees of Goal Coherence.

7.3.7 Operationalizations of vertical Goal Coherence

The calculations in Appendices I, J and K of pretest degrees of Goal Coherence within and between the Management constituency and the Steelworks, the Rolling-mill and the Finishing-center constituencies respectively are summarized in Table 7-7. The table shows low degrees of consensus on goal priorities between vertically goal interdependent constituencies. Moreover, ordering preferences are even opposite between the Management constituency and the Finishing-center constituency, as indicated by the negative measures of association.

Table 7-7: Summary of operationalizations.

Goal Coherence (i.e. association)	Management constituency	Steelworks constituency	Management constituency	Rolling-mill constituency	Management constituency	Finishing-center constituency
within-constituency	.756	.562	.756	.701	.756	.375
between-constituency	.281	.175	.287	.194	-.414	-.094

The findings of Table 7-7 are furthermore illustrated by Figure 7-5. This figure shows the dominant dimensions in the CATPCA analyses of the pretest ranking data. As can be seen, the figure demonstrates the existence of divergent mental models of organizational effectiveness between general management and local management.

Most striking in Figure 7-5 is the fact that general management's overemphasis on low cost performance (as indicated by a high and positive metric priority) is not at all recognized by local management. More precisely, the Steelworks constituency and the Finishing-center constituency rate decreasing the Costs For Casting and decreasing the Costs For Finishing as unimportant for the business unit's overall good (as indicated by negative metric priorities), while the Rolling-mill constituency rates decreasing the Costs For Rolling as of average importance (as indicated by a metric priority near zero). In addition, the high interest of increasing Casting Plan Conformity as recognized by the Steelworks constituency, is disregarded by the Management constituency, as is the high interest of increasing Rolled Loadings as recognized by the Rolling-mill constituency. Regarding the Finishing-center, what its local management team finds of the utmost importance (decreasing Work In Process) is found least important by the business unit management team. Moreover, the dominant dimension each of these two latter constituencies is almost reversed!

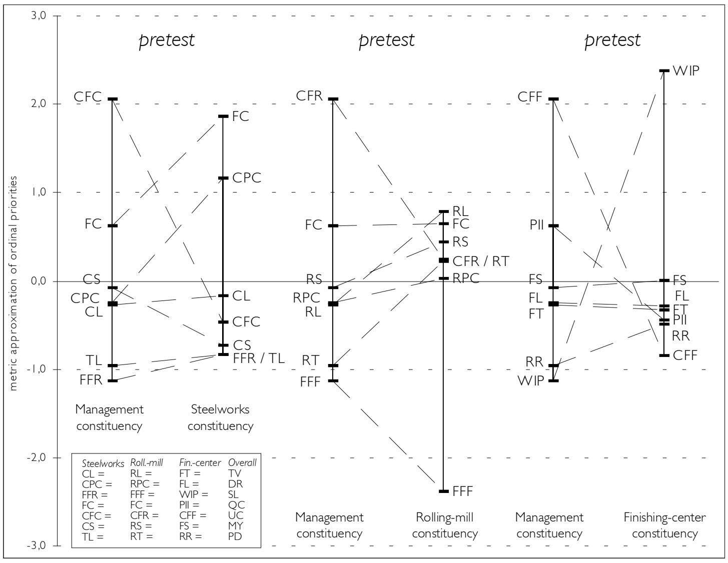

Figure 7-5: Similarity of dominant dimensions.

Given the situation of lacking consensus on goal priorities between top management and shop floor constituencies, it is all the more a pity that we did not have the opportunity to continue the Strategic Dialogue. This situation offered a promising basis for demonstrating additional effects and finding further support for the intervention's effectiveness.

To close this chapter on vertical Goal Coherence, the contents of Figure 7-5 introduce the next chapter of this monograph on horizontal Goal Coherence. As can be seen, goal priorities do not only differ between the vertically goal interdependent Management constituency and the shop floor constituencies, but, in addition, between the horizontally goal interdependent Steelworks, Rolling-mill and Finishing-center constituencies as well. Like the partial intervention of the current chapter, the Strategic Dialogue intervention of Chapter 8 could only be partially facilitated as well.

Chapter 8.
HORIZONTAL GOAL COHERENCE
PARTIAL INTERVENTION

This chapter covers the intervention of Strategic Dialogue between the Steelworks constituency, the Rolling-mill constituency and the Finishing-center constituency: three horizontally goal interdependent constituencies at the micro level of the Corus IJmuiden Long Products organization. Horizontal Goal Coherence refers to the degree of intra- and inter-group consensus on shared goal priorities between a customer- and a supplier-constituency. This chapter furthermore covers the intervention within each of the three operational units between horizontally goal interdependent production shifts.

8.1 INTRODUCTION

The meaning of Strategic Dialogue in this chapter is restricted to the preliminary design team meetings on strategic priorities only. The intervention between horizontally goal interdependent constituencies coincided with the intervention presented in the previous chapter at the micro level. Hence, the intervention could only be partially facilitated due to the corporate decision to cease all activities related to the producing and selling of long steel products at the IJmuiden production site. Follow-up design team meetings on the operationalization of short-term means-end relations into relevant Operational Result Indicators and Operational Process Indicators and the subsequent constructive controversy about the validity of the design proposals during management approval meetings could thus not be facilitated.

Therefore, this chapter contains no practical illustration of how to organize and facilitate the interactive process of Strategic Dialogue between horizontally goal interdependent constituencies; likewise, this chapter contains no demonstration of possible effects on degrees of horizontal Goal Coherence since the posttest data is lacking. However, based on the collection of pretest data during the preliminary design team meetings, this chapter illustrates the CATPCA technique and the derived measure of association to demonstrate divergent mental models of organizational effectiveness among horizontally goal interdependent customer- and supplier constituencies.

Horizontal goal interdependence regards the chain of operational constituencies that execute the non-physical and physical transformation of customer orders into finished products. This horizontal value chain is also referred to as the organization's order fulfillment process. Since Corus IJmuiden Long Products is mainly a production unit, our study focuses on the physical part of order fulfillment process, i.e. the physical transformation of hot metal into finished forging steel billets and bars in the Steelworks, the Rolling-mill and the Finishing-center.

Horizontal goal interdependence relations do not only relate to these three operational units (i.e. production plants) of the Corus IJmuiden Long Products business unit, but additionally relate to the production shifts within each of these units. The goal interdependent nature of the relation between the upstream Steelworks and the downstream Rolling-mill on the one hand, and between the upstream Rolling-mill and the downstream Finishing-center on the other hand is obvious: one can imagine these operational units being separated by external markets on which the Rolling-mill and the Finishing-center act as principals towards the respective Steelworks and Rolling-mill acting as agents.

However, the five production shifts of the Steelworks, the three production shifts of the Rolling-mill and the five production shifts of the Finishing-center are mutually goal interdependent as well: not in the sense that the one shift consumes the output supplied by the other shift in a chain of upstream and downstream transformation processes, but in the sense that the one shift successes the other shift in executing the same transformation process. Concretely, the multiple shifts of a single operational unit operate the same installations, plan and execute jobs based on the same weekly production schedule, deal with the same external suppliers and maintenance service providers, etc, thereby pursuing identical goals, however at successive moments in time.

Therefore, we operationalized degrees of horizontal Goal Coherence at the micro level between: 1) the three operational units, which is described in Section 8.2; 2) the three or five production shifts of each of these operational units, which is described in Section 8.3. For the purpose of measuring Goal Coherence between the Steelworks and the Rolling-mill constituency and between the Rolling-mill and the Finishing-center constituency, we used the pretest ranking data presented in Chapter 7. We did not have the opportunity to make the supplier-constituency directly rank the Operational Result Indicators of the customer-constituency during follow-up design team meetings. In order to measure pretest between-constituency Goal Coherence, we therefore assumed consistent ordering preferences by the agent constituency regarding the goals of the principal constituency. E.g., this assumption implies that if a local manager of the Steelworks would give a high priority to Casting Plan Conformity, which is deployed from the macro means of Delivery Reliability, he would prioritize the corresponding goal for the Rolling-mill in terms of Rolling Plan Conformity highly as well. A similar assumption of consistent ordering preferences was made in Chapter 7 regarding the Management constituency ranking the local goals of the vertically goal interdependent agent constituencies at the micro level.

The partial interventions presented in Section 8.2 between the local management constituencies, composed of the plant manager and his shift managers, are diagrammed in Figure 8-1, where S, R and F stand for Steelworks, Rolling-mill and Finishing-center constituency respectively, 'X' indicates the design team meetings to be preliminary in nature, and 'O' indicates the assumption of consistent ordering preferences by the agent constituency.

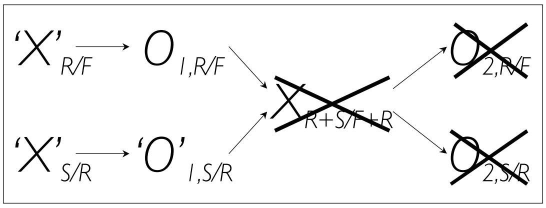

Figure 8-1: Partial design: Steelworks and Rolling-mill constituency and Rolling-mill and Finishing-center constituency.

For the purpose of measuring Goal Coherence within and between production shifts, we collected additional ranking data on the same micro level goals by inviting 55 first-line operators to participate in a preliminary design team meeting of the Strategic Dialogue. The five Steelworks Shift constituencies, the three Rolling-mill Shift constituencies and the five Finishing-center Shift constituencies were composed of one shift manager and a number of first-line operators, who were selected on educational grounds. In order to measure between-constituency Goal Coherence, we did not need to make the assumption of consistent ordering preferences. By ranking the Operational Result Indicators of the operational unit, which are identical for each of the unit's multiple production shifts, a shift constituency simultaneously and directly ranks the goals of its horizontally goal interdependent shift constituency. The partial intervention of Section 8.3 between two production shifts is diagrammed in Figure 8-2, where $S_{a/b}$, $R_{a/b}$ and $F_{a/b}$ stand for two successive Steelworks Shift, Rolling-mill Shift and Finishing-center Shift constituencies respectively, and 'X' indicates the design team meetings to be preliminary in nature.

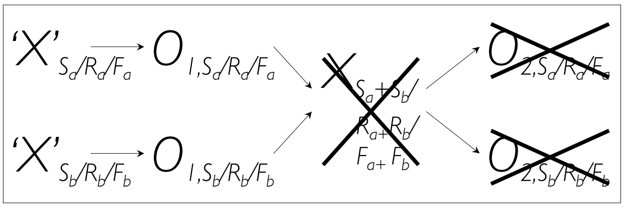

Figure 8-2: Partial design: two Steelworks, Rolling-mill and Finishing-center Shift constituencies.

8.2 STRATEGIC DIALOGUE AT THE MICRO LEVEL: OPERATIONAL UNITS

In this section, degrees of horizontal Goal Coherence are operationalized between the 3 operational units of the Corus IJmuiden Long Products business unit. Subsection 8.2.1 deals with the supplying Steelworks constituency and the consuming Rolling-mill constituency, while Subsection 8.2.3 deals with the supplying Rolling-mill constituency and the consuming Finishing-center constituency.

8.2.1 The Steelworks and the Rolling-mill constituency

The Steelworks and the Rolling-mill are horizontally goal interdependent in the sense that within the value chain of Corus IJmuiden Long Products, the downstream Rolling-mill consumes the cast forging steel billets supplied by the upstream Steelworks. Low performance by the upstream supplier – regarding the number of Cast Loadings, the degree of Casting Plan Conformity, the number of loadings Free For Rolling, the number of First Choices, the Costs For Casting, the amount of Casting Scrap and/or the number of Test Loadings – harms a potentially high performance on corresponding aspects of performance by the downstream customer – regarding the number of Rolled Loadings, the degree of Rolling Plan Conformity, the number of loadings Free For Finishing, the number of First Choices, the Costs For Rolling, the amount of Rolling Scrap and/or the number of Round Tests. In turn, low performance by the downstream customer might undo a possibly achieved high performance by the upstream supplier.

8.2.2 Design of Operational Result Indicators: collecting pretest data '$O'_{1,S}$' and $O_{1,R}$

The pretest ranking data of the Steelworks constituency and the Rolling-mill constituency have been previously presented in Chapter 7. The categorical data sets '$O'_{1,S}$' of the Steelworks constituency and $O_{1,R}$ of the Rolling-mill constituency are depicted in Table 8-1 and Table 8-2 respectively. The pretest feature of the data is highlighted by the figure 1 extension of the abbreviated constituency member names.

Table 8-1: Categorical data '$O'_{1,S}$': pretest of the Steelworks constituency.

	BRSN1	HSMN1	WTVR1	KNAP1	BSMA1	VRIS1
increase Rolled Loadings (RL)	7	5	2	1	6	5
increase Rolling Plan Conformity (RPC)	3	6	4	7	5	7
increase Free For Finishing (FFF)	2	3	1	5	1	4
increase First Choices (FC)	4	7	7	6	7	6
decrease Costs For Rolling (CFR)	5	4	6	4	2	3
decrease Rolling Scrap (RS)	6	2	5	3	4	2
increase Round Tests (RT)	1	1	3	2	3	1

Table 8-2: Categorical data $O_{1,R}$: pretest of the Rolling-mill constituency.

	LDON1	NLTN1	VLYN1	DVRS1
increase Rolled Loadings (RL)	7	3	6	7
increase Rolling Plan Conformity (RPC)	3	2	5	4
increase Free For Finishing (FFF)	2	1	1	1
increase First Choices (FC)	4	7	7	6
decrease Costs For Rolling (CFR)	5	5	2	3
decrease Rolling Scrap (RS)	6	6	4	2
increase Round Tests (RT)	1	4	3	5

8.2.3 The Rolling-mill and the Finishing-center constituency

Within the value chain of Corus IJmuiden Long Products, the downstream Finishing-center consumes the rolled forging steel billets and bars supplied by the upstream Rolling-mill. In a similar way as the Steelworks and the Rolling-mill, the Rolling-mill and the Finishing-center are thus horizontally goal interdependent in the sense that low performance by the upstream supplier – in this case regarding the number of Rolled Loadings, the degree of Rolling Plan Conformity, the number of loadings Free For Finishing, the number of First Choices, the Costs For Rolling, the amount of Rolling Scrap and/or the number of Round Tests – harms a potentially high performance on corresponding aspects of performance by the downstream customer – in this case regarding the amount of Finished tons, the length of the Finishing Lead-time, the amount of Work In Process, the number of Post-IRUS Infections, the Costs For Finishing, the amount of Finishing Scrap and/or the required Round Repairtime.

8.2.4 Design of Operational Result Indicators: collecting pretest data 'O'$_{I,R}$ and O$_{I,F}$

The pretest ranking data of the Rolling-mill constituency and the Finishing-center constituency have also been previously presented in Chapter 7. The reader is referred to Appendix K for the categorical data sets *'O'$_{I,R}$* of the Rolling-mill constituency and *O$_{I,F}$* of the Finishing-center constituency.

8.2.5 Operationalizations of horizontal Goal Coherence

The results of the CATPCA analyses of the pretest data in terms of vector coordinates (representing the subjects in the analysis) and point coordinates (representing the options in the analysis) are presented in Table 8-3 and Table 8-4 for the Steelworks constituency and the Rolling-mill constituency respectively.

Table 8-3: Dimension loadings and scores: pretest of the Steelworks constituency.

Active variable (Steelworks)	DIM1 loading	DIM2 loading	Supplementary variable (Rolling-mill)	DIM1 loading	DIM2 loading
BRSN1	-.028	.795	LDON1	-.028	.795
HSMN1	.986	.094	NLTN1	.505	.719
WTVR1	.663	.548	VLYN1	.798	.480
KNAP1	.782	-.573	DVRS1	.435	.446
BSMA1	.798	.480			
VRIS1	.844	-.438			
eigenvalue	3.371	1.692	eigenvalue	1.082	1.578
Cronbach's α	.844	.491	Cronbach's α	.101	.489
VAF (Σ=.844)	.562	.282	VAF (Σ=.665)	.270	.395
association	**.562**	.109	association	**.270**	.395

Unit (i.e. option)	DIM1 score	DIM2 score
Cast Loadings (CL)	-.172	.855
Casting Plan Conformity (CPC)	1.160	-1.721
Free For Rolling (FFR)	-.832	-1.056
First Choices (FC)	1.869	.935
Costs For Casting (CFC)	-.469	.702
Casting Scrap (CS)	-.725	.769
Test Loadings (TL)	-.832	-.485

Table 8-4: Dimension loadings and scores: pretest of the Rolling-mill constituency.

Active variable (Rolling-mill)	DIM1 loading	DIM2 loading	Supplementary variable (Steelworks)	DIM1 loading	DIM2 loading
LDON1	.587	.798	BRSN1	.587	.798
NLTN1	.925	.050	HSMN1	.306	-.348
VLYN1	.914	-.184	WTVR1	.814	-.199
DVRS1	.876	-.395	KNAP1	.023	-.536
			BSMA1	.914	-.184
			VRIS1	.166	-.513
eigenvalue	2.803	.829	eigenvalue	1.964	1.382
Cronbach's α	.858	-.275	Cronbach's α	.589	.332
VAF (Σ=.908)	.701	.207	VAF (Σ=.558)	.327	.230
association	**.701**	.112	association	**.327**	-.018

Unit (i.e. option)	DIM1 score	DIM2 score
Rolled Loadings (RL)	.788	.811
Rolling Plan Conformity (RPC)	.033	-1.160
Free For Finishing (FFF)	-2.378	.303
First Choices (FC)	.650	-.431
Costs For Rolling (CFR)	.242	.726
Rolling Scrap (RS)	.439	1.317
Round Tests (RT)	.226	-1.567

Concretely, Table 8-3 shows the non-metric transformation of Table 8-1 for determining the degree of pretest within-constituency Goal Coherence of the Steelworks constituency (association of .562), whereas Table 8-4 shows the non-metric transformation of Table 8-2 for determining the degree of pretest within-constituency Goal Coherence of the Rolling-mill constituency (association of .701). In addition, the supplementary analyses operationalize degrees of pretest between-constituency Goal Coherence in Table 8-4 for the Rolling-mill constituency (association of .270) and in Table 8-3 for the Steelworks constituency (association of .327).

The data of Table 8-3 and Table 8-4 regarding the supplementary variables in the CATPCA analyses are graphically depicted in Figure 8-3 and Figure 8-4, visualizing pretest degrees of Goal Coherence between the horizontally goal interdependent Steelworks and Rolling-mill constituencies. The displayed variance in vector angles illustrate the relatively low degree of inter-group consensus.

For the CATPCA analyses of the categorical data sets '$O'_{I,R}$ of the Rolling-mill constituency and $O_{I,F}$ of the Finishing-center constituency, the resulting measures of association and the graphic representations of vector and point coordinates, the reader is referred to Appendix K. The negative measures of association of -.480 for the Rolling-mill constituency and -.363 for the Finishing-center constituency indicate divergent, or rather, opposite mental models of organizational effectiveness between these horizontally goal interdependent constituencies. This finding is furthermore illustrated by the negatively directed vectors upon the first dimension in the graphic representations of Appendix K.

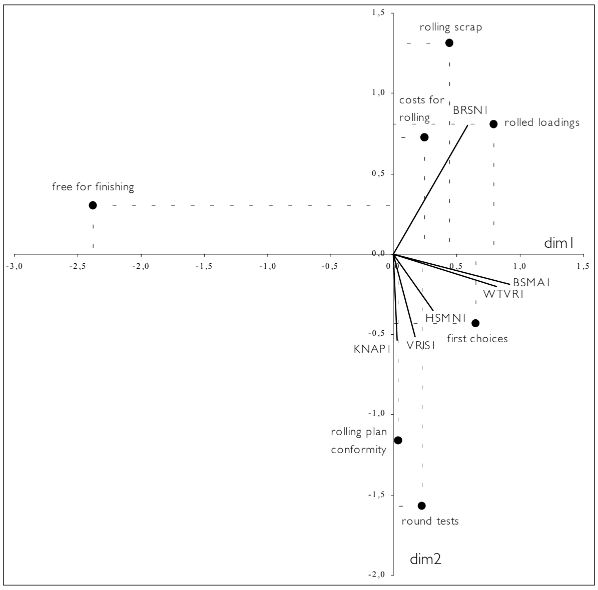

Figure 8-3: Supplementary pretest of the Steelworks constituency.

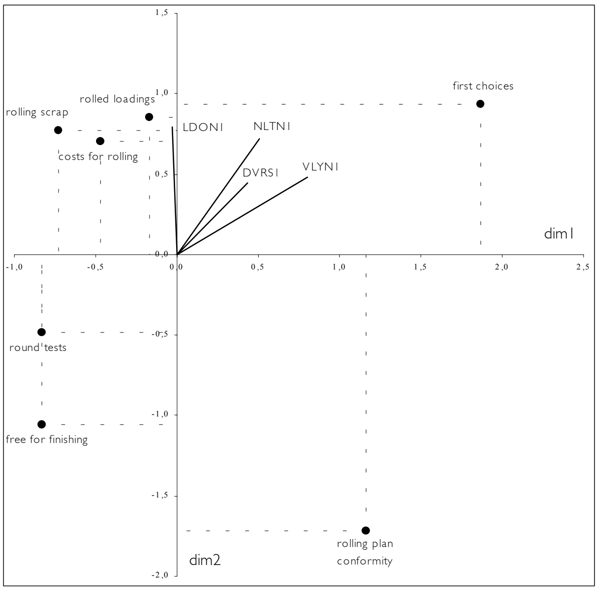

Figure 8-4: Supplementary pretest of the Rolling-mill constituency.

The previous calculations of pretest degrees of Goal Coherence within and between the Steelworks constituency, the Rolling-mill constituency and the Finishing-center constituency are summarized in Table 8-5.

Table 8-5: Summary of operationalizations.

Goal Coherence (i.e. association)	Steelworks constituency	Rolling-mill constituency	Rolling-mill constituency	Finishing-center constituency
within-constituency	.562	.701	.701	.375
between-constituency	.327	.270	-.480	-.363

The findings of Table 8-5 are furthermore illustrated by Figure 8-5. This figure shows the dominant dimensions in the CATPCA analyses of the pretest ranking data. As can be seen, the figure demonstrates the existence of divergent mental models of organizational effectiveness between the local management teams of three operational units within one value chain.

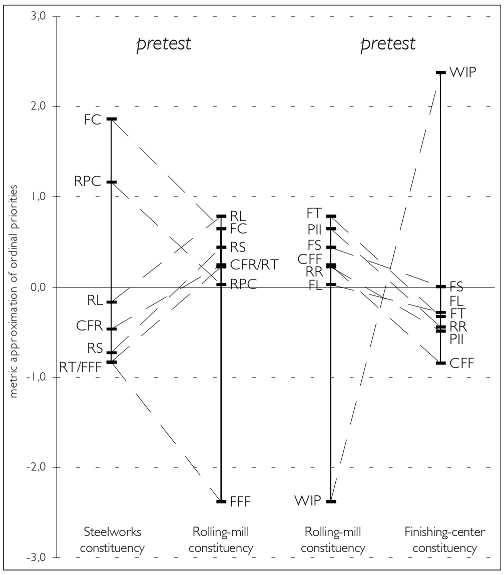

Figure 8-5: Similarity of dominant dimensions.

Most striking in Figure 8-5 are the reversed dimensions of the Rolling-mill and the Finishing-center constituencies. The opposite priorities are most strongly regarding the goal of decreasing Work In Process: an extreme low priority is attributed by the Rolling-mill constituency (metric priority of -2.378) and an extreme high priority is attributed by the Finishing-center constituency (metric priority of +2.380). The current high amount of Work In Process, caused by the logistical control structure as analyzed at the meso level by the Logistics constituency, is a thorn in the side of the Finishing-center constituency. The profusion of released work orders in the Finishing-center, piled on top of each other and jointly taking up all the available floor space, hampers the efficient and effective execution of finishing activities. From this perspective, the Finishing-center's concern for the amount of Work In Process is clear. However, this concern is not at all shared with the horizontally goal interdependent Rolling-mill constituency. This constituency does not bother to decrease the number of loadings Free For Finishing; the ambition is to produce as many loadings as possible, as indicated in Figure 8-5 by the high metric priority of +.788 attributed to the goal of increasing Rolled Loadings. The loadings that have been rolled but have not yet been given Free For Finishing, take up additional, valuable floor space in the Finishing-center. The Rolling-mill has no inventory facilities of its own, but is allowed to use the Finishing-center for this purpose.

In the perception of the Finishing-center constituency, their operational unit serves as 'the garbage can of the business unit', to be used by the upstream operational unit to dump its rolled loadings. Recall from the previous chapter that a similar disagreement on goal priorities was found between the vertically goal interdependent Management constituency and Finishing-center constituency: the importance of the goal of decreasing Stock Levels and thus of decreasing Work In Process was found of little interest by the Management constituency as well. In other words, the negative perception of the Finishing-center constituency being 'the garbage can of the business unit' is reinforced by general management.

The situation of lacking inter-group consensus on goal priorities between the operational units within the Corus IJmuiden Long Products value chain is clearly demonstrated. The counterproductive consequences are clear from Figure 8-5: next to the goal of decreasing Work In Process, the other valuable goals for the Finishing-center – and for the business unit! – are disregarded at all. The human resources of the Finishing-center are exclusively allocated to this one goal, which produces frustration since these efforts are demonstrated to be uncoordinated within the big picture.

8.3 STRATEGIC DIALOGUE AT THE MICRO LEVEL: PRODUCTION SHIFTS

In this section, degrees of horizontal Goal Coherence are operationalized between the shifts of each operational unit. Subsection 8.3.1 deals with the 5 production shifts of the Steelworks, Subsection 8.3.2 with the 3 production shifts of the Rolling-mill and Subsection 8.3.3 with the 5 production shifts of the Finishing-center.

8.3.1 The Steelworks Shift constituencies

The multiple production shifts of a single operational unit are horizontally goal interdependent in the sense that the one shift successes the other shift in executing the same transformation process and pursuing the same goals. The Steelworks operates in a 5-shift system. These multiple shifts are indicated by colors as the Blue Shift, the Green Shift, the Red Shift, the White Shift and the Yellow Shift. A part of the fixed shift schedule of this operational unit is depicted in Table 8-6 ('m' stands for the morning shift that operates from 6 a.m. till 2 p.m., 'a' for the afternoon shift from 2 p.m. till 10 p.m. and 'n' for the night shift from 10 p.m. till 6 a.m.).

Table 8-6: Shift schedule of the Steelworks.

	day x	day x+1	day x+2	day x+3	day x+4	day x+5	day x+6	day x+7	day x+8	day x+9	day x+10	day x+11	day x+12	day x+13	day x+14
Blue Shift	n	n	•	•	a	a	a	•	•	m	m	m	•	•	n
Green Shift	m	m	m	•	•	n	n	n	•	•	a	a	a	•	•
Red Shift	•	a	a	a	•	•	m	m	m	•	•	n	n	n	•
White Shift	•	•	n	n	n	•	•	a	a	a	•	•	m	m	m
Yellow Shift	a	•	•	m	m	m	•	•	n	n	n	•	•	a	a

As can be seen, the Blue Shift hands over production to the Green Shift two out of three times and to the White Shift one out of three times, the Green Shift two out of three times to the Red Shift and one out of three times to the Yellow Shift, etc. On the basis of these statistics, we decided the Blue Shift and the Green Shift, the Green Shift and the Red Shift, the Red Shift and the White Shift, the White Shift and the Yellow Shift and the Yellow Shift and the Blue Shift to be horizontally goal interdependent.

8.3.1.1 Design of Operational Result Indicators: collecting pretest data $O_{1,S-b}$, $O_{1,S-g}$, $O_{1,S-r}$, $O_{1,S-w}$ and $O_{1,S-y}$

In addition to the five shift managers, 34 first-line operators were invited during preliminary design team meetings to discuss and rank the goals related to the Operational Result Indicators of the Steelworks in order of interest for the business unit's overall effectiveness. Unfortunately, 10 of these 34 operators did not respond to the ordering exercise for which they had been invited: they could not see the benefit of it in light of the current and uncertain situation. For the categorical data sets $O_{1,S-b}$, $O_{1,S-g}$, $O_{1,S-r}$, $O_{1,S-w}$ and $O_{1,S-y}$ for the Steelworks Blue Shift, Green Shift, Red Shift, White Shift and Yellow Shift constituencies respectively, the reader is referred to Appendix L.

8.3.1.2 Operationalizations of horizontal Goal Coherence

The results of the CATPCA analyses of the pretest ranking data are also presented in Appendix L. One of these analyses is presented in Table 8-7, which reveals 2 sets of supplementary variables, since each production shift is goal interdependent bilaterally upon a preceding and a succeeding shift.

Table 8-7: Dimension loadings and scores: pretest of the Steelworks Blue Shift constituency.

Active variable (Blue Shift)	DIM1 loading	DIM2 loading	Suppl. variable (Yellow Shift)	DIM1 loading	DIM2 loading	Suppl. variable (Green Shift)	DIM1 loading	DIM2 loading
HSMN1	.975	-.205	VRIS1	.502	-.670	KNAP1	.492	-.710
GRHS1	.919	.295	KPPS1	.646	.133	SPDR1	.848	-.006
GDHT1	.765	.638	TIJS1	.827	-.049	VDBS1	.506	-.638
HOOP1	.872	.347	BART1	.040	.611	HAAN1	-.001	.557
BNTJ1	.975	-.205	KUIL1	.975	-.205	TAS1	.527	-.058
TON1	.959	-.265						
SPBJ1	.980	-.173						
HWGH1	.962	-.247						
eigenvalue	6.897	.860	eigenvalue	2.305	.884	eigenvalue	1.495	1.225
Cronbach's α	.977	-.187	Cronbach's α	.708	-.163	Cronbach's α	.414	.229
VAF (Σ=.970)	.862	.107	VAF (Σ=.638)	.461	.177	VAF (Σ=.544)	.299	.245
association	**.862**	.046	association	**.461**	-.020	association	**.299**	-.121

Unit (i.e. option)	DIM1 score	DIM2 score
Cast Loadings (CL)	-.323	.864
Casting Plan Conformity (CPC)	.234	-1.841
Free For Rolling (FFR)	-.610	-.056
First Choices (FC)	2.331	.217
Costs For Casting (CFC)	-.231	1.583
Casting Scrap (CS)	-.725	-.299
Test Loadings (TL)	-.675	-.468

Degrees of Goal Coherence within and between the horizontally goal interdependent Steelworks Shift constituencies, which have been operationalized by the measure of association in Appendix L, are summarized in Table 8-8. This table demonstrates that there is a more than average agreement on goal priorities within as well as between the constituencies involved, with the exception of between-constituency Goal Coherence that regards the Steelworks Green Shift constituency.

Table 8-8: Summary of operationalizations.

Goal Coherence (i.e. association)	Blue Shift constituency	Green Shift constituency	Green Shift constituency	Red Shift constituency	Red Shift constituency	White Shift constituency	White Shift constituency	Yellow Shift constituency	Yellow Shift constituency	Blue Shift constituency
within-constituency	.862	.546	.546	.659	.659	.616	.616	.602	.602	.862
between-constituency	.381	.229	.356	.457	.766	.533	.567	.468	.461	.704

The findings of Table 8-8 are graphically illustrated in Figure 8-6 by the metric approximations of ordering preferences that are mostly shared within each of the Steelworks Shift constituencies. There is agreement on the interest of contributing to decreasing the number of reported Quality Complaints by the business unit's customers through increasing the cast loadings of First Choice in the Steelworks. Only the Steelworks Green Shift constituency rates the contribution to Delivery Reliability through increasing the degree of Casting Plan Conformity as of higher interest for the organization's well-being, which explains the relatively low degrees of between-constituency Goal Coherence regarding this constituency as reported in Table 8-8. Moreover, striving for the goal of increasing Casting Plan Conformity by this single shift will only result in wasting valuable and scarce human resources, if the other shifts – that operate upon the same casting plan – have not put this goal high on their agenda's as well.

Furthermore, Figure 8-6 reinforces a conclusion already drawn in Chapter 7 regarding the underestimated interest of low cost performance. Apparently, local management of the Steelworks convinced their first-line operators what to think is good and bad for their operational unit to strive for in light of common goal attainment: just as the Steelworks constituency (i.e. the local management of this operational unit), the five Steelworks Shift constituencies prove to find the goal of decreasing the Costs For Casting of low interest. From a macro perspective, the Management constituency has quite other ideas about the interest of this micro goal for the Steelworks.

