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Intelligent Organizations: An Integrative Framework

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The purpose of this paper is to demonstrate how cybernetic theories open new paths towards organizational intelligence. This is illustrated by means of three theoretical models from organizational cybernetics. These models are integrated into a framework for a virtuous design, (self-)control and (self-)transformation of organizations. It is proposed that changes in activities, structure and behaviour – three of the dimensions of this framework – have to be synchronized among one another, and aligned with a fourth dimension: fundamental parameters such as organizational identity, ethos and vision. It is also claimed that a continued and integrative application of the models outlined can trace the path towards excelling organizational intelligence more effectively than merely punctual uses of one or more of them. Copyright © 2001 John Wiley & Sons, Ltd.

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1. THE QUEST FOR ORGANIZATIONAL INTELLIGENCE

The ubiquitous complexity, speed of change and uncertainty lend credit to those who denote our time as 'turbulent (Drucker, 1980) or even speak of the 'age of chaos' (Abraham, 1994). In this context, not only private firms but also organizations of the public sector and non-profit organizations of all kinds face enormous challenges.

Accordingly, practitioners and researchers of management have produced new concepts, recipes, models and methods at an accelerating rate. *Organizational learning* and *knowledge creation* are only two key terms to subsume much of this effort.

It may seem paradoxical, but the faster the change they confront, the more managers need durable concepts to contend with that change; the more variable the phenomena faced, the more vital knowledge about the invariants underlying the apparent chaos becomes. This is the essence of being ahead of change – which according to Peter Drucker, the Nestor among the management thinkers, is the only way of coping with change effectively (Drucker, 1999, p. 73).

In this situation, the potential contribution of the systems approach to management research and practice turns out to be enormous; even though this is not yet widely known or understood (cf. Beer, 1988; Espejo *et al*., 1996). Namely, the cybernetic stream of systems research has developed powerful theories and models to enable an effective design, control and transformation of organizations of all kinds.

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Systems theories and cybernetics have inquired into the adaptation and learning of organisms and social systems for several decades (for an overview, see François, 1999). Adaptation has usually been conceived as passive, e.g. as 'the process of accommodating to change' (cf. UNESCO-UNEP, 1983, p.5). Systems thinkers have introduced an understanding of reciprocity, which implies that a system and its environment affect and change each other (e.g. Ashby, 1965, p.58, Ackoff and Emery, 1972, p.123f.)[1].

Similarly, the concept of learning comes from a notion focused on the acquisition of knowledge and skills (UNESCO-UNEP, 1983), rooted in pedagogy and developmental psychology (e.g. Piaget, 1967)[2]. Later, in the context of systems research the aspect of knowledge acquirement was extended to that of knowledge creation (Nonaka and Takeuchi, 1995) and linked to action: learning was framed as a system's enhancement of its potential for effective action (in extension of Senge, 1992). Grounded in this tradition, a concept of the intelligent organization has emerged, which integrates these aspects of adaptation and learning with those of self-reference, (self-)transformation, (self-)renewal and ultimately (self-)transcendence[3].

From a cybernetic stance, the basic faculties which distinguish intelligent organizations are[4]:

(1) to adapt, i.e. to change as a function of external stimuli;
(2) to influence and shape their environment;
(3) to find a new milieu, if necessary, or to reconfigure themselves virtuously with their environment;
(4) to make a positive net contribution to the viability and development[5] of the larger wholes into which they are embedded.

As social systems are at stake here, this set of capabilities goes far beyond the criteria of intelligence as established by psychology (Sternberg, 1987). It also transcends those theories of management, in which organizational performance is conceived and measured in terms of criteria such as profit, efficiency or shareholder value only.

Such a broader view promises to lead to better models and ultimately to better management. The foundation for this bold assumption lies in the Conant–Ashby theorem: 'Every good regulator of a system must be a model of that system' (Conant and Ashby, 1981). In other words, the result of a management process cannot be better than the model on which it is based, except by accident. The term *model* is used in a broad sense here, to include theories, frameworks and mental models.

The purpose of this paper is to contribute to better management by leveraging available models of organizational cybernetics, integrating them into what I call a *Framework for Intelligent Organizations.*

2. THREE THEORETICAL MODELS TO SUPPORT ORGANIZATIONAL INTELLIGENCE

The fundamental characteristic of complexity inherent in all kinds of social systems has triggered efforts to know more about (a) the set of parameters which substantially impinge on a system's patterns of behaviour, and (b) the subset of design parameters and control variables, and their interrelationships, by which these patterns of behaviour can be shaped[6]. In the domains of organization and society, these efforts have been focused on gaining better models that capture the structures or generative mechanisms underlying system behaviour, and evoked insights for better system design and (self-)control.

I shall draw on three theories from organizational cybernetics which have opened new dimensions in this endeavour:

(1) *the Model of Systemic Control (MSC);*

[1]This is also the crucial principle underlying the more recent concept of coevolution.
[2]For Piaget, a biologist by training, learning is essentially a (biological) process of adaptation.
[3]For an overview, see Müller-Merbach (1999) and Schwaninger (1999).
[4]Schwaninger (1998), in extension of Sternberg (1987).
[5]One could also use the term *sustainability* here.

[6]Cf. Ross Ashby's concept of 'essential variables' which were meant to be indicators of viability, or at least of actual survival (Ashby, 1965, p. 42).

(2) *the Viable System Model (VSM);*
(3) *the Team Syntegrity model*[7] *(TSM).*

My proposal is that integrating these theories can provide a systemic framework for the development and learning of organizations which enhances organizational intelligence (as defined in section 1) more than isolated uses of one or more of them.

Hereafter, the three theoretical models named above will be outlined. All of them have been described and underpinned extensively elsewhere. But only little has been done to integrate them. However, such an endeavour seems promising. A first attempt at integration is the main contribution of this article, because these theories are complementary and, in principle, highly synergetic:

(1) The *Model of Systemic Control* furnishes a framework for a comprehensive (self-)control of the *activities* of an organization to enhance its fitness.
(2) The *Viable System Model* addresses issues of diagnosing and designing the *structures* of an organization for viability and development.
(3) The *Team Syntegrity model* provides a structural framework for developing interactive *behaviour* in an organization so as to foster cohesion, synergy and knowledge creation.

The beauty of all three theoretical models lies in at least two characteristics they share: first, they are based on insights about invariant features of organizations, which generate patterns of behaviour, which can be anticipated and twenty influenced proactively; second, these models are linked by an inherent, cogent logic, which, however, I shall only elaborate after having expounded each one of them (section 6).

In relation to the complexity of the events that continually occur in organizations, these features are relatively simple, i.e. they embody a degree of complexity which can be handled by the actors designing those systems. In this sense, my paper addresses both

(1) the simplicity *of* complexity (i.e. the invariant characteristics of behaviour patterns), and
(2) the simplicity *underlying* complexity (i.e. the comprehensibility of structural features which bring about complex events).

Substantial empirical evidence corroborates the effectiveness of each one of these models. The respective sources cannot be reviewed extensively in this paper. However, I shall cite a subset of references which can furnish some support and which are relatively easy to trace:

- for the MSC: Schwaninger (1988, 1989, 2000); Gälweiler (1990);
- for the VSM: Espejo and Harnden (1989); Espejo and Schwaninger (1993); Espejo *et al*. (1996);
- for the TSM: Beer (1994b); Truss *et al* (2000); Schwaninger (forthcoming).

3. THE MODEL OF SYSTEMIC CONTROL (MSC)

Organizational cybernetics conceives management in terms of coping with complexity. The Model of Systemic Control specifies and interrelates the control variables which are necessary and, in principle, sufficient to deal with that complexity.

The cybernetic concept of control embraces regulation and steering of a system in order to achieve its purpose or goals, or in a more limited sense to carry out its tasks or activities (what it has to do or what it does). The cybernetics of social systems emphasize intrinsic control[8] as opposed to extrinsic control (cf. Geyer and van der Zouwen, 1978, Vol. 1, p. 2; Schwaninger, 1996; Espejo *et al*., 1996).[9]

Effective (self-)control implies a dynamic equilibrium, at a satisfactory level of performance, between a corporation (or an organizational unit)

[7]As the materials of TSI – Team Syntegrity Inc., Toronto – which makes the Team Syntegrity protocols available to organizations, refer to Team Syntegrity as a methodology, the word 'model' which I use in this context is not capitalized.

