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Organizing for Sustainability

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Editor's Note: This is the text of the *Ross Ashby Memorial Lecture* delivered by the author at the European Meeting of Cybernetics and Systems Research, Vienna, April 24, 2014.

Abstract: The quest for the ecological sustainability of planet earth could be much more successful than is currently the case. The purpose of my presentation is to corroborate this claim and to propose a structure by which a sustainable future can be achieved. The issue of sustainability has been addressed in different contexts — local, regional and worldwide. I maintain that these efforts can only be effective, if actors at multiple structural levels strive simultaneously and cooperate for materializing the vision of a sustainable world. The distribution of tasks along these organizational strata is a nontrivial task. To master it, a recursive structure based on the Viable System Model is presented, which shows how the efforts for sustainability can be organized in a much more powerful way than by conventional approaches. The proposed structure enables agents at each level to generate variety in balance with the complexity they face. This presentation should also help decision-makers understand that pertinent frameworks are needed to enable actors at each level, from individual to global.

Keywords: Sustainability; Organization Design; Organizing for Sustainability; Cybernetics; Viable System Model; Structures; Systems Approach; Recursive Structure

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Ladies and Gentlemen

Ross Ashby taught us how to deal with the complexity of our world. We are in an ecological crisis today: The complexities we have created ourselves do not loosen their grip on us. Fortunately we can revert to Ashby's advice about how to cope with our predicament: That is the purpose of my talk.

I feel honoured and pleased to deliver this lecture. Many thanks to the organizers for inviting me!

1 Introduction

The Brundtland Report "Our Common Future", from 1987, which was delivered by the United Nations' World Commission on Environment and Development, defines sustainable development as a "development that meets the needs of the present without compromising the ability of future generations to meet their own needs". Despite this well-intended declaration, we have not seen much change for the better.

Accordingly, the improvements have been punctual, for example in the greening of European industry. What we see, however, is a deluge of monstrosities - a gigantic squandering of resources, pollution of air, soil and water, depletion of biodiversity, altogether: a disruption of the web of life.

We humans are part of that web, and we carry responsibility for it. In other words, we need better ways of dealing with the ecological challenge. Hence, the question I would like to address in this lecture is: "How must humanity organize itself in order to develop sustainably?"

Sustainability has several dimensions known as the triad "Ecological, Social, Economic." These three spheres interdepend (Figure 1).

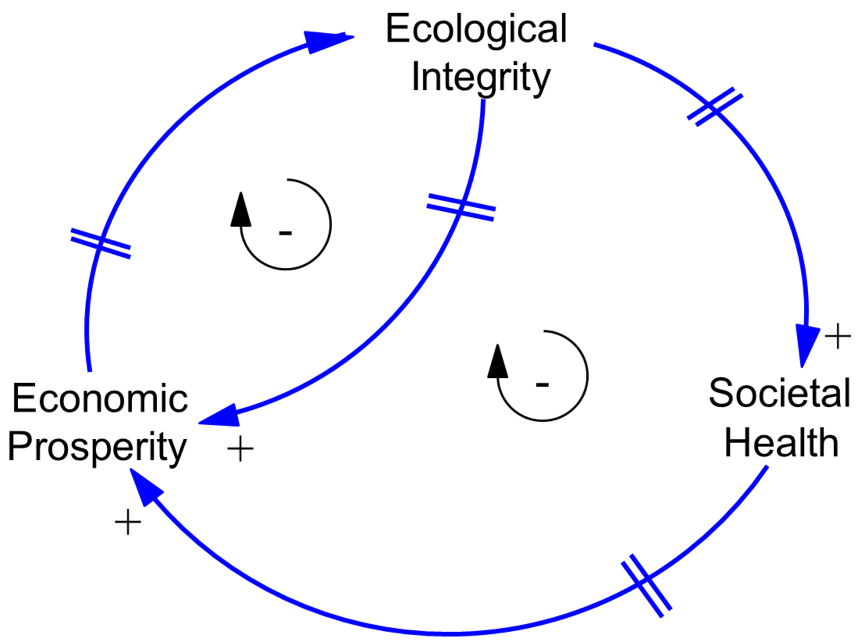

Figure 1: Dimensions of Sustainability

Ecological integrity furthers the health of a social system, which then enhances economic prosperity. A thriving economy – as the evidence shows – can become disruptive to the environment (therefore the negative sign on the arrow). That is what we have had in the industrialized world at least since World War II, and increasingly also in the emerging economies. The dynamics of this system are summarized in the negative signum denoting a balancing loop: This appears to be a self-regulating system, in which damages are eventually compensated.

Yet, the situation is more complex: A healthy environment enhances economic prosperity. Accordingly, injuries to the environment result in dysfunctionalities of the economy. This makes another self-regulating loop, which is supposed to be a good omen. But the appearance deceives: there are delays in the system (marked by the crossbars in Figure 1). Due to these retardations it is likely that the economy thrives even more, until at some point the environment strikes back, unexpectedly and forcefully. Examples have been described, such as the collapse of the Easter Islands, where a whole society was eradicated within very short time, after having destroyed the forests, which were its main resource.

This diagram is a simplification, as additional feedbacks might play a role. My point here is that I will focus on ecological sustainability, which is, in some sense the most fundamental of the three dimensions. It is interdependent with the other two dimensions, to which I will therefore refer in my analysis as well.

From a long-term perspective, the viability of humanity hinges on a sustainable development. If we want to organize for viability, we have to organize for sustainability.

2 Choosing a Model

The strongest approach is to choose a model that targets viability and allows us to channel the efforts for sustainability into that quest for viability. In other words, organize sustainability measures so that they enhance the viability of a system.