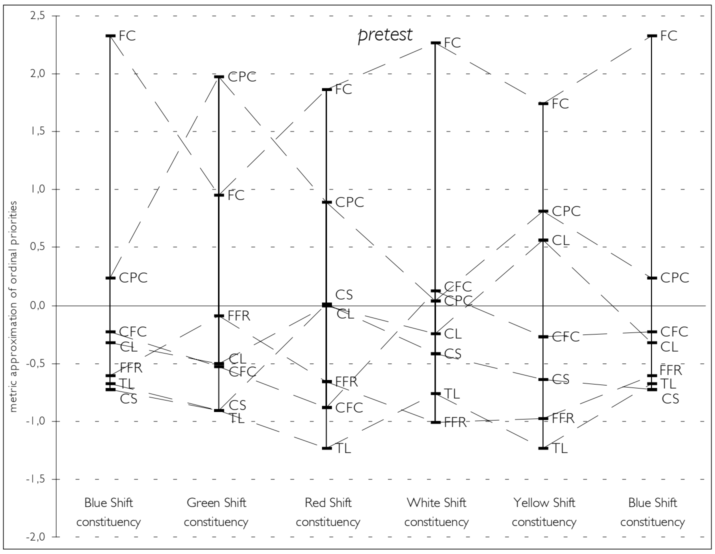

Figure 8-6: Similarity of dominant dimensions.

8.3.2 The Rolling-mill Shift constituencies

The Rolling-mill operates in a 3-shift system. These multiple shifts are numerically indicated as the First Shift, the Second Shift and the Third Shift. A part of the fixed shift schedule of this operational unit is depicted in Table 8-9.

Table 8-9: Shift schedule of the Rolling-mill.

	midweek					weekend		midweek					weekend		midweek				
1st Shift	m	m	m	m	m	•	•	n	n	n	n	n	•	•	a	a	a	a	a
2nd Shift	n	n	n	n	n	•	•	a	a	a	a	a	•	•	m	m	m	m	m
3rd Shift	a	a	a	a	a	•	•	m	m	m	m	m	•	•	n	n	n	n	n

As can be seen, the First Shift always hands over production to the Third Shift, the Third Shift always to the Second Shift and the Second Shift always to the First Shift. On the basis of the shift schedule, the First Shift and the Second Shift, the Second Shift and the Third Shift and the Third Shift and the First Shift are horizontally goal interdependent constituencies.

8.3.2.1 Design of Operational Result Indicators: collecting pretest data $O_{I,R-1}$,$O_{I,R-2}$ and $O_{I,R-3}$

In addition to the three shift managers, 14 first-line operators were invited during preliminary design team meetings to discuss and rank the goals related to the Operational Result Indicators of the Rolling-mill in order of interest for the business unit's overall effectiveness. For the categorical data sets $O_{I,R-1}$, $O_{I,R-2}$ and $O_{I,R-3}$ for the Rolling-mill First Shift, Second Shift and Third Shift constituencies respectively, the reader is referred to Appendix M. This appendix furthermore presents the CATPCA analyses and the resulting measures of association that operationalize degrees of horizontal Goal Coherence.

8.3.2.2 Operationalizations of horizontal Goal Coherence

The calculations in Appendix M of Goal Coherence within and between the horizontally goal interdependent Rolling-mill Shift constituencies are summarized in Table 8-10. This table demonstrates little agreement on goal priorities within the Rolling-mill Third Shift constituency, which in turn causes low degrees of between-constituency Goal Coherence between this constituency and the other two goal interdependent constituencies.

Table 8-10: Summary of operationalizations.

Goal Coherence (i.e. association)	First Shift constituency	Second Shift constituency	Second Shift constituency	Third Shift constituency	Third Shift constituency	First Shift constituency
within-constituency	.735	.719	.719	.227	.227	.735
between-constituency	.398	.547	.499	.117	.314	-.025

The findings of Table 8-10 are graphically illustrated by Figure 8-7. Most striking are the opposite interests regarding the goals of increasing Rolled Loadings and increasing Round Tests. These two goals are contradictory in nature: increasing the number of Round Tests has a negative impact on the number of regularly Rolled Loadings and, *vice versa*, increasing the number of Rolled Loadings leaves no machine time available for innovative Round Tests. The Rolling-mill Second Shift constituency and Third Shift constituency find the goal of increasing Round Tests to be of high interest and the goal of increasing Rolled Loadings to be of low interest (the Third Shift constituency even has an extreme opinion on this matter as can be seen in Figure 8-7), whereas the Rolling-mill First Shift constituency rates these goals exactly the other way round. Opposite interests moreover exist between the Third Shift constituency and the other two constituencies regarding the goal of increasing Rolling Plan Conformity. At least one of these mental models of organizational effectiveness is faulty, resulting in dysfunctional behavior of first-line operators which harms the contribution of their operational unit to the attainment of the overall goals of the business unit.

An additional observation regards the goal of decreasing the number of loadings that are Free For Finishing. Just as the local management team of the Rolling-mill (see Figure 8-5 in Subsection 8.2.5), the first-line operators of this operational unit have a low interest in this goal. The care for increasing the number of First Choices is apparently shared with the fellow first-line operators of the upstream Steelworks. The average interest in decreasing the Costs For Rolling is also shared with local management, which is contradictory with general management's ideas on the interest of low cost performance.

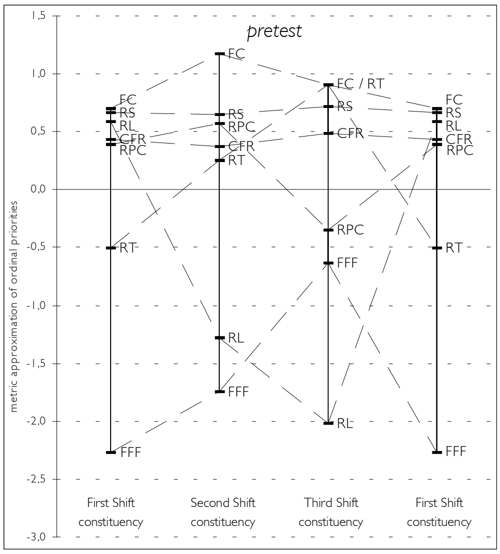

Figure 8-7: Similarity of dominant dimensions.

8.3.3 The Finishing-center Shift constituencies

Just as the Steelworks, the Finishing-center operates in a 5-shift system. The same, fixed shift schedule, as previously presented in Table 8-6, thus applies to the Finishing-center. Therefore, the same pairs of shifts are horizontally goal interdependent: the Blue Shift and the Green Shift, the Green Shift and the Red Shift, the Red Shift and the White Shift, the White Shift and the Yellow Shift and the Yellow Shift and the Blue Shift

8.3.3.1 Design of Operational Result Indicators: collecting pretest data $O_{1,F\text{-}b}$, $O_{1,F\text{-}g}$, $O_{1,F\text{-}r}$, $O_{1,F\text{-}w}$ and $O_{1,F\text{-}y}$

In addition to the 5 shift managers, 10 first-line operators were invited during preliminary design team meetings to discuss and rank the goals related to the Operational Result Indicators of the Finishing-center in order of interest for the business unit's overall effectiveness. For the categorical data sets $O_{1,F\text{-}b}$, $O_{1,F\text{-}g}$, $O_{1,F\text{-}r}$, $O_{1,F\text{-}w}$ and $O_{1,F\text{-}y}$ for the Finishing-center Blue Shift, Green Shift, Red Shift, White Shift and Yellow Shift constituencies respectively, the reader is referred to Appendix N. This appendix furthermore presents the CATPCA analyses and the resulting measures of association that operationalize degrees of horizontal Goal Coherence.

8.3.3.2 Operationalizations of horizontal Goal Coherence

Degrees of Goal Coherence within and between the horizontally goal interdependent Finishing-center Shift constituencies, which have been operationalized by the measure of association in Appendix N, are summarized in Table 8-11. This table demonstrates little agreement on goal priorities between the horizontally goal interdependent Shift constituencies of the Finishing-center; the table even demonstrates opposite interests where the Red Shift and White Shift constituencies are involved.

Table 8-11: Summary of operationalizations.

Goal Coherence (i.e. association)	Blue Shift constituency	Green Shift constituency	Green Shift constituency	Red Shift constituency	Red Shift constituency	White Shift constituency	White Shift constituency	Yellow Shift constituency	Yellow Shift constituency	Blue Shift constituency
within-constituency	.668	.731	.731	.343	.343	.407	.407	.862	.862	.668
between-constituency	.336	.398	.159	.267	-.047	-.121	.456	.746	.583	.026

The findings of Table 8-11 are graphically illustrated by Figure 8-8: the opposite interests between the Red Shift and the White Shift constituencies are clearly demonstrated: the goals that are found of high interest by the one constituency are found of low interest by the other and *vice versa*. At least one of the mental models of organizational effectiveness involved is faulty, which consequently hampers the contribution of the Finishing-center to common goal attainment.

Furthermore, the interest in the goal of increasing the number of Finished Tons causes discord between the operational unit's multiple constituencies. It is remarkable to see that the high interest in the goal of decreasing the amount of Work In Process by local management, is not shared by the first-line operators of the Finishing-center. The care for decreasing the number of Post-IRUS Infections, which contributes to the integral goal of decreasing Quality Complaints, is shared with the fellow first-line operators of the upstream Rolling-mill and Steelworks.

Again, the minor interest in low cost performance, here in terms of decreasing the Costs For Finishing, is shared with local management, which contradicts general management's interests.

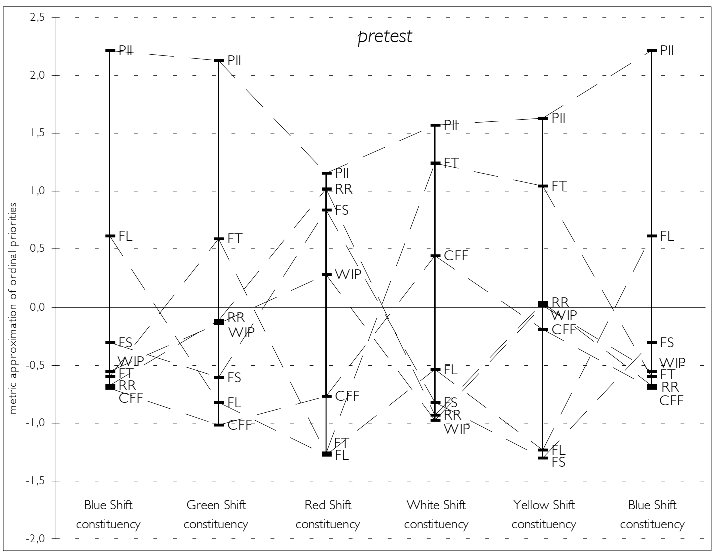

Figure 8-8: Similarity of dominant dimensions.

To close this chapter, we clearly demonstrated the existence of divergent and sometimes even opposite opinions on goal priorities between horizontally goal interdependent constituencies. From this perspective, it is all the more a pity that we did not have the opportunity to organize and facilitate moments of constructive controversy between these constituencies at Corus IJmuiden Long Products. The existence of disagreement on goal priorities represents a promising basis for finding further support for the Strategic Dialogue intervention's effectiveness. Despite the necessary and partial interventions, we can learn from our experiences and derive conditions for the effective application of the full intervention in future cases. A general reflection upon our empirical endeavor is the subject of the following and final chapter of this monograph.

Chapter 9.
GENERAL REFLECTION

This chapter presents the main research findings in relation to the practical research objective and the theoretical research question, revisits the leading construct of Goal Coherence, critically reflects upon the Strategic Dialogue at Corus IJmuiden Long Products and recommends directions for further research.

9.1 MAIN RESEARCH FINDINGS

This monograph has been presented as a search for Goal Coherence. In order to arrive at Goal Coherence, the intervention of Strategic Dialogue is proposed. The Strategic Dialogue is an organization-wide and interactive process, which prescribes the multilevel designing of performance measurement systems by the organization's multiple and goal interdependent constituencies. In practice, the application of the Strategic Dialogue results in a multilevel design of performance measurement systems. This product of designing is at all times unique, since it will be contingent upon the specifics of the organizational context in which the process of designing is facilitated.

The main research findings are presented in Subsection 9.1.1 as the achievement of the practical research objective by delivering the unique product of designing at Corus IJmuiden Long Products, and in Subsection 9.1.2 as the answer to the theoretical research question by the empirical demonstration of enhanced degrees of Goal Coherence after the intervention of Strategic Dialogue at Corus IJmuiden Long Products.

9.1.1 Achievement of the research objective

The objective of our research, repeated from Chapter 4, reads:

"To initiate and facilitate the Strategic Dialogue at the macro, meso and micro level of the Corus IJmuiden Long Products organization from the perspective of the enforced strategic redirection, and to deliver, as a result of this intervention, multiple performance measurement systems."

Recall the multilevel design of performance measurement systems presented in Figure 6-1 of Chapter 6. By delivering this multilevel product of designing, the practical research objective is achieved, albeit partially due to the premature ending of the Strategic Dialogue.

The value that is attributed to the multilevel product of designing is illustrated by the fact that the business unit's annual business plan was restructured on the basis of the overall performance indicators of Figure 6-1. The annual plan is the strategic document that is discussed quarterly with the Corporate Board of Directors during forecast meetings.

Another conclusion regarding the value of the multilevel product of designing is drawn in light of the existing ProMES systems in the Steelworks. Due to the circumstances, we have not been able to put the validity of these systems on the agenda, as planned, during follow-up design team meetings of the Steelworks Shift constituencies. However, in this final chapter, we do reflect upon the ProMES systems' validity in light of the proposed Operational Result Indicators of the Steelworks.

When taking a closer look at the contents of the ProMES systems, it first becomes clear that performance indicators are not differentiated to the business unit's product/market combinations. The Steelworks transforms loadings of hot metal supplied from the blast-furnaces into loadings of Forging Steel that are supplied to the Rolling-mill, loadings of Quality Steel and Merchant Steel that are supplied to the Finishing-center, and loadings of Rebar Steel that are supplied to the Rebar-mill. Each loading is managed through the Steelworks routing by the first-line operators on the basis of the same performance indicators. It might be that the same aspects of performance, such as costs and quality, apply to different products, which would justify the chosen approach. But it cannot be that a loading of high-quality Forging Steel requires the same level of performance compared to a loading of low-quality Merchant Steel. Moreover, a Forging Steel loading will require a different trade-off between multiple aspects of performance compared to a Merchant Steel loading. These perspectives on performance management are not recognized in the current design of the Steelworks' ProMES systems.

When taking a second look, it next becomes clear that the ProMES systems mainly focus the first-line operators' attention on two process parameters: the analysis or chemical composition and the temperature of the steel at successive stages in the Steelworks routing. The ProMES indicators that monitor these process parameters are exclusively linked to the goal of increasing the number of First Choice cast loadings. This implies that the ProMES systems (over)emphasize this single aspect of performance. Our observation is nicely illustrated by Figure 8-6 in the previous chapter: this figure demonstrates all Steelworks Shift constituencies besides one to rate First Choices by far as the most important goal to strive for. The Strategic Dialogue though has brought multiple aspects of performance regarding the Forging Steel product/market combination that require the Steelworks' time and attention. Besides quality i.e. First Choices, these multiple aspects of performance relate to quantity i.e. Cast Loadings, costs i.e. Costs For Casting, time i.e. Casting Plan Conformity, waste i.e. Casting scrap, innovation i.e. Test Loadings and stock i.e. Free For Rolling.

We thus can conclude that the contents of the organization's current ProMES systems are invalid and incomplete. Providing that this conclusion is indeed true, it implies a loss of human resources i.e. a loss of scarce time and attention. The multilevel product of designing presented in this monograph thus helps to diagnose the validity and completeness of existing ProMES systems. This feature furthermore underlines its value for Corus IJmuiden Long Products.

9.1.2 Answer to the research question

Our research question, repeated from Chapter 4, reads:

"Does the intervention of Strategic Dialogue positively affect degrees of Goal Coherence within and between Corus IJmuiden Long Products' multiple and goal interdependent constituencies?"

The main research question incorporates the instrumental hypothesis that is leading our research. This instrumental hypothesis is illustrated by our research approach in Figure 9-1, which is repeated from Chapter 1.

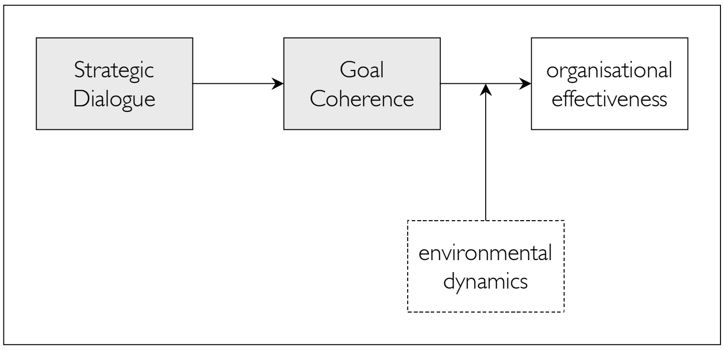

Figure 9-1: Research approach.

From the main research question, three sub-questions were derived that regard the measurement of a theoretical construct, the testing of an instrumental hypothesis and the generalizing of a unique finding:

1. "How can we operationalize the Goal Coherence construct?";
2. "How can we empirically demonstrate the effect of the Strategic Dialogue intervention on degrees of within-constituency and between-constituency Goal Coherence?";
3. "Under what conditions are the empirical findings of our unique case transmittable to other cases?" or, in other words, "What general design rules regarding the interactive process of designing can be derived from the empirical findings?"

Ad 1:

The construct of Goal Coherence has been defined in terms of group consensus on goal priorities. More precisely, two equivalents of Goal Coherence have been identified:

- Between-constituency Goal Coherence: "the degree of inter-group consensus (i.e. between 2 groups) on constituency goal priorities".
- Within-constituency Goal Coherence: "the degree of intra-group consensus (i.e. within 1 group) on constituency goal priorities".

Both constructs are logically related in the sense that the degree of Goal Coherence between constituencies is a function of the degree of Goal Coherence within constituencies: there can be no between-constituency Goal Coherence if the within-constituency equivalent is lacking.

Depending on the level of organizational analysis and the corresponding degrees of controllability by a specific constituency acting at that level, constituency goals either refer to the organizational goals at the macro level or to deployed goals at the meso and micro level. For the purpose of measuring degrees of inter-group and intra-group consensus on constituency goal priorities, we learned from the illustrative case study of Chapter 3 that constituency goal priorities should relate to those performance indicators which principal- and agent-constituencies jointly share.

Regarding vertically goal interdependent principal- and agent-constituencies (i.e. superior- and subordinate-constituencies), the relevant means as identified by the principal-constituency therefore have to correspond with the relevant ends as identified by the agent-constituency. Consequently, the process indicators of the principal-constituency correspond with the result indicators of the agent-constituency, causing the associated targets for these indicators (which are goals) to be shared between vertically goal interdependent constituencies. Regarding horizontally goal interdependent principal- and agent-constituencies (i.e. customer- and supplier-constituencies), the relevant ends as identified by the principal-constituency have to correspond with the relevant ends as identified by the agent-constituency. Consequently, the result indicators of the principal-constituency correspond with the result indicators of the agent-constituency, causing the associated targets for these indicators to be shared between horizontally goal interdependent constituencies.

By making constituency members order their performance indicators and associated goals, which they share with a vertically or horizontally goal interdependent constituency in the way as described above, degrees of within-constituency and between-constituency Goal Coherence can be operationalized through the application of CATPCA (Meulman and Heiser, 1999). The ordering exercise per constituency, which produces ranking i.e. categorical data, in fact reveals the mental models of the constituency members involved. Their views and opinions about what they think is good and bad in light of common goal attainment get translated into a one-dimensional mental model, which can be thought of as a straight line of equidistantly positioned goals. Most likely, these one-dimensional mental models of organizational effectiveness will be divergent across multiple individuals because of some well-known cognitive limitations of humans, as explained in Chapter 1, or because they simply do not agree. In other words, the categorical data set per constituency will be high-dimensional, incorporating divergent, one-dimensional mental models as multiple sources of variance.

Since CATPCA is a technique that reduces the dimensionality of a categorical data set, the dominant dimension that accounts for most of the variance found in the original data set can be identified. The dominant dimension is loaded upon most strongly by all variables in the data set. This dimension, which forms a metric equivalent of ordinal goal priorities due to the non-metric transformation of the original data as part of the CATPCA procedure, determines the degree of intra- and inter-group consensus. By correcting the calculation of VAF for the dominant dimension for opposite loading signs, a measure of correlation is produced that operationalizes the Goal Coherence construct, as illustrated in Chapter 6, 7 and 8. This measure varies between 0 and 1 regarding within-constituency Goal Coherence and between -1 and 1 regarding between-constituency Goal Coherence.

In case of our subject-oriented multivariate analysis, in which the subjects are the variables, the resulting measure of correlation should be interpreted as an intersubjective measure of association. Measures of intersubjectivity are commonly applied in social science research due to lacking measures of objectivity. In particularly, Q-methodology (Stephenson, 1953; Brown, 1986; McKeown and Thomas, 1988) has evolved as a science of the subjective. A common measure of association is represented by Cohen's Kappa (Cohen, 1960). The application of CATPCA in our study produces a new measure of association, which is calculated as (m being the number of variables in the analysis):

$$association = \frac{SSQ(loading_{pos}) - SSQ(loading_{neg})}{m}$$

Ad 2:

In order to empirically demonstrate the effect of the Strategic Dialogue intervention, we calculated pretest and posttest measures of association for Corus IJmuiden Long Products' goal interdependent constituencies, enabled by the two-group pretest-posttest research design. The treatment concerned the design team meeting and, moreover, the management approval meeting: a vital moment of constructive controversy on constituency goal priorities in light of the organization's overall well-being.

We intended to fully apply the two-group pretest-posttest design multiple times. However, we were not allowed to do so due to unfortunate circumstances. We thus have to restrict our findings to Chapter 6, which covered the full intervention between the Management constituency and the Quality constituency, which are vertically goal interdependent constituencies at the macro and meso level. The summary of operationalizations and effects is repeated from Chapter 6 in Table 9-1.

Table 9-1: Summary of operationalizations and effects.

	Management constituency		Quality constituency	
Goal Coherence (i.e. association)	pretest	posttest	pretest	posttest
within-constituency	.507	.756	.593	.930
effect		**.249**		**.337**
between-constituency	.191	.720	.163	.871
effect		**.529**		**.708**

Given effects greater than one, we can conclude that the Strategic Dialogue positively affects degrees of Goal Coherence within and between the vertically goal interdependent Management constituency and Quality constituency. As can be seen, this applies all the more to between-constituency Goal Coherence. This is a promising finding since especially the between-constituency equivalent of Goal Coherence is of major interest in search for a coordinated allocation of human resources. These findings thus provide support for the instrumental hypothesis of our research.

The partial intervention covered in Chapter 7 between the Management constituency and the Logistics constituency, which are also vertically goal interdependent constituencies at the macro and meso level, provides less convincing support for the Strategic Dialogue intervention's effectiveness. The summary of operationalizations and effects is repeated from Chapter 7 in Table 9-2.

Table 9-2: Summary of operationalizations and effects ('non-crisis' version).

	Management constituency		Logistics constituency	
Goal Coherence (i.e. association)	pretest	posttest	pretest	posttest
within-constituency	.756	.756	.481	.601
effect		**.000**		**.120**
between-constituency	.329	.300	.454	.446
effect		**-.029**		**-.008**

Due to the corporate threat at the time of closing down the business unit, a treatment comparable to the one in the previous analysis of the Management and the Quality constituency could unintentionally not be applied. The management approval meeting turned out to be some sort of a pseudo-event. The neutral effects of approximately zero in Table 9-2 can, from an experimental point of view, be interpreted as further support for the instrumental hypothesis of our research. We present our interpretations with the greatest care though, since an experiment design in the true sense of the word never was intended.

Unfortunately, we were not given the opportunity to provide any further support. After the corporate decision to close down the Corus IJmuiden Long Products business unit in due time, the Strategic Dialogue was ended prematurely. We were not able to facilitate follow-up design team meetings and management approval meetings by goal interdependent constituencies at the micro level of organizational analysis. This is all the more a pity, since in Chapter 7 we did demonstrate, by means of the pretest measures of association, low degrees of vertical Goal Coherence to exist between the Management constituency and the Steelworks, the Rolling-mill and the Finishing-center constituency. Likewise, we did demonstrate low degrees of horizontal Goal Coherence to exist between these local management constituencies and between the shop floor constituencies within each operational unit in Chapter 8. In light of the call for convergence, the diagnosis of lacking pretest Goal Coherence still is a finding of interest. The diagnosed situation offered a promising basis for demonstrating additional effects and finding further support for the instrumental hypothesis of the research.

Ad 3:

Recall from Chapter 1 the ultimate purpose of our study: to produce prescriptions i.e. design knowledge regarding the Strategic Dialogue intervention that change professionals in the practical field can apply to change an existing or create a new organizational reality (which means an organizational reality that is characterized by enhanced degrees of Goal Coherence). Especially the third sub-question is connected with the purpose of our scientific endeavor. For the purpose of producing design knowledge, a critical reflection is presented in Section 9.3 that produces the conditions for effectively transferring the Strategic Dialogue prescriptions to other contexts. First however, the leading construct of Goal Coherence is revisited in Section 9.2.

9.2 GOAL COHERENCE REVISITED

The search for Goal Coherence has been leading our research efforts. Goal Coherence is a group level construct that is of interest for the organization as a network of goal interdependent constituencies. This principal view of the organization requires its constituencies to positively perceive goal interdependence relations as such. The perception of positive goal interdependence is to contribute to a coordinated allocation of human resources across the organization's multiple constituencies. The basic idea of the research is that the organization's overall effectiveness benefits from such a coordinated allocation.

Humans in organizations allocate their personal resources in terms of time and energy to various courses of action in order to achieve multiple goals. Since these resources are scarce, tradeoffs regarding the interest of each goal need to be explicitly made. Such decision making is largely based on an individual's mental model of organizational reality: personal views and convictions of what is good and bad in light of the organization's overall wellbeing. Existing mental models within and between the organization's multiple and goal interdependent constituencies thus need to be convergent. In the first chapter of this monograph, we presented some well-known cognitive limitations of human beings that make it highly unlikely that, without a deliberate intervention, the existing mental models within the organization are indeed convergent.

The call for convergence, proclaimed by leading researchers in the fields of Organizational Psychology and Management Accounting, is adhered to in this research. In reaction to this call for convergence, the construct of Goal Coherence has been put forward. The measure of association that operationalizes the construct of Goal Coherence in fact expresses the degree in which the mental models among group members are similar i.e. convergent.

From this point of view, the relevance of a search for Goal Coherence seems indisputable for organization research. In studying the phenomenon, one should bare in mind its limitations. One major limitation concerns the risk of organizational myopia.

The empirical demonstration of high degrees of Goal Coherence does not at all have to mean that the convergent mental models of organizational actors are correct and consequently will foster functional decision making behavior. It is possible that goal priorities, on which a consensus is reached, have been derived from a faulty business strategy. Goal Coherence then causes the coordinated allocation of human resources to contribute to organizational ineffectiveness. In other words, the empirical demonstration of Goal Coherence says nothing of the validity of the contents of multiple performance measurement systems. This corresponds with our emphasis on the process of designing over the product of designing; our framework for multilevel designing prescribes the former rather than the latter, since we do not believe in a transferable design 'blueprint'.

The fact that Goal Coherence provides no proof of a performance measurement system's validity stresses the interest of the organization's capability of double loop learning (Argyris and Schön, 1978) in order to break the risk of organizational myopia. The Strategic Dialogue has been presented as a process of designing. But the process of designing is not finished after the initial design phase is finished with the delivery and implementation of the resulting products of designing. The Strategic Dialogue in fact is a recurring process of designing which continues during the subsequent phase of applying the performance measurement systems. During this phase of application, feedback meetings within and between goal interdependent constituencies should become events of hypothesis testing based on the reported result feedback (i.e. feedback on result indicators) and process feedback (i.e. feedback on process indicators). The question during these meetings should be whether the initial assumptions, translated into means-end relations at the macro, meso and/or micro level of organizational analysis, have remained valid. The answer to this question is periodically provided by the feedback reports. If the objective feedback on performance trends gives rise to questioning the validity of the system that produces the feedback, redesign proposals for performance indicators, performance targets and/or performance weight factors should be prepared and discussed during follow-up management approval meetings.

In other words, the threat of organizational myopia implies further prescriptions for the Strategic Dialogue intervention. Concretely, it is required that the Strategic Dialogue in practice is approached as a continuous, recurring event of explicating and testing hypothesized relations between means and ends. By doing so, the limitation of a search for Goal Coherence will be overcome.

9.3 TRANSFERRING THE STRATEGIC DIALOGUE

From a scientific point of view, it is impossible to make generalizations of a single study for the purpose of universal knowledge production. It is not even our ambition to produce a general law statement that passively explains an empirical reality. Our ambition is to learn from the active intervening in an empirical reality: we are not researching the truthfulness of a causal hypothesis, but the effectiveness of an instrumental hypothesis.

In the single case study of Corus IJmuiden Long Products, we empirically demonstrated the effectiveness of the instrumental relation between the intervention of Strategic Dialogue and the construct of Goal Coherence. Learning from this intervention means detecting the conditions which make the transfer of design knowledge to other cases beyond the scope of the initial case, in which its application has been demonstrated to be effective, just as effective. Thus, the transfer of the Strategic Dialogue as such to other organizational contexts is not the issue. This conviction is the result of our principal view of the organization as a network of multiple and goal interdependent constituencies. The issue though is which conditions in the organizational context will enhance the chance of the intervention to be effective.

Since design knowledge refers to the (interactive) process of designing and not to the (diagnostic) product of designing, we thus need to learn from the empirical design process that we have put in motion at the initial case by critically reflecting upon it. The choice for a participatory action research type (Whyte, 1991) allowed for the researcher's reflection-in-action (Schön, 1983; 1987). The result in terms of the conditions for the effective transfer of the Strategic Dialogue prescriptions to other cases is presented here.

Recognizing that further research is required as recommended in Subsection 9.4, this subsection contains practical clues for academic researchers and for professionals in the practical field, such as consultants and managers, who want to initiate and facilitate the Strategic Dialogue intervention elsewhere.

As explained in Chapter 4, the process of reflection aims at finding an answer to the question "Why does it work?". Translated to our research, this question is "Why does the Strategic Dialogue positively affect degrees of Goal Coherence in the case of Corus IJmuiden Long Products?". In Chapter 2, we mentioned some a-priori conditions for designing that ideally should be present. These conditions refer to:

- an organizational culture of respect, trust and openness;
- visible management commitment;
- a liberal management style;
- the individual willingness to contribute.

These conditions are basic and therefore appropriate for any organizational change process. Being part of the process of change at Corus IJmuiden Long Products, we revealed additional, specific conditions. These conditions refer to:

- the belief that Goal Coherence is important;
- the belief that Goal Coherence is insufficient.

For one thing, everyone in the organization valued the idea of designing overall performance indicators from the business strategy and deploying these indicators down to lower level constituencies. As a matter of fact, the organization was relieved that "finally someone is paying attention to explicitly linking the performance indicators of management to the performance indicators of the shop floor". Apparently, the idea of a strategic focus, translated throughout the organization by means of performance indicators, resulting in coordinated goals and coordinated priorities for different departments and units, was valued. In other words, it was believed that Goal Coherence was important. This belief was illustrated by the fact that the necessary succession of the Managing Director and the Controller, who had advocated the Strategic Dialogue, did not result in its premature ending. For many projects, such management instability will turn out to be the final blow. However, the belief that Goal Coherence was important was widely spread at Corus IJmuiden Long Products by the time the champions of the first hour were succeeded: a process of change was put in motion that could not be reversed.

In addition, the organization realized that in order to achieve the new business strategy, new performance indicators, new goals and new priorities were required. Management openly wondered whether they sufficiently saw through the consequences of the strategic redirection for the daily operations. Clearly, the degree of Goal Coherence was questioned as a direct consequence of the strategic shift from a high-volume producer of low-value added commodities to a low-volume producer of high-value added specialties. The belief that Goal Coherence is insufficient is thus an additional condition for the Strategic Dialogue intervention to be effective.

The belief that Goal Coherence is important corresponds with one of Pritchard's (1990) conditions for the effective implementation of a ProMES system. In addition, he mentions that the process of designing and implementing these operational control systems must be considered as a long-range organizational change effort which therefore is a time-consuming event. Since the Strategic Dialogue encompasses more than the designing of performance measurement systems for the organization's operational core, this condition is all the more applicable. Based on our experiences with the case of Corus IJmuiden Long Products, we propose additional conditions. These conditions do not refer directly to the effectiveness of the intervention, but indirectly through the shortening of its duration. Concretely, these conditions refer to:

- the availability of IT (information technology) interfaces;
- the role of the Controller;
- the consequences of understaffing.