[8]The terms *intrinsic control, eigen-control, auto-control* and *self-control* are used synonymously.

[9]If Heinz von Foerster (1984) designates social systems as *observing systems* as opposed to *observed systems*, he thereby addresses such aspects as self-control, self-reference, self-organization and self-transformation – which are among the main concerns of organizational cybernetics (cf. Schwaninger, 1994a).

and the milieu in which it operates. But which variables define adequate performance?

Traditional corporate control models took their bearings largely or exclusively from the goal of *profit*. It has been demonstrated that such models no longer meet today's requirements (Gälweiler, 1990; Schwaninger, 1989). This is not a dismissal of profit – there is no doubt that profit is a necessary prerequisite for a firm to stay in business. The claim here is a different one: management models are insufficient if they leave out the pre-controls which ultimately generate or obstruct profitability and finally liquidity. Under the evolutionary pressure of increasing complexity and turbulence a more sophisticated view of the criteria of competent management has emerged.

These are rather defined in terms of a comprehensive organizational fitness or intelligence. Profit, then, as an example, is an objective at the operative level, and an outcome of pre-controls originating at higher logical levels.

In this context, a *model of systemic control* has been developed. It is based on the insight that one and the same system must govern itself by means of a set of control variables which belong to different logical levels: the levels of operative, strategic and normative management (Schwaninger, 1989; Gälweiler, 1990). This implies possible (and probable) contradictions between these control variables.

As shown in Figure 1, there are interrelationships between these levels. Particularly, the control variables of the higher logical levels exert a *pre-control* influence on those of the lower levels. This has been outlined and specified elsewhere for the case of business organizations in a more detailed way (Schwaninger, 1989, 1993). Pre-control is about the anticipative creation of prerequisites at a higher logical level, which largely predetermine what can be achieved in terms of control and performance, by the lower logical levels of management (cf. Schwaninger, 2000).

3.1. Operative Level

The general goal at the operative level is to create *value*, i.e. benefits for the stakeholders of an organization (particularly customers, personnel and owners). Specific control variables to achieve this are customer benefit, social and ecological benefits and shareholder value.

The traditional steering models of firms, for example, were almost exclusively oriented towards *profit* and *liquidity*. However, profit behaves in an inherently short-term mode, and its level is largely predetermined by parameters of another nature (just as liquidity is largely predetermined by profits). Similarly, a customer benefit derived from a product or service hinges on prerequisites which must be fully available in, and therefore built up well ahead of the 'moments of truth' (Carlzon, 1988), i.e. when production and delivery take place.

Good managers have always known that the attainment of operative goals is bound to preconditions that have to be created in advance. Practitioners and writers in many domains of management have become aware of this, increasingly. Tentatives have been made, to link the operative and the strategic logic, e.g. in production (Underwood, 1994), logistics (Bowersox and Closs, 1992) and marketing (Kotler, 1994). Beyond that, however, there has emerged a comprehensive theory, which provides access to the relevant higher-order variables of control.

3.2 Strategic Level

The values which a company can generate are largely predetermined by the *value potentials* created beforehand. Value potentials are defined as the set of all applicable business-specific prerequisites (e.g. in the form of resources, capabilities, core competencies) that must be fulfilled when value is to be provided (in extension of Gälweiler, 1990). These represent operational and calculable categories. Their patterns of behaviour can be foreseen and influenced (*controlled*). Value potentials must be controlled separately from value, based on independent criteria.

Research on strategic management has clarified the nature of these criteria and shown, for instance, how to apprehend the critical success factors (such as market share, relative market

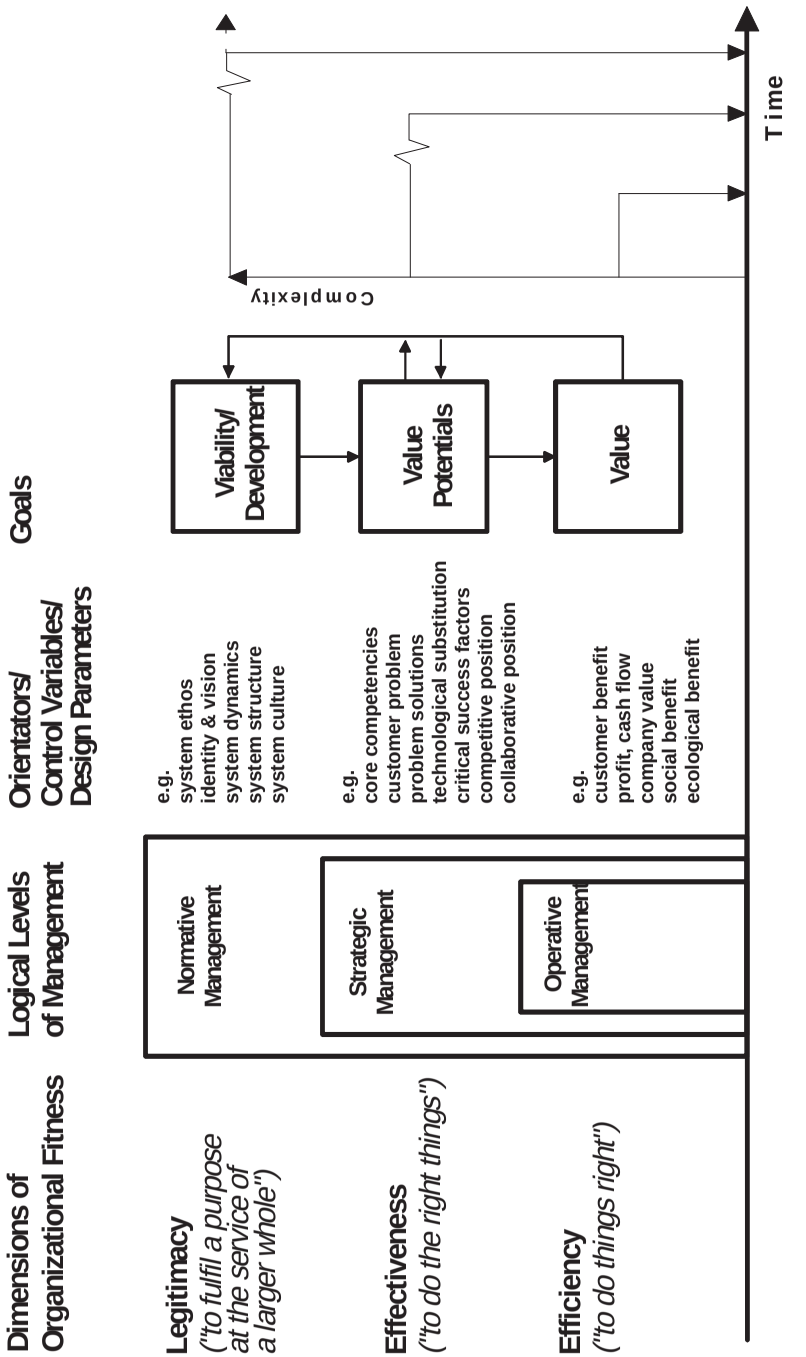

Figure 1. A model of systemic control

share, quality/customer benefit, speed, flexibility etc.) in a given business system (for details see Buzzell and Gale, 1987). With the help of the PIMS database and a statistical toolbox for quantitative analysis related to it, valuable conclusions about the strategic position of a business and the actions to be taken can be derived[10]. However, such a calculus remains in the domain of *extant value potentials* and is therefore of limited usefulness in turbulent environments.

The management of *new value potentials* includes changing established patterns, taking into account the dynamics of customer problems,[11] problem solutions (i.e. products/services),[12] technological substitution, along the value chain, or in the value-generating network, respectively. This involves a sustained long-term effort for innovation, and it often requires a redesign of the business system. Hamel and Prahalad (1994) have emphasized that too much of strategic efforts rests on established modes, while the essence of genuine innovation is reframing the reference system completely, which often leads to the emergence of new modes of doing business, creates new opportunities and may reshape entire industries.

For strategic business units a mature strategy methodology has become accessible. This methodology has made more transparent and controllable the essential variables of the strategic level – as, a long time ago, bookkeeping did for the operative domain. Gälweiler (1990), for the most part, but also Porter (1980, 1985), Schwaninger (1987, 1989) and other authors have elaborated on this methodological concept. The support for strategy at the corporate level has grown into a relatively mature methodology as well (Pümpin, 1991; Hamel and Prahalad, 1994; Schoemaker, 1992), although the heuristic devices available must remain more general and abstract here. The main idea is building and strengthening core competencies to ensure new value potentials.