We learned that the availability of IT interfaces in terms of automated data registration systems in combination with graphical applications has a profound impact on the speed of the process. As a result, performance indicator proposals can easily be illustrated with pictures. Such a picture, e.g. a histogram that shows the historic development of a specific performance indicator against the targeted performance level as illustrated in Appendix B and Appendix C, instantaneously tells the story of that performance indicator. Since humans are mainly graphically focused, pictures directly appeal to someone's imagination; they are unambiguous, need less explanation and consequently save a lot of discussion time during design team meetings and management approval meetings. This lesson is no novel finding but merely a confirmation of the well-known saying that 'a picture tells more than a thousand words'. Nonetheless, taking advantage of this lesson benefits the duration of the Strategic Dialogue intervention.

In relation to the former lesson, we learned about the changing role of the Controller, who is the formal owner of the organization's control systems and underlying data registration systems. Anthony's (1965, 1988) rather arbitrary distinction between management control and operational control has caused the focus of study within the Management Accounting discipline to be fixed almost exclusively on the former. Accordingly, the professional Controller in the practical field has developed the same focus. His/her responsibility primarily concerns the design of the management control system. However, according to Otley (1994), treating the management control function separately from other organisational controls is no longer valid for contemporary organisations. This statement connects with Scapens' (1998) remarks on organizational accounting. As a consequence, the responsibility of today's Controller should encompass the design of lower level control systems as well. The modern Controller who is aware of the required role change is an effective enabler of the Strategic Dialogue intervention.

A final lesson learned concerns the consequences of understaffing. A situation of understaffing had clearly developed through the years in our research case of Corus IJmuiden Long Products. As a consequence of understaffing, hardly any opportunity for organizational actors remained to distance oneself from daily matters. All available resources were required to execute the necessary operational activities. The Strategic Dialogue though requires participating actors to forget about everyday hassle and to focus on ways to improve and innovate. Concretely, participating actors should take the time to do so. Recognizing that the Strategic Dialogue is time-consuming anyhow, a situation of understaffing represents an unfavorable condition for its duration.

Academic researchers and professional practitioners such as consultants and managers who are considering to introduce the Strategic Dialogue elsewhere, should make an assessment of the conditions mentioned in this subsection in advance. Those who are already familiar with the Balanced Scorecard approach (Kaplan and Norton, 1992, 1993, 1996[a], 1996[b]) will find the Strategic Dialogue to be an enrichment of this approach.

The Balanced Scorecard has been presented in Chapter 1 as a product of research in the field of Management Accounting. The Balanced Scorecard relates to the macro level of organizational analysis, since the unit of analysis concerns the entire business unit. In their 1996 book, which is a practical guide illustrated with case studies, Kaplan and Norton are continuously speaking of creating shared understanding, aligning strategic initiatives, communicating throughout the organization, aligning departmental and personal goals, linking strategic objectives, cascading the business unit scorecard, etc. From the perspective of our research, we recognize a search for vertical Goal Coherence in their statements. Very briefly, they mention three mechanisms to achieve this: 1) communication and education programs; 2) goal setting programs; 3) reward system linkage. Especially the second mechanism connects with the Strategic Dialogue approach. Kaplan and Norton's suggestion to explicitly link traditional MBO (management-by-objectives) programs to the objectives and measures articulated in the Balanced Scorecard is not elaborated upon: it therefore remains unclear how the process of translating higher level goals into lower level goals by vertically goal interdependent constituencies is organized and facilitated (the notion of horizontal goal interdependence is left aside entirely). This elaboration though has been the subject of this monograph. The framework for the multilevel designing of performance measurement systems, presented as the Strategic Dialogue, thus represents an enrichment of the Balanced Scorecard.

Regarding the other applied field of research presented in Chapter 1, the field of Organizational Psychology, the Strategic Dialogue can be seen as an enrichment as well. The product of research from this field concerns the ProMES approach (Pritchard *et al.*, 1988, 1989; Pritchard, 1990, 1995). ProMES relates to the micro level of organizational analysis, since the unit of analysis concerns work units at the operational shop floor. The Strategic Dialogue provides the ProMES approach with a strategic frame of reference. As a consequence, ProMES is embedded in an organization-wide change process, without running the chance of remaining an isolated intervention ignoring vertically and horizontally goal interdependent constituencies.

9.4 RECOMMENDATIONS FOR FURTHER RESEARCH

To close this monograph, three directions to further research the instrumental relation between Strategic Dialogue and Goal Coherence are recommended.

First, we recommend to initiate additional case studies. The empirical case of Corus IJmuiden Long Products presented here is only the first in a required series of follow-up case studies. We have found support for the Strategic Dialogue's effect on degrees of Goal Coherence. Although promising, it can only be explained as preliminary support, due to its foundation on a single case study. It would be very interesting to find out what the Strategic Dialogue brings about in terms of Goal Coherence in other cases in the same industry, but also in other industries.

Second, we recommend to explicitly research the perception of goal interdependence at the group level to be the mechanism through which Strategic Dialogue affects Goal Coherence. This mechanism is assumed by us to account for the demonstrated effects. To find out whether our assumption is valid, pretest and posttest measurements of these perceptions should be incorporated in the recommended series of follow-up case studies.

Third, we recommend to explicitly research the intervention's consequences for organizational effectiveness. In our research, we logically assume Goal Coherence to benefit the organization's overall good; this relation, which provides relevance to our scientific efforts, is not as such researched by us. It would be very interesting to find out whether enhanced degrees of intra- and inter-group consensus on goal priorities indeed are beneficial for common goal attainment. For this purpose, the recommended series of follow-up case studies should be longitudinal in nature.

References

Ackoff, R.L. (1970). *A concept of corporate planning*. New York: John Wiley.

Ackoff, R.L. (1974). *Redesigning the future*. New York: John Wiley.

Adair, J.G. (1984). The Hawthorne effect: a reconsideration of the methodological artifact. *Journal of Applied Psychology*, 69, 334-345.

Akao, Y. (1991). *Hoshin Kanri: policy deployment for successful TQM*. Cambridge, MA: Productivity Press.

Aken, J.E., van (1994). De bedrijfskunde als ontwerpwetenschap [The study of management as a design science]. *Bedrijfskunde*, 66, 16-26.

Algera, J.A. & De Haas, M. (1999). Leistungsmanagement auf verschiedenen organisatorischen Ebenen [Performance management at different organizational levels]. In H. Holling, F. Lammers & R.D. Pritchard (Eds.), *Effektivität durch partizipatives Produktivitätsmanagement* (pp. 135-145). Göttingen, Germany: Hogrefe-Verlag.

Algera, J.A. (1990). Feedback systems in organizations. In C.L. Cooper, & I.T. Robertson (Eds.), *International review of industrial and organizational psychology*. Chichester, UK: John Wiley.

Alper, S., Tjosvold, D., & Law, K.S. (1998). Interdependence and controversy in group decision making: antecedents to effective self-managing teams. *Organizational Behavior and Human Decision Processes*, 74, 33-52.

Andriessen, E.J.H., & Drenth, P.J.D. (1984). Leadership: theories and models. In P.J.D. Drenth, Hk. Thierry, P.J. Willems, & C.J. de Wolff (Eds.), *Handbook of work and organizational psychology*. Chichester, UK: John Wiley.

Ansari, S.L. (1977). An integrated approach to control system design. *Accounting, Organizations and Society*, 2, 101-112.

Anthony, R.N. (1965). *Planning and control systems: framework for analysis*. Boston, MA: Harvard University.

Anthony, R.N. (1988). *The management control function*. Boston, MA: Harvard Business School Press.

Argyris, C., & Schön, D.A. (1978). *Organizational learning: a theory of action perspective*. Amsterdam: Addison-Wesley.

Ashby, W.R. (1958). *An introduction to cybernetics*. Chichester, UK: John Wiley.

Bertrand, J.W.M., Wortman, J.C., & Wijngaard, J. (1997). *Productiebeheersing en material management* [Production control and material management]. Leiden, The Netherlands: Stenfert-Kroese.

Bourgeois, L.J., III (1980). Performance and consensus. *Strategic Management Journal*, 1, 227-248.

Bourgeois, L.J., III (1985). Strategic goals, perceived uncertainty and economic performance in volatile environments. *Academy of Management Journal*, 28, 548-573.

Brown, S.R. (1986). Q-technique and method. In W. Berry, & M. Lewis-Beck (Eds.), *New tools for social scientists*. Beverly Hills, CA: Sage Publications.

Buren, P. van (1999). *Integrale goederenstroombeheersing* [Integral goods flow control]. Master's thesis, Eindhoven University of Technology, Eindhoven, The Netherlands.

Carroll, J. D. (1972). Individual differences and multidimensional scaling. In R. N. Shepard, A. K. Romney, & S. B. Nerlove (Eds.), *Multidimensional scaling: theory and applications in the behavioral sciences* (pp. 105-155). New York: Seminar Press.

Checkland, P., & Scholes, J. (1990). *Soft systems methodology in action*. Chichester, UK: John Wiley

Cohen, J. (1960). A coefficient of agreement for nominal scales. *Educational and Psychological Measurement*, 20, 37-46.

Cohen, M.D., March, J.G., & Olsen, J.P. (1972). A garbage can model of organizational choice. *Administrative Science Quarterly*, 17, 1-25.

Connolly, T., Conlon, E.J., & Deutsch, S.J. (1980). Organizational effectiveness: a multiple-constituency approach. *Academy of Management Review*, 5, 211-217.

Cook, T.D., & Campbell, D.T. (1979). *Quasi-experimentation: design and analysis issues for field settings*. Chicago: Rand McNally.

Cronbach, L.J., & Gleser, G.C. (1953). Assessing similarity between profiles. *Psychological Bulletin*, 50, 456-473.

Cyert, R.M., & March, J.G. (1963). *A behavioral theory of the firm*. Englewood Cliffs, NJ: Prentice-Hall.

Dess, G.G. (1987). Consensus on strategy formulation and organizational performance: competitors in a fragmented industry. *Strategic Management Journal*, 8, 259-277.

Deutsch, M. (1949). A theory of cooperation and competition. *Human Relations*, 2, 129-152.

Deutsch, M. (1973). *The resolution of conflict*. New Haven, CT: Yale University Press.

Deutsch, M. (1980). Fifty years of conflict. In L. Festinger (Ed.), *Retrospections on social psychology*. New York: Oxford University Press.

Deutsch, M. (1990). Sixty years of conflict. *The International Journal of Conflict Management*, 1, 237-263.

Dorf, R.C., & Bishop, R.H. (1995). *Modern control systems*. Amsterdam: Addison-Wesley.

Dörner, D. (1980). On the difficulties people have in dealing with complexity. *Simulation and Games*, 11, 87-106.

Earley, P.C., Northcraft, G.B., Lee, C., & Lituchy, T. (1990). Impact of process and outcome feedback on the relation of goal setting to task performance. *Academy of Management Journal*, 33, 87-105.

Eccles, R.G. (1991). The performance measurement manifesto. *Harvard Business Review*, 69, 131-137.

Emery, F.E., & Trist, E.L. (1969). Socio-technical systems. In F.E. Emery (Ed.), *Systems thinking* (pp. 281-296). Harmondsworth, UK: Penguin Books.

Etzioni, A. (1964). *Modern organizations*. Englewood Cliffs, NJ: Prentice-Hall.

Euske, K.J., Lebas, M.J., & McNair, C.J. (1993). Performance management in an international setting. *Management Accounting Research*, 4, 275-299.

Franklin, G.F., Powell, J.D., & Emami-Naeini, A. (1994). *Feedback control of dynamic systems*. Amsterdam: Addison-Wesley.

Gabriel, K.R. (1971). The biplot graphic display of matrices with application to principal components analysis. *Biometrika*, 58, 453-467.

Galbraith, J.R. (1973). *Designing complex organizations*. London: Addison-Wesley.

Gentner, D., & Stevens, A.L. (1983). *Mental models*. Hillsdale, NJ: Erlbaum.

Gifi, A. (1990). *Nonlinear multivariate analysis*. Chichester, UK: John Wiley.

Goldratt, E.M., & Cox, J. (1992). *The goal: a process of ongoing improvement*. Great Barrington, MA: North River Press.

Gower, J.C., & Meulman, J.J. (1993). The treatment of categorical information in physical anthropology. *International Journal of Anthropology*, 8, 43-51.

Grinyer, P.H., & Norburn, D. (1975). Planning for existing markets: perceptions of executives and financial performance. *The Journal of the Royal Statistical Society*, 138, 70-97.

Groot, A.D., de (1961). *Methodologie: grondslagen van onderzoek en denken in de gedragswetenschappen* [Methodology: principals of research and thinking in the behavioral sciences]. The Hague, The Netherlands: Mouton.

Gupta, A.K., & Govindarajan, V. (1984). Business unit strategy, managerial characteristics and business unit effectiveness at strategy implementation. *Academy of Management Journal*, 27, 25-41.

Guzzo, R.A., Jette, R.D., & Katzell, R.A. (1985). Effects on psychologically based intervention programs on worker productivity: a meta-analysis. *Personnel Psychology*, 38, 275-291.

Haas, M. de, & Kleingeld, P.A.M. (1999). Multilevel design of performance measurement systems: enhancing strategic dialogue throughout the organization. *Management Accounting Research*. 10, 233-261.

Haas, M., de, Algera, J.A., Van Tuijl, H.F.J.M. & Meulman, J.J. (2000). Macro and micro goal setting: in search of coherence. *Applied Psychology: an International Review*, 49, 577-593.

Ham, Th., van der, Meulman, J.J., Van Strien, D.C., & Van Engeland, H. (1997). Empirically based subgrouping of eating disorders in adolescents: a longitudinal perspective. *British Journal of Psychiatry*, 170, 363-368.

Heiser, W.J., & Meulman, J.J. (1983). Analyzing rectangular tables by joint and constrained multidimensional scaling. *Journal of Econometrics*, 22, 139-167.

Heiser, W.J., & Meulman, J.J. (1994). Homogeneity analysis: exploring the distribution of variables and their nonlinear relationships. In M. Greenacre, & J. Blasius (Eds.), *Correspondence analysis in the social sciences: recent developments and applications* (pp. 179-209). New York: Academic Press.

Heiser, W.J., & Meulman, J.J. (1995). Nonlinear methods for the analysis of homogeneity and heterogeneity. In W.J. Kzranowski (Ed), *Recent advances in descriptive multivariate analysis* (pp. 51-89). Oxford, UK: Oxford University Press.

Hinsz, V.B. (1995). Mental models of groups as social systems. *Small Group Research*, 26, 200-233.

Hogarth, R. (1987). *Judgement and choice*. Chichester, UK: John Wiley.

Hronec, S.M. (1993). *Vital signs: using quality, time and cost performance measurements to chart your company's future*. New York: Amacom.

Ickes, W., & Gonzales, R. (1994). "Social" cognition and *social* cognition: from the subjective to the intersubjective. *Small Group Research*, 25, 294-315.

Ilgen, D.R., Fisher, C.D., & Taylor, M.S. (1979). Consequences of individual feedback on behavior in organizations. *Journal of Applied Psychology*, 64, 349-371.

Imai, M. (1986). *Kaizen: the key to Japan's competitive success*. New York: Random House Business Division.

Jensen, M.C., & Meckling, W. (1976). Theory of the firm: managerial behavior, agency costs and ownership structure. *Journal of Financial Economics*, 3, 305-360.

Johnson, D.W., Johnson, R.T., Smith, K., & Tjosvold, D. (1990). Pro, con, and synthesis: training managers to engage in constructive controversy. In B. Sheppard, M. Bazerman, & R. Lewicki (Eds.), *Research in negotiations in organizations*. Greenwich, CT: JAI Press.

Johnson, G., & Scholes, K. (1993). *Exploring corporate strategy*. London: Prentice-Hall.

Johnson, H.T., & Kaplan, R.S. (1987). *Relevance lost: the rise and fall of management accounting*. Boston, MA: Harvard Business School Press.

Johnson-Laird, P.N. (1983). *Mental models*. Cambridge, MA: Harvard University Press.

Juran, J.M. (1964). *Managerial breakthrough: a new concept of the manager's job*. New York: McGraw-Hill.

Kaplan, R.S. (1998). Perspectives on field research in management accounting – innovation action research: creating new management theory and practice. *Journal of Management Accounting Research*, 30, 89-118.

Kaplan, R.S., & Norton, D.P. (1992). The balanced scorecard: measures that drive performance. *Harvard Business Review*, 70, 71-79.

Kaplan, R.S., & Norton, D.P. (1993). Putting the balanced scorecard to work. *Harvard Business Review*, 71, 134-147.

Kaplan, R.S., & Norton, D.P. (1996[a]). Using the balanced scorecard as a strategic management system. *Harvard Business Review*, 74, 75-85.

Kaplan, R.S., & Norton, D.P. (1996[b]). *The balanced scorecard: translating strategy into action*. Boston, MA: Harvard Business School Press.

Kasanen, E., Lukka, K., & Siitonen, A. (1993). The constructive approach in management accounting research. *Journal of Management Accounting Research*, 5, 243-264.

Katz, D., & Kahn, R.L. (1978). *The social psychology of organizations*. New York: John Wiley.

Kerkhof, A.J.F.M., Van der Wal, J., & Hengeveld, M.W. (1988). Typology of persons who attempted suicide with predictive value for repetition: a prospective cohort study. In H.J. Möller, A. Schmidtke, & R. Welz (Eds.), *Current issues of suicidology* (pp. 194-203). Berlin: Springer-Verlag.

Kleingeld, P.A.M. (1994). *Performance management in a field service department: design and transportation of a productivity measurement and enhancement system*. Monograph, Eindhoven University of Technology, Eindhoven, The Netherlands.

Kopelman, R.E. (1982). Improving productivity through objective feedback: a review of the evidence. *National Productivity Review*, 2, 43-55.

Kopelman, R.E. (1986). Objective feedback. In E.A. Locke (Ed.), *Generalizing from laboratory to field settings*. Lexington, MA: Lexington Books.

Kotter, J.P. (1982). *The general managers*. New York: Free Press.

Kruskal, J.B., & Shepard, R. N. (1974). A nonmetric variety of linear factor analysis. *Psychometrika*, 39, 123-157.

Krzanowski, W.J., & Marriott, F.H.C. (1994). *Multivariate analysis, part 1: distributions, ordination and inference*. London: Edward Arnold.

Kuipers, H. & Van Amelsfoort, P. (1990). *Slagvaardig organiseren* [Organizing effectively]. Deventer, The Netherlands: Kluwer Bedrijfswetenschappen.

Kuo, B.C. (1995). *Automatic control systems*. London: Prentice-Hall.

Langfield-Smith, K. (1997). Management control systems and strategy: a critical review. *Accounting, Organizations and Society*, 22, 207-232.

Latham, G.P., & Locke, E.A. (1991). Self-regulation through goal setting. *Organizational Behavior and Human Decision Processes*, 46, 212-247.

Lawler, E.E., III (1976). Control systems in organizations. In M.D. Dunnette (Ed.), *Handbook of industrial and organizational psychology*. Chicago: Rand McNally College Publishing Company.

Lawrence, P., & Lorsch, J. (1967). *Organization and environment*. Boston, MA: Harvard Business School.

Lebas, M. (1994). Managerial accounting in France: overview of past tradition and current practice. *European Accounting Review*, 3, 471-488.

Leeuw, A.C.J., de (1996). *Bedrijfskundige methodologie* [Methodology of research in management science]. Assen, The Netherlands: Van Gorcum.

Lewin, K. (1951). *Field theory in social science*. New York: Harper and Row.

Likert, R. (1961). *New patterns of management*. London: McGraw-Hill.

Likert, R. (1967). *The human organization: its management and value*. London: McGraw-Hill.

Locke, E.A., & Latham, G.P. (1990). *A theory of goal setting and task performance*. Englewood Cliffs, NJ: Prentice-Hall.

Locke, E.A., & Schweiger, D.M. (1979). Participation in decision making: one more look. In B. Staw (Ed.), *Research in organizational behavior*. Geenwich, CT: JAI Press.

Lynch, R.L., & Cross, K.F. (1991). *Measure up: yardsticks for continuous improvement*. Cambridge, MA: Blackwell.

March, J.G., & Simon, H.A. (1958). *Organizations*. New York: John Wiley.

Mattessich, R. (1995). Conditional-normative accounting methodology: incorporating value judgements and means-end relations of an applied science. *Accounting, Organizations and Society*, 20, 259-285.

McGregor, D. (1960). *The human side of enterprise*. New York: McGraw-Hill.

McKeown, B., & Thomas, D. (1988). *Q-methodology*. Newbury Park, CA: Sage Publications (series: Quantitative applications in the social sciences, paper 66).

Meulengraaf, H.J.T., van de (1997). *Een prestatie meetsysteem voor logistieke customer service* [A performance measurement system for logistical customer service]. Master's thesis, Eindhoven University of Technology, Eindhoven, The Netherlands.

Meulman, J.J. (1992). The integration of multidimensional scaling and multivariate analysis with optimal transformations. *Psychometrika*, 57, 539-565.

Meulman, J.J., & Heiser, W.J. (1999). *SPSS Categories 10.0*. Chicago: SPSS Inc.

Miller, G.A. (1956). The magical number seven, plus or minus two: some limits on our capacity for processing information. *The Psychological Review*, 63, 81-97.

Miller, K.I., & Monge, P.R. (1986). Participation, satisfaction and productivity: a meta-analytical review. *Academy of Management Journal*, 29, 727-753.

Mintzberg, H. (1990). Strategy formation: schools of thought. In J.W. Frederickson (Ed.), *Perspectives on strategic management* (pp. 105-235). New York: Harper and Row.

Mintzberg, H., & Quinn, J.B. (1991). *The strategy process: concepts, contexts, cases*. London: Prentice-Hall.

Moorhead, G., & Griffin, R.W. (1992). *Organizational behavior: managing people and organizations*. Boston, MA: Houghton Mifflin.

Naylor, J.C., Pritchard, R.D., & Ilgen, D.R. (1980). *A theory of behavior in organizations*. New York: Academic Press

Neisser, U. (1967). *Cognitive psychology*. New York: Appleton-Century-Crofts.

Otley, D.T. (1994). Management control in contemporary organizations: towards a wider framework. *Management Accounting Research*, 5, 289-299.

Otley, D.T., & Berry, A.J. (1980). Control, organization and accounting. *Accounting, Organizations and Society*, 5, 231-244.

Ouchi, W.G. (1979). A conceptual framework for the design of organizational control mechanisms. *Management Science*, 25, 833-848.

Pennings, J.M., & Goodman, P.S. (1977). Toward a workable framework. In P.S. Goodman, & J.M. Pennings (Eds.), *New perspectives on organizational effectiveness*. San Francisco: Jossey-Bass.

Perrow, C. (1970). *Organizational analysis: a sociological review*. Belmont, CA: Wadsworth.

Popper, K.R. (1972). *The logic of scientific discovery*. London: Hutchinson.

Porter, M.E. (1980). *Competitive strategy: techniques for analyzing industries and competitors*. New York: Free Press.

Porter, M.E. (1985). *Competitive advantage: creating and sustaining superior performance*. London: Collier Macmillan.

Powers, W.T. (1973). Feedback: beyond behaviorism. *Science*, 179, 351-356.

Pritchard, R.D. (1990). *Measuring and improving organizational productivity: a practical guide*. New York: Praeger.

Pritchard, R.D. (1995). *Productivity measurement and improvement: organizational case studies*. New York: Praeger.

Pritchard, R.D., & Roth, P. J. (1991). Accounting for non-linear utility functions in composite measures of productivity and performance. *Organizational Behavior and Human Decision Processes*, 50, 341-359.

Pritchard, R.D., Jones, S.E., Roth, P.L., Steubing, K.K., & Ekeberg, S.E. (1988). The effects of group feedback, goal setting and incentives on organizational productivity. *Journal of Applied Psychology Monograph*, 73, 337-358.

Pritchard, R.D., Jones, S.E., Roth, P.L., Steubing, K.K., & Ekeberg, S.E. (1989). The evaluation of an integrated approach to measuring organizational productivity. *Personnel Psychology*, 42, 69-115.

Ramsay, J.O. (1989). Monotone regression splines in action. *Statistical Science*, 4, 425-441.

Roozenburg, N.F.M., & Eekels, J. (1991). *Productontwerpen, structuur en methoden* [Product design, structure and methods]. Utrecht, The Netherlands: Lemma.

Scapens, R.W. (1998). Management accounting and strategic control: implications for management accounting research. *Bedrijfskunde*, 70, 11-17.

Schneiderman, A.M. (1996[a]). Metrics for the order fulfillment process (part 1). *Journal of Cost Management*, 10, 30-42.

Schneiderman, A.M. (1996[b]). Metrics for the order fulfillment process (part 2). *Journal of Cost Management*, 10, 6-17.

Schön, D.A. (1983). *The reflective practitioner: how professionals think in action*. New York: Basic Books.

Schön, D.A. (1987). *Educating the reflective practitioner*. San Francisco: Jossey Bass.

Shields, M.D. (1997). Research in management accounting by North Americans in the 1990's. *Journal of Management Accounting Research*, 9, 3-62.

Simchi-Levi, D., Kaminsky, P., & Simchi-Levi, E. (2000). *Designing and managing the supply chain: concepts, strategies and case studies*. New York: McGraw-Hill.

Simon, H.A. (1948). *Administrative behavior: a study of decision-making processes in administrative organizations*. New York: MacMillan.

Simon, H.A. (1960). *The new science of management decision*. New York: Harper and Row.

Simon, H.A. (1985). Human nature in politics: the dialogue of psychology with political science. *The American Political Science Review*, 79, 293-304.

Simons, R. (1995). *Levers of control: how managers use innovative control systems to drive strategic renewal*. Boston, MA: Harvard Business School Press.

Snow, C.C., & Miles, R.E. (1995). The new network firm: a spherical structure built on a human investment philosophy. *Organizational Dynamics*, 23, 5-18.

Snow, C.C., Miles, R.E., & Coleman H.J., Jr. (1992). Managing 21st century network organizations. *Organizational Dynamics*, 20, 5-20.

Steers, R.M. (1977). *Organizational effectiveness: a behavioral view*. Santa Monica, CA: Goodyear Publishing Company.

Stephenson, W. (1953). *The study of behavior: Q-technique and its methodology*. Chicago: University of Chicago Press.

Strien, P.J., van (1986). *Praktijk als wetenschap* [Practice as science]. Assen, The Netherlands: Van Gorcum.

Taylor, F.W. (1911). *Scientific management*. New York: Harper and Row.

Thompson, J.D. (1967). *Organizations in action*. New York: McGraw-Hill.

Tjosvold, D. (1982). Effects of the approach to controversy on superiors' incorporation of subordinates' information in decision making. *Journal of Applied Psychology*, 67, 189-193.

Tjosvold, D. (1985). Implications of controversy research for management. *Journal of Management*, 11, 21-37.

Tjosvold, D. (1986). The dynamics of interdependence in organizations. *Human Relations*, 39, 517-540.

Tjosvold, D. (1989). Interdependence and power between managers and employees: a study of the leader relationship. *Journal of Management*, 15, 49-62.

Tjosvold, D., & Deemer, D.K. (1980). Effects of controversy within a cooperative or competitive context on organizational decision-making. *Journal of Applied Psychology*, 65, 590-595.

Toffler, A. (1970). *Future shock*. London: Bodley Head.

Tucker, L. R (1960). Intra-individual and inter-individual multidimensionality. In H. Gulliksen, & S. Messick (Eds.), *Psychological scaling: theory and applications*. New York: John Wiley.

Tuijl, H.F.J.M., van (1997[a]). ProMES, a method for "accepted control loops". *Leadership and Organization Development Journal*, 18, 295-303.

Tuijl, H.F.J.M., van (1997[b]). Critical success factors in developing ProMES: will the end result be an "accepted control loop"? *Leadership and Organization Development Journal*, 18, 346-354.

Tuijl, H.F.J.M., van, & Pritchard, R.D. (1994). Attending to productivity: a method and two examples. In J.W. Hoorn, J.B.A. Lettink, H.F.J.M. van Tuijl, J.M.H. Vissers & G. de Vries (Eds.), *Design and change of health care processes* (pp. 105-130). Utrecht, The Netherlands: De Tijdstroom.

Tuijl, H.F.J.M., van, Kleingeld, P.A.M., & Algera, J.A. (1995). Prestatiemeting en beloning: contextafhankelijk ontwerpen [Performance measurement and rewards: context dependent design]. *Gedrag en Organisatie*, 8, 419-438.

Tuijl, H.F.J.M., van, Kleingeld, P.A.M., Schmidt, K.H., Kleinbeck, U., Pritchard, R.D., & Algera, J.A. (1997). Measuring and enhancing organizational productivity by means of ProMES: three practical implications. *European Journal of Work and Organizational Psychology*, 6, 279-301.

Vancouver, J.B., & Schmitt, N.W. (1991). An exploratory examination of person-organization fit: organizational goal congruence. *Personnel psychology*, 44, 333-352.

Vancouver, J.B., Millsap, R.E., & Peters, P.A. (1994). Multilevel analysis of organizational goal congruence. *Journal of Applied Psychology*, 79, 666-679.

Vegt, G., van der, Emans, B., & Van der Vliert, E. (1996). Effecten van interdependentie in projectteams [The effects of interdependence in project teams]. *Gedrag en Organisatie*, 9, 416-429.

Veld, J., in 't (1988). *Analyse van organisatieproblemen* [Analysis of organizational problems]. Leiden, The Netherlands: Stenfert Kroese.

Vennix, J.A.M. (1996). *Group model building: facilitating team learning using system dynamics*. Chichester, UK: John Wiley.

Verschuren, P., & Doorewaard, H. (1995). *Het ontwerpen van een onderzoek* [The designing of a research]. Utrecht, The Netherlands: Lemma.

Vlek, C., & Stallen, P.J. (1981). Judging risks and benefits in the small and in the large. *Organizational Behavior and Human Performance*, 28, 235-271.

Vosselman, E.G.J. (1996). De ontwerpgerichte benadering in management accounting en control onderzoek [The design approach in management accounting and control research]. In M. Boneco, A. de Bos, & C.D. Knoops (Eds.), *FMA-kroniek 1996* (pp. 397-417). Alphen a/d Rijn, The Netherlands: Samson.

Vosselman, E.G.J. (1999). Management accounting. *Maandblad voor Accountancy en Bedrijfseconomie*, 73, 95-105.

Vroom, V. (1964). *Work and motivation*. New York: John Wiley.

Vroom, V.H., & Yetton, P.W. (1973). *Leadership and decision-making*. Pittsburgh, PA: University of Pittsburgh Press.

Wagenaar, W.A. (1988). *Paradoxes of gambling behaviour*. London: Lawrence Erlbaum Associates.

Whyte, W.F. (1991). *Participatory action research*. Newbury Park, CA: Sage Publications.

Winsberg, S., & Ramsay, J.O. (1983). Monotone spline transformations for dimension reduction. *Psychometrika*, 48, 575-595.

Witt, L.A. (1998). Enhancing organizational congruence: a solution to organizational politics. *Journal of Applied Psychology*, 83, 666-674.

Woltring, C. (1998). *Strategie meetbaar gemaakt* [Making strategy measurable]. Master's thesis, Eindhoven University of Technology, Eindhoven, The Netherlands.

Wood, R.E., & Locke, E.A. (1990). Goal setting and strategy effects on complex tasks. In B. Staw, & L. Cummings (Eds.), *Research in organizational behavior*. Greenwich, CT: JAI Press.

Yin, R.K. (1994). *Case study research: design and methods*. Thousand Oaks, CA: Sage Publications.

Young, F.W., Takane, Y., & De Leeuw, J. (1978). The principal components of mixed measurement level multivariate data: an alternating least squares method with optimal scaling features. *Psychometrika*, 43, 279-281.

Zairi, M. (1994). *Measuring performance for business results*. London: Chapman and Hall.

Appendix A.
CATPCA EXAMPLE

This appendix illustrates the categorical principal component analysis (CATPCA) technique with an uncomplicated example. The example will clarify how CATPCA optimally reduces the dimensionality of a categorical data set (ordinal level of measurement) with minimal loss of information, enabled by the non-metric transformation and optimal scaling of the categorical variables. Concretely, the example shows a reduction from three to two dimensions. Typically, the result of a CATPCA transformation is graphically displayed.

In the example, we have three subjects and their ordering preferences regarding four alternatives A, B and C. Rank number 4 indicates a high priority, 3 a moderately high priority, 2 a moderately low priority and 1 a low priority. The ranking data i.e. categorical data is depicted in Table A-1. This table is a transposed data matrix in which the subjects are the variables and the options are the units. We use a transposed data matrix to illustrate CATPCA, since in our search for Goal Coherence we also analyze transposed data matrices.