Long-term empirical evidence and solid conceptual reflection (cf. Utterback, 1994; Christensen, 1997) cogently suggest that organizations must consistently embrace innovation, even when this appears to undermine traditional strengths. The respective authors plead for continually renewing core capabilities, while abandoning the logic of past successes: innovating incrementally is not enough, because in the long run the regeneration of a corporation's business relies on radical innovation. A 'strategic architecture' is needed, 'that is less concerned with ensuring a tight fit between goals and resources and ... more ... with creating *stretch goals* that challenge employees to accomplish the seemingly impossible' (Hamel and Prahalad, 1994, P. 23). In the language used here, the requirements of building up new core competencies to ensure new value potentials may contradict those of extant value potentials, but in the long run it must have priority.

To resume, in broad outline, profit is not a strategic control variable, and consequently not a strategic goal either. Rather, its appearance or absence is a consequence of good or bad strategies. This divergence from the traditional view, which regarded profit (or other monetary values statically related to it) as the fundamental corporate objective, has also been expressed to a certain extent in more recent attempts to integrate finance theory with strategic considerations. The methodologies developed for assessing the shareholder value of companies calculate net present value, which is derived from discounted future free cash flows, a corporation can potentially generate at a certain point in time, in function of possible strategies (cf. Rappaport, 1997; Copeland *et al.*, 1994). The crux in these assessments is not – as it may seem – the calculus, which relies on more sophisticated accounting techniques, but the

[10]The PIMS (Profit Impact of Market Strategy) database is the most extensive database in the world for strategy analysis and research. The 'academic' core of the database contains complete and validated datasets on more than 3000 business units. Datasets include financial data as well as information on competitive environments, customers, markets and operations. The database and related statistical tools were developed and are maintained by the Strategic Planning Institute, Cambridge, MA.

[11]I prefer the term *customer problems* to *customer needs*, because, in principle, the value for a customer is more sustainable if a problem is solved superbly than if merely more or less ephemeral needs are covered.

[12]With regard to longer time horizons, a very powerful orientator is the solution-invariant definition of (manifest or latent) customer problems posed in relation to solutions that are (a) currently available, (b) still in the development phase and (c) potentially available, i.e. still in the research process (cf. Gälweiler, 1990).

proper knowledge of the variables pre-controlling profits, and their interrelationships.

3.3 Normative Level

Meanwhile, insights into the referents of normative management have also improved. The research which has led to this is primarily based on systems theory and cybernetics and once more presents independent criteria for the assessment of the *viability* and *development* of organizations. Viability, understood as the ability to maintain a separate existence (Beer, 1979, p. 113), i.e. a distinct configuration which makes a system identifiable as such, can be assessed on the grounds of structural considerations which are not bound by the orientators of the strategic and operational levels.

To date, the most advanced theory for assessing the viability of an organization in functional terms is Stafford Beer's VSM – to be outlined in Section 4. This model is an excellent conceptual device for diagnosing and enhancing the viability of an organization, independent of the steering criteria of the lower levels (strategic and operative).

As far as the *soft factors* of organization are concerned – referred to under the common denominator of *culture* – some models have been elaborated which, for the time being, appear more appropriate for description and diagnosis than for design purposes (e.g. Deal and Kennedy, 1982; Schein, 1985; Frank and Fahrbach, 1999). Beyond that, the emerging paradigms of the *learning organization* (cf. Argyris and Schön, 1978; Senge, 1992) and of organizational knowledge (cf. Nonaka and Takeuchi, 1995) are about to outline a developmental and transformative orientation to structure, process and culture.

From a systemic point of view, however, an organization must and should aim at *viability beyond survival*. Systems thinkers have become more interested in designing evolving structures, in which an organization's identity may completely change, than in sticking to viability in the narrow sense; that after all, has often led to the self-maintenance or self-production of systems which show a dysfunctional behaviour *vis-à-vis* the larger wholes into which they are embedded. This negative effect on the larger whole is referred to sometimes as *pathological autopoiesis*[13] (Beer, 1979). Progressive managers are increasingly adopting a systemic viewpoint in which they enlarge their reference system, eliminating narrow boundaries: this is corroborated by the growing rate of economic, juridical and structural transformations of companies with the aim of creating new viable organizational entities. *Development* in the sense used by Russell Ackoff is a good term for such viability beyond survival.

At the level of development – defined as a system's growing ability and desire to fulfil its own and others' needs (after Ackoff, 1994, p. 65) – the quest of an organization is in fact viability beyond survival. At this level, it can become difficult to operationalize substantive indicators of effectiveness. Yet, social system theories provide important insights to diagnose a system's propensity for development, as a function of its ethos (e.g. openness), its identity, and the pattern of a system's dynamics: criteria such as catalytic reinforcement, instability, consensus, self-governance and organizational learning help to judge whether a change process qualifies as development or not (cf. Etzioni, 1968; Jantsch and Waddington, 1976).

In sum, the field of indicators at the normative level is multifaceted. Social, political, cultural and ecological aspects have to be taken into consideration. Adequate space must be given to ethical and aesthetic concerns, for the pursuit of ideals such as beauty, truth, good and plenty (cf. Ackoff, 1981). Multiple constituents and viewpoints ascribe different purposes to a social system, which leads to varying preferences concerning the criteria of organizational fitness (cf. Espejo and Schwaninger, 1993). For an organization to be viable in the long run, the legitimate claims of these different stakeholders must be matched[14] (cf. Kotter and Heskett, 1992).

[13]Pathological autopoiesis, as used here, is the self-maintenance or self-production of a system despite (over the long term) a consequently negative balance of its effects on the larger whole.

[14]The fact that conflicts between stakeholders' claims do arise and ways of dealing with them have been addressed elsewhere (e.g. in Freeman, 1984; Meyer and Zucker, 1989; Janisch, 1992; Wheeler and Sillanpää, 1997).

The concept of control which applies at the level of normative management is in a certain sense incompatible with the understanding derived from traditional sciences: instability is no longer a feature to be eliminated completely. In a sense and to a certain extent it is a necessary and valuable precondition for development (cf. Prigogine, 1989); (self-)control must nevertheless maintain instability within acceptable levels and frequencies. The coming turbulent decades will increasingly demand for *control by development*, *control by learning* or *control by transformation*.[15]

3.4 Relationships Between the Three Levels

So much for a survey of the goals and control variables at each one of the logical levels. It must be noted that they cannot be compared in every respect, since they belong to three different logical levels; ultimate consistency can be achieved within, but not between, these levels.[16] The variables regulated at one level are the pre-control parameters for the next level down.

Figure 1 illustrates that operational, strategic and normative management are by no means three subsystems detached from each other; rather, each higher level envelops those below it. However, a rigid view of this embedment would be too static. If a normative framework expresses a certain identity, this encapsulates a huge set of possible strategies. Nevertheless, at a certain stage, strategy making may find new ways of relating to the environment, which may reach out beyond the borders of the identity defined by the actual normative framework. In many companies, such attempts are out of the question *a priori* – a trait which sooner or later turns out to be pathological. Even the distinctive features of an identity and its normative implications must be reviewed over time. Most industries are subject to fundamental change; boundaries between industries collapse, so organizational intelligence demands reinventing the company, abolishing (*unlearning*) outdated recipes of success and building new competencies. Constant creative tension between normative management and strategy making are necessary for a company to evolve. The pertinent connection is not an algorithmic one, but it must express itself in a strenuous process of organizational discourse. In a large study, Collins and Porras have given an empirical account of this 'dynamic interplay between core ideology and the drive for progress' (Collins and Porras, 1994, p. 85).

Figure 1 further demonstrates that the relevant time horizon increases from operational to normative management. At the same time, the factual horizon is also extended, as is the complexity, which is to be coped with. The dotted arrow indicates that certain principles relevant to normative management (e.g. ethical and aesthetic ones) are largely timeless.

The diagram also shows that the concerns of the higher levels are not detached from those of the lower ones. A company can only survive if it is in possession of value potentials that are actualized, i.e. converted into value. Equilibrium between the sacrifices incurred in building up value potentials and reaping their fruits is a further necessary precondition of viability which normative management has to ensure.