Table A-1: Categorical data set.

Option	SUBJECT1	SUBJECT2	SUBJECT3
A	1	1	2
B	2	2	1
C	3	4	4
D	4	3	3

The categorical data of Table A-1 can be graphically represented. Just as in a typical CATPCA display, the variables i.e. subjects are represented by vectors and the units i.e. options by points. By using a 3-dimensional space for Table A-1, we are able to graphically represent the data with no loss of information. This is because the categorical data set itself has three dimensions (i.e. sources of variance): the minimum of the number of variables and the number of options minus one. In such a case, there is no distortion in the model and, consequently, all variance can be accounted for. With regard to the categorical data of Table A-1, its graphical representation in three dimensions is depicted in Figure A-1.

The 3-dimensional space is described by the mutual positions of the options, which in Figure A-1 are indicated by points. Hence, the options define the dimensions through the perpendicular projection of the points. A point projection on the positive side of a dimension indicates a high priority for the corresponding option, on the negative side a low priority and on the origin a moderate priority. Consequently, DIM1 corresponds with D-C-B-A as the equidistantly positioned and thus ordinally arranged options in sequence of decreasing interest, DIM2 with C-D-B-A and DIM3 with C-D-A-B.

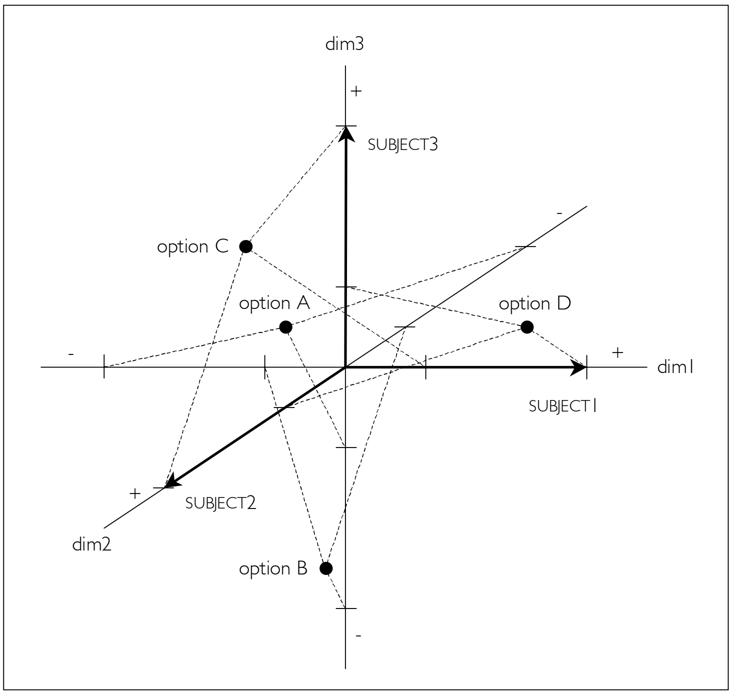

Figure A-1: 3-dimensional representation of categorical data.

In Figure A-1, the subjects are represented by vectors departing from the origin. The perpendicular projection of the points on each of these vectors should produce, without any loss, the categorical information found in Table A-1. Verify that in the 3-dimensional space of Figure A-1, the ordering preferences of SUBJECT1 are exactly represented by the first dimension i.e. DIM1, those of SUBJECT2 by DIM2 and those of SUBJECT3 by DIM3. Hence, the vector that represents SUBJECT1 coincides completely in positive direction with DIM1, the SUBJECT2 vector with DIM2 and the SUBJECT3 vector with DIM3.

By applying the CATPCA technique to Table A-1, the same information can be graphically depicted in a 2-dimensional space. By reducing the number of dimensions, distortion is created and information is possibly lost after dimension reduction. In order to account for as many variance as possible, CATPCA non-metrically transforms and optimally scales the original, categorical data. The result of a CATPCA analysis is stated in terms of: 1) loadings per variable upon each of the reduced number of dimensions; 2) scores per option which relate the option to each of the reduced number of dimensions. Loadings can actually be calculated since the data is metric after dimension reduction. For graphical purposes, the loadings thus describe the vector coordinates, while the scores describe the point coordinates. The result of the CATPCA analysis of Table A-1 is found in Table A-2. (Verify that a similar table related to Figure A-1 would have demonstrated SUBJECT1 to perfectly load on DIM1 (DIM1 loading of 1 and DIM2 and DIM3 loadings of 0), SUBJECT2 on DIM2 and SUBJECT3 on DIM3.) The data of Table A-2 is graphically displayed in Figure A-2.

Table A-2: Non-metric transformation result.

Variable (i.e. subject)	DIM1 loading	DIM2 loading	Unit (i.e. option)	DIM1 score	DIM2 score
SUBJECT1	.879	.476	A	-1.253	-1.003
SUBJECT2	1.000	-.017	B	-.670	1.054
SUBJECT3	.893	-.451	C	1.220	-.996
			D	.702	.945
VAF (Σ=1.000)	.857	.143			

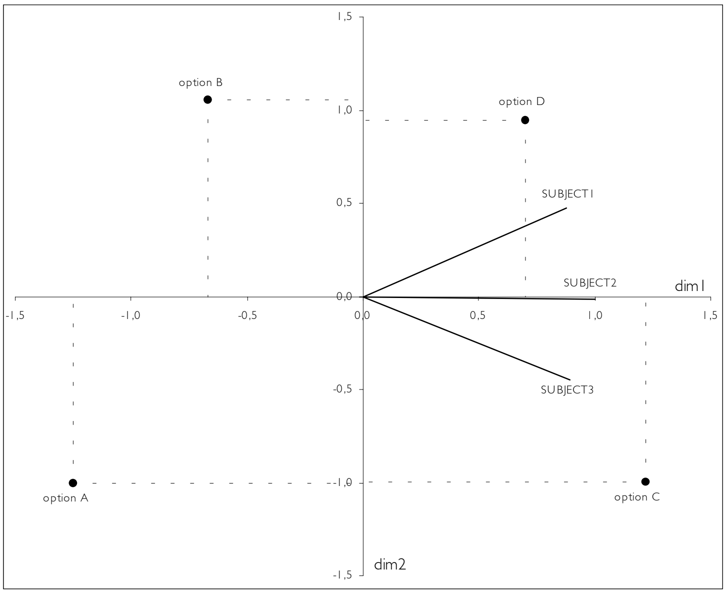

Figure A-2: 2-dimensional representation of CATPCA data.

The variance accounted for by each dimension is calculated as the sum of squared loadings per dimension divided by the number of variables. Apparently, no information is lost since the reduced dimensions jointly account for all the variance. In other words, Figure A-2 contains exactly the same information, without any distortion, as Figure A-1. The reader should be aware of the fact that the transposed data presented here thus represent an ideal situation, which will not be encountered in the analysis of true, empirical data. Generally, dimension reduction results in a loss of information, expressed by the sum of VAF being less than 1.

The perpendicular projection of the points on each of the three vectors i.e. subjects would have to generate a reflection of the initial, categorical data of Table A-1. The perpendicular projections for SUBJECT1 are graphically demonstrated in Figure A-1.

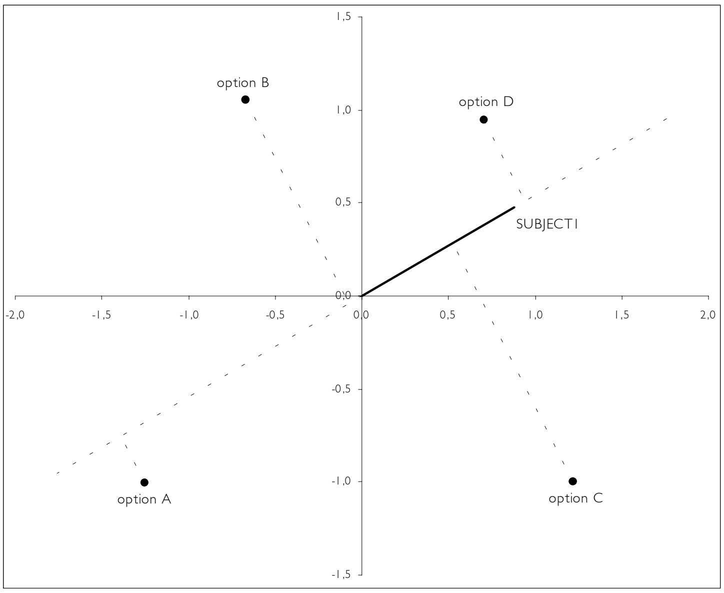

Figure A-3: Perpendicular point projections on vector SUBJECT1.

A perpendicular point projection in the direction of the vector head indicates the corresponding option to be of high interest for the corresponding subject, whereas a projection in the opposite direction indicates a low interest; projections near the origin indicate a moderate interest. The distance from the intersection of the perpendicular line of point D with vector SUBJECT1 (or its extension) to the origin is +1.068. This figure is positive since the intersection is situated in the direction of the vector head indicating a high interest for SUBJECT1. Similar calculations for point C result in +.599 (indicating a moderately positive interest), for point B in –.087 (indicating a moderately low interest) and for point A in –1.579 (indicating a low interest). All calculations, including those for SUBJECT2 and SUBJECT3, are summarized in Table A-3. The data of Table A-3 is graphically displayed in Figure A-4.

Table A-3: Perpendicular point projections on vectors.

Option	SUBJECT1	SUBJECT2	SUBJECT3
A	-1.579	-1.236	-.667
B	-.087	-.687	-1.072
C	.599	1.236	1.538
D	1.068	.687	.201

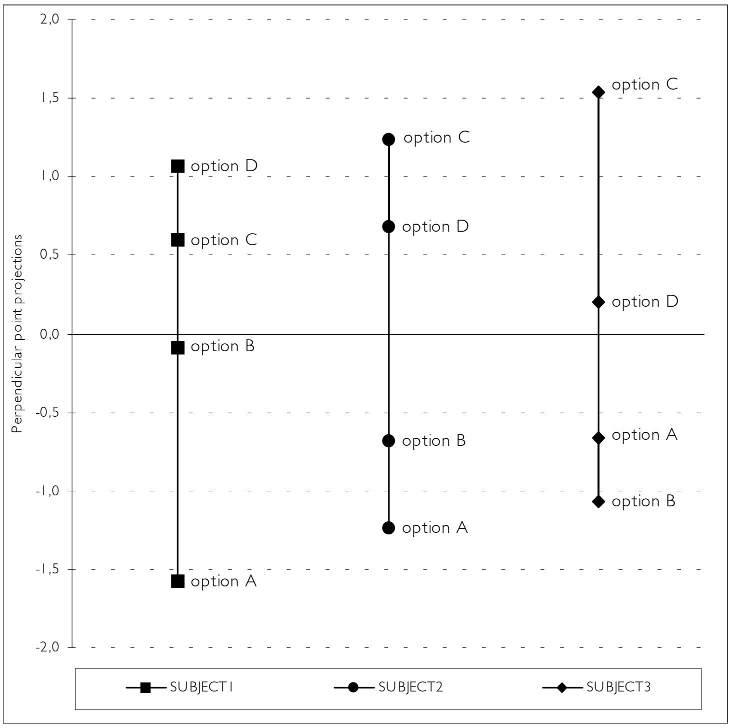

Figure A-4: Graphical representation of perpendicular point projections.

Compared to Table A-1, Figure A-4 contains the exact same categorical information. However, the options are no longer equidistantly positioned after the non-metric transformation. For the interpretation of Figure A-4 in terms of ordering preferences at an ordinal level of measurement, this has no consequences. The comparison is all the more evident if we represent Table A-1 alternatively, as is shown in Table A-4.

Table A-4: Alternative representation of original, categorical data.

Rank number	SUBJECT1	SUBJECT2	SUBJECT3
4	D	C	C
3	C	D	D
2	B	B	A
1	A	A	B

Appendix B.
STRATEGIC RESULT INDICATORS

What to achieve from a macro perspective: strategic ends	
Profitability	• Return on Invested Capital • Profit Margin • Productmix Composition
Growth	• Market Share • Geographic Distribution • Top-5 Position

Each of the Strategic Result Indicators above is next explained and graphically illustrated. In a graph, the actually achieved performance over the years 1996, 1997 and 1998 as well as the targeted performance for the year 1999 is presented. The targets represent the common goals of the entity, which are formally communicated to the Corporate Board of Directors through the Annual Plan 1999 (AP99).

B.1 Return on Invested Capital

The performance indicator Return on Invested Capital (ROIC) is a clear operationalization of the strategic end of profitability. ROIC indicates how much profit is generated by each currency unit invested in fixed assets and working capital. From the spearhead position of the Forging Steel product/market combination in relation to the other product/market combinations identified in the overall business strategy, the interest of ROIC is clear. ROIC is not graphically illustrated, since the business unit's accounting systems were not (yet) designed to report ROIC per product/market combination. Given the corporate target for business units to generate an overall ROIC of 12½%, the common goal for the organization regarding Forging Steel / Automotive was set at 22½% in 1999 in order to compensate for the business unit's other, less profitable product/market combinations.

B.2 Profit Margin

In addition to ROIC, the performance indicator Profit Margin, which is measured as the average margin over the family of forging steel products, expressed per unit of output (i.e. per ton), is another and clear operationalization of the strategic end of profitability. As is shown in Figure B-1, the actual performance was € 41 in 1998 (at a net salesprice of € 349); the target performance for 1999 was set at € 28 (at a net salesprice of € 320). As a consequence of the anticipated price drop due to the Asia crisis, the common goal for the organization was to minimize the negative performance trend in Profit Margin with € 13 in 1999.

Figure B-1: Profit Margin.

B.3 Productmix

Furthermore, the performance indicator Productmix Composition is an operationalization of the strategic end of profitability. Forging Steel in fact represents a family of forging steel products. Concretely, this product family represents a mix of 5 different product types: 1) Rounds i.e. forging steel bars; 2) SBQ's i.e. special bar qualities; 3) Critical Squares i.e. forging steel billets for critical industry application; 4) Non-critical Squares i.e. forging steel billets for non-critical industry application; 5) Re-rollers i.e. forging steel billets that need to be re-rolled by the customer. The 5 forging steel product types are not listed randomly, they are listed in order of decreasing value added. The more value is added to a product, the more profitability that product generates. Therefore, the Management constituency pursued a specific composition of the mix of forging steel products. As can be seen in Figure B-2, the common goal for the organization in 1999 was to add more value, notwithstanding the absolute increase of each product type's share in the productmix. Concretely, the goal was to increase the relative share of Rounds from 10% (15 kilotons) to 16% (40 kilotons), to increase the relative share of SBQ's from 0% (0 kilotons) to 4% (10 kilotons), to stabilize the relative share of Critical Squares from 66% (100 kilotons) to 63% (161 kilotons), to decrease the relative share of Non-critical Squares from 11% (17 kilotons) to 8% (20 kilotons) and to decrease the relative share of Re-rollers from 14% (21 kilotons) to 10% (25 kilotons).

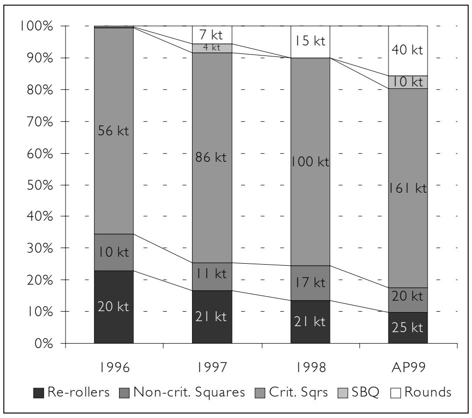

Figure B-2: Productmix Composition.

B.4 Market Share

The performance indicator Market Share (concerning Rounds, Critical Squares and Non-critical Squares) is a clear operationalization of the strategic end of growth. In order to grow, the Management constituency wanted to focus organizational attention at two main markets: Germany and the UK. As is shown in Figure B-3, the actual performance in terms of absolute Market Share was 100 kilotons for Germany and 13 kilotons for the UK in 1998; the target performance for 1999 was set at 121 kilotons for Germany and at 26 kilotons for the UK. These figures correspond with relative Market Shares of 8½% for Germany and 3½% for the UK in 1998 and with 12% for Germany and 7½% for the UK in 1999. The common goal for the organization was thus to increase Market Share by 4% for Germany and by 4% for the UK in 1999.

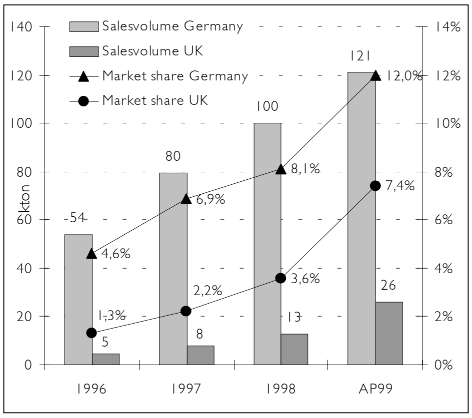

Figure B-3: Market Share.

B.5 Geographic Distribution

The performance indicator Geographic Distribution is another operationalization of the strategic end of growth. In order to grow, management recognized that the German market, although of vital importance, was too narrow a basis for growth in the long run. Therefore, other geographic markets needed to be developed as well. As can be seen in Figure B-4, the common goal for the organization in 1999 was to more evenly distribute its relative sales over multiple geographic markets, notwithstanding absolute growth in each market. Concretely, the goal was to decrease the relative share of German sales from 73% (111 kilotons) to 69% (175 kilotons) in favor of an increase in the relative share of UK, Belgian, French and other geographic sales from 27% (15 kilotons) to 31% (31 kilotons).

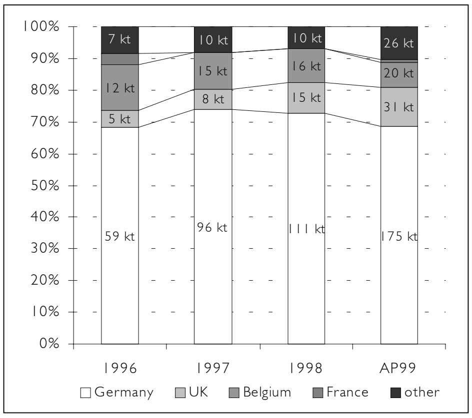

Figure B-4: Geographic Distribution.

B.6 Top-5 Position

Finally, the performance indicator Top-5 Position (concerning Rounds, Critical Squares and Non-critical Squares) is an operationalization of the strategic end of growth. In order to grow, especially in high value added forging steel products, management foresaw a solid supplier position at the major forgers in the market. A position is calculated as the ratio of supplied kilotons by Corus IJmuiden Long Products and the totally required steel supply of a forger. The top-5 forgers, with the required steel supply in kilotons at an annual basis, are listed in Figure B-5. As can be seen, the common goal for the organization is thus to (further) develop these positions in 1999. Concretely, the goal is to increase the position at Gerlach from 0% to 5% (6 kilotons supplied as a portion of a 120 kilotons steel requirement), to increase the position at Peddinghaus from 10% (8 kilotons) to 25% (20 kilotons), to increase the position at Thyssen from 10% (6 kilotons) to 19% (12 kilotons), to increase the position at Hay from 25% (15 kilotons) to 42% (25 kilotons) and to increase the position at Schoneweiss from 26% (13 kilotons) to 50% (25 kilotons).

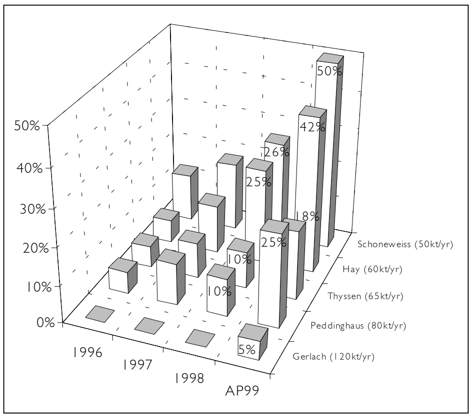

Figure B-5: Top-5 Position.

Concretely, the strategic end of profitable growth concerning the product/market combination Forging Steel / Automotive implied for the organization as a whole in 1999 to simultaneously:

- achieve a more than average ROIC of 22½%;
- minimize the negative trend in Profit Margin from € 41 to € 28;
- (further) upgrade the Productmix Composition from a 10% to a 20% share of Rounds and SBQ's;
- increase Market Share in Germany from 8% to 12% and in the UK from 3½% to 7½%;
- increase Geographic Distribution of sales in other than the main, German market from 27% to 31%;
- increase supplier positions at the top-5 forgers in the market (Top-5 Position).

Appendix C.
STRATEGIC PROCESS INDICATORS

How to achieve from a macro perspective: strategic means	
Production Capacity	• Throughput Volume • Material Yield • Stock Levels
Customer Satisfaction	• Quality Complaints • Delivery Reliability • Product Development
Low Cost	• Unit Cost

Each of the Strategic Process Indicators above is next explained and graphically illustrated. As in Appendix B, a graph presents the actually achieved performance over the years 1996, 1997 and 1998 as well as the targeted performance for the year 1999. The targets represent the additional, common goals of the entity, which are formally communicated to the Corporate Board of Directors through the Annual Plan 1999 (AP99).

C.1 Throughput Volume

The performance indicator Throughput Volume is a clear operationalization of the strategic means of Production Capacity. Performance on Throughput Volume is measured as the weekly amount of finished forging steel tons that is reported as ready for sending. The maximum number of tons equals the bottleneck capacity in the Forging Steel routing from customer order to physical delivery. In order to increase bottleneck capacity, which is currently located in the Finishing Center, and thus performance on Throughput Volume, management recently invested in so called Infra-Red Ultra-Sonic (IRUS) billet inspection technology. As is shown in Figure C-1, the actual performance was 2,6 tons per week in 1998; as a consequence of the investment in IRUS technology, the target performance for 1999 was set at 4,2 tons per week. Thus, the common goal for the organization in 1999 was to increase Throughput Volume by 1,6 tons per week.

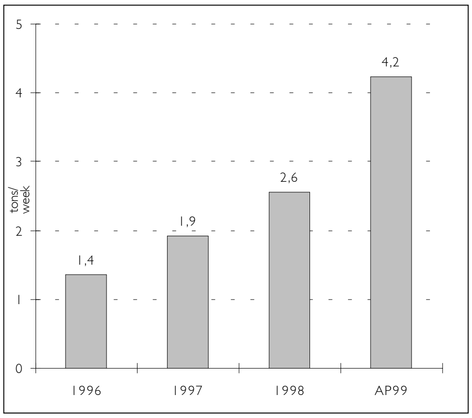

Figure C-1: Throughput Volume.

C.2 Material Yield

The performance indicator Material Yield is another and clear operationalization of the strategic means of Production Capacity: the less scrap is being produced, the higher the actual availability of production capacity. As a matter of fact, Material Yield is an important steel industry indicator in general. It is calculated as a ratio, in this case indicating the relative tonnage of finished product that is produced per ton of liquid steel. As a consequence of this calculation, it is an integral yield incorporating all three operational units. As can be seen in Figure C-2, the actual performance was 80,8% in 1998; the target performance for 1999 was set at 81,7%. Thus, the common goal for the organization in 1999 was to increase Material Yield by 0,9%.

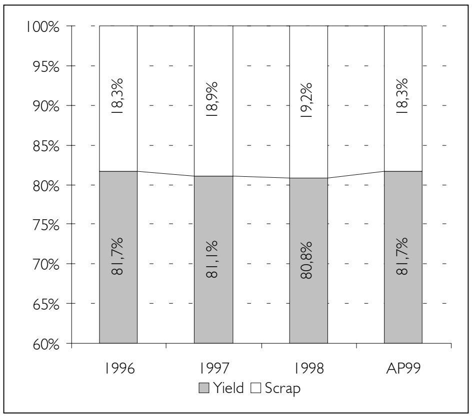

Figure C-2: Material Yield.

C.3 Stock Levels

The performance indicator Stock Levels, calculated as a monthly average, is an additional operationalization of the strategic means of Production Capacity. There are three stocks in the Corus IJmuiden Long Products value chain: 1) the stock of cast billets after the Steelworks; 2) the stock of rolled billets and bars after the Rolling-mill; 3) the stock of finished (i.e. ready for sending) billets and bars after the Finishing-center. Management's idea is that the more stock is hold in the manufacturing system, the less production capacity will actually be available. This is especially true for the Finishing-center, which already is the bottleneck. The stock of rolled billets and bars is in fact a work-in-process stock that is literally lying on the Finishing-center's shop floor, creating needless handling that is reducing actual availability of production capacity. In addition, since stocks represent working capital, performance on Stock Levels is of direct interest from the perspective of ROIC. As can be seen in Figure C-3, the actual performance was 29,2 kilotons in 1998; the target performance for 1999 was set at 28 kilotons. Thus, the common goal for the organization in 1999 was to decrease Stock Levels by 1,2 kilotons.

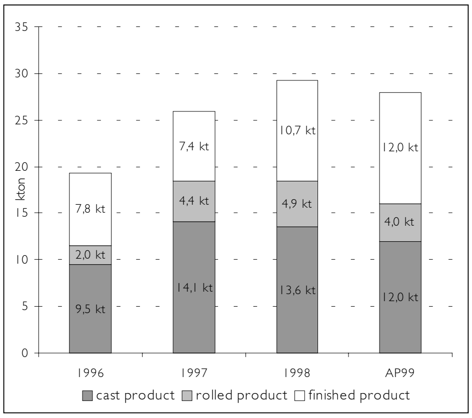

Figure C-3: Stock Levels.

C.4 Quality Complaints

The performance indicator Quality Complaints is a clear operationalization of the strategic means of Customer Satisfaction. Performance on Quality Complaints is measured by the yearly number of complaints reported by the customer regarding the quality (i.e. fitness for use) of a delivered and invoiced forging steel product. Additionally, Quality Complaints is expressed per kiloton delivered and invoiced in the corresponding year. As is shown in Figure C-4, the actual performance was 56 reported customer complaints in 1998, which per kiloton corresponded with 0,43 complaints; the target performance for 1999 was set at 50 complaints, corresponding with 0,22 complaints per kiloton. Thus, the common goal for the organization in 1999 was to decrease Quality Complaints by 6 complaints or by 0,21 complaints per kiloton delivered and invoiced.

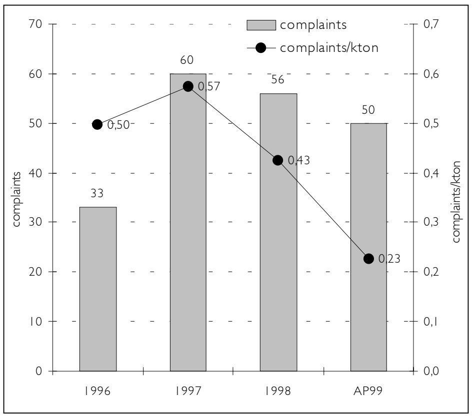

Figure C-4: Quality Complaints.

C.5 Delivery Reliability

The performance indicator Delivery Reliability is another and clear operationalization of the strategic means of Customer Satisfaction. For a supplier of forging steel products with an automotive application, the interest of Delivery Reliability (i.e. in time and complete delivery) is evident. Being a link in the automotive supply chain simply makes high Delivery Reliability an obligation. Not without reason, principles like just-in-time management have been developed in the automotive industry. Still, it required an external customer survey among twenty German forgers (see Van de Meulengraaf, 1997) to convince the Management constituency of the impact of logistical performance on customer satisfaction.

Since customers are promised a delivery week, the Delivery Reliability calculation was based on a comparison between the week that a customer order had been reported as ready for sending and the agreed upon delivery due week with the customer. For the exact calculation of Delivery Reliability, customer orders were weighted by the accompanying amounts of ordered kilotons. Reporting an order as ready for sending before or in the delivery due week was defined as in time; after due week was defined as late. Given the stochastically distributed process yields which are typical for the steel industry, a distinction was made between timely customer orders that are either complete or incomplete. A timely customer order was defined as complete if the actual, produced tonnage lies within a range of plus or minus 10% of the ordered tonnage; outside this range, a timely customer order was defined as incomplete. As can be seen in Figure C-5, the actual performance was 84% in time delivery (subdivided in 70% complete and 14% incomplete) and 16% late delivery in 1998; for 1999, the target performance was set at 90% in time and complete delivery and 10% late delivery. Thus, the common goal for the organization in 1999 was to increase Delivery Reliability by 20%.

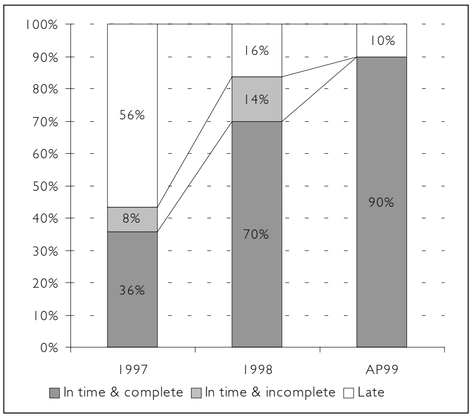

Figure C-5: Delivery Reliability.

C.6 Product Development

The performance indicator Product Development is another operationalization of the strategic means of Customer Satisfaction. In order to achieve future customer satisfaction, management recognized the importance of developing new forging steel products for its customers. Product Development concerned the production and sales of Rounds i.e. forging steel bars. From an industry perspective, forging steel bar was not an innovation; the product already existed. However, for Corus IJmuiden Long Products, integrating forging steel bar into its production routing represented an innovation. As can be seen in Figure C-6, the actual performance was 15 kilotons Rounds delivered and invoiced in 1998; the target performance was set at 40 kilotons Rounds in 1999. Thus, the common goal for the organization in 1999 was to increase Product Development by 25 kilotons Rounds.

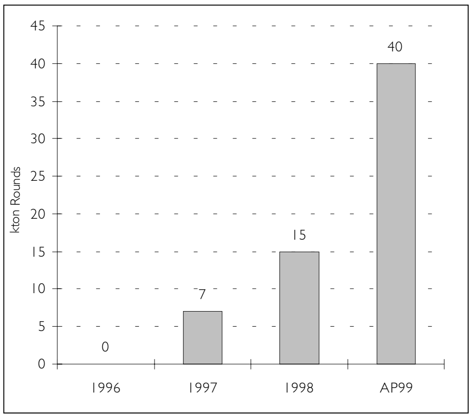

Figure C-6: Product Development.

C.7 Unit Cost

Finally, the performance indicator Unit Cost is a clear operationalization of the strategic means of Low Cost. Notwithstanding the added value of forging steel, it largely remains a commodity product. In commodity markets, price setting is the most powerful weapon in competing for the customer's favors. Hence, management recognized the interest of low cost performance. Unit Cost is measured as the average costs, over the family of forging steel products, expressed per unit of output (i.e. per ton). As can be seen in Figure C-7, the actual performance was € 308 in 1998; the target performance for 1999 was set at € 292. Hence, the common goal for the organization in 1999 was to decrease Unit Cost by € 16.

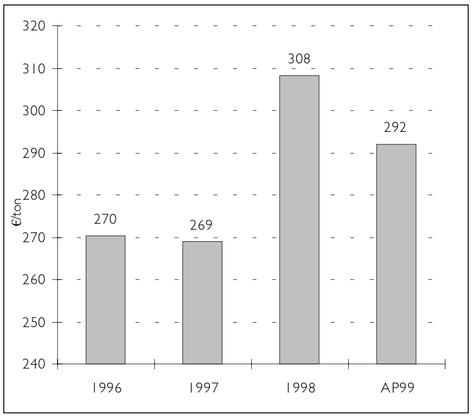

Figure C-7: Unit Cost.

Concretely, the strategic means of Production Capacity, Customer Satisfaction and Low Cost concerning the product/market combination Forging Steel / Automotive implied for the organization as a whole in 1999 to simultaneously:

- increase Throughput Volume from 2,6 to 4,2 tons per week;
- increase Material Yield from 80,8% to 81,7%;
- decrease Stock Levels from 29,2 to 28 kilotons;
- decrease Quality Complaints from 56 to 50 complaints (i.e. from 0,43 to 0,22 complaints per kiloton);
- increase Delivery Reliability from 70% to 90%;
- increase Product Development from 15 to 40 kilotons Rounds;
- decrease Unit Cost from € 308 to € 292.

Appendix D.
TACTICAL PROCESS INDICATORS (I)

		Steelworks	Rolling-mill	Finishing-center
Production Capacity	(Material Yield)	• Casting Scrap	• Rolling Scrap	• Finishing Scrap
Customer Satisfaction	(Quality Complaints)	• First Choices	• First Choices	• Post-IRUS Infections
	(Product Development)	• Test Loadings	• Round Tests	• Round Repairtime

The Tactical Process Indicators as proposed by the Quality constituency are not illustrated graphically due to lacking data registration.

The performance indicator Casting Scrap for the Steelworks is measured as a scrap rate: the relative tonnage of cast billets of solid steel (whether or not being of first choice) per ton of liquid steel to be cast. By disregarding the quality of the cast product, the scrap rate is separated from the metallurgic rejection rate. Scrap i.e. waste is the result of slag removal at the converter installation and at the casting installation due to loss in the liquid steel division bin and due to transition during casting of one steel specification into another (required by different external customers) in a batch of loadings.

The performance indicator First Choices for the Steelworks is measured as a metallurgic rejection rate: the ratio of the number of first choice cast loadings and the total number of cast loadings. A first choice cast loading results in flawless billets of solid steel: no surface defects i.e. longitudinal cracks, transverse cracks, corner cracks, slag enclosures or pinholes, no structure defects i.e. internal cracks or steel analysis deviations and no dimensional defects i.e. rhomboid billet sections.

The performance indicator Test Loadings for the Steelworks is measured as the number of experimental or test loadings for developing new or changing existing forging steel specifications. The number of test loadings is expressed as a percentage of the number of regular loadings that are customer order related.

The Quality constituency thus assumes from a meso perspective that if the Steelworks constituency focuses at the micro level at decreasing Casting Scrap, increasing First Choices and increasing Test Loadings, this will contribute to enhanced Production Capacity and Customer Satisfaction, which in turn is assumed by the Management constituency – as well as by the Quality constituency – to contribute to the macro ends of Profitability and Growth.

The performance indicator Rolling Scrap for the Rolling-mill is measured as a scrap rate: the relative tonnage of rolled billets and bars (whether or not being of first choice) per ton of cast billets to be rolled. By disregarding the quality of the rolled product, the scrap rate is separated from the metallurgic rejection rate. Scrap i.e. waste is the result of oxidation of preheated billets, rolling jams, loss of cutting the billets' heads and toes and loss of rest lengths (i.e. the length of the last billet or bar being out of tolerance).

The performance indicator First Choices for the Rolling-mill is measured as a metallurgic rejection rate: the ratio of the number of first choice rolled loadings and the total number of rolled loadings. A first choice rolled loading results in flawless rolled billets or bars: no surface defects and no out of tolerance of length, section and straightness dimensions.

The performance indicator Round Tests for the Rolling-mill is measured as the number of experiments or tests that are conducted for new or narrowed round section tolerances. In contrast to the Steelworks, experiments in the Rolling-mill relate to single billets rather than to entire loadings.

The Quality constituency thus assumes from a meso perspective that if the Rolling-mill constituency focuses at the micro level at decreasing Rolling Scrap, increasing First Choices and increasing Round Tests, this will contribute to enhanced Production Capacity and Customer Satisfaction, which in turn is assumed by the Management constituency – as well as by the Quality constituency – to contribute to the macro ends of Profitability and Growth.

The performance indicator Finishing Scrap for the Finishing-center is measured as a scrap rate: the relative tonnage of finished billets and bars per ton of rolled billets and bars to be finished. Scrap i.e. waste is the result of damaging and thus rejection during handling and loss at the sawing installation.

The performance indicator Post-IRUS Infections for the Finishing-center is measured as the number of loadings that are actually finished but appear afterwards to be infected with defects that slipped through the infra-red ultra-sonic inspection. These infections are found internally by randomly controlling the stock of finished products that are ready for sending or, worse, these infections are found externally at the customer's premises after the product has already been sent.

The performance indicator Round Repairtime for the Finishing-center is measured as the mean lead-time that is required for repairing a loading of round bars. Repairing means correcting a bar for any defects found at the IRUS inspection installation, which will not be accepted by the customer.

The Quality constituency thus assumes from a meso perspective that if the Finishing-center constituency focuses at the micro level at decreasing Finishing Scrap, decreasing Post-IRUS Infections and increasing Round Tests, this will contribute to enhanced Production Capacity and Customer Satisfaction, which in turn is assumed by the Management constituency – as well as by the Quality constituency – to contribute to the macro ends of Profitability and Growth.

Appendix E.
DESIGN TEAM MEETINGS $O_{I,L}$

The Logistics constituency first analyzed the existing logistical control structure in light of the weak logistical performance of the business unit, especially in terms of Delivery Reliability (see Appendix C: 70% in time and complete delivery in 1998; halfway 1999, performance had only been 40% against a targeted performance of 90%). The Logistics constituency diagnosed an extremely long production lead-time between the moment of casting a loading in the Steelworks and the moment of that loading being reported as ready for sending in the Finishing-center: 26 days for a loading of square forging steel billets and 35 days for a loading of round forging steel bars. Realize that the physical transformation time per loading is approximately 10 hours: 1 hour in the Steelworks, 3 hours in the Rolling-mill and approximately 6 hours in the Finishing-center (which makes the Finishing-center the bottleneck in the production routing). The remaining production lead-time is thus waiting-time: idle time that a loading lies waiting between two successive transformation steps.

In addition to these long lead-times, the Logistics constituency moreover diagnosed an uncontrolled production lead-time. The lead-time of 26 days for a loading of square forging billets varied roughly between 1 and 11 weeks, which corresponded with a standard deviation of 18 days; the lead-time of 35 days for a loading of round forging bars varied roughly between 1 and 10 weeks, which corresponded with a standard deviation of 20 days. Since the production lead-time mainly consisted of waiting-time, the extreme variance in production lead-time was thus variance in waiting-time.

In relation to the standard delivery time of 6 weeks that was promised to the customer, which also incorporated the non-physical activities of order acceptance, manufacturing engineering (sometimes even product engineering) and work order release planning, the long and uncontrolled production lead-times were diagnosed as the main cause of lagging logistical performance. The new logistical control structure would therefore have to contribute to short and controlled production lead-times. Apparently, the existing logistical control structure stimulated logistical decision making on the acceptance of external customer orders and the release of internal work orders (i.e. loadings) that were counterproductive. Next, the Logistics constituency analyzed the main logistical decisions of customer order acceptance and work order release.

Customer orders were accepted by the Sales department on the basis of the planned production capacity as forecasted in the Quarterly Plans that were derived from the Annual Plan. In the Annual Plan, the annually available hot metal supplied from the blast-furnace was allocated by management to the business unit's portfolio of product/market combinations on the basis of a demand forecast per customer. This means that the decision to accept a customer order was not based on the actually available production capacity as historically reported. Even more so, the Finishing-center being the bottleneck capacity was not at all regarded for the purpose of customer order acceptance.

In spite of the intention to accept customer orders on the basis of the planned production capacity, daily practice proved to be otherwise. For the product/market combination Forging Steel/Automotive having the highest priority as a consequence of the profitable growth ambition, every customer order that came across the business unit got accepted. So, in a way, there was no formal customer order acceptance decision at all, since the answer to the customer was always yes.

In addition, after customer orders had been accepted, accompanying work orders were commonly released shortly after, especially if the non-physical order fulfillment phase had already taken a considerable portion of the standard delivery time of 6 weeks. Just as was the customer order acceptance decision, the work order release decision was not underpinned by an explicit check on the actual availability of production capacity either, let alone on the actual availability of bottleneck capacity in the Finishing-center. Moreover, the dominant idea was that the higher the pressure was on the production system, the higher the resulting output in terms of finished products would be. Probably, this conviction stemmed from the time of the first Managing Director, as previously described. Hence, the unbridled release of work orders was not found to be a problem at all; it was even seen as a good thing.

As a consequence of the presence of so many released work orders in the production system at one time, the system frequently got overheated, which manifested itself in the Finishing-center as the bottleneck to literally get full to bursting with work-in-process inventory. The profound and negative impact on Delivery Reliability is obvious, since in such a situation hardly any physical output resulted from the production system. Forced by the circumstances, the Sales department was led to reschedule and re-release work orders in the Finishing-center. This department determined the sequence of finishing work orders on the basis of the so called priority list, which consisted of all due and overdue deliveries. On the list, customers were ordered by their history of being damaged by Corus IJmuiden Long Products.

The phenomenon of re-releasing work orders implied a decoupled logistical control of the business unit's three operational units: the Logistical Planning department prepared the weekly casting schedule for the Steelworks and the weekly rolling schedule for the Rolling-mill, while the Sales department prepared the weekly finishing schedule for the Finishing-center. In practice, logistical control of the Steelworks and the Rolling-mill were decoupled as well, which manifested itself in the work-in-process inventory between both operational units. Because customers had learned to deal with their non-reliable supplier, they placed orders for forging steel products with delivery due dates way before the shipment of the product was actually required. These customer orders were therefore more some sort of a preliminary reservation of the supplier's production capacity by the customer in order to protect himself against the chance of being damaged due to non-delivery. (Moreover, if production lead-times had been short, many customers did not bother to collect their ordered products in advance of the actual due date they had in mind. This resulted in finished loadings taking up floor space and causing additional handling, which furthermore reduced the actual availability of bottleneck capacity in the Finishing-center.) Not surprisingly, the Sales department was confronted frequently with customer order changes in terms of delivery due date, not only before but also after the accompanying work order(s) had been taken into production. These frequent changes resulted in work orders, after being released in the Steelworks, to be re-released in the Rolling-mill in due time. Concretely, the decoupled nature of logistical control thus implied three different production schedules for the three operational units.

To summarize the analysis of logistical decision making, the Logistics constituency found there was no formal decision on customer order acceptance and that the decision on work order acceptance was unbridled and even multiple due to decoupled control of the operational units. In the opinion of the Logistics constituency, the problem of the long and uncontrolled production lead-times would be solved by a formal acceptance of customer orders and, subsequently, by a single and limited release of work orders. In order to foster such decision making behavior, they proposed a new integral logistical control structure that was based on the principles of:

- Flow Production;
- Workload Control;
- Available-to-Promise.

Flow Production (Bertrand *et al.*, 1997) is a product-oriented organization of the physical transformation operations at the shop floor. Pure Flow Production is characterized by a single production routing i.e. a single sequence of operations for each work order, by a single and constant transformation time at each work station and by work stations being free of interference. Since Flow Production aims at creating a true flow of work orders, it implies that work orders are released once and only once: at the first work station. After release at this station, there is nothing that can stop the work order from 'flowing' over the factory shop floor towards the stock of finished products as soon as possible. So, the basic aim of Flow Production is to create a short production lead-time.

At Corus IJmuiden Long Products, all forging steel work orders had equal routings. Hence, the basic idea of Flow Production would indeed be applicable. The single release decision for each work order (by the Logistical Planning department) would result in equal production schedules for the Steelworks, the Rolling-mill and the Finishing-center. Since the business unit's multiple work stations had different and varying transformation times and since these stations were certainly not free of interference, pure Flow Production would not be possible. In order to cope with variance and interference, the introduction of buffer inventory between the Steelworks and the Rolling-mill and between the Rolling-mill and the Finishing-center would be required. A buffer lengthens the production lead-time. However, the size of a buffer expressed in hours production capacity does not need to exceed the average duration of an interference (the minimal buffer size is a typical management decision). Note that a buffer of released work orders is thus completely different from the current work-in-process inventories with work orders waiting for re-release that caused a decoupled logistical control of the three operational units.

Of even greater interest than a short production lead-time is a controlled i.e. constant production lead time. This would require to reduce the diagnosed variance in waiting-time, which can be achieved by the application of Workload Control (Bertrand *et al.*, 1997). The workload per period (e.g. per week) of a work station equals the scheduled work orders for that period expressed in required transformation time (e.g. in hours). The idea of Workload Control is to determine the maximum workload for the bottleneck work station in the production routing and to derive workloads for the non-bottleneck work stations accordingly. The practice of Workload Control then aims at keeping these workloads per work station constant at the predetermined value. By keeping the workload constant, the waiting-time in the buffer and thus the production lead-time is kept constant. Workload Control, which corresponds with Goldratt and Cox' (1992) 'Theory of Constraints', will cause an under-utilization of non-bottleneck work stations. Hence, one can imagine these ideas would be revolutionary for Corus IJmuiden Long Products since the under-utilization of production capacity is a shame in light of the current practice to maximize the pressure on the production system.

The amount of workload in the production system is directly influenced by the work order release decision. In case of an interference at any work station, especially in the Finishing-center but also in the Rolling-mill or in the Steelworks, no work orders should be released at all. If an interference occurs in the Rolling-mill, the buffer inventory before the Finishing-center will have been reduced to nearly zero by the time the interference is repaired. Henceforth, this buffer is being replenished with work orders due to the availability of over-capacity at the non-bottleneck work stations of the Steelworks and the Rolling-mill, allowing for temporarily speeding up production. If an interference occurs in the Steelworks, the same mechanism applies: the buffer inventory before the Rolling-mill will have been reduced to nearly zero by the time the interference is repaired. Henceforth, this buffer is being replenished with work orders due to the availability of over-capacity at the non-bottleneck work stations of the Steelworks.

So in addition to a single release of work orders for the purpose of Flow Production (i.e. short production lead-times), the new logistical control structure would imply a limited release of work orders for the purpose of Workload Control (i.e. constant production lead-times). The Logistics constituency calculated that a mean production lead-time of 20 days with a standard deviation of 2 days for loadings of square forging steel billets and a mean production lead-time of 22 days with a standard deviation of 3 days for round forging steel bars would be possible as a consequence of this control structure.

However, the Logistics constituency argued that in the perception of the customer, the delivery time is not restricted to the physical transformation lead-time of work orders, but is related to an integral timeframe that incorporates the non-physical lead-time of customer order acceptance as well. Hence, in analogy with work order release, customer order acceptance should be strictly related to the (bottleneck) production capacity that is actually available for forthcoming periods in order to promise a reliable delivery due date to the customer. Very simply, the basic idea is not to promise more than you can actually achieve by taking into account the cumulative production capacity as yet allocated per period to customer orders that have already been accepted plus possible demand prognoses and capacity reservations. A helpful technique for this purpose is the calculation of Available-to-Promise (Bertrand *et al.*, 1997) in the so called Master Production Schedule, which coordinates the supply of production capacity as indicated by the production plan and the demand of production capacity as indicated by the sales plan at an aggregate level of product families. In practice, the application of Available-to-Promise might result in not accepting a customer order if the required delivery due date by the customer cannot be realistically promised by the supplier. One can imagine these ideas to be revolutionary for Corus IJmuiden Long Products in light of the ambition to grow.

Appendix F.
MANAGEMENT & LOGISTICS CONSTITUENCY

The pretest ranking data $O_{1,M}$ of the Management constituency and $O_{1,L}$ of the Logistics constituency is depicted in Table F-1 and Table F-2 respectively. The pretest feature of the data is highlighted in both tables by the figure 1 extension of the abbreviated constituency member names.

Table F-1: Categorical data $O_{1,M}$: pretest of the Management constituency.

	STRI1	DORT1	GEER1	BROE1	WOUD1	BREE1	SCHI1
increase Throughput Volume (TV)	4	2	3	1	4	7	5
increase Delivery Reliability (DR)	3	5	5	3	6	5	3
decrease Stock Levels (SL)	2	3	2	2	1	3	2
decrease Quality Complaints (QC)	5	6	6	6	7	6	6
decrease Unit Cost (UC)	7	7	7	7	5	7	7
increase Material Yield (MY)	6	4	4	5	3	7	4
increase Product Development (PD)	1	1	1	4	2	4	1

Table F-2: Categorical data $O_{1,L}$: pretest of the Logistics constituency.

	VDAA1	BOGE1	BOOM1	KENT1	LOUD1	DMOL1	VRDS1
increase Throughput Volume (TV)	5	4	1	3	1	4	7
increase Delivery Reliability (DR)	6	5	7	6	2	7	1
decrease Stock Levels (SL)	2	1	2	4	3	1	2
decrease Quality Complaints (QC)	7	6	5	7	6	6	5
decrease Unit Cost (UC)	3	7	6	5	7	5	6
increase Material Yield (MY)	4	2	3	2	5	2	4
increase Product Development (PD)	1	3	4	1	4	3	3

The posttest ranking data $O_{2,M}$ of the Management constituency and $O_{2,L}$ of the Logistics constituency is depicted in Table F-3 (without data for variable BREE2) and Table F-4 respectively. These data represent the posttest data: collected after the pseudo management approval meeting. The posttest feature of the data is highlighted in both tables by the figure 2 extension of the abbreviated constituency member names.

Table F-3: Categorical data $O_{2,M}$: posttest of the Management constituency.

	STRI2	DORT2	GEER2	BROE2	WOUD2	SCHI2
increase Throughput Volume (TV)	5	6	6	7	1	3
increase Delivery Reliability (DR)	2	3	5	3	5	5
decrease Stock Levels (SL)	3	2	2	2	2	6
decrease Quality Complaints (QC)	4	4	4	4	7	7
decrease Unit Cost (UC)	7	7	7	6	6	7
increase Material Yield (MY)	6	5	3	5	4	7
increase Product Development (PD)	1	1	1	1	3	7

Table F-4: Categorical data $O_{2,L}$: posttest of the Logistics constituency.

	VDAA2	BOGE2	BOOM2	KENT2	LOUD2	DMOL2	VRDS2
increase Throughput Volume (TV)	5	4	1	1	7	4	4
increase Delivery Reliability (DR)	6	5	7	7	3	7	2
decrease Stock Levels (SL)	3	2	2	2	2	3	1
decrease Quality Complaints (QC)	7	6	6	6	4	6	6
decrease Unit Cost (UC)	4	7	5	5	5	5	7
increase Material Yield (MY)	2	1	3	3	6	2	5
increase Product Development (PD)	1	3	4	4	1	1	3

The results of the CATPCA analysis of the pretest data in terms of vector coordinates (representing the subjects in the analysis) and point coordinates (representing the options in the analysis) are presented in Table F-5 and Table F-6 for the Management constituency and the Logistics constituency respectively.

Table F-5: Dimension loadings and scores: pretest of the Management constituency.

Active variable (Management)	DIM1 loading	DIM2 loading	Supplementary variable (Logistics)	DIM1 loading	DIM2 loading
STRI1	.902	-.050	VDAA1	.198	.682
DORT1	.949	-.279	BOGE1	.941	-.282
GEER1	.968	-.211	BOOM1	.600	.071
BROE1	.949	-.283	KENT1	.505	-.177
WOUD1	.637	.761	LOUD1	.949	-.283
BREE1	.627	.776	DMOL1	.518	.656
SCHI1	.968	-.195	VRDS1	.683	.246
eigenvalue	5.290	1.424	eigenvalue	3.177	1.152
Cronbach's α	.946	.348	Cronbach's α	.799	.154
VAF (Σ=.959)	.756	.203	VAF (Σ=.618)	.454	.165
association	**.756**	.134	association	**.454**	.110

Unit (i.e. option)	DIM1 score	DIM2 score
Throughput Volume (TV)	-.270	1.054
Delivery Reliability (DR)	-.250	.796
Stock Levels (SL)	-1.133	-1.964
Quality Complaints (QC)	.627	.184
Unit Cost (UC)	2.064	-.865
Material Yield (MY)	-.080	.784
Product Development (PD)	-.960	.009

Table F-6: Dimension loadings and scores: pretest of the Logistics constituency.

Active variable (Logistics)	DIM1 loading	DIM2 loading	Supplementary variable (Management)	DIM1 loading	DIM2 loading
VDAA1	.712	.083	STRI1	.219	.787
BOGE1	.719	.659	DORT1	.714	.656
BOOM1	.884	-.204	GEER1	.732	.652
KENT1	.939	.096	BROE1	.430	.859
LOUD1	.414	.867	WOUD1	.907	.206
DMOL1	.868	-.462	BREE1	.087	.601
VRDS1	-.493	.813	SCHI1	.440	.876
eigenvalue	3.856	2.118	eigenvalue	2.302	3.384
Cronbach's α	.864	.616	Cronbach's α	.660	.822
VAF (Σ=.854)	.551	.303	VAF (Σ=.812)	.329	.483
association	**.481**	.230	association	**.329**	*.483*
Unit (i.e. option)	DIM1 score	DIM2 score			
Throughput Volume (TV)	-.736	.022			
Delivery Reliability (DR)	1.618	-1.690			
Stock Levels (SL)	-.645	-.629			
Quality Complaints (QC)	.977	.813			
Unit Cost (UC)	.738	1.736			
Material Yield (MY)	-.887	.018			
Product Development (PD)	-1.066	-.269			

Concretely, Table F-5 shows the non-metric transformation of Table F-1 for determining the degree of pretest within-constituency Goal Coherence of the Management constituency (association of .756), whereas Table F-6 shows the non-metric transformation of Table F-2 for determining the degree of pretest within-constituency Goal Coherence of the Logistics constituency (association of .481). In addition, the supplementary analyses operationalize degrees of pretest between-constituency Goal Coherence in Table F-6 for the Management constituency (association of .329) and in Table F-5 for the Logistics constituency (association of .454).

The data of Table F-5 and Table F-6 regarding the active variables in the CATPCA analyses are graphically depicted in Figure F-1 and Figure F-2, visualizing pretest degrees of within-constituency Goal Coherence.

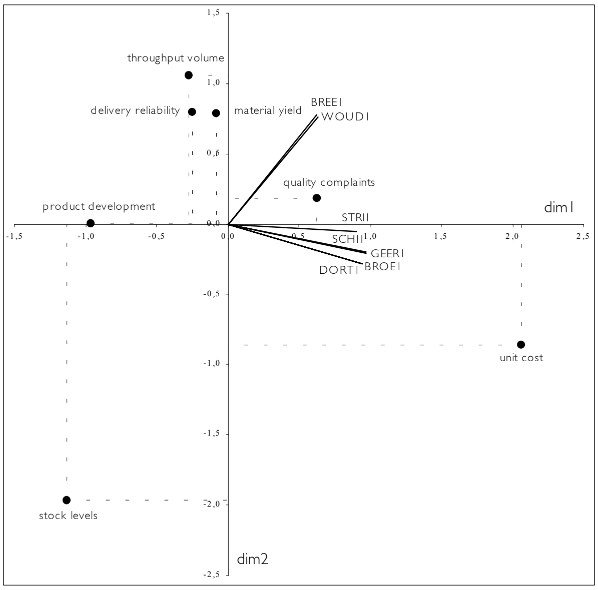

Figure F-1: Pretest of the Management constituency.

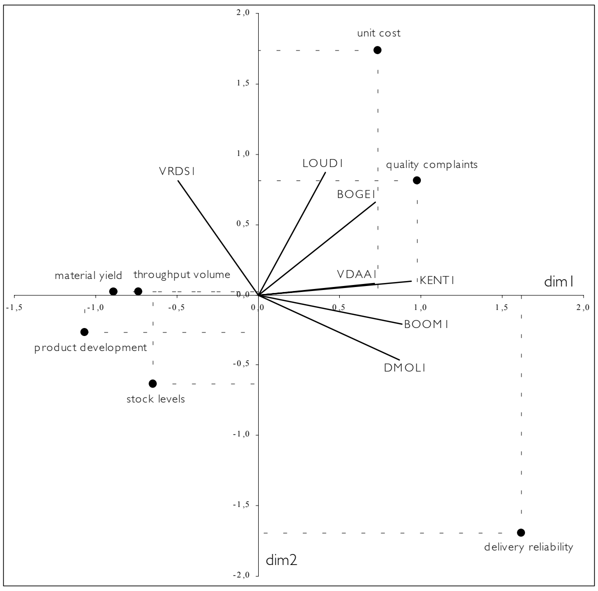

Figure F-2: Pretest of the Logistics constituency.

The data of Table F-5 and Table F-6 regarding the supplementary variables in the CATPCA analyses are graphically depicted in Figure F-3 and Figure F-4, visualizing pretest degrees of between-constituency Goal Coherence.

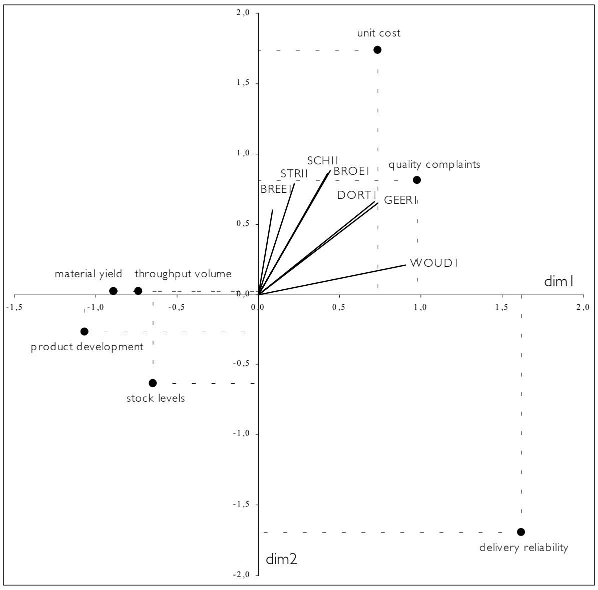

Figure F-3: Supplementary pretest of the Management constituency.

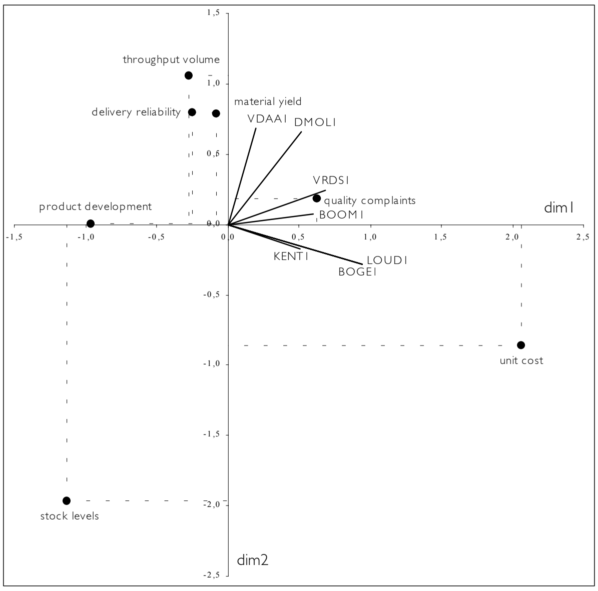

Figure F-4: Supplementary pretest of the Logistics constituency.

The results of the CATPCA analysis of the posttest ranking data of Table F-3 and Table F-4 are presented in Table F-7 and Table F-8 for the Management constituency and the Logistics constituency respectively. Concretely, Table F-7 shows the non-metric transformation of Table F-3 for determining the degree of posttest within-constituency

Goal Coherence of the Management constituency (association of .348), whereas Table F-8 shows the non-metric transformation of Table F-4 for determining the degree of posttest within-constituency Goal Coherence of the Logistics constituency (association of .601). In addition, the supplementary analyses operationalize degrees of posttest between-constituency Goal Coherence in Table F-8 for the Management constituency (association of .132) and in Table F-7 for the Logistics constituency (association of .086).

Table F-7: Dimension loadings and scores: posttest of the Management constituency.

Active variable (Management)	DIM1 loading	DIM2 loading	Supplementary variable (Logistics)	DIM1 loading	DIM2 loading
STRI2	.602	.768	VDAA2	.431	-.006
DORT2	.897	.438	BOGE2	.428	.764
GEER2	.873	.431	BOOM2	-.557	.772
BROE2	.928	-.348	KENT2	-.557	.772
WOUD2	-.535	.803	LOUD2	.686	-.530
SCHI2	-.648	.740	DMOL2	.431	-.006
			VRDS2	.446	.787
eigenvalue	3.497	2.281	eigenvalue	1.846	2.678
Cronbach's α	.857	.674	Cronbach's α	.535	.731
VAF (Σ=.963)	.583	.380	VAF (Σ=.646)	.264	.383
association	**.348**	.340	association	**.086**	*.302*

Unit (i.e. option)	DIM1 score	DIM2 score
Throughput Volume (TV)	1.678	-1.738
Delivery Reliability (DR)	-.602	-.049
Stock Levels (SL)	-.605	-.492
Quality Complaints (QC)	-.733	.070
Unit Cost (UC)	1.446	1.854
Material Yield (MY)	-.342	.515
Product Development (PD)	-.842	-.159

Table F-8: Dimension loadings and scores: posttest of the Logistics constituency.

Active variable (Logistics)	DIM1 loading	DIM2 loading	Supplementary variable (Management)	DIM1 loading	DIM2 loading
VDAA2	.884	.210	STRI2	-.192	.911
BOGE2	.823	.392	DORT2	.012	.937
BOOM2	.938	-.256	GEER2	.604	.611
KENT2	.938	-.256	BROE2	.001	.932
LOUD2	-.075	.903	WOUD2	.709	.384
DMOL2	.993	-.046	SCHI2	-.190	.427
VRDS2	.090	.930			
eigenvalue	4.220	2.010	eigenvalue	.940	3.279
Cronbach's α	.890	.586	Cronbach's α	-.076	.834
VAF (Σ=.890)	.603	.287	VAF (Σ=.703)	.157	.546
association	**.601**	.249	association	**.132**	*.546*

Unit (i.e. option)	DIM1 score	DIM2 score
Throughput Volume (TV)	-.323	.907
Delivery Reliability (DR)	1.747	-1.151
Stock Levels (SL)	-.888	-1.331
Quality Complaints (QC)	1.114	.670
Unit Cost (UC)	.224	1.149
Material Yield (MY)	-1.006	.678
Product Development (PD)	-.867	-.923

The data of Table F-7 and Table F-8 regarding the active variables in the CATPCA analyses are graphically depicted in Figure F-5 and Figure F-6, visualizing posttest degrees of within-constituency Goal Coherence.

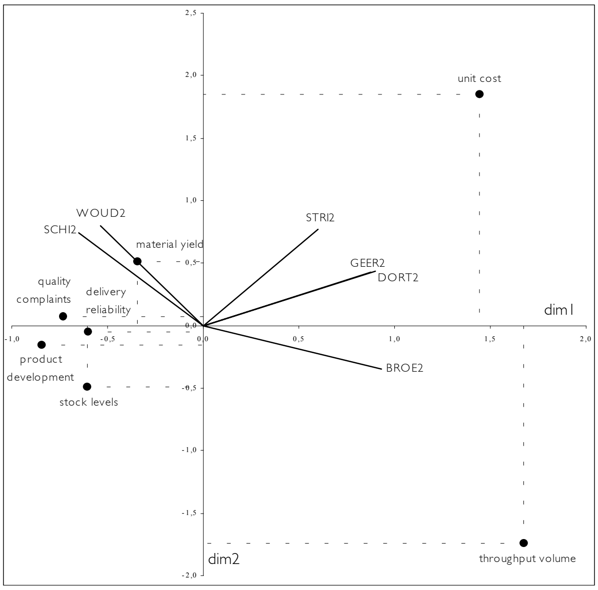

Figure F-5: Posttest of the Management constituency.

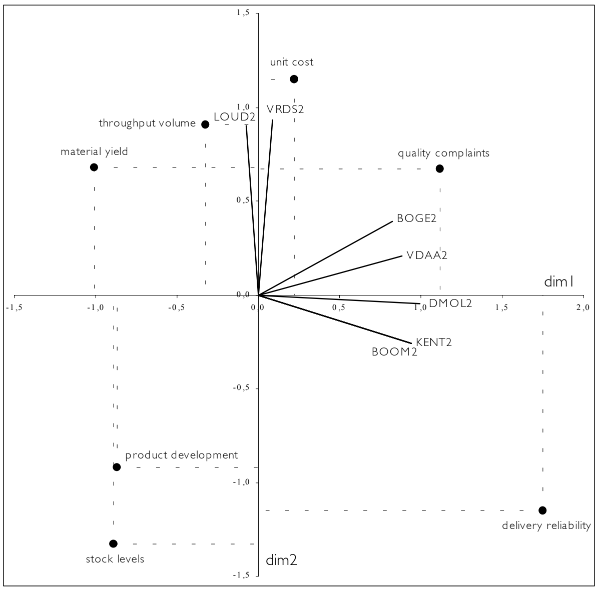

Figure F-6: Posttest of the Logistics constituency.

The data of Table F-7 and Table F-8 regarding the supplementary variables in the CATPCA analyses are graphically depicted in Figure F-7 and Figure F-8, visualizing posttest degrees of between-constituency Goal Coherence.