3.5 Criteria of Sytemic Effectiveness

At the three levels of management, different *criteria of organizational fitness* – or, to speak more generally, *systemic effectiveness* – apply:

(1) At the *operative level*, the criterion is that of *efficiency*, mainly in terms such as quality, productivity and profitability.
(2) At the *strategic level*, it is *effectiveness* in both the competitive and the co-operative sense.
(3) At the *normative level* it is *legitimacy*, defined as the ability to fulfil the claims of all relevant stakeholders.

In other words a different language is needed for dealing with the issues of each level; each one of them obeys a distinct logic.

[15]The terms in italics should be read with the prefix *self-*, i.e. as *self-control by (self-)development*, *self-control by learning*, *self-control by (self-)transformation*, to indicate the priority of intrinsic control (or eigen-control) over extrinsic control.
[16]In logical terms, the strategic level offers a metalanguage to the operative, the normative to the strategic and the operative levels.

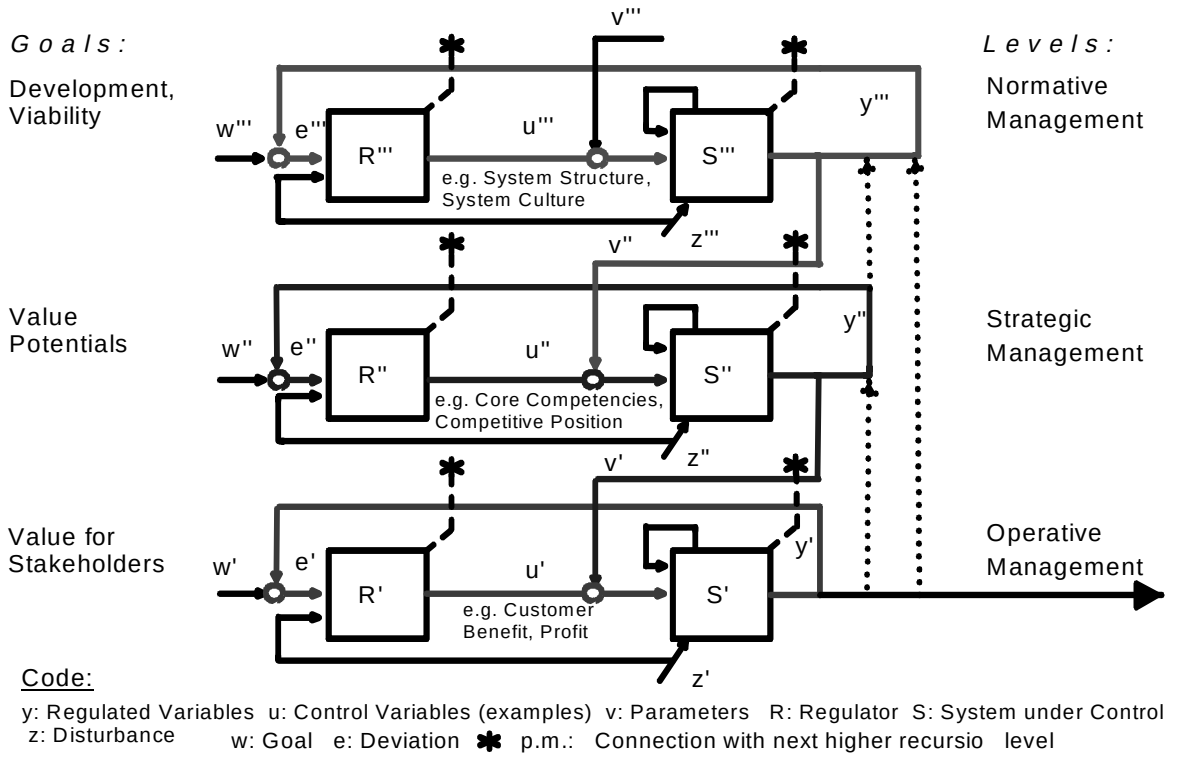

Figure 2. Integral Management as a multilevel control cycle, (abridged diagram for a recursion level y)

The key duty of an integral or systemic management is to meet all three requirements in the long run. In order to achieve such a delicate task a corporation will require – as has been illustrated in detail in Schwaninger (1993) – considerably higher-developed mental models than established ones, and more complex control systems than the simple feedback systems traditionally used.

The hierarchy of control variables delineated above results in a *multilevel* control structure (Figure 2), which clarifies that one and the same state of affairs cannot be pre-controlled by means of the variables by which it is controlled[17]. If, at the operative level of a firm, control is, for example, exercised in the interest of profit – by means of revenues and costs – then profit cannot be pre-controlled by means of these traditional accounting variables. For pre-control other kinds of referents are required: extant and new value potentials, which in turn are pre-controlled by viability and development. In Figure 2 this relationship is represented by the solid lines, which connect each cycle with the one immediately before it. A closure of the hierarchy of control variables is provided insofar as the outcomes at the operative level not only result from higher-levels pre-controls, but also they pre-control higher-level parameters in a specific sense. For instance, not only the innovative capabilities but also the actually available liquid financial resources might play an important role in the building-up of value potentials: at least, substantial own funds can add a degree of freedom to it.

4. THE VIABLE SYSTEM MODEL (VSM)

Organizational cybernetics conceives management in terms of coping with complexity. If the

[17]It has been argued (cf. Jackson, 1989, p.428) that the use of *control models* prevents organizational learning, leading to 'increasing dominance of history' (de Zeeuw, 1986, p.139). A concept of control that embraces development as a goal defies this argument in principle, although it cannot guarantee that there will be learning in every organization striving for development.

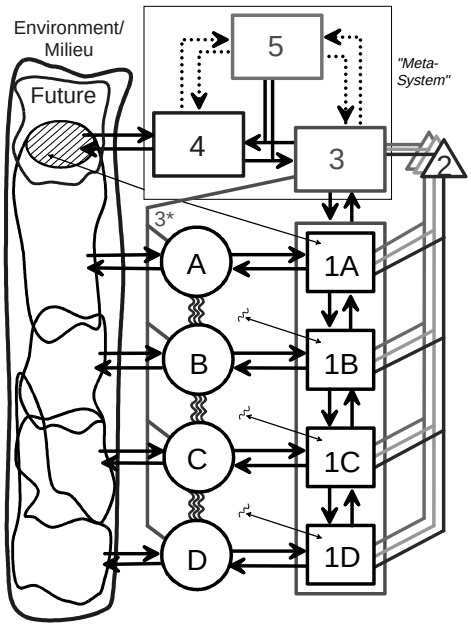

Figure 3. The Viable System Model - Overview[18]

former section dealt with the control variables to contend with that complexity, the question arises now, how an organization must be structured to make its (self-)control and (self-)development possible. Stafford Beer, the founder of management cybernetics, offers a model for that purpose.

A set-theoretic model (Beer, 1994a), in which he defined the organizational prerequisites for the viability of systems, was later operationalized in a topological model, known as the *VSM (Viable Systems Model)* (Beer, 1979, 1981, 1985). In this model, a set of functions is distinguished, which provide the 'necessary and sufficient conditions' (Beer, 1979) for the viability of any social system – organizations in particular (Figure 3). These functions and their interrelationships are specified in a comprehensive theory, the propositions of which can be summarised as follows:

(1) An organization is viable if and only if it disposes of a set of management functions with a specific set of interrelationships, identified and formalized in the model:

- *System 1*: Regulatory capacity of the basic units (A,B,C,D), autonomous adaptation, to their environment, optimization of ongoing business (e.g. the business areas of a company).
- *System 2*: Amplification of self-regulatory capacity and attenuation to damp oscillations and coordinate activities via information and communication (e.g. information systems, service units and coordination teams, standards of behaviour).
- *System 3*: Establishment of an overall optimum among basic units, providing for synergies, as well as resource allocation (e.g. the executive corporate management).
- *System 3**: Investigation and validation of information flowing between Systems 1–3 and 1–2–3 via auditing/monitoring activities (e.g. operations analysts, special studies and surveys).
- *System 4*: Dealing with the future, especially the long term and with the overall outside environment, diagnosis and modelling of the organization in its environment (e.g. corporate development, strategy, research and knowledge creation).
- *System 5*: Balancing present and future as well as internal and external perspectives; moderation of the interaction between Systems 3 and 4; ascertaining the identity of the organization and its role in its environment; embodiment of supreme values, norms and rules – the ethos of the system (normative management).