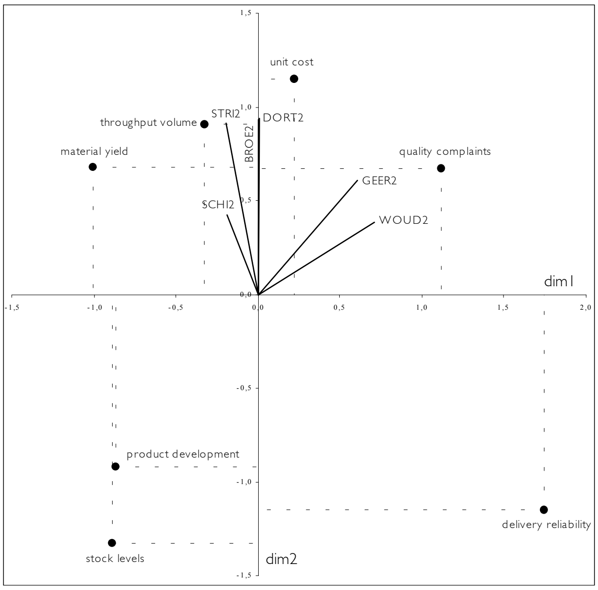

Figure F-7: Supplementary posttest of the Management constituency.

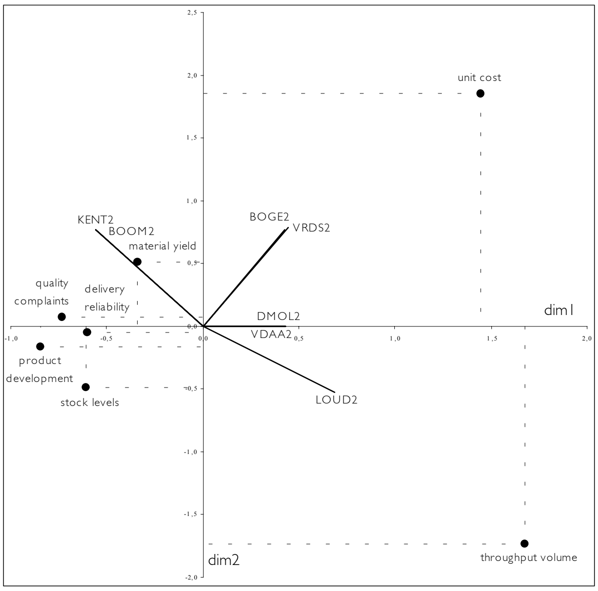

Figure F-8: Supplementary posttest of the Logistics constituency.

The resulting CATPCA data from the follow-up analyses, in which the posttest data of the Management constituency has been substituted by the pretest data, are depicted in Table F-9 and Table F-10 for the Management constituency and the Logistics constituency respectively. These tables can be interpreted as the 'non-crisis' equivalents of Table F-7 and Table F-8.

Table F-9: 'Non-crisis' equivalent of Table F-7: posttest of the Management constituency.

Active variable (Management)	DIM1 loading	DIM2 loading	Supplementary variable (Logistics)	DIM1 loading	DIM2 loading
STRI2	.902	-.050	VDAA2	.353	.344
DORT2	.949	-.279	BOGE2	.941	-.282
GEER2	.968	-.211	BOOM2	.512	.136
BROE2	.949	-.283	KENT2	.512	.136
WOUD2	.637	.761	LOUD2	.600	.435
BREE2	.627	.776	DMOL2	.574	.159
SCHI2	.968	-.195	VRDS2	.949	-.283
eigenvalue	5.290	1.424	eigenvalue	3.125	.529
Cronbach's α	.946	.348	Cronbach's α	.793	-1.038
VAF (Σ=.959)	.756	.203	VAF (Σ=.522)	.446	.076
association	**.756**	.134	association	**.446**	.030

Unit (i.e. option)	DIM1 score	DIM2 score
Throughput Volume (TV)	-.270	1.054
Delivery Reliability (DR)	-.250	.796
Stock Levels (SL)	-1.133	-1.964
Quality Complaints (QC)	.627	.184
Unit Cost (UC)	2.064	-.865
Material Yield (MY)	-.080	.784
Product Development (PD)	-.960	.009

Table F-10: 'Non-crisis' equivalent of Table F-8: posttest of the Logistics constituency.

Active variable (Logistics)	DIM1 loading	DIM2 loading	Supplementary variable (Management)	DIM1 loading	DIM2 loading
VDAA2	.884	.210	STRI2	.153	.894
BOGE2	.823	.392	DORT2	.707	.362
BOOM2	.938	-.256	GEER2	.725	.537
KENT2	.938	-.256	BROE2	.234	.632
LOUD2	-.075	.903	WOUD2	.915	.403
DMOL2	.993	-.046	BREE2	.225	.932
VRDS2	.090	.930	SCHI2	.331	.918
eigenvalue	4.220	2.010	eigenvalue	2.101	3.491
Cronbach's α	.890	.586	Cronbach's α	.611	.832
VAF (Σ=.890)	.603	.287	VAF (Σ=.779)	.300	.499
association	**.601**	.249	association	**.300**	.499

Unit (i.e. option)	DIM1 score	DIM2 score
Throughput Volume (TV)	-.323	.907
Delivery Reliability (DR)	1.747	-1.151
Stock Levels (SL)	-.888	-1.331
Quality Complaints (QC)	1.114	.670
Unit Cost (UC)	.224	1.149
Material Yield (MY)	-1.006	.678
Product Development (PD)	-.867	-.923

The data of Table F-9 and Table F-10 regarding the supplementary variables in the CATPCA analyses are graphically depicted in Figure F-9 and Figure F-10, visualizing posttest degrees of between-constituency Goal Coherence in a 'non-crisis' situation.

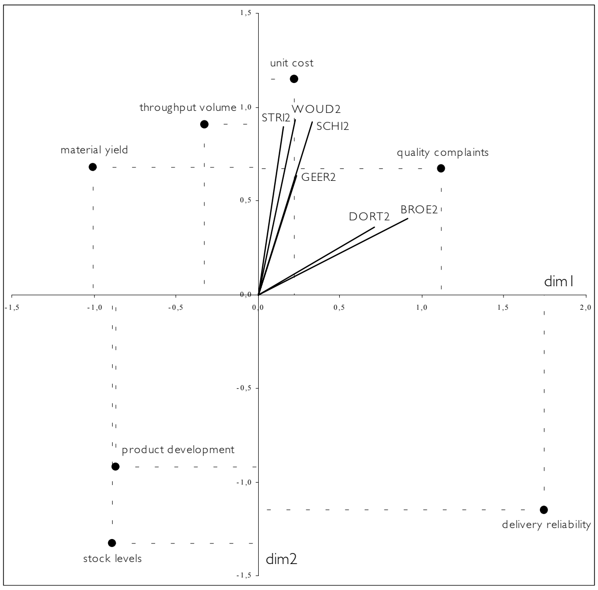

Figure F-9: 'Non-crisis' equivalent of Figure F-7: supplementary posttest of the Management constituency.

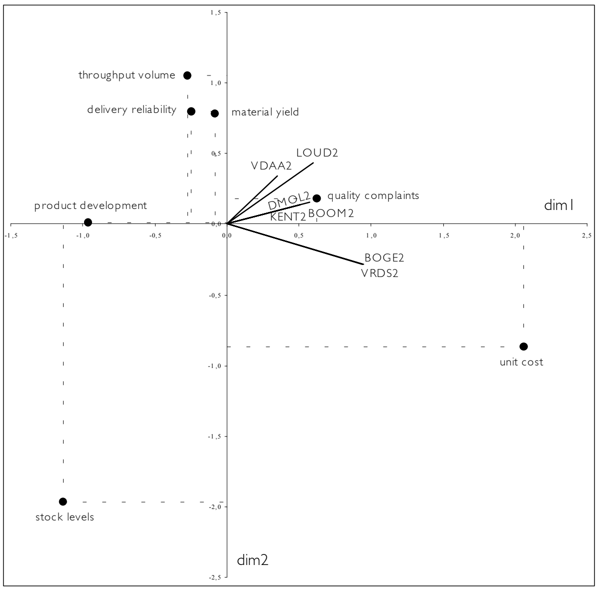

Figure F-10: 'Non-crisis' equivalent of Figure F-8: supplementary posttest of the Logistics constituency.

Appendix G.
TACTICAL PROCESS INDICATORS (2)

		Steelworks	Rolling-mill	Finishing-center
Production Capacity	(Throughput Volume)	• Cast Loadings	• Rolled Loadings	• Finished Tons
	(Stock Levels)	• Free For Rolling	• Free For Finishing	• Work In Process
Customer Satisfaction	(Delivery Reliability)	• Casting Plan Conformity	• Rolling Plan Conformity	• Finishing Lead-time

The Tactical Process Indicators as proposed by the Quality constituency are not illustrated graphically due to lacking data registration.

The performance indicator Cast Loadings for the Steelworks is measured as the number of loadings that are cast per week. Within the current logistical control structure, output was overemphasized due to the common practice of maximizing the pressure at the production system. Consequently, there is a clear field of tension between this indicator and the previous Casting Plan Conformity indicator. The overemphasis on output resulted in the early casting of 'easy' loadings planned for forthcoming weeks at the expense of 'difficult' loadings planned for the appropriate week, thereby undermining Delivery Reliability. The performance indicator Free For Rolling for the Steelworks is measured as the number of loadings that are free for further transformation in the Rolling-mill. After being cast, every loading is temporarily blocked by the Quality Assurance department in order to assess whether it is a first choice cast loading or not. The Steelworks has an impact on the average blocking duration by prompt delivery of billet samples at the Quality Assurance department's laboratory for technical analysis. Loadings that are not technically released in time make up a stock (without buffering function) after the Steelworks. The performance indicator Casting Plan Conformity for the Steelworks is measured as the degree in which the indicated loadings in the weekly production plans (as proposed by the Logistical Planning department) are actually cast in the corresponding week. This indicator is a direct result of the new logistical control structure. The local planner of the Steelworks remains the freedom to reschedule the sequence of casting in order to minimize transition losses in a batch of loadings with different steel specifications (which contributes to increasing Material Yield), as long as the requested loadings get produced.

The Logistics constituency thus assumes from a meso perspective that if the Steelworks constituency focuses at the micro level at increasing Cast Loadings, increasing Free For Rolling and increasing Casting Plan Conformity, this will contribute to enhanced Production Capacity and Customer Satisfaction, which in turn is assumed by the

Management constituency – as well as by the Logistics constituency – to contribute to the macro ends of Profitability and Growth.

The performance indicator Rolled Loadings for the Rolling-mill is measured as the number of loadings that are rolled per week. As in the Steelworks, there is a clear field of tension between this indicator and the previous Rolling Plan Conformity indicator. The current overemphasis on output caused the set up times of the rolling gear between loadings with different sections to be minimized in order to put the Steelworks' supply through. In the new logistical control structure, the Rolling-mill will have ample opportunity to use its over-capacity for set up purposes. The performance indicator Free For Finishing for the Rolling-mill is measured as the number of loadings that are free for further transformation in the Finishing-center. Just as after being cast, every loading is temporarily blocked by the Quality Assurance department after being rolled in order to assess whether it is a first choice rolled loading or not. The Rolling-mill has a similar impact on the average blocking duration as the Steelworks by prompt delivery of billet or bar samples at the Quality Assurance department's laboratory for technical analysis. Loadings that are not technically released in time make up a stock (without buffering function) after the Rolling-mill.

The performance indicator Rolling Plan Conformity for the Rolling-mill is measured as the degree in which the indicated loadings in the weekly production plans (as proposed by the Logistical Planning department) are actually rolled in the corresponding week. This indicator is also a direct result of the new logistical control structure. The local planner of the Rolling-mill remains the freedom to make a reschedule of the sequence of rolling that best fits the fixed rolling cycle (2 weeks square forging steel billets from large to small sections; 1 week round forging steel bars from large to small sections) as long as the requested loadings get produced. The Logistics constituency thus assumes from a meso perspective that if the Rolling-mill constituency focuses at the micro level at increasing Rolled Loadings, increasing Free For Finishing and increasing Rolling Plan Conformity, this will contribute to enhanced Production Capacity and Customer Satisfaction, which in turn is assumed by the Management constituency – as well as by the Logistics constituency – to contribute to the macro ends of Profitability and Growth.

The performance indicator Finished Tons for the Finishing-center is measured as the amount of tons that is reported as being ready for sending per week. The performance indicator Work In Process for the Finishing-center is measured as the number of loadings Free For Finishing that are waiting at the factory shop floor to be finished. The performance indicator Finishing Lead-time for the Finishing-center is measured as the average time per loading between the moment of starting with the finishing activities and the moment of reporting the loading as being ready for sending. The new logistical control structure makes this indicator a valid and controllable one for the Finishing-center. Due to the restricted release of work orders which is tuned to the bottleneck capacity in this operational unit, the Finishing-center can now apply the preferred FIFO (first-in-first-out) way of sequencing loadings in order to minimize handling time of loadings that literally weigh tons.

The Logistics constituency thus assumes from a meso perspective that if the Finishing-center constituency focuses at the micro level at increasing Finished Tons, decreasing Work In Process and decreasing Finishing Lead-time, this will contribute to enhanced Production Capacity and Customer Satisfaction, which in turn is assumed by the Management constituency – as well as by the Logistics constituency – to contribute to the macro ends of Profitability and Growth.

Appendix H.
MANAGEMENT & STEELWORKS CONSTITUENCY

The pretest ranking data *'O'*$_{1,M}$ of the Management constituency and $O_{1,S}$ of the Steelworks constituency is depicted in Table H-1 and Table H-2 respectively. The pretest feature of the data is highlighted by the figure 1 extension of the abbreviated constituency member names.

Table H-1: Categorical data 'O'$_{1,M}$*: pretest of the Management constituency.*

	STRI1	DORT1	GEER1	BROE1	WOUD1	BREE1	SCHI1
increase Cast Loadings (CL)	4	2	3	1	4	7	5
increase Casting Plan Conformity (UCC)	3	5	5	3	6	5	3
increase Free For Rolling (FFR)	2	3	2	2	1	3	2
increase First Choices (FC)	5	6	6	6	7	6	6
decrease Costs For Casting (CFC)	7	7	7	7	5	7	7
decrease Casting Scrap (CS)	6	4	4	5	3	7	4
increase Test Loadings (TL)	1	1	1	4	2	4	1

Table H-2: Categorical data $O_{1,S}$*: pretest of the Steelworks constituency.*

	BRSN1	HSMN1	WTVR1	KNAP1	BSMA1	VRIS1
increase Cast Loadings (CL)	7	5	2	1	6	5
increase Casting Plan Conformity (UCC)	3	6	4	7	5	7
increase Free For Rolling (FFR)	2	3	1	5	1	4
increase First Choices (FC)	4	7	7	6	7	6
decrease Costs For Casting (CFC)	5	4	6	4	2	3
decrease Casting Scrap (CS)	6	2	5	3	4	2
increase Test Loadings (TL)	1	1	3	2	3	1

The results of the CATPCA analyses of the pretest data in terms of vector coordinates (representing the subjects in the analysis) and point coordinates (representing the options in the analysis) are presented in Table H-3 and Table H-4 for the Management constituency and the Steelworks constituency respectively. Concretely, Table H-3 shows the non-metric transformation of Table H-1 for determining the degree of pretest within-constituency Goal Coherence of the Management constituency (association of .756), whereas Table H-4 shows the non-metric transformation of Table H-2 for determining the degree of pretest within-constituency Goal Coherence of the

Steelworks constituency (association of .463). In addition, the supplementary analyses operationalize degrees of pretest between-constituency Goal Coherence in Table H-4 for the Management constituency (association of .351) and in Table H-3 for the Steelworks constituency (association of .210).

Table H-3: Dimension loadings and scores: pretest of the Management constituency.

Active variable (Management)	DIM1 loading	DIM2 loading	Supplementary variable (Steelworks)	DIM1 loading	DIM2 loading
STRI1	.902	-.050	BRSN1	.600	.435
DORT1	.949	-.279	HSMN1	.353	.344
GEER1	.968	-.211	WTVR1	.686	.463
BROE1	.949	-.283	KNAP1	.287	-.466
WOUD1	.637	.761	BSMA1	.120	.959
BREE1	.627	.776	VRIS1	-.001	.405
SCHI1	.968	-.195			
eigenvalue	5.290	1.424	eigenvalue	1.052	1.822
Cronbach's α	.946	.348	Cronbach's α	.059	.541
VAF (Σ=.959)	.756	.203	VAF (Σ=.479)	.175	.304
association	**.756**	.134	association	**.175**	.231

Unit (i.e. option)	DIM1 score	DIM2 score
Cast Loadings (CL)	-.270	1.054
Casting Plan Conformity (UCC)	-.250	.796
Free For Rolling (FFR)	-1.133	-1.964
First Choices (FC)	.627	.184
Costs For Casting (CFC)	2.064	-.865
Casting Scrap (CS)	-.080	.784
Test Loadings (TL)	-.960	.009

Table H-4: Dimension loadings and scores: pretest of the Steelworks constituency.

Active variable (Steelworks)	DIM1 loading	DIM2 loading	Supplementary variable (Management)	DIM1 loading	DIM2 loading
BRSN1	-.028	.795	STRI1	.157	.790
HSMN1	.986	.094	DORT1	.606	.164
WTVR1	.663	.548	GEER1	.641	.306
KNAP1	.782	-.573	BROE1	.186	.562
BSMA1	.798	.480	WOUD1	.960	.208
VRIS1	.844	-.438	BREE1	.264	.788
			SCHI1	.373	.809
eigenvalue	3.371	1.692	eigenvalue	1.968	2.380
Cronbach's α	.844	.491	Cronbach's α	.574	.676
VAF (Σ=.844)	.562	.282	VAF (Σ=.621)	.281	.340
association	**.562**	.109	association	**.281**	.340

Unit (i.e. option)	DIM1 score	DIM2 score
Cast Loadings (CL)	-.172	.855
Casting Plan Conformity (UCC)	1.160	-1.721
Free For Rolling (FFR)	-.832	-1.056
First Choices (FC)	1.869	.935
Costs For Casting (CFC)	-.469	.702
Casting Scrap (CS)	-.725	.769
Test Loadings (TL)	-.832	-.485

The data of Table H-3 and Table H-4 regarding the supplementary variables in the CATPCA analyses are graphically depicted in Figure H-1 and Figure H-2, visualizing posttest degrees of between-constituency Goal Coherence. Low degrees of association with the dominant dimension of the goal interdependent constituency (DIM1) are nicely illustrated by the variance in vector angles.

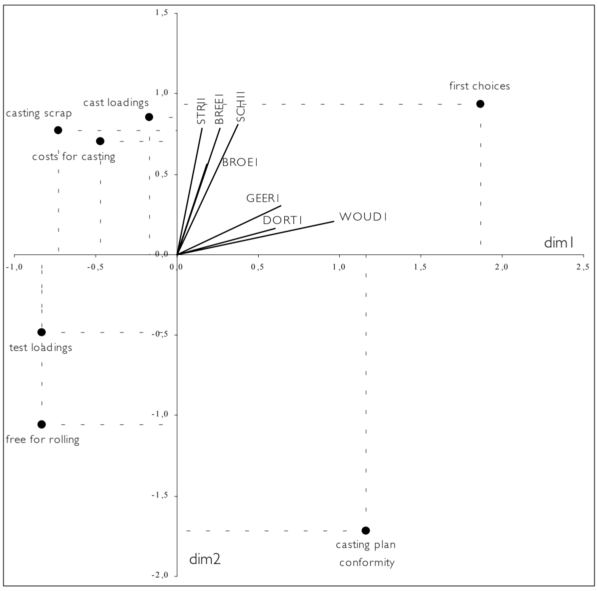

Figure H-1: Supplementary pretest of the Management constituency.

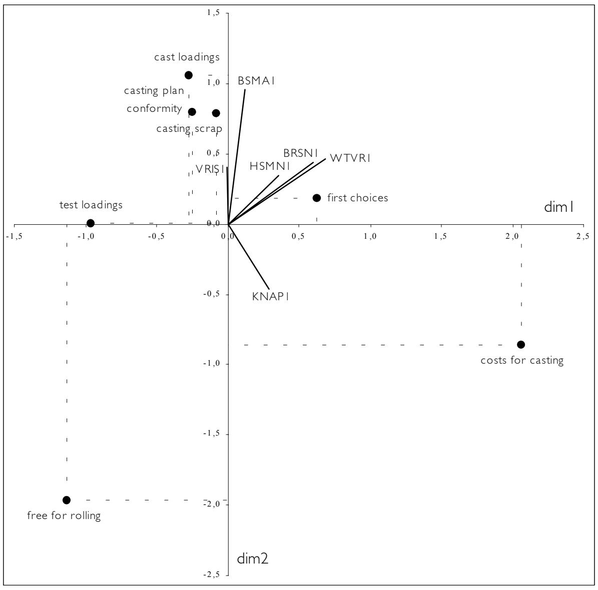

Figure H-2: Supplementary pretest of the Steelworks constituency.

Appendix I.
MANAGEMENT & ROLLING-MILL CONSTITUENCY

The pretest ranking data *'O'$_{I,M}$* of the Management constituency and *$O_{I,S}$* of the Steelworks constituency is depicted in Table I-1 and Table I-2 respectively. The pretest feature of the data is highlighted by the figure 1 extension of the abbreviated constituency member names.

Table I-1: Categorical data 'O'$_{I,M}$: pretest of the Management constituency.

	STRI	DORT I	GEER I	BROE I	WOUD I	BREE I	SCHI I
increase Rolled Loadings (RL)	4	2	3	1	4	7	5
increase Rolling Plan Conformity (RPC)	3	5	5	3	6	5	3
increase Free For Finishing (FFF)	2	3	2	2	1	3	2
increase First Choices (FC)	5	6	6	6	7	6	6
decrease Costs For Rolling (CFR)	7	7	7	7	5	7	7
decrease Rolling Scrap (RS)	6	4	4	5	3	7	4
increase Round Tests (RT)	1	1	1	4	2	4	1

Table I-2: Categorical data: pretest of the Rolling-mill constituency.

	LDON I	NLTN I	VLYN I	DVRS I
increase Rolled Loadings (RL)	7	3	6	7
increase Rolling Plan Conformity (RPC)	3	2	5	4
increase Free For Finishing (FFF)	2	1	1	1
increase First Choices (FC)	4	7	7	6
decrease Costs For Rolling (CFR)	5	5	2	3
decrease Rolling Scrap (RS)	6	6	4	2
increase Round Tests (RT)	1	4	3	5

The results of the CATPCA analyses of the pretest data in terms of vector coordinates (representing the subjects in the analysis) and point coordinates (representing the options in the analysis) are presented in Table I-3 and Table I-4 for the Management constituency and the Rolling-mill constituency respectively. Concretely, Table I-3 shows the non-metric transformation of Table I-1 for determining the degree of pretest within-constituency Goal Coherence of the Management constituency (association of .756), whereas Table I-4 shows the non-metric transformation of Table I-2 for determining the degree of pretest within-constituency Goal Coherence of the Rolling-mill constituency (association of .701). In addition, the supplementary analyses operationalize degrees of pretest between-constituency Goal Coherence in Table I-4 for the Management constituency (association of .287) and in Table I-3 for the Rolling-mill constituency (association of .194).

Table I-3: Dimension loadings and scores: pretest of the Management constituency.

Active variable (Management)	DIM1 loading	DIM2 loading	Supplementary variable (Rolling-mill)	DIM1 loading	DIM2 loading
STRI1	.902	-.050	LDON1	.600	.435
DORT1	.949	-.279	NLTN1	.524	.603
GEER1	.968	-.211	VLYN1	.120	.959
BROE1	.949	-.283	DVRS1	.357	.713
WOUD1	.637	.761			
BREE1	.627	.776			
SCHI1	.968	-.195			
eigenvalue	5.290	1.424	eigenvalue	.776	1.981
Cronbach's α	.946	.348	Cronbach's α	-.384	.660
VAF (Σ=.959)	.756	.203	VAF (Σ=.689)	.194	.495
association	**.756**	.134	association	**.194**	.495

Unit (i.e. option)	DIM1 score	DIM2 score
Rolled Loadings (RL)	-.270	1.054
Rolling Plan Conformity (RPC)	-.250	.796
Free For Finishing (FFF)	-1.133	-1.964
First Choices (FC)	.627	.184
Costs For Rolling (CFR)	2.064	-.865
Rolling Scrap (RS)	-.080	.784
Round Tests (RT)	-.960	.009

Table I-4: Dimension loadings and scores: pretest of the Rolling-mill constituency.

Active variable (Rolling-mill)	DIM1 loading	DIM2 loading	Supplementary variable (Management)	DIM1 loading	DIM2 loading
LDON1	.587	.798	STRI1	.513	.682
NLTN1	.925	.050	DORT1	-.127	.477
VLYN1	.914	-.184	GEER1	.302	.546
DVRS1	.876	-.395	BROE1	.438	.118
			WOUD1	.906	.100
			BREE1	.619	.766
			SCHI1	.525	.579
eigenvalue	2.803	.829	eigenvalue	2.042	1.937
Cronbach's α	.858	-.275	Cronbach's α	.595	.564
VAF (Σ=.908)	.701	.207	VAF (Σ=.568)	.292	.277
association	**.701**	.112	association	**.287**	.277

Unit (i.e. option)	DIM1 score	DIM2 score
Rolled Loadings (RL)	.788	.811
Rolling Plan Conformity (RPC)	.033	-1.160
Free For Finishing (FFF)	-2.378	.303
First Choices (FC)	.650	-.431
Costs For Rolling (CFR)	.242	.726
Rolling Scrap (RS)	.439	1.317
Round Tests (RT)	.226	-1.567

The data of Table I-3 and Table I-4 regarding the supplementary variables in the CATPCA analyses are graphically depicted in Figure I-1 and Figure I-2, visualizing posttest degrees of between-constituency Goal Coherence. Low degrees of association with the dominant dimension of the goal interdependent constituency (DIM1) are nicely illustrated by the small vector lengths and the relatively large loadings upon the second dimension (DIM2).

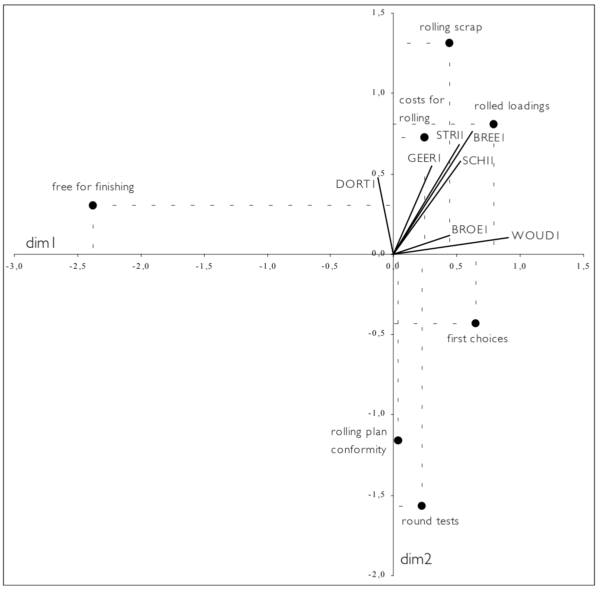

Figure I-1: Supplementary pretest of the Management constituency.

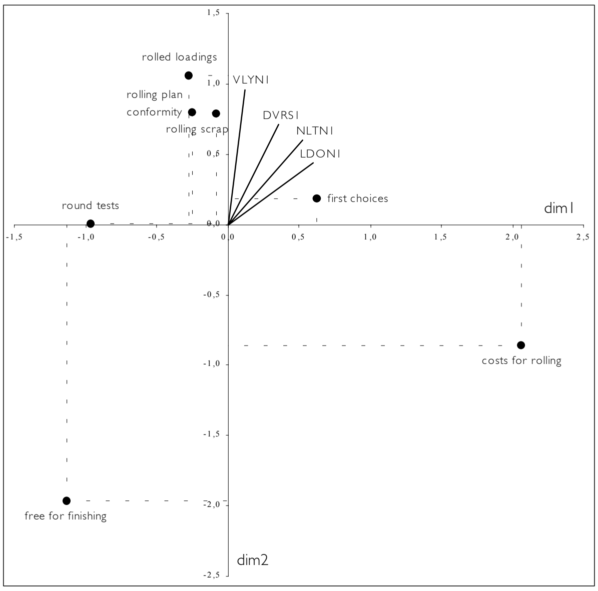

Figure I-2: Supplementary pretest of the Rolling-mill constituency.

Appendix J.

MANAGEMENT & FINISHING-CENTER CONSTITUENCY

The pretest ranking data *'O'$_{I,M}$* of the Management constituency and $O_{I,F}$ of the Finishing-center constituency is depicted in Table J-1 and Table J-2 respectively. The pretest feature of the data is highlighted by the figure 1 extension of the abbreviated constituency member names.

Table J-1: Categorical data 'O'$_{I,M}$: pretest of the Management constituency.

	STRI1	DORT1	GEER1	BROE1	WOUD1	BREE1	SCHI1
increase Finished Tons (FT)	4	2	3	1	4	7	5
decrease Finishing Lead-time (FL)	3	5	5	3	6	5	3
decrease Work In Process (WIP)	2	3	2	2	1	3	2
decrease Post-IRUS Infections (PII)	5	6	6	6	7	6	6
decrease Costs For Finishing (CFF)	7	7	7	7	5	7	7
decrease Finishing Scrap (FS)	6	4	4	5	3	7	4
decrease Round Repairtime (RR)	1	1	1	4	2	4	1

Table J-2: Categorical data $O_{I,F}$: pretest of the Finishing-center constituency.

	PRNK1	SCGT1	TLDR1	MDRK1	VERK1	ESSR1
increase Finished Tons (FT)	6	6	6	4	5	3
decrease Finishing Lead-time (FL)	3	3	1	2	1	6
decrease Work In Process (WIP)	1	7	4	7	7	7
decrease Post-IRUS Infections (PII)	4	5	7	6	2	4
decrease Costs For Finishing (CFF)	7	1	5	1	4	1
decrease Finishing Scrap (FS)	2	4	3	3	6	2
decrease Round Repairtime (RR)	5	2	2	5	3	5

The results of the CATPCA analyses of the pretest data in terms of vector coordinates (representing the subjects in the analysis) and point coordinates (representing the options in the analysis) are presented in Table J-3 and Table J-4 for the Management constituency and the Finishing-center constituency respectively. Concretely, Table J-3 shows the non-metric transformation of Table J-1 for determining the degree of pretest within-constituency Goal Coherence of the Management constituency (association of .756), whereas Table J-4 shows the non-metric transformation of Table J-2 for determining the degree of pretest within-constituency Goal Coherence of the Finishing-center constituency (association of .375). In addition, the supplementary analyses operationalize degrees of pretest between-constituency Goal Coherence in Table J-4 for the Management constituency (association of -.414) and in Table J-3 for the Finishing-center constituency (association of -.094).

Table J-3: Dimension loadings and scores: pretest of the Management constituency.

Active variable (Management)	DIM1 loading	DIM2 loading	Supplementary variable (Finishing-center)	DIM1 loading	DIM2 loading
STRI1	.902	-.050	PRNK1	.625	.485
DORT1	.949	-.279	SCGT1	-.481	-.600
GEER1	.968	-.211	TLDR1	.495	-.111
BROE1	.949	-.283	MDRK1	-.390	-.765
WOUD1	.637	.761	VERK1	-.487	-.609
BREE1	.627	.776	ESSR1	-.761	-.416
SCHI1	.968	-.195			
eigenvalue	5.290	1.424	eigenvalue	1.835	1.737
Cronbach's α	.946	.348	Cronbach's α	.546	.509
VAF (Σ=.959)	.756	.203	VAF (Σ=.595)	.306	.289
association	**.756**	.134	association	**-.094**	-.211

Unit (i.e. option)	DIM1 score	DIM2 score
Finished Tons (FT)	-.270	1.054
Finishing Lead-time (FL)	-.250	.796
Work In Process (WIP)	-1.133	-1.964
Post-IRUS Infections (PII)	.627	.184
Costs For Finishing (CFF)	2.064	-.865
Finishing Scrap (FS)	-.080	.784
Round Repairtime (RR)	-.960	.009

Table J-4: Dimension loadings and scores: pretest of the Finishing-center constituency.

Active variable (Finishing-center)	DIM1 loading	DIM2 loading	Supplementary variable (Management)	DIM1 loading	DIM2 loading
PRNK1	-.956	.161	STRI1	-.472	.148
SCGT1	.889	.306	DORT1	-.437	.087
TLDR1	-.272	.953	GEER1	-.527	.151
MDRK1	.857	.436	BROE1	-.530	.097
VERK1	.954	-.091	WOUD1	-.880	.113
ESSR1	.895	-.162	BREE1	-.932	.035
			SCHI1	-.534	.478
eigenvalue	4.224	1.252	eigenvalue	2.901	.304
Cronbach's α	.916	.242	Cronbach's α	.764	-2.669
VAF (Σ=.913)	.704	.209	VAF (Σ=.458)	.414	.043
association	**.375**	.197	association	**-.414**	.043

Unit (i.e. option)	DIM1 score	DIM2 score
Finished Tons (FT)	-.327	.700
Finishing Lead-time (FL)	-.282	-.873
Work In Process (WIP)	2.380	.049
Post-IRUS Infections (PII)	-.447	2.101
Costs For Finishing (CFF)	-.842	-.646
Finishing Scrap (FS)	.005	-.789
Round Repairtime (RR)	-.488	-.540

The data of Table J-3 and Table J-4 regarding the supplementary variables in the CATPCA analyses are graphically depicted in Figure J-1 and Figure J-2, visualizing posttest degrees of between-constituency Goal Coherence. Opposite ordering preferences between the Management constituency and the Finishing-center constituency are nicely illustrated by the negatively directed vectors, caused by the negative loadings upon the dominant dimension of the goal interdependent constituency (DIM1).

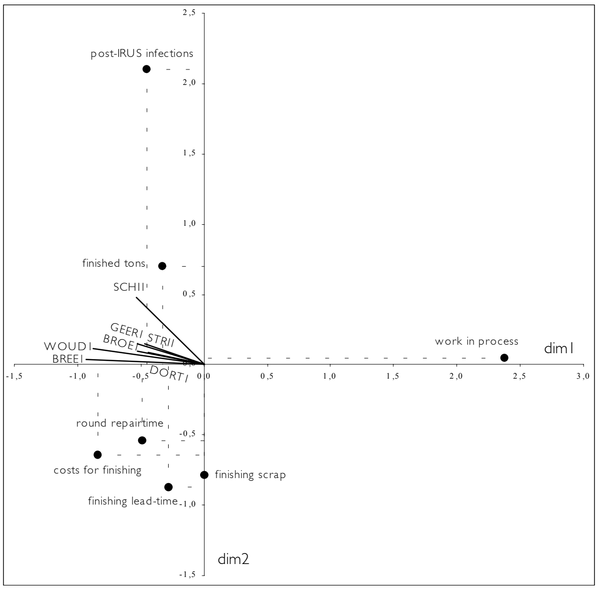

Figure J-1: Supplementary pretest of the Management constituency.

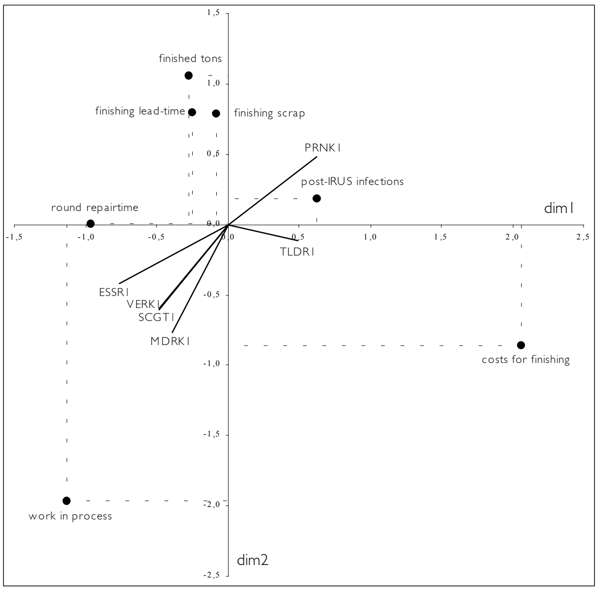

Figure J-2: Supplementary pretest of the Finishing-center constituency.

Appendix K.
ROLLING-MILL & FINISHING-CENTER CONSTITUENCY

The pretest ranking data *'O'$_{I,R}$* of the Rolling-mill constituency and $O_{I,F}$ of the Finishing-center constituency is depicted in Table K-1 and Table K-2 respectively. The pretest feature of the data is highlighted by the figure 1 extension of the abbreviated constituency member names.

Table K-1: Categorical data 'O'$_{I,R}$: pretest of the Rolling-mill constituency.

	LDON1	NLTN1	VLYN1	DVRS1
increase Finished Tons (FT)	7	3	6	7
decrease Finishing Lead-time (FL)	3	2	5	4
decrease Work In Process (WIP)	2	1	1	1
decrease Post-IRUS Infections (PII)	4	7	7	6
decrease Costs For Finishing (CFF)	5	5	2	3
decrease Finishing Scrap (FS)	6	6	4	2
decrease Round Repairtime (RR)	1	4	3	5

Table K-2: Categorical data $O_{I,F}$: pretest of the Finishing-center constituency.

	PRNK1	SCGT1	TLDR1	MDRK1	VERK1	ESSR1
increase Finished Tons (FT)	6	6	6	4	5	3
decrease Finishing Lead-time (FL)	3	3	1	2	1	6
decrease Work In Process (WIP)	1	7	4	7	7	7
decrease Post-IRUS Infections (PII)	4	5	7	6	2	4
decrease Costs For Finishing (CFF)	7	1	5	1	4	1
decrease Finishing Scrap (FS)	2	4	3	3	6	2
decrease Round Repairtime (RR)	5	2	2	5	3	5

The results of the CATPCA analyses of the pretest data in terms of vector coordinates (representing the subjects in the analysis) and point coordinates (representing the options in the analysis) are presented in Table K-3 and Table K-4 for the Rolling-mill constituency and the Finishing-center constituency respectively. Concretely, Table K-3 shows the non-metric transformation of Table K-1 for determining the degree of pretest within-constituency Goal Coherence of the Rolling-mill constituency (association of .701), whereas Table K-4 shows the non-metric transformation of Table K-2 for determining the degree of pretest within-constituency Goal Coherence of the Finishing-center constituency (association of .375). In addition, the supplementary analyses operationalize degrees of pretest between-constituency Goal Coherence in Table K-4 for the Rolling-mill constituency (association of -.480) and in Table K-3 for the Finishing-center constituency (association of -.363).

Table K-3: Dimension loadings and scores: pretest of the Rolling-mill constituency.

Active variable (Rolling-mill)	DIM1 loading	DIM2 loading	Supplementary variable (Finishing-center)	DIM1 loading	DIM2 loading
LDON1	.587	.798	PRNK1	.886	-.309
NLTN1	.925	.050	SCGT1	-.795	.250
VLYN1	.914	-.184	TLDR1	-.074	.695
DVRS1	.876	-.395	MDRK1	-.839	-.025
			VERK1	-.846	.411
			ESSR1	-.951	-.157
eigenvalue	2.803	.829	eigenvalue	3.747	.835
Cronbach's α	.858	-.275	Cronbach's α	.880	-.237
VAF (Σ=.908)	.701	.207	VAF (Σ=.764)	.624	.139
association	**.701**	.112	association	**-.363**	.099

Unit (i.e. option)	DIM1 score	DIM2 score
Finished Tons (FT)	.788	.811
Finishing Lead-time (FL)	.033	-1.160
Work In Process (WIP)	-2.378	.303
Post-IRUS Infections (PII)	.650	-.431
Costs For Finishing (CFF)	.242	.726
Finishing Scrap (FS)	.439	1.317
Round Repairtime (RR)	.226	-1.567

Table K-4: Dimension loadings and scores: pretest of the Finishing-center constituency.

Active variable (Finishing-center)	DIM1 loading	DIM2 loading	Supplementary variable (Rolling-mill)	DIM1 loading	DIM2 loading
PRNK1	-.956	.161	LDON1	-.417	.115
SCGT1	.889	.306	NLTN1	-.902	.106
TLDR1	-.272	.953	VLYN1	-.253	.941
MDRK1	.857	.436	DVRS1	-.931	.152
VERK1	.954	-.091			
ESSR1	.895	-.162			
eigenvalue	4.224	1.252	eigenvalue	1.918	.933
Cronbach's α	.916	.242	Cronbach's α	.638	-.096
VAF (Σ=.913)	.704	.209	VAF (Σ=.713)	.480	.233
association	**.375**	.197	association	**-.480**	.233

Unit (i.e. option)	DIM1 score	DIM2 score
Finished Tons (FT)	-.327	.700
Finishing Lead-time (FL)	-.282	-.873
Work In Process (WIP)	2.380	.049
Post-IRUS Infections (PII)	-.447	2.101
Costs For Finishing (CFF)	-.842	-.646
Finishing Scrap (FS)	.005	-.789
Round Repairtime (RR)	-.488	-.540

The data of Table K-3 and Table K-4 regarding the supplementary variables in the CATPCA analyses are graphically depicted in Figure K-1 and Figure K-2, visualizing pretest degrees of between-constituency Goal Coherence. Opposite ordering preferences between the Rolling-mill constituency and the Finishing-center constituency are nicely illustrated by the negatively directed vectors, caused by the negative loadings upon the dominant dimension of the goal interdependent constituency (DIM1).

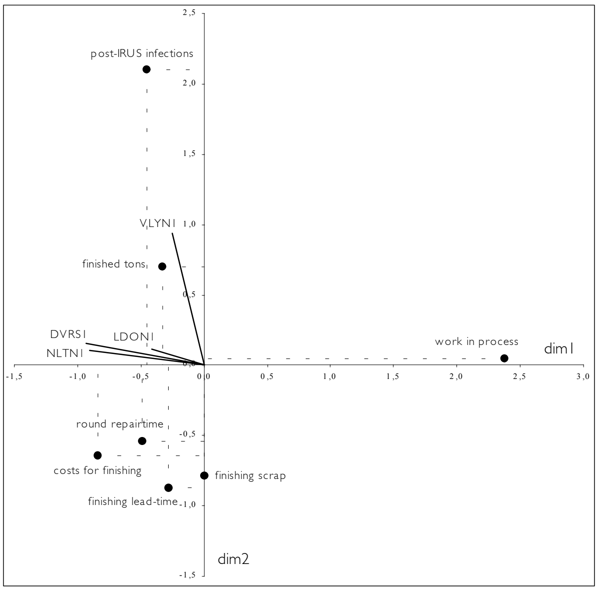

Figure K-1: Supplementary pretest of the Rolling-mill constituency.

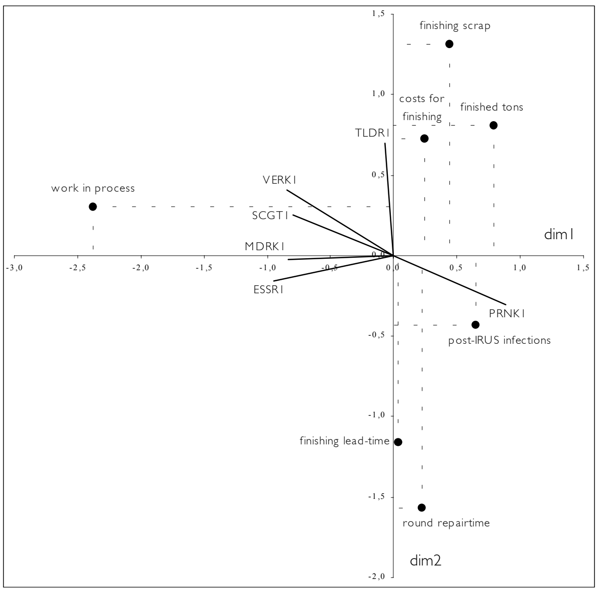

Figure K-2: Supplementary pretest of the Finishing-center constituency.

Appendix L.
STEELWORKS SHIFT CONSTITUENCIES

The categorical data sets obtained are depicted in Table L-1, Table L-2, Table L-3, Table L-4 and Table L-5.

Table L-1: Categorical data $O_{1,S\text{-}b}$: pretest of the Steelworks Blue Shift constituency.

	HSMN1	GRHS1	GDHT1	HOOP1	BNTJ1	TON1	SPNJ1	HWGH1
increase Cast Loadings (CL)	5	3	5	6	5	4	3	2
increase Casting Plan Conformity (CPC)	6	5	1	4	6	6	6	6
increase Free For Rolling (FFR)	3	4	4	1	1	1	2	5
increase First Choices (FC)	7	7	7	7	7	7	7	7
decrease Costs For Casting (CFC)	4	6	6	5	4	2	5	4
decrease Casting Scrap (CS)	2	1	3	2	2	3	1	3
increase Test Loadings (TL)	1	2	2	3	3	5	4	1

Table L-2: Categorical data $O_{1,S\text{-}g}$: pretest of the Steelworks Green Shift constituency.

	KNAP1	BTEN1	SPDR1	VDBS1	KRHR1	ARP1	HAAN1	TAS1
increase Cast Loadings (CL)	1	-	4	4	-	-	7	6
increase Casting Plan Conformity (CPC)	7	-	5	7	-	-	3	7
increase Free For Rolling (FFR)	5	-	6	2	-	-	2	1
increase First Choices (FC)	6	-	7	6	-	-	4	5
decrease Costs For Casting (CFC)	4	-	2	5	-	-	5	4
decrease Casting Scrap (CS)	3	-	3	1	-	-	6	3
increase Test Loadings (TL)	2	-	1	3	-	-	1	2

Table L-3: Categorical data $O_{1,S\text{-}r}$: pretest of the Steelworks Red Shift constituency.

	BSMA1	NWHZ1	KIEF1	GUL1	STAM1	MNDN1	KATS1
increase Cast Loadings (CL)	6	-	2	-	-	-	-
increase Casting Plan Conformity (CPC)	5	-	6	-	-	-	-
increase Free For Rolling (FFR)	1	-	5	-	-	-	-
increase First Choices (FC)	7	-	7	-	-	-	-
decrease Costs For Casting (CFC)	2	-	3	-	-	-	-
decrease Casting Scrap (CS)	4	-	4	-	-	-	-
increase Test Loadings (TL)	3	-	1	-	-	-	-

Table L-4: Categorical data $O_{1,S\text{-}w}$: pretest of the Steelworks White Shift constituency.

	WTVR1	DIJK1	RSBR1	SSLK1	BURG1	VRSS1	MLBG1	RBBR1	CZZL1
increase Cast Loadings (CL)	2	4	3	2	7	4	5	6	6
increase Casting Plan Conformity (CPC)	4	5	5	6	3	5	6	2	7
increase Free For Rolling (FFR)	1	1	4	4	1	3	2	3	4
increase First Choices (FC)	7	7	7	7	4	7	7	7	5
decrease Costs For Casting (CFC)	6	6	6	5	6	1	3	5	1
decrease Casting Scrap (CS)	5	3	2	3	5	6	4	4	3
increase Test Loadings (TL)	3	2	1	1	2	2	1	1	2

Table L-5: Categorical data $O_{1,S\text{-}y}$: pretest of the Steelworks Yellow Shift constituency.

	VRIS1	ENDL1	KPPS1	NCLA1	TIJS1	BART1	KUIL1
increase Cast Loadings (CL)	5	-	7	-	3	4	5
increase Casting Plan Conformity (CPC)	7	-	5	-	5	3	6
increase Free For Rolling (FFR)	4	-	2	-	2	1	2
increase First Choices (FC)	6	-	6	-	7	5	7
decrease Costs For Casting (CFC)	3	-	4	-	1	7	4
decrease Casting Scrap (CS)	2	-	3	-	6	6	1
increase Test Loadings (TL)	1	-	1	-	4	2	3

The results of the CATPCA analyses of the pretest ranking data of Table L-1, Table L-2, Table L-3, Table L-4 and Table L-5 are presented in Table L-6, Table L-7, Table L-8, Table L-9 and Table L-10 respectively. Each table reveals 2 sets of supplementary variables, since each shift is goal interdependent bilaterally upon a preceding and a succeeding shift.

Table L-6: Dimension loadings and scores: pretest of the Steelworks Blue Shift constituency.

Active variable (Blue Shift)	DIM1 loading	DIM2 loading	Suppl. variable (Yellow Shift)	DIM1 loading	DIM2 loading	Suppl. variable (Green Shift)	DIM1 loading	DIM2 loading
HSMN1	.975	-.205	VRIS1	.502	-.670	KNAP1	.492	-.710
GRHS1	.919	.295	KPPS1	.646	.133	SPDR1	.848	-.006
GDHT1	.765	.638	TIJS1	.827	-.049	VDBS1	.506	-.638
HOOP1	.872	.347	BART1	.040	.611	HAAN1	-.001	.557
BNTJ1	.975	-.205	KUIL1	.975	-.205	TAS1	.527	-.058
TON1	.959	-.265						
SPBJ1	.980	-.173						
HWGH1	.962	-.247						
eigenvalue	6.897	.860	eigenvalue	2.305	.884	eigenvalue	1.495	1.225
Cronbach's α	.977	-.187	Cronbach's α	.708	-.163	Cronbach's α	.414	.229
VAF (Σ=.970)	.862	.107	VAF (Σ=.638)	.461	.177	VAF (Σ=.544)	.299	.245
association	**.862**	.046	association	**.461**	-.020	association	**.299**	-.121

Unit (i.e. option)	DIM1 score	DIM2 score
Cast Loadings (CL)	-.323	.864
Casting Plan Conformity (CPC)	.234	-1.841
Free For Rolling (FFR)	-.610	-.056
First Choices (FC)	2.331	.217
Costs For Casting (CFC)	-.231	1.583
Casting Scrap (CS)	-.725	-.299
Test Loadings (TL)	-.675	-.468

Table L-7: Dimension loadings and scores: pretest of the Steelworks Green Shift constituency.

Active variable (Green Shift)	DIM1 loading	DIM2 loading	Suppl. variable (Blue Shift)	DIM1 loading	DIM2 loading	Suppl. variable (Red Shift)	DIM1 loading	DIM2 loading
VRIS1	.982	-.145	HSMN1	.774	.474	BSMA1	.493	.659
KPPS1	.711	-.055	GRHS1	.664	-.117	KIEF1	.819	-.253
TIJS1	.953	.054	GDHT1	-.598	.077			
BART1	-.390	.899	HOOP1	.298	.585			
KUIL1	.709	.678	BNTJ1	.707	.494			
			TON1	.711	-.077			
			SPBJ1	.748	-.070			
			HWGH1	.845	-.296			
eigenvalue	3.033	1.295	eigenvalue	3.765	.929	eigenvalue	.914	.498
Cronbach's α	.838	.285	Cronbach's α	.839	-.087	Cronbach's α	-.189	-2.014
VAF (Σ=.866)	.607	.259	VAF (Σ=.587)	.471	.116	VAF (Σ=.706)	.457	.249
association	**.546**	.249	association	**.381**	.088	association	**.457**	.185

Unit (i.e. option)	DIM1 score	DIM2 score
Cast Loadings (CL)	-.500	2.077
Casting Plan Conformity (CPC)	1.976	.226
Free For Rolling (FFR)	-.088	-1.234
First Choices (FC)	.955	-.247
Costs For Casting (CFC)	-.528	-.070
Casting Scrap (CS)	-.906	.242
Test Loadings (TL)	-.908	-.994

Table L-8: Dimension loadings and scores: pretest of the Steelworks Red Shift constituency.

Active variable (Red Shift)	DIM1 loading	DIM2 loading	Suppl. variable (Green Shift)	DIM1 loading	DIM2 loading	Suppl. variable (White Shift)	DIM1 loading	DIM2 loading
BSMA1	.812	-.584	VRIS1	.520	.793	WTVR1	.605	.034
KIEF1	.812	.584	KPPS1	.799	.378	DIJK1	.602	-.420
			TIJS1	.676	.150	RSBR1	.673	.341
			BART1	-.038	-.660	SSLK1	.850	.418
			KUIL1	.646	-.448	BURG1	.326	-.648
						VRSS1	.895	-.037
						MLBG1	.976	-.153
						RBBR1	.718	-.282
						CZZL1	.721	-.121
eigenvalue	1.319	.682	eigenvalue	1.785	1.431	eigenvalue	4.799	1.007
Cronbach's α	.483	-.932	Cronbach's α	.550	.376	Cronbach's α	.891	.008
VAF (Σ=1)	.659	.341	VAF (Σ=.643)	.357	.286	VAF (Σ=.645)	.533	.112
association	**.659**	.000	association	**.356**	.032	association	**.533**	-.047

Unit (i.e. option)	DIM1 score	DIM2 score
Cast Loadings (CL)	.000	-1.673
Casting Plan Conformity (CPC)	.894	.430
Free For Rolling (FFR)	-.654	1.724
First Choices (FC)	1.864	.000
Costs For Casting (CFC)	-.885	.441
Casting Scrap (CS)	.011	.000
Test Loadings (TL)	-1.230	-.921

Table L-9: Dimension loadings and scores: pretest of the Steelworks White Shift constituency.

Active variable (White Shift)	DIM1 loading	DIM2 loading	Suppl. variable (Red Shift)	DIM1 loading	DIM2 loading	Suppl. variable (Yellow Shift)	DIM1 loading	DIM2 loading
WTVR1	.931	-.303	BSMA1	.866	.357	VRIS1	.551	.536
DIJK1	.969	-.245	KIEF1	.884	.323	KPPS1	.681	.193
RSBR1	.947	-.215				TIJS1	.849	.242
SSLK1	.935	.186				BART1	.078	-.848
BURG1	.547	-.245				KUIL1	.919	.316
VRSS1	.133	.972						
MLBG1	.928	.319						
RBBR1	.884	.171						
CZZL1	.107	.993						
eigenvalue	5.548	2.355	eigenvalue	1.531	.232	eigenvalue	2.339	1.202
Cronbach's α	.922	.647	Cronbach's α	.694	-6.629	Cronbach's α	.716	.210
VAF (Σ=.878)	.616	.262	VAF (Σ=.882)	.766	.116	VAF (Σ=.708)	.468	.240
association	**.616**	.204	association	**.766**	.116	association	**.468**	-.047

Unit (i.e. option)	DIM1 score	DIM2 score
Cast Loadings (CL)	-.243	.625
Casting Plan Conformity (CPC)	.041	.707
Free For Rolling (FFR)	-1.011	.744
First Choices (FC)	2.268	.394
Costs For Casting (CFC)	.125	-2.253
Casting Scrap (CS)	-.415	.279
Test Loadings (TL)	-.765	-.496

Table L-10: Dimension loadings and scores: pretest of the Steelworks Yellow Shift constituency.

Active variable (Yellow Shift)	DIM1 loading	DIM2 loading	Suppl. variable (White Shift)	DIM1 loading	DIM2 loading	Suppl. variable (Blue Shift)	DIM1 loading	DIM2 loading
VRIS1	.855	-.469	WTVR1	.542	.704	HSMN1	.977	-.168
KPPS1	.928	-.059	DIJK1	.806	.463	GRHS1	.698	.394
TIJS1	.631	.521	RSBR1	.764	.310	GDHT1	.687	.427
BART1	.323	.879	SSLK1	.851	.121	HOOP1	.852	.197
KUIL1	.958	-.163	BURG1	.576	.519	BNTJ1	.964	-.121
			VRSS1	.654	.497	TON1	.819	.062
			MLBG1	.971	.094	SPBJ1	.848	.074
			RBBR1	.794	.322	HWGH1	.821	.046
			CZZL1	.722	-.563			
eigenvalue	3.012	1.294	eigenvalue	5.105	1.767	eigenvalue	5.633	.431
Cronbach's α	.835	.284	Cronbach's α	.905	.488	Cronbach's α	.940	-1.511
VAF (Σ=.861)	.602	.259	VAF (Σ=.764)	.567	.196	VAF (Σ=.758)	.704	.054
association	**.602**	.159	association	**.567**	.126	association	**.704**	.043

Unit (i.e. option)	DIM1 score	DIM2 score
Cast Loadings (CL)	.564	-.584
Casting Plan Conformity (CPC)	.815	-1.299
Free For Rolling (FFR)	-.975	-.920
First Choices (FC)	1.747	.709
Costs For Casting (CFC)	-.270	.913
Casting Scrap (CS)	-.642	1.613
Test Loadings (TL)	-1.238	-.432

Appendix M.
ROLLING-MILL SHIFT CONSTITUENCIES

The categorical data sets obtained are depicted in Table M-1, Table M-2 and Table M-3.

Table M-1: Categorical data $O_{1,R-1}$: pretest of the Rolling-mill First Shift constituency.

	NLTN1	WNDR1	KRDN1	HYNH1	ZWRT1
increase Rolled Loadings (RL)	3	4	6	4	4
increase Rolling Plan Conformity (RPC)	2	3	7	5	7
increase Free For Finishing (FFF)	1	1	4	1	1
increase First Choices (FC)	7	7	5	7	6
decrease Costs For Rolling (CFR)	5	6	2	3	3
decrease Rolling Scrap (RS)	6	5	3	6	5
increase Round Tests (RT)	4	2	1	2	2

Table M-2: Categorical data $O_{1,R-2}$: pretest of the Rolling-mill Second Shift constituency.

	VLYN1	ZDMR1	FRTM1	TOKK1	LUTE1
increase Rolled Loadings (RL)	6	2	2	1	1
increase Rolling Plan Conformity (RPC)	5	4	6	5	3
increase Free For Finishing (FFF)	1	1	1	2	2
increase First Choices (FC)	7	7	7	7	7
decrease Costs For Rolling (CFR)	2	5	4	6	5
decrease Rolling Scrap (RS)	4	6	5	4	6
increase Round Tests (RT)	3	3	3	3	4

Table M-3: Categorical data $O_{1,R-3}$: pretest of the Rolling-mill Third Shift constituency.

	DVRS1	ZWAR1	VRBR1	VDMY1
increase Rolled Loadings (RL)	7	2	1	3
increase Rolling Plan Conformity (RPC)	4	1	2	5
increase Free For Finishing (FFF)	1	7	3	1
increase First Choices (FC)	6	4	7	7
decrease Costs For Rolling (CFR)	3	5	5	2
decrease Rolling Scrap (RS)	2	6	4	6
increase Round Tests (RT)	5	3	6	4

The results of the CATPCA analyses of the pretest ranking data of Table M-1, Table M-2 and Table M-3 are presented in Table M-4, Table M-5 and Table M-6 respectively. Each table reveals 2 sets of supplementary variables, since each shift is goal interdependent bilaterally upon a preceding and a succeeding shift.

Table M-4: Dimension loadings and scores: pretest of the Rolling-mill First Shift constituency.

Active variable (First Shift)	DIM1 loading	DIM2 loading	Suppl. variable (Third Shift)	DIM1 loading	DIM2 loading	Suppl. variable (Second Shift)	DIM1 loading	DIM2 loading
NLTN1	.804	-.589	DVRS1	.782	-.056	VLYN1	.868	.039
WNDR1	.995	-.004	ZWAR1	-.240	-.800	ZDMR1	.844	-.242
KRDN1	.257	.965	VRBR1	.152	-.820	FRTM1	.839	-.227
HYNH1	.993	.115	VDMY1	.823	-.071	TOKK1	.556	-.019
ZWRT1	.993	.116				LUTE1	.507	-.573
eigenvalue	3.675	1.305	eigenvalue	1.370	1.321	eigenvalue	2.736	.440
Cronbach's α	.910	.292	Cronbach's α	.360	.324	Cronbach's α	.793	-1.589
VAF (Σ=.996)	.735	.261	VAF (Σ=.673)	.342	.330	VAF (Σ=.635)	.547	.088
association	**.735**	.122	association	**.314**	-.330	association	**.547**	-.087

Unit (i.e. option)	DIM1 score	DIM2 score
Rolled Loadings (RL)	.584	.619
Rolling Plan Conformity (RPC)	.388	1.853
Free For Finishing (FFF)	-2.266	.444
First Choices (FC)	.701	-.202
Costs For Rolling (CFR)	.436	-.806
Rolling Scrap (RS)	.663	-.466
Round Tests (RT)	-.505	-1.442

Table M-5: Dimension loadings and scores: pretest of the Rolling-mill Second Shift constituency.

Active variable (Second Shift)	DIM1 loading	DIM2 loading	Suppl. variable (First Shift)	DIM1 loading	DIM2 loading	Suppl. variable (Third Shift)	DIM1 loading	DIM2 loading
VLYN1	.613	-.777	NLTN1	.757	-.408	DVRS1	-.219	-.924
ZDMR1	.965	-.218	WNDR1	.685	-.567	ZWAR1	-.575	.613
FRTM1	.964	-.239	KRDN1	-.159	-.602	VRBR1	.495	.771
TOKK1	.834	.544	HYNH1	.730	-.603	VDMY1	.775	-.574
LUTE1	.813	.570	ZWRT1	.662	-.640			
eigenvalue	3.593	1.329	eigenvalue	2.039	1.624	eigenvalue	1.224	2.153
Cronbach's α	.902	.310	Cronbach's α	.637	.480	Cronbach's α	.244	.714
VAF (Σ=.984)	.719	.266	VAF (Σ=.732)	.408	.325	VAF (Σ=.844)	.306	.538
association	**.719**	-.018	association	**.398**	-.325	association	**.117**	-.053

Unit (i.e. option)	DIM1 score	DIM2 score
Rolled Loadings (RL)	-1.276	-2.017
Rolling Plan Conformity (RPC)	.569	-.069
Free For Finishing (FFF)	-1.745	1.363
First Choices (FC)	1.174	-.527
Costs For Rolling (CFR)	.374	.826
Rolling Scrap (RS)	.649	.117
Round Tests (RT)	.255	.307

Table M-6: Dimension loadings and scores: pretest of the Rolling-mill Third Shift constituency.

Active variable (Third Shift)	DIM1 loading	DIM2 loading	Suppl. variable (Second Shift)	DIM1 loading	DIM2 loading	Suppl. variable (First Shift)	DIM1 loading	DIM2 loading
DVRS1	.976	.085	VLYN1	.903	.127	NLTN1	.712	.443
ZWAR1	-.981	-.048	ZDMR1	.705	.609	WNDR1	.776	.112
VRBR1	-.397	.914	FRTM1	.723	.593	KRDN1	.412	-.588
VDMY1	.886	.262	TOKK1	.046	.901	HYNH1	.815	.074
			LUTE1	.053	.971	ZWRT1	.818	.076
eigenvalue	2.858	.914	eigenvalue	1.840	2.493	eigenvalue	2.612	.566
Cronbach's α	.867	-.126	Cronbach's α	.571	.749	Cronbach's α	.771	-.959
VAF (Σ=.943)	.714	.228	VAF (Σ=.867)	.368	.499	VAF (Σ=.636)	.522	.113
association	.154	**.227**	association	.368	**.499**	association	.522	**-.025**

Unit (i.e. option)	DIM1 score	DIM2 score
Rolled Loadings (RL)	.882	-2.021
Rolling Plan Conformity (RPC)	.766	-.353
Free For Finishing (FFF)	-2.226	-.638
First Choices (FC)	.515	.903
Costs For Rolling (CFR)	-.113	.489
Rolling Scrap (RS)	-.350	.717
Round Tests (RT)	.526	.903

Appendix N.
FINISHING-CENTER SHIFT CONSTITUENCIES

The categorical data sets obtained are depicted in Table N-1 for the Blue Shift, Green Shift and Red Shift constituencies and in Table N-2 for the White Shift and Yellow Shift constituencies.

Table N-1: Categorical data $O_{1,F\text{-}b}$, $O_{1,F\text{-}g}$, $O_{1,F\text{-}r}$: pretest of the Finishing-center Blue, Green and Red Shift constituencies.

	Blue Shift			Green Shift			Red Shift		
	SCGT1	HRTM1	GLOR1	MDRK1	VREE1	KLOP1	VERK1	ZNDG1	GLIE1
increase Finished Tons (FT)	6	2	1	4	6	6	5	1	7
decrease Finishing Lead-time (FL)	3	6	6	2	3	2	1	2	2
decrease Work In Process (WIP)	7	3	4	7	2	3	7	4	1
decrease Post-IRUS Infections (PII)	5	7	7	6	7	7	2	7	6
decrease Costs For Finishing (CFF)	1	1	2	1	1	1	4	3	5
decrease Finishing Scrap (FS)	4	5	5	3	4	4	6	5	3
decrease Round Repairtime (RR)	2	4	3	5	5	5	3	6	4

Table N-2: Categorical data $O_{1,F\text{-}w}$, $O_{1,F\text{-}y}$: pretest of the Finishing-center White and Yellow Shift constituencies.

	White Shift			Yellow Shift		
	ESSR1	GTSM1	BKKR1	TLDR1	VDRL1	LOON1
increase Finished Tons (FT)	3	7	6	6	6	6
decrease Finishing Lead-time (FL)	6	3	4	1	2	2
decrease Work In Process (WIP)	7	5	1	4	4	4
decrease Post-IRUS Infections (PII)	4	6	7	7	7	7
decrease Costs For Finishing (CFF)	1	4	5	5	3	3
decrease Finishing Scrap (FS)	2	2	2	3	1	1
decrease Round Repairtime (RR)	5	1	3	2	5	5

The results of the CATPCA analyses of the pretest ranking data of Table N-1 and Table N-2 are presented in Table N-3, Table N-4, Table N-5, Table N-6 and Table N-7 respectively. Each table reveals 2 sets of supplementary variables, since each shift is goal interdependent bilaterally upon a preceding and a succeeding shift.