In this structure, the primary units (basic units with the regulatory capacity supplied by System 1) must dispose of high autonomy in order to be able to adapt to their respective environment or milieu. The combined activities of Systems 1, 2 and 3 (including 3*) provide for management of the present and short term, while System 4 is the fulcrum for long-term adaptation, and System 5 the embodiment of the ethos – the basic principles governing the orientation of the organization as a whole.

Systems 1–2–3 (including 3*) comprise the operative level, System 4, in interaction with System 3, the strategic level, and System 5 the

[18]This is a slightly adapted version. For the full-fledged original, see Beer (1985, p.136) and Beer (1979, 1981).

normative level of management (cf. Model of Systemic Control in section 3).

(2) Any deficiencies in this system, e.g. missing functions, insufficient capacity of the functions, faulty communications or interactions between them weaken or jeopardize the viability of the organization.
(3) The viability, cohesion and self-organization of an enterprise depend upon these functions being *recursively* working in all levels of the organization. A recursive structure comprises autonomous wholes within autonomous units. Moreover, a viable organization is made up of viable wholes and it is itself embedded in more comprehensive viable wholes. Each unit, inasmuch as it is producing the organization's task, rather than servicing or supporting this producing, replicates – in structural terms – the totality in which it is embedded: It has all the functions outlined under (1), to be able to manage, from start to finish, the processes for the purpose of which it exists. If we take such a viable organization as a *system-in-focus*, depending on the perspective adopted, it 'may have more than one next higher and next lower recursion' (Beer, 1985; for a pertinent application, see Leonard, 1989).

The VSM has been transduced into the language of private and public firms and has been widely applied, as documented in several books (e.g. Espejo and Harnden, 1989; Espejo and Schwaninger, 1993; Espejo *et al*., 1996), and on a CD-ROM edited as a festschrift for Stafford Beer (Espejo and Schwaninger, 1998).

5. THE TEAM SYNTEGRITY MODEL (TSM)

While the two models outlined up to now address the issues of control and design, the *Team Syntegrity model* is a structural framework to foster cohesion and synergy in larger groups of individuals, or the transformation of mere aggregates of individuals with similar interests, into organizations with their own identities. Stafford Beer (1994b) invented it. It is a future-oriented approach to the design for democratic management in the sense of the heterarchical–participative type of organization (cf. Schwaninger, 1996). The TSM is a holographic model for organizing processes of communication, in particular for the (self-)management of social systems, in a non-hierarchical fashion. This model can be mathematically shown to be optimal in terms of the distribution and sharing of knowledge in large group settings (Beer, 1994b). Based on the *structure of polyhedra* it is especially suitable for realizing team-oriented structures as well as for supporting processes of planning, knowledge generation and innovation in turbulent environments. This applies mainly to numbers of people transcending the size of face-to-face groups, the limits of which are given by 'the magical number seven, plus or minus two' (Miller, 1967).

The formation of networks by persons in different locations, who are connected by mutual interests, is a manifestation of the information society and a structural answer to challenges of our time. An *infoset* is defined as a set of individuals who share a common concern, and who are in possession of pertinent information or knowledge connected with the issue of interest, as well as motivated to tackle it. The *Team Syntegrity model*[19] supplies the structural framework for a synergetic interaction of such an infoset. The purpose of that interaction is to entail an integration of multiple topics and perspectives towards a shared body of knowledge, and hopefully the emergence of new knowledge in the process.

The term *syntegrity* results from a combination of *synergy* and *tensile integrity*. Synergy is the cooperation of actors, producing a combined effect greater than the sum of their individual effects. Tensile integrity is the structural strength provided by tension, as opposed to compression (Fuller and Applewhite, 1982).

In the following, the architecture of the model will be illustrated by using the structure of an *icosahedron* (Figure 4), which is the most complex of the regular, convex polyhedra, also referred to as 'Platonic solids'. The icosahedral structure is one of the the structures frequently used to

[19]For details see Beer (1994b).

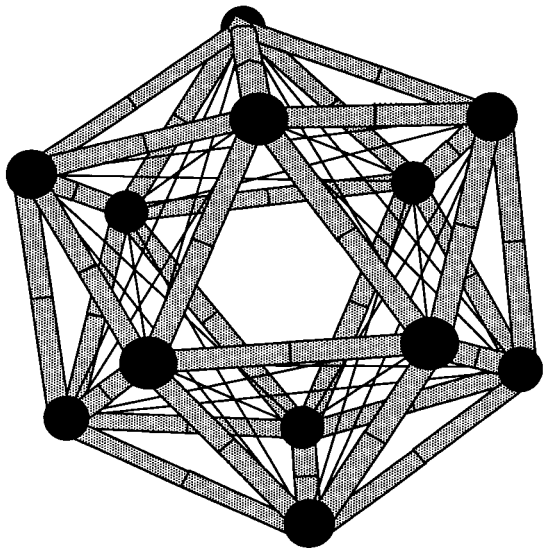

Figure 4. Icosahedral structure of the Team Syntegrity model

organize syntegration events. It applies to the case of 30 participants; for different numbers of people, solutions based on other polyhedra (e.g. modified icosahedron, octahedron) are possible.

Each member of the infoset is represented by one edge of the icosahedron. Five edges lead to each vertex, i.e. there are five players to each team (as players). An icosahedron has 12 vertices; different colours mark each of those. Thus each participant as a player belongs to two different teams – those connected by the edge that represents him or her. Mrs *Red–Yellow*, for instance, belongs to the teams (→ vertices) *Red* and *Yellow*. At the same time she is acting as a critic to two other teams (e.g. *Black* and *Silver*, which are next neighbours). This means that each team consists of five players and five critics. Altogether, the 30 agents fulfil 120 roles: 30 times two roles as a player and two as a critic. In addition there is the observer role: any member of the infoset can attend ongoing working sessions of other teams, at the times he or she is not involved in discussions of the teams they are part of.

The polyhedral structures used for Team Syntegrity dissolve the paradox of peripherality versus centrality of actors in an organization (as formalized by Bavelas, 1952): while peripherality leads to communication pathologies, alienation and low morale, centrality is needed for effective action. However, as a group grows, centrality can only be bought at the cost of increasing peripherality (Leonard, 1995). Team Syntegrity enables an infoset to acquire centrality via a reverberative process, although the peripherality of each one of its members equals zero, i.e. there is no peripherality at all.

A *process of syntegration* typically has the following phases (this is a simplified outline):

(1) *Opening*: The syntegration is dedicated to a general topic that focuses all mutual efforts and is explicated by an opening question. In syntegrations realized with students at the University of St Gallen, the question was: *'How should management education be designed in the future?'*
(2) *Generation of the agenda ('Problem Jostle'):* Each participant hands in contributions that seem important to him or her (Statements of Importance). In the following steps, these are discussed and combined (Aggregated Statements of Importance). Then, in a process of successive synthesis through discussion and voting, an agenda for the actual work on the general topic or problem is generated (Hexadic Reduction). This is finally expressed in 12 topics (Consolidated Statements of Importance).
(3) *Assignment to groups ('Topic Auction'):* Each member of the infoset ranks all 12 topics on a preference form. These are entered into the computer and an optimization algorithm assigns the membership for a topic. An alternative would be random assignment of membership to the edges linking the vertices of the polyhedron (i.e. topics).
(4) *Working on the topic ('Outcome Resolve'):* The individual teams (consisting of five players and five critics each) explore their respective topic. Each team meets several times (usually in three iterations) and writes up a summary of its results to share with the whole infoset. The fact that the same issue with its different but interconnected aspects is continually and iteratively processed by the same set of people, who gather in alternating

compositions (topic teams), implies strong reverberation. This leads to a self-organizing process with high levels of knowledge integration. There is no need for a centre to integrate the multiple efforts; integration just happens 'by itself'.

It can be shown mathematically that this is a geometrically ergodic process, in which the eigenvalue[20] of the process converges to a minimum: 90% of the information in the system will be shared after three iterations, and 96% after four iterations (Jalali, 1994, p. 277).

(5) *Finalization:* The teams present their conclusions in a final plenary session. Planning for subsequent action or other coordinative measures may be added as necessary.

Despite its newness, Team Syntegrity has been employed in approximately 140 syntegration events (as calculated per the end of 2000).[21] Examples of applications have a wide range; the following list is non-exhaustive:

- planning processes in universities, a polytechnical institute and a hospital;
- organizational change in two Swiss banks;
- strategic management in industrial firms;
- governmental agencies in Canada;
- regional and community planning;
- non-profit organizations;
- reorganization of a political organization in Great Britain;
- preparation for peace negotiations;
- seminars and workshops with students and researchers.;

Between 1995 and 1996, the first electronic syntegration of an infoset distributed over the world was realized. A group of 30 cyberneticians from 16 countries and four continents engaged in distributed interaction (mostly via the World Wide Web and electronic mail), with a local syntegration in England, mid-way in the process, to produce a festschrift for Stafford Beer (for a detailed account, see Schwaninger, 1997, 1998). The outcome of this process – an electronic medium – has been published on a CD-ROM (Espejo and Schwaninger, 1998). In this case, the potential of Team Syntegrity to create new organizational forms was shown: a new protocol for the cooperative development of knowledge-intensive products in distributed settings had emerged.

At this stage, there seems to be no other equally powerful model to systematically foster deep involvement, self-organization and the emergence of collective consciousness of large numbers of people.[22] Sociometric studies have ascertained significant increases of different measures of cohesion between the beginning and the end of the respective syntegration events (cf. Hechenblaickner *et al.*, 1995; Espejo and Schwaninger, 1998; Baer and Schwaninger, 1998). Furthermore, exploratory investigations have highlighted the phenomena of reverberation, self-organization and self-reference in syntegration events (Beer, 1994b; Espejo and Schwaninger, 1998; Ahmad, 1999). There is also substantial evidence that the structural arrangement fosters conceptual learning; the conceptual mental models of participants are enriched as the process evolves. Finally, new qualities of shared knowledge and a collective consciousness or identity are likely to emerge (cf. Schwaninger, 1998).

Team Syntegrity is not the model to be applied to all kinds of group endeavours. It rather provides a methodology to maximize the effectiveness of interaction and communication of large groups dealing with complex issues or ill-defined problems, which require knowledge of different kinds or disciplines. Most of the applications enumerated above were in the domains of strategic and normative management, and resulted in a high degree of knowledge conversion or knowledge generation (cf. Nonaka and Takeuchi, 1995). As tacit and explicit knowledge interact, for which syntegrations provide ample opportunity, the creation of new knowlege becomes possible and innovations are more likely to take place (Nonaka and Takeuchi; 1995). The strategy syntegrations realized have

[20]The formula to calculate the eigenvalue is: $y = (1/\sqrt{5})^n$, with n denoting the number of iterations.

[21]Information from Team Syntegrity Inc., Toronto, 10 November, 2000.

[22]Comparative studies to assess the degrees of effectiveness of different methodologies for communication and interaction in large groups are still to be accomplished.

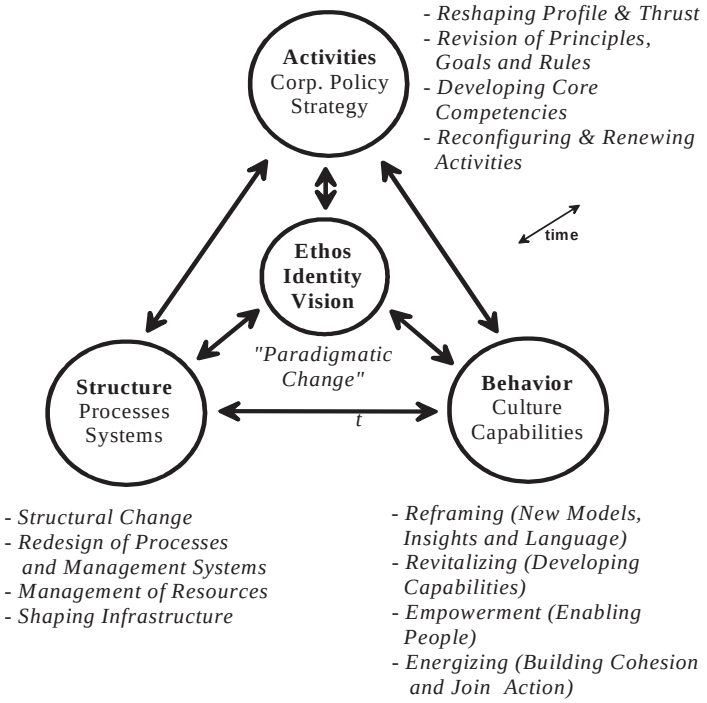

Figure 5. A Framework for Intelligent Organizations

shown many cases in point (e.g. Espejo and Schwaninger, 1998; Ahmad, 1999).

TSM was aimed at making an optimal design for the communications processes in the homeostat of Systems 3–4 in the VSM (see Section 4) available. The evidence reported here underpins this conceptual link between the two models, VSM and TSM. The Stafford Beer festschrift project, briefly outlined above, was an ongoing syntegration with a duration of one year, with only one local syntegration, preceded and followed by five to six months of electronic syntegration. The results of that venture lend support to the assumption that ongoing or repeated syntegrations could prove to be a useful mode of organizing the continuous dialogue on strategic issues in organizations.

6. OUTLINE OF AN INTEGRATIVE FRAMEWORK

In this section, a framework, which I call *Framework for the Design of Intelligent Organizations*, will be presented (Figure 5), which integrates the three models expounded up to here[23].

6.1 Overview

This framework builds on a set of specific notions of systemic management:

(1) The proposed framework is *integrative* – in what respect? In contrast with many frameworks which emphasize partial aspects of organizations – e.g. strategy, structure or organization culture – the emphasis in the one proposed here is on bringing together the different components so as to provide a more complete picture. Integration – the making up or composition of wholes – is a natural capability of humans, largely based on unconscious inferences (cf. Gregory,

[23] An earlier version of this framework was elaborated in Schwaninger (1995) and published in Espejo *et al.* (1996). It built on earlier works in the context of the St Gallen Management Concept, namely Krieg (1985) and Bleicher (1999).

1987, p. 375). However, in the face of the complexity of real-world phenomena a proneness to reductionism and fragmentation of models has become widespread. The present framework is a device to overcome this limitation. It is made up of an integrated set of *essential parameters* and their identifiable interrelationships, which have to be developed in co-alignment, to enhance organizational intelligence. Thereby it does more than merely furnish a list of important aspects. It provides a frame of reference, which is robust, broad enough and sufficiently structured, to enable actors to initiate and catalyse organizational development and transformation more effectively.

(2) The essential parameters which make up the framework can be *designed*, within limits. Certain aspects of design must take indirect ways; e.g. proper influence on behaviour is taken, rather via the design of rules for interaction, appropriate structures etc., than directly (see also 6).

(3) The framework is *multidimensional.* In the scheme, five crucial dimensions are combined. Three of them – activities, structure and behaviour – are the dimensions that make up the pillars of the *St Gallen Management Concept*, an architecture for structuring management issues, developed at the University of St Gallen (cf. Bleicher, 1999) . The fourth dimension is made up of fundamental parameters, such as organizational identity, ethos and vision. The fifth dimension is time.

(4) In logical terms, management is conceived as a *multi-level process* with:

- normative management fulfilling the foundational function, embodied by System 5 in the VSM;
- strategic management, the orientational function, embodied by System 4 and the interrelationship between Systems 3 and 4 in the VSM;
- operative management, the function of realization, embodied by Systems 1, 2 and 3 (including System 3*) and their interrelationships in the VSM.

(5) Management is conceived as a *recursive process*. In principle, the whole scheme applies to any level of recursion of an organization, although some of the terms may contain a certain bias towards the higher levels of recursion.

(6) The components, which constitute the framework, are *dynamically interrelated*, as visualized in Figure 5. The terms in the diagram give an overview of the domains in which management/leadership can influence the *essential parameters* and thereby catalyse organizational transformation. The dynamical interrelationships between these components call for balanced interventions and a thorough consideration of possible chain reactions and side effects.

6.2. Dimensions of the Framework

The *activities dimension* describes the ensemble of intended operations of or actions taken by an organization. In this dimension, the emphasis of change is on reshaping profile and thrust, and on revising principles, goals and rules that govern the behaviour of the organization both internally and in relation to its environment. Here we also find the challenges of developing core competencies and of renewing or reconfiguring activities. The *structural dimension* is about the arrangement of relatively stable mutual relationships between the elements or components of an organization. In this context, the levers of transformation are structural change, the redesign of processes and management systems, the management of resources – particularly people, knowledge and time – and, in many cases, a reconsideration of the composition of the team. The *dimension of behaviour* describes the pattern of actual or desired qualitative features of conduct, which are characteristic of an organization or its subsystems The spectrum of potential impulses for transformation in the behavioural–cultural domain can be subsumed under categories such as reframing, revitalizing, empowering and energizing.