Table N-3: Dimension loadings and scores: pretest of the Finishing-center Blue Shift constituency.

Active variable (Blue Shift)	DIM1 loading	DIM2 loading	Suppl. variable (Yellow Shift)	DIM1 loading	DIM2 loading	Suppl. variable (Green Shift)	DIM1 loading	DIM2 loading
SCGT1	.094	.996	TLDR1	.763	.210	MDRK1	.199	.794
HRTM1	.999	-.049	VDRL1	.764	.225	VREE1	.765	.243
GLOR1	.999	-.045	LOON1	.764	.225	KLOP1	.754	.262
eigenvalue	2.005	.996	eigenvalue	1.750	.145	eigenvalue	1.193	.758
Cronbach's α	.752	-.005	Cronbach's α	.643	-8.820	Cronbach's α	.243	-.479
VAF (Σ=1)	.668	.332	VAF (Σ=.632)	.583	.048	VAF (Σ=.650)	.398	.253
association	**.668**	.329	association	**.583**	.048	association	**.398**	.253

Unit (i.e. option)	DIM1 score	DIM2 score
Finished Tons (FT)	-.595	1.053
Finishing Lead-time (FL)	.612	-.655
Work In Process (WIP)	-.551	1.715
Post-IRUS Infections (PII)	2.219	.189
Costs For Finishing (CFF)	-.704	-1.266
Finishing Scrap (FS)	-.307	-.103
Round Repairtime (RR)	-.675	-.933

Table N-4: Dimension loadings and scores: pretest of the Finishing-center Green Shift constituency.

Active variable (Green Shift)	DIM1 loading	DIM2 loading	Suppl. variable (Blue Shift)	DIM1 loading	DIM2 loading	Suppl. variable (Red Shift)	DIM1 loading	DIM2 loading
MDRK1	.554	.832	SCGT1	.246	.790	VERK1	-.141	.871
VREE1	.967	-.255	HRTM1	.688	-.248	ZNDG1	.816	-.101
KLOP1	.975	-.220	GLOR1	.688	-.248	GLIE1	.394	-.791
eigenvalue	2.193	.806	eigenvalue	1.007	.747	eigenvalue	.841	1.395
Cronbach's α	.816	-.362	Cronbach's α	.011	-.508	Cronbach's α	-.284	.424
VAF (Σ=.999)	.731	.269	VAF (Σ=.585)	.336	.249	VAF (Σ=.745)	.280	.465
association	**.731**	.193	association	**.336**	.167	association	**.267**	.041

Unit (i.e. option)	DIM1 score	DIM2 score
Finished Tons (FT)	.590	-.585
Finishing Lead-time (FL)	-.824	-.488
Work In Process (WIP)	-.142	2.266
Post-IRUS Infections (PII)	2.127	-.379
Costs For Finishing (CFF)	-1.022	-1.008
Finishing Scrap (FS)	-.610	-.131
Round Repairtime (RR)	-.119	.327

Table N-5: Dimension loadings and scores: pretest of the Finishing-center Red Shift constituency.

Active variable (Red Shift)	DIM1 loading	DIM2 loading	Suppl. variable (Green Shift)	DIM1 loading	DIM2 loading	Suppl. variable (White Shift)	DIM1 loading	DIM2 loading
VERK1	-.941	.210	MDRK1	-.753	.419	ESSR1	-.921	-.071
ZNDG1	.123	.989	VREE1	.555	.341	GTSM1	-.276	-.510
GLIE1	.959	.079	KLOP1	.429	.429	BKKR1	.926	-.313
eigenvalue	1.820	1.028	eigenvalue	1.059	.476	eigenvalue	1.782	.363
Cronbach's α	.676	.042	Cronbach's α	.084	-1.652	Cronbach's α	.658	-2.631
VAF (Σ=.950)	.607	.343	VAF (Σ=.512)	.353	.159	VAF (Σ=.715)	.594	.121
association	.016	**.343**	association	-.025	**.159**	association	-.022	**-.121**

Unit (i.e. option)	DIM1 score	DIM2 score
Finished Tons (FT)	.410	-1.257
Finishing Lead-time (FL)	-.084	-1.281
Work In Process (WIP)	-2.310	.281
Post-IRUS Infections (PII)	.747	1.161
Costs For Finishing (CFF)	.612	-.770
Finishing Scrap (FS)	-.112	.843
Round Repairtime (RR)	.737	1.023

Table N-6: Dimension loadings and scores: pretest of the Finishing-center White Shift constituency.

Active variable (White Shift)	DIM1 loading	DIM2 loading	Suppl. variable (Red Shift)	DIM1 loading	DIM2 loading	Suppl. variable (Yellow Shift)	DIM1 loading	DIM2 loading
ESSR1	-.535	.834	VERK1	-.487	.670	TLDR1	.936	.191
GTSM1	.739	.655	ZNDG1	-.429	-.092	VDRL1	.825	.106
BKKR1	.981	-.038	GLIE1	.529	-.836	LOON1	.825	.106
eigenvalue	1.795	1.126	eigenvalue	.701	1.156	eigenvalue	2.237	.059
Cronbach's α	.664	.168	Cronbach's α	-.640	.203	Cronbach's α	.830	-23.94
VAF (Σ=.974)	.598	.375	VAF (Σ=.619)	.234	.385	VAF (Σ=.765)	.746	.020
association	**.407**	.374	association	**-.047**	-.086	association	**.746**	.020

Unit (i.e. option)	DIM1 score	DIM2 score
Finished Tons (FT)	1.244	.198
Finishing Lead-time (FL)	-.538	.167
Work In Process (WIP)	-.972	2.101
Post-IRUS Infections (PII)	1.574	.105
Costs For Finishing (CFF)	.445	-.405
Finishing Scrap (FS)	-.818	-1.065
Round Repairtime (RR)	-.935	-1.100

Table N-7: Dimension loadings and scores: pretest of the Finishing-center Yellow Shift constituency.

Active variable (Yellow Shift)	DIM1 loading	DIM2 loading	Suppl. variable (White Shift)	DIM1 loading	DIM2 loading	Suppl. variable (Blue Shift)	DIM1 loading	DIM2 loading
TLDR1	.835	.550	ESSR1	.076	-.775	SCGT1	.496	.242
VDRL1	.972	-.236	GTSM1	.809	.303	HRTM1	-.112	-.504
LOON1	.972	-.236	BKKR1	.842	.203	GLOR1	-.394	-.200
eigenvalue	2.587	.414	eigenvalue	1.369	.734	eigenvalue	.414	.353
Cronbach's α	.920	-2.124	Cronbach's α	.404	-.545	Cronbach's α	-2.125	-2.754
VAF (Σ=1)	.862	.138	VAF (Σ=.701)	.456	.245	VAF (Σ=.255)	.138	.118
association	**.862**	.064	association	**.456**	-.156	association	**.026**	-.078

Unit (i.e. option)	DIM1 score	DIM2 score
Finished Tons (FT)	1.049	.182
Finishing Lead-time (FL)	-1.230	-.926
Work In Process (WIP)	.010	.002
Post-IRUS Infections (PII)	1.627	.282
Costs For Finishing (CFF)	-.193	1.158
Finishing Scrap (FS)	-1.304	1.142
Round Repairtime (RR)	.041	-1.840

SUMMARY

An organization is people. This statement reflects the basic idea of the research. Managing an organization primarily corresponds with managing its human resources. The organization's human resources refer to the available time and attention of people. The basic idea of the research furthermore is that organizational effectiveness requires a coordinated effort. Organizational effectiveness refers to the degree in which an organization is successful in attaining its strategic goals. Managing the organization thus corresponds more precisely with coordinating the allocation of human resources to alternative courses of action. And such alternative courses of action are amply available given the existence of multiple goals within today's organization: simultaneously taking care of multiple aspects of performance such as time, quality, quantity and costs most certainly applies for industrial organizations. These multiple goals both refer to overall goals at the organizational level and to local goals at the group level; individual level goals are not considered in this study.

A coordinated allocation of human resources requires the mental models of people in an organization to converge. A mental model is a conceptual representation of reality in the human mind. Regarding an organizational reality, a mental model contains personal views and thoughts of what is good and bad to strive for in light of organizational effectiveness. Convergence in this respect means that these personal views and thoughts have a collectively shared, strategic ground. There are several reasons that make a divergent perception of organizational reality more plausible than a convergent one. For one thing, people might just disagree on what is important and what is not. Moreover, there are some well-known cognitive limitations such as bounded rationality that make it highly unlikely that people fully grasp reality and make similar interpretations of it.

Human decision making behavior is heavily influenced by mental models: people make decisions according to their perceptions of reality. From the basic idea that organizational effectiveness requires a coordinated effort, the relevance of convergence is evident. Without convergent mental models, dysfunctional decision making behavior results, causing sub-optimization of integral performance and a loss of scarce human resources. The research question of this study is how to achieve convergence, especially, we have been puzzled by this question from a multiple-constituency perspective. From this perspective, the organization is represented as a social system of several constituencies. A constituency is a group of people within the organization that implicitly or explicitly pursues certain goals. The organization's multiple constituencies are mutually goal interdependent in the sense that their joint performance determines the degree of common goal attainment.

The multiple-constituency perspective on the phenomenon organization stresses this phenomenon's complexity. As a consequence of goal interdependence at the group level, organizational actors should not limit their time and attention to the multiple, local goals of their own constituency, but should include the multiple, local goals of goal interdependent constituencies as well. Moreover, organizational actors should consider

how to jointly contribute to the multiple, integral goals of the organizational entity. Goal interdependence between the organization's multiple constituencies manifests itself in two ways: 1) vertical goal interdependence between a superior- and a subordinate-constituency that maintain a vertical principal-agent relation at successive levels of organizational analysis; 2) horizontal goal interdependence between a customer- and a supplier-constituency that maintain a horizontal principal-agent relation at successive stages in the supply chain.

The human decision making processes that need to be coordinated between vertically and horizontally goal interdependent constituencies are reflected in the designing of performance indicators and, additionally, in the setting of performance targets including the making of explicit trade-offs between multiple goals. Such trade-offs are of the greatest interest in light of convergence, since multiple goals are conflicting in the sense that each goal competes for the allocation of the limited time and attention of constituency-members. The focus on performance measurement and goal setting from a behavioral point of view makes human performance management the actual subject of this research.

In order to coordinate the designing of performance indicators and goal setting throughout the organization, we propose the Strategic Dialogue. The Strategic Dialogue is an organization-wide intervention referring to the multilevel and interactive designing of performance indicators and setting of goals. The adverb multilevel indicates that the intervention takes place at multiple levels of organizational analysis. In this research, a distinction is made between three organizational levels: the macro level, the meso level and the micro level. The adverb interactive indicates that the intervention is highly participatory in nature: it are the organization's multiple and goal interdependent constituencies themselves that design performance indicators and set goals.

In this monograph, a framework for multilevel designing is outlined that prescribes how to organize and facilitate the Strategic Dialogue in practice during so called design team meetings and management approval meetings. In light of convergence, a shared understanding of overall business strategy is required. Hence, the Strategic Dialogue is initiated at the macro level during design team meetings of the organization's dominant constituency i.e. management. As a result, business strategy is (formulated and) made explicit in terms of Strategic Result Indicators and Strategic Process Indicators. These indicators jointly describe the long-term means-end relations for the organization as a whole, reflecting the strategic assumptions made by management.

The framework for multilevel designing next prescribes the means at the macro level to correspond with the ends at the meso level. Concretely, the Strategic Process Indicators of the principal-constituency at the macro level are deployed as the Tactical Result Indicators of one or more agent-constituencies at the meso level. As a consequence, a shared interest is created between vertically goal interdependent constituencies. During design team meetings of the agent-constituency at the meso level, the medium-term means-end relations for the organization as a system of interacting parts are made explicit. These relations are stated in terms of Tactical Result Indicators and Tactical Process Indicators. Meso level constituencies are cross-functionally composed of representatives from customer- and supplier-constituencies at the micro level of daily operations that are horizontally goal interdependent.

Likewise, the framework for multilevel designing prescribes the means at the meso level to correspond with the ends at the micro level. Concretely, the Tactical Process Indicators of the principal-constituency at the meso level are deployed as the

Operational Result Indicators of one or more agent-constituencies at the micro level. As a consequence, a shared interest is again created between vertically goal interdependent constituencies. During design team meetings of the agent-constituencies at the micro level, the short term means-end relations for each of the organization's parts are made explicit in terms of Operational Result Indicators and Operational Process Indicators. A shared interest is also created between the agent-constituencies mutually, since corresponding Operational Result Indicators apply for these horizontally goal interdependent customer- and supplier-constituencies.

The applicability of the framework for multilevel designing is hypothetically explored in an illustrative case study during the conceptual research phase. The illustrative case concerns the company of Copytec Service and sketches a context-specific and thus unique, multilevel product of designing: the interrelated performance indicators at multiple levels of organizational analysis. However, the purpose of the Strategic Dialogue is not primarily to generate performance indicators. The purpose is far more to make the organization's multiple constituencies aware of their goal interdependent nature. Stated differently, the purpose is to stimulate perceptions of positive goal interdependence at the group level. This purpose stresses the relevance of the management approval meetings of the Strategic Dialogue. During these meetings, the shared interest between goal interdependent constituencies is discussed in terms of performance indicators. In fact, the management approval meeting is a moment of so called constructive controversy, during which the members of two vertically or horizontally goal interdependent constituencies exchange views, supported by arguments, of what they believe is good and bad in light of common goal attainment.

The research is not restricted to the outline of an intervention, but seeks to empirically demonstrate that intervention's effectiveness as well. The Strategic Dialogue's effectiveness should be interpreted in light of the assumed need for convergence. In this light, we propose the construct of Goal Coherence. Goal Coherence is defined at the group level as the degree of consensus on goal priorities. These goals relate to the shared interest, expressed in performance indicators, between vertically and horizontally goal interdependent constituencies. Two equivalents of Goal Coherence are distinguished: 1) within-constituency Goal Coherence, which regards the degree of intra-group consensus within a single constituency; 2) between-constituency Goal Coherence, which regards the degree of inter-group consensus between two goal interdependent constituencies. Especially, the between-constituency equivalent is of interest in light of a coordinated allocation of human resources between groups at different organizational levels.

Our research hypothesis concerns the instrumental relation between the Strategic Dialogue intervention and the Goal Coherence construct. The theoretical research question thus reads whether the Strategic Dialogue positively affects degrees of Goal Coherence. To demonstrate the Strategic Dialogue's effectiveness and to find support for our instrumental hypothesis, a second, real-life case study was initiated during the empirical phase of the research. The empirical case study concerns a business unit of the Corus corporation, viz. Corus IJmuiden Long Products. Here, we were invited as researchers to organize and facilitate the Strategic Dialogue and to deliver, as a practical result of this intervention, a context-specific, multilevel product of designing. As a matter of fact, this product of designing refers to our practical research objective.

As part of the intervention, empirical data is collected on goal priorities within a multiple two-group pretest-posttest design. Ranking i.e. categorical data is collected before and after the constructive controversy between two goal interdependent constituencies. A categorical principal component analysis was applied to the categorical data sets obtained. As a result of this analysis, a categorical data set is non-metrically transformed and its dimensionality is at the same time optimally (i.e. with minimal loss of information) reduced. Based on the dimension reduction, a measure of association is developed that measures degrees of intra- and inter-group consensus and thus operationalizes the Goal Coherence construct, both within and between constituencies. The difference between pretest and posttest measurements next provides insight in the effect of the Strategic Dialogue.

Based on the empirical intervention at Corus IJmuiden Long Products, our main research finding is that the Strategic Dialogue positively affects Goal Coherence. However, this is only a preliminary finding, since we have not been able to realize all planned interventions part of the multiple two-group pretest-posttest design. As a consequence of the corporate decision to close down the business unit in due time, the Strategic Dialogue was ended prematurely. However, we did demonstrate the hypothesized increase in convergence for two of the three levels of goal interdependent constituencies The demonstrated effect relates to one fully and one partially facilitated constructive controversy between two vertically goal interdependent constituencies at the macro and the meso level. With regard to the operational constituencies at the micro level, the collection of posttest ranking data unfortunately had to be skipped. However, we have been able to diagnose low degrees of pretest Goal Coherence between general management of the business unit and local management of the three operational units. In light of convergence, this observation is also a research finding of interest.

To close, this monograph contains a critical reflection upon the multilevel process of designing that took place at Corus. As a result of this critical reflection, a number of conditions are derived. These conditions should support both academic researchers and change professionals, such as managers and consultants, in effectively transferring the Strategic Dialogue intervention beyond the scope of the initial case. A final critical reflection revisits the leading construct of Goal Coherence. The danger of organizational myopia is recognized. In order to prevent organizational myopia from happening, the Strategic Dialogue should be approached as a recurring event of testing means-end relations, which are assumed and interconnected at multiple levels of organizational analysis.

SAMENVATTING (SUMMARY IN DUTCH)

Een organisatie wordt primair door mensen gevormd. Deze uitspraak vormt de basisgedachte van het onderzoek. Het managen van een organisatie komt hiermee neer op het managen van de haar ter beschikking staande menselijke bronnen of resources. De menselijke resources van een organisatie verwijzen naar de beschikbare tijd en aandacht van de organisatieleden. De basisgedachte van het onderzoek houdt aansluitend in dat de effectiviteit van een organisatie een gecoördineerde inspanning vereist. Deze effectiviteit verwijst naar de mate waarin een organisatie erin slaagt haar strategische doelen te realiseren. Om precies te zijn komt het managen van een organisatie hiermee neer op het coördineren van de allocatie van tijd en aandacht van mensen aan alternatieve inspanningsrichtingen. En dergelijke alternatieve inspanningsrichtingen zijn ruimschoots voorhanden gegeven het bestaan van meervoudige doelen binnen de organisatie van vandaag: zeker voor industriële organisaties geldt dat prestatieaspecten als tijd, kwaliteit, kwantiteit en kosten gelijktijdig in ogenschouw genomen dienen te worden. Deze meervoudige doelen verwijzen zowel naar de integrale doelen op organisatieniveau als naar locale doelen op groepsniveau; individuele doelen zijn niet in ogenschouw genomen in dit onderzoek.

Een gecoördineerde allocatie van tijd en aandacht vereist het convergeren van de mentale modellen van mensen in een organisatie. Een mentaal model is een conceptuele representatie van de werkelijkheid in het menselijk brein. Wat een organisatorische werkelijkheid betreft bevatten mentale modellen van organisatieleden persoonlijke opvattingen en gedachten over wat wel en wat niet nastrevenswaardig is in het licht van het integrale welzijn van de organisatie. Convergeren betekent in dit verband dat dergelijke persoonlijke opvattingen en gedachten een collectief gedeelde, strategische grondslag hebben. Een divergente perceptie van de werkelijkheid is om verschillende redenen meer aannemelijk dan een convergente. Allereerst kunnen mensen het simpelweg oneens zijn over wat wel en wat niet belangrijk is. Veel meer bepalend echter is een aantal welbekende cognitieve beperkingen van mensen, zoals begrensde rationaliteit, die het zeer onwaarschijnlijk maakt dat de werkelijkheid volledig wordt begrepen en gelijkelijk wordt geïnterpreteerd.

Menselijk beslissingsgedrag wordt grotendeels bepaald door mentale modellen: mensen nemen beslissingen die passen binnen en niet strijdig zijn met hun percepties van de werkelijkheid. De relevantie van convergentie is evident vanuit de basisgedachte dat de effectiviteit van een organisatie om een gecoördineerde inspanning vraagt. Het ontbreken van convergente mentale modellen zal in disfunctioneel beslissingsgedrag resulteren, hetgeen sub-optimalisatie van integraal presteren en verlies aan schaarse, menselijke resources tot gevolg heeft. De vraagstelling van het onderzoek luidt hoe convergentie kan worden bereikt, in het bijzonder vanuit een multipel-constitutie perspectief. Vanuit dit perspectief wordt een organisatie gezien als een sociaal systeem van meervoudige constituties. Een constitutie is een groep mensen als onderdeel van een grotere organisatie die impliciet of expliciet bepaalde doelen nastreeft. Onderling zijn de constituties doelafhankelijk van elkaar in die zin dat hun gezamenlijk presteren de integrale prestatie van de organisatorische entiteit bepaalt.

De multipel-constitutie benadering van het fenomeen organisatie benadrukt de complexiteit van dit fenomeen. Als gevolg van het bestaan van doelafhankelijkheidsrelaties op groepsniveau dienen organisatieleden hun tijd en aandacht niet te beperken tot de meervoudige, locale doelen van de eigen constitutie. Zij zouden hierin ook de meervoudige, locale doelen van doelafhankelijke constituties moeten betrekken. Bovendien zouden leden van doelafhankelijke constituties zich af moeten vragen hoe gezamenlijk kan worden bijgedragen aan de meervoudige, integrale doelen op organisatieniveau. Doelafhankelijkheid tussen de meervoudige constituties van een organisatie manifesteert zich op twee manieren: 1) verticale doelafhankelijkheid tussen hogere en lagere constituties die een verticale principaal-agent relatie onderhouden op opeenvolgende organisatieniveaus; 2) horizontale doelafhankelijkheid tussen klant- en leverancier-constituties die een horizontale principaal-agent relatie onderhouden binnen opeenvolgende fasen van de voortbrengingsketen.

De menselijke beslissingsprocessen die gecoördineerd dienen te worden tussen verticaal en horizontaal doelafhankelijke constituties betreffen het ontwerpen van prestatie indicatoren en het aansluitend toekennen van targets aan prestatie indicatoren, inclusief het maken van expliciete afwegingen tussen meervoudige doelen. Zulke afwegingen zijn van het grootste belang in het licht van convergentie, aangezien meervoudige doelen conflicterend van aard zijn, in die zin dat elk doel op zich vraagt om de allocatie van schaarse tijd en aandacht van constitutie-leden. Prestatie meting en doelen stellen in relatie tot menselijk beslissingsgedrag maakt prestatie sturing het eigenlijke thema van dit onderzoek.

Om het ontwerpen van prestatie indicatoren en het aansluitend stellen van doelen te coördineren, stellen wij de Strategische Dialoog voor. De Strategische Dialoog is een organisatie-brede interventie gericht op het multi-niveau en interactief indicatoren ontwerpen en doelen stellen. Het bijwoord multi-niveau duidt op een interventie die op meerdere organisatieniveaus plaatsvindt. In dit onderzoek is een onderscheid gemaakt tussen drie organisatieniveaus: het macro, het meso en het micro niveau. Het bijwoord interactief duidt op een interventie die hoogst participatief van aard is: het zijn de meervoudige en doelafhankelijke constituties zelf die prestatie indicatoren ontwerpen en doelen stellen.

In deze dissertatie wordt een raamwerk voor een multi-niveau ontwerpproces uiteengezet dat voorschrijft hoe de Strategische Dialoog in praktijk gebracht kan worden tijdens zogenaamde ontwerpteam bijeenkomsten en management afstemmingsbijeenkomsten. Met het oog op convergentie is een gedeeld begrip van de integrale bedrijfsstrategie een vereiste. Vandaar dat de Strategische Dialoog aanvangt op het macro niveau tijdens ontwerpteam bijeenkomsten van de dominante constitutie binnen de organisatie: het management. Als resultaat van deze inspanning wordt de bedrijfsstrategie (geformuleerd en) geëxpliciteerd in termen van Strategische Resultaat Indicatoren en Strategische Proces Indicatoren. In relatie tot elkaar beschrijven deze indicatoren de lange termijn doel-middel relaties voor de organisatie als geheel. Deze relaties reflecteren de strategische assumpties die door het management zijn gemaakt.

Het raamwerk voor multi-niveau ontwerpen schrijft vervolgens voor dat de middelen op het macro niveau overeen dienen te komen met de doelen op het meso niveau. In concreto worden de Strategische Proces Indicatoren van de principaal-constitutie op het macro niveau doorvertaald als de Tactische Resultaat Indicatoren van een of meer agent-constituties op het meso niveau. Als resultaat is een gedeeld belang gecreëerd tussen verticaal doelafhankelijke constituties. Tijdens ontwerpteam bijeenkomsten van de agent-constituties op het meso niveau worden hierna de middellange termijn doel-middel relaties voor de organisatie als een geheel van interacterende delen geëxpliciteerd. Deze relaties worden geformuleerd in termen van Tactische Resultaat Indicatoren en Tactische Proces Indicatoren. De constituties op het meso niveau worden crossfunctioneel samengesteld uit vertegenwoordigers van horizontaal doelafhankelijke klant- en leverancier-constituties op het micro niveau.

Dienovereenkomstig schrijft het raamwerk voor multi-niveau ontwerpen voor dat de middelen op het meso niveau overeen dienen te komen met de doelen op het micro niveau. In concreto worden de Tactische Proces Indicatoren van de principaal-constitutie op het meso niveau doorvertaald als de Operationele Resultaat Indicatoren van agent-constituties op het micro niveau. Als resultaat is wederom een gedeeld belang gecreëerd tussen verticaal doelafhankelijke constituties. Tijdens ontwerpteam bijeenkomsten van de agent-constituties op het micro niveau worden hierna de korte termijn doel-middel relaties voor elk der delen afzonderlijk geëxpliciteerd. Deze relaties worden geformuleerd in termen van Operationele Resultaat Indicatoren en Operationele Proces Indicatoren. Tussen de agent-constituties op het micro niveau onderling is ook een gedeeld belang gecreëerd, aangezien overeenkomstige Operationele Resultaat Indicatoren op deze horizontaal doelafhankelijke klant- en leverancier-constituties van toepassing zijn.

De toepasbaarheid van het raamwerk voor multi-niveau ontwerpen is hypothetisch onderzocht in een illustratieve gevalstudie tijdens de conceptuele onderzoeksfase. De illustratieve casus betreft het bedrijf Copytec Service en schetst een contextspecifiek en dus uniek, multi-niveau ontwerpproduct: de onderling gerelateerde prestatie indicatoren op meervoudige organisatieniveaus. Echter, de bedoeling van de Strategische Dialoog is niet primair gericht op het genereren van prestatie indicatoren. De bedoeling is veel meer om de meervoudige constituties binnen een organisatie bewust te maken van hun doelafhankelijke aard. Anders gezegd, de bedoeling is om percepties van positieve doelafhankelijkheid op groepsniveau te stimuleren. Deze bedoeling onderstreept het belang van de management afstemmingsbijeenkomsten als onderdeel van de Strategische Dialoog. Tijdens deze bijeenkomsten wordt het gedeelde belang dat doelafhankelijke constituties hebben bediscussieerd in termen van prestatie indicatoren. Feitelijk vindt tijdens de management afstemmingsbijeenkomsten een zogenaamde constructieve controverse plaats. Hierbij wisselen de leden van twee verticaal of horizontaal doelafhankelijke constituties heersende opvattingen uit, voorzien van argumenten, over wat huns inziens wel en niet past in het algemeen belang.

Het onderzoek heeft zich niet beperkt tot het uiteenzetten van een interventie, maar heeft zich tevens gericht op het empirisch demonstreren van de effectiviteit van die interventie. De effectiviteit van de Strategische Dialoog moet geïnterpreteerd worden in het licht van de veronderstelde noodzaak van convergentie. In dit licht stellen wij het construct van Doel Coherentie voor. Doel Coherentie is gedefinieerd op groepsniveau als de mate van consensus over doelprioriteiten. Deze doelen hebben betrekking op het gedeelde belang, uitgedrukt in prestatie indicatoren, tussen verticaal en horizontaal doelafhankelijke constituties. Een onderscheid bestaat tussen twee equivalenten van Doel Coherentie: 1) binnen-constitutie Doel Coherentie, hetgeen betrekking heeft op de mate van intra-groepsconsensus binnen één enkele constitutie; 2) tussen-constitutie Doel Coherentie, hetgeen betrekking heeft op de mate van inter-groepsconsensus tussen twee doelafhankelijke constituties.

Onze onderzoekshypothese betreft de instrumentele relatie tussen de Strategische Dialoog interventie en het Doel Coherentie construct. De theoretische onderzoeksvraagstelling luidt derhalve of de Strategische Dialoog al dan niet een positief effect heeft op de mate van Doel Coherentie. Om de effectiviteit van de Strategische Dialoog te demonstreren, en hiermee ondersteuning te vinden voor de instrumentele hypothese, is een tweede, levensechte gevalstudie uitgevoerd tijdens de empirische fase van het onderzoek. De empirische casus betreft een business unit van het Corus concern, namelijk Corus IJmuiden Lange Producten. Hier zijn wij als onderzoeker uitgenodigd om de Strategische Dialoog te organiseren en te faciliteren en, als resultaat van die inspanning, een contextspecifiek, multi-niveau ontwerpproduct op te leveren. Dit op te leveren ontwerpproduct verwijst naar ons praktische onderzoeksdoel.

Als onderdeel van de interventie zijn empirische data sets verzameld. Deze data sets, die betrekking hebben op toegekende doelprioriteiten, zijn verzameld als onderdeel van een meervoudig twee-groeps pretest-posttest onderzoeksdesign. De rangordeningsdata d.w.z. de categorische data zijn ingewonnen voor en na de constructieve controverse tussen twee verticaal of horizontaal doelafhankelijke constituties. Op de data is een categorische principale component analyse toegepast. Als onderdeel van deze analyse wordt een categorische data set non-metrisch getransformeerd en wordt tevens de dimensionaliteit van de data set optimaal (d.w.z. met minimaal verlies van informatie) gereduceerd. Gebaseerd op de dimensie reductie is een associatie maat ontwikkeld, die de mate van intra- en inter-groepsconsensus meet en dus het Doel Coherentie construct operationaliseert. Het verschil tussen voor- en nametingen verschaft vervolgens inzicht in het effect van de Strategische Dialoog.

Gebaseerd op de empirische interventie uitgevoerd bij Corus IJmuiden Lange Producten, luidt ons belangrijkste onderzoeksresultaat dat de Strategische Dialoog de mate van Doel Coherentie in positieve zin beïnvloedt. Echter, dit is slechts een voorbarig resultaat, aangezien we niet in staat zijn geweest om alle geplande interventies als onderdeel van het meervoudige twee-groeps pretest-posttest onderzoeksdesign uit te voeren. Als gevolg van de beslissing op concern niveau om onze business unit in de loop der tijd te doen sluiten, werd de Strategische Dialoog voortijdig beëindigd. Echter, we hebben de veronderstelde toename in convergentie vast kunnen stellen voor twee van de drie niveaus van doelafhankelijke constituties. Het aangetoonde effect stoelt op een volledig en een partieel gefaciliteerde constructieve controverse tussen twee verticaal doelafhankelijke constituties op het macro en meso niveau. Wat betreft de operationele constituties op het micro niveau diende het verzamelen van posttest rangordeningsdata helaas te worden geannuleerd. Echter, we zijn wel in staat geweest om een gebrek aan pretest Doel Coherentie te diagnosticeren tussen het algemene management van de business unit en het locale management van de drie operationele eenheden. In het licht van convergentie is deze constatering eveneens een belangrijk onderzoeksresultaat.

Ter afsluiting bevat deze dissertatie een kritische reflectie op het multi-niveau ontwerpproces dat heeft plaatsgevonden bij Corus. Deze reflectie heeft geresulteerd in een aantal condities, die zowel academische onderzoekers als professionele managers of consultants moeten helpen bij het introduceren van de Strategische Dialoog op andere plaatsen. Een laatste kritische reflectie komt terug op het leidende Doel Coherentie construct. Het gevaar van bedrijfsblindheid wordt onderkend. Om bedrijfsblindheid te voorkomen, dient de Strategische Dialoog benaderd te worden als een zich continu herhalend proces van testen van doel-middel relaties, welke in onderlinge samenhang zijn verondersteld op meervoudige organisatieniveaus.

About the Author

Marco de Haas was born on June 25, 1971 in Alblasserdam, the Netherlands. In 1989, he received his VWO diploma from the *Lage Waard* in Papendrecht. He started studying at the university in the same year. For one year, he studied Architecture at the Delft University of Technology, where he received his Propaedeutic degree. Next, he studied Industrial Engineering and Management Science at the Eindhoven University of Technology. Here, he received his Master's degree in 1996, after a Master's project on management accounting at Fokker Aircraft, Amsterdam. He started his Ph.D. research in the same year at the Graduate School of Technology Management at the Eindhoven University of Technology. The subject of research concerned human performance management. During the research, he has been working with a business unit of Corus, IJmuiden. This monograph concludes his Ph.D. research.