Finally, those essential parameters which are *fundamental* to all organizational activity, and

which are subsumed under terms such as *identity*, *ethos* and *vision*, are, in a sense, most powerful *levers* of change, which impinge on all three domains: activities, structure and behaviour. Therefore they have to be reflected continually in a self-referential process, and revised, if necessary.

Intelligent organizations conceive their viability in a broader way than in the sense of mere survival at any price, or of autopoiesis, i.e. self-reproduction. Ultimately, they adhere to the goal of development. In extreme cases they even disband, if they can no longer make a significant contribution to the larger whole (cybernetically speaking: at the service of the systems of the higher recursive levels, in which they are embedded). From there, they may reconfigure themselves anew, develop a distinct identity or become part of a different system. This inclusion of the principle of (self-)development into a management model (see Model of Systemic Control, Section 3) is a conceptual prerequisite for self-renewal – an essential characteristic of intelligent organizations. In the future, *control by development*, *control by learning* and *control by transformation* will increasingly be required; each of these kinds of control being a mode of self-control. *Continuity through discontinuity* can become a sound organizational principle under certain circumstances (as specified above).

A virtuous transformation leading to ever more vigorous viability and development requires synchronous evolution and transformation in all three domains – activities, structure and behaviour,[24] in alignment with the fourth dimension – the underlying *fundamental parameters* named.[25] The reflection and development of the latter is an additional prerequisite of a higher order. In other words, also the concepts of organizational identity, ethos and vision are dynamic ones (cf. Gioia *et al*., 2000).

Isolated, unidimensional non-aligned or asynchronous changes in any one of these dimensions are in principle less robust and subject to failure more easily. The delicacy of managing a transformation is in large part due to the fact that the *time* constants inherent in each one of these domains are different. Strategies can often be reinvented quickly, whereas structural transformation takes more time. The variables that react most slowly are the behavioural ones.

6.3 Integrating the Dimensions and Models

The three models outlined in sections 3–5 can in principle leverage and facilitate organizational transformation substantially, if they are used in an integrated and synchronized manner. In Figure 6, the three models are integrated graphically. The frowning analyst in me – and probably in many readers – must require further elucidation of this rather impressionistic image. In this respect, two points must be made.

First, an integration of the three models is neither artificial nor arbitrary, as they are bound together by strong and cogent conceptual links (see also Figure 7).

The MSC and the VSM are intrinsically connected by the equivalence of three logical levels: operative, strategic and normative. In the case of the MSC these are represented by respective referents for conceiving and controlling what the organization does, in the case of the VSM by the structure of the management functions which embody these three logical levels. The TSM is complementary to both the MSC and the VSM. It was conceived as a methodology for the optimal design of communications and interactions in the managerial metasystem of organizations (Systems 3/4/5 in terms of the VSM, in particular the homeostat of Systems 3 and 4, in which the checks and balances between 'inside and now' and 'outside and then' occur). This design turned out to be necessary: on one hand, the number of people involved in the issues at stake in such a metasystem usually transcend the size of face-to-face groups. On the other hand, there was no theoretically well-founded protocol available to provide for an optimal design of communications in large groups (cf. Beer, 1994b).

[24]For some empirical evidence – even though collected in more specific domains – to support this argument, see Pettigrew and Whipp (1993) and Rudolph (1999). See also footnote 24.

[25]These fundamental parameters can be operationalized by means of constructs such as *values*, *norms* or *lead distinctions*, which are logically superordinate to the distinctions drawn in the three other dimensions.

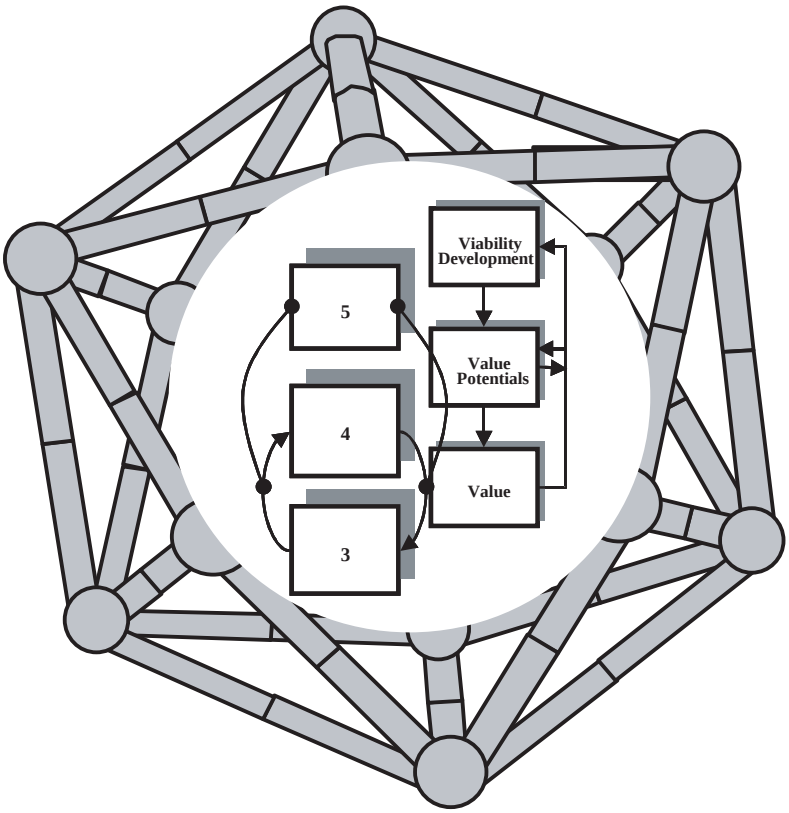

Figure 6. Integrative view of the models (I)

These inherent logical relationships provide a naturally integrative force, which may not be recognized by outside observers who are unfamiliar with the links made explicit here. It can be imputed that the effectiveness of any combined application will significantly depend on the knowledge of these relationships on the parts of the key actors, particularly the facilitators involved in respective projects of organizational transformation. It must be added that a combination with other models is not in principle excluded from consideration. Also, in practice, methods and methodologies not explicitly specified here will necessarily be included in the toolboxes of change agents and facilitators of organizational transformations.

The second point is that each one of the three models outlined has a strong link to one of the dimensions of the framework:

(1) The aspect of *activities*: The *Model of Systemic Control* furnishes a frame of reference which supports an integral (self-)control. It helps agents to distinguish between the three logical levels of management and orients them in keeping the steering variables of all three levels under control simultaneously, even if contradictions occur.
(2) The aspect of *structure*: The *Viable System Model* is a highly powerful device to diagnose an organization and to design it in a way that the self-control to achieve viability and development can be achieved.
(3) The aspect of *behaviour*: The *Team Syntegrity model* provides a design for developing virtuous synergetic interactions and relationships in an organization. This holds in particular for an increase of cohesion and the generation of knowledge in multi-person

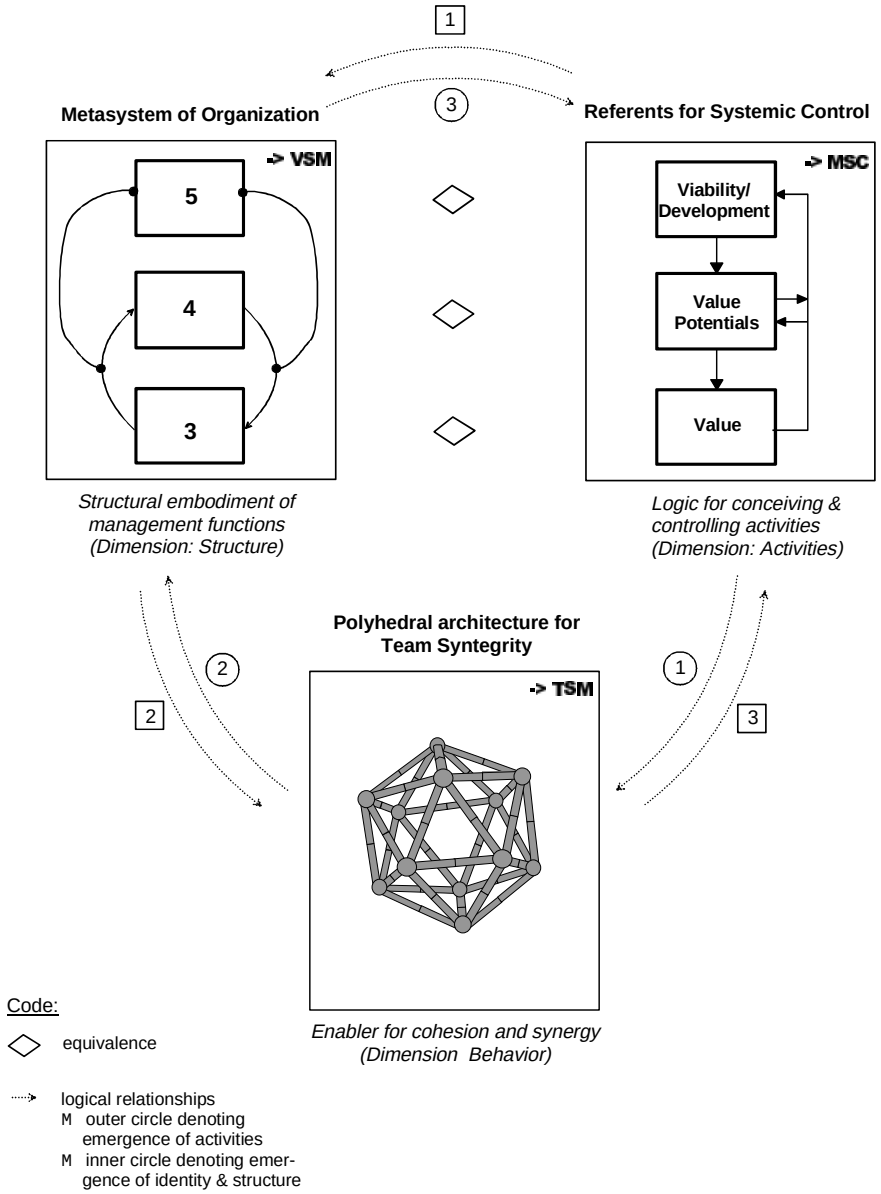

Figure 7. Integrative view of the models (II)

settings, and in the context of reflective and innovative processes.

However, the utility of each one of these three models is not limited to any one of the dimensions of activities, structure of behaviour, as this enumeration might seem to imply. On the contrary, all three of them incorporate a systemic perspective, which to some extent also considers the other dimensions. In addition, each one has a substantial contribution to make concerning reflecting such fundamental issues as ethos, identity and vision of an organization (cf. Schwaninger, 1998).

On the other hand, organizational identity, ethos and vision can be considered *fundamental parameters* insofar as they shape an organization in a basic way. Their impact on the other

dimensions – activities, structure and behaviour – is, in principle, primordial. At this stage it is also necessary to specify how they are tied to the concept of an intelligent organization, as formulated at the outset. For this purpose, it is indicated to specify brief working definitions for *identity*, *ethos* and *vision*, and then link these concepts to the four criteria which distinguish intelligent organizations (see Section 1).

Identity may be defined as a mark of an organization, which can be consistently recognized, or which persists over time (Leonard, *Coming Concepts: Glossary of Cybernetic Terms*, forthcoming); thereby making it distinguishable or unique. The e*thos* consists in the salient ethical principles or the characteristic spirit of an organization. Finally, v*ision*, in this context, may be conceived as a highly imaginative anticipation of, or a complex insight into the possible future of an organization. I re-emphasize that the relative persistence over time of an identity does not preclude that it may change, and even at a fast pace, in some cases[26]. Neither is change excluded from ethos or vision; e.g. growing insight and wisdom may lead to the emergence of new ethical principles or to sharper anticipations of desirable futures.

A specific set of these fundamental parameters always enables certain modes of *adaptation*, while it precludes others. For example, those firms which have established strong identities as leaders in environment-friendly problem solutions exclude toxic products and technologies from their options to adapt to market demand.

Similarly, the modes by which a company can *shape its environment* will strongly depend on these fundamental parameters. An ethos of opportunistic reaction will provide little space for influencing the milieu constructively. On the other hand, a strong sense of ethical responsibility is often at the root of innovation and leadership by which firms have helped society at large in coping with problems such as disease or scarcity of resources. For pertinent empirical evidence, see Collins and Porras (1994).

Furthermore, *finding a new milieu* and, if necessary, *reconfiguring itself* with its environment, can instil new vigour into an organization. However, such a process of renewal is risky. A virtuous trajectory will be favoured by a strong sense of identity, e.g. to avoid the fallacy of disordered diversification, with its potentially disastrous implications for competitiveness and economic performance (cf. Palich *et al*., 2000).

Finally, an organization confined by a narrow perspective will not be prone to making a substantial *contribution to the larger whole* of which it is part. The responsible leaders need a sufficiently ample vision, which includes an understanding of the embeddedness of the organization (see VSM, Section 4) and of the requirement of legitimacy for viability and development (see MSC, Section 3).

A more extensive elaboration on the potential and the difficulties of applying the framework presented here will have to be the object of follow-on research. At this stage, I can postulate, on the grounds of provisional empirical evidence[27], that such a systemic approach is superior to an approach where only one of the models outlined – MSC, VSM and TSM – is applied or where several or all of them are used in a merely additive mode. It must be said, in the same instance, that the systemic nature of each one of the three theories, their conceptual interrelationships as specified above, and in particular the framework proposed here, also facilitate such an integrative application.

7. SYNOPSIS AND OUTLOOK

In this paper I have emphasized the aim of designing organizations so that they can achieve higher intelligence, which implies higher cohesion, self-control and self-reference, and ultimately more vigorous viability and development.

[26]For example, *Encyclopedia Britannica*, the traditional edition and seller of the 'ultimate home library', founded in 1768 in Edinburgh, weathered its greatest crisis in the 1990s. After several tentatives to revise its business model (increase of sale efforts, availability via paid Internet services) the firm transformed itself into an electronic information centre in 1999. This change has been compared metaphorically with the transformation of a time-honoured steamship into a modern speed-boat (Weber, 2000). One could argue that the identity, in this case, has not changed fundamentally; *Encyclopedia Britannica* always was and remains a knowledge source. There are indeed different degrees of changes in identity.

[27]Cf. Schwaninger (2000), Contraloria General de la República (unpublished, 1997) and Reyes (2000).

A crucial challenge which I have stressed in this context is coming up with better models – including theories, frameworks, etc. – apt to enhance the capability of organizations to cope with the paramount and growing complexities they face.

First, three *models from organizational cybernetics* – MSC, VSM and TSM – have been outlined as building blocks for the design of intelligent organizations. The benefits of these models lie (a) in the deeper understanding of the causal structures underlying organizational behaviour and performance, which they convey, and (b) in the principles they furnish, for the design of organizations to cope with complexity in a more comprehensive way, than if supported by conventional management models.

Finally, a *Framework for Intelligent Organizations* has been proposed. It has also been described with its essential features, and reference to provisional empirical evidence has been made to support it. Given the novelty of the framework, this empirical support to date has its limitations, as far as systematic knowledge about the outcomes of applications of the framework as a whole is concerned. Therefore the potential claimed here for the overall framework has mainly been underlaid in a deductive mode. The empirical support given for the three individual models – MSC, VSM and TSM – is much stronger.

In sum, my suggestion is that (a) a virtuous transformation of organizations can only be achieved if the dimensions of activities, structure and behaviour are developed in a balanced, synchronic mode, and (b) to excel in this endeavour, the three models outlined have to be applied in a combined and integrative manner – in accordance with such underlying fundamental parameters as organizational identity, ethos and vision. The latter have to be subject to development in their own right.

Such a systemic use of these models can trace the path towards superior organizational intelligence more effectively than merely punctual uses of any one or more of them. Also, the incorporation of ethics and aesthetics as explicit components of design, as advocated here, should contribute to broader-minded, less reductionist and myopic modes of management, and ultimately foster sociocultural progress. On the grounds of the arguments developed in this paper, the proposed framework promises to be a powerful response to the needs of the new types of intelligent organizations, which already have begun to emerge.

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