There are two models that aim at making such viability possible:

- James Grier Miller’s Living Systems Theory (Miller, 1978), and
- Stafford Beer's Viable System Model (Beer, 1972; 1984; 1985).

Both of these models have an organismic perspective in common. Both have an enormous potential which has spurred their increasing use in organizations. While Living Systems Theory is older and therefore has been corroborated by a greater number of published empirical studies, the Viable System Model (in short: VSM) has the advantage of being stronger in its theoretical claim and falsifiability, as well as its diagnostic potency. The claim is that this model specifies the sufficient preconditions for a system to be viable. This prerogative reaches much further than the mere reference to “necessary requirements”. Even so, the VSM has not been falsified, in other words, it has not been proven to be wrong. Serious attempts to falsify the model have not been successful (Frost, 2005; Crisan Tran, 2006). Therefore, following Popper’s Falsification Principle, it can be assumed that it holds. Consequently I shall revert to this model as a guideline. It is a special pleasure to have Dr. Allenna Leonard, Stafford Beer’s partner, among us.

In the VSM a set of “control mechanisms” is specified, which Beer describes as the necessary and sufficient conditions for the viability of any human or social system.

3 Outline of the Viable System Model

A social body is viable if and only if it has a dovetailed structure of regulatory units whose functions and inter-relationships are precisely specified in the theory. I will guide you quickly through the generic structure of the model:

To start with, the basic units: these might be divisions if we look at a firm, nation states if we look at a nation, nations if we look at a continent, and continents if we look at the world. These basic units absorb the complexity of the environment they are confronted with.

If we zoom in, this is what we get (Figure 2).

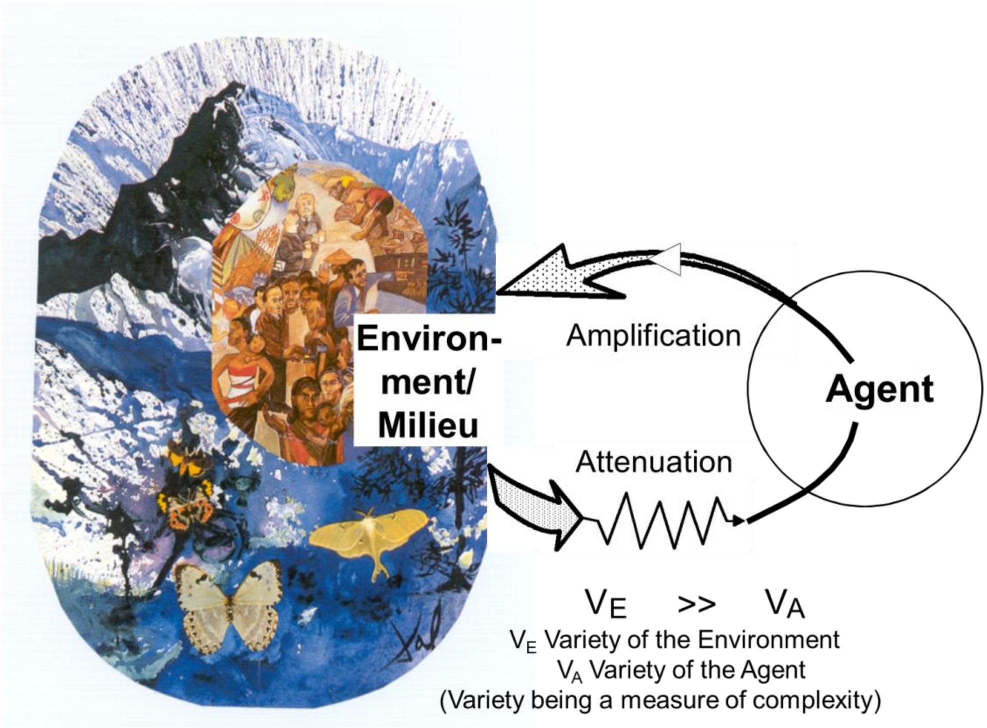

Figure 2: Variety Engineering with Attenuation and Amplification of Complexity

The basic unit (denoted as 'agent') adapts itself to the environment by attenuating its complexity and by amplifying its own Variety, namely its repertory of behaviors.

This way, environmental complexity and eigen-complexity are brought into balance. That is what Ashby called *Variety Engineering*. The term *Variety* here denotes a measure for complexity – the property (potential or actual) of a system to assume many states or behaviors.

Now, let us follow the components of the management system (Figure 3):

- System 1: This is the regulatory capacity of the largely autonomous and mutually adaptive operative basic units, in charge of optimizing the ongoing business. Basic units with their respective management are called primary units. An example: the company's business units.
- System 3: In a company we would have the executive corporate management here. It provides overall direction, allocation of resources, striving for an overall performance optimum, which is often different from the optima of the subsystems (primary units).
- System 2: This is the coordination function, which reduces oscillations and enhances self-regulation. For example the information- and budgeting-systems, internal service-units, standards of behaviour, knowledge-bases, a good deal of communication.

- System 3*: The Auditing Channel, where the information flowing through channels 1-3 and 1-2-3, are validated through direct access to the basic units. For example, monitoring and Management by walking around, cultural activities and informal communication.
- System 4: It stands for the long-term orientation to the future and the overall environment. Here we have company development /strategic management, research and development, knowledge creation, etc.
- System 5: Striking the balance between present and future, keeping the internal and external perspectives in proportion. Here we have the supreme norms and values that govern the system – the ethos of the organization or normative management.[1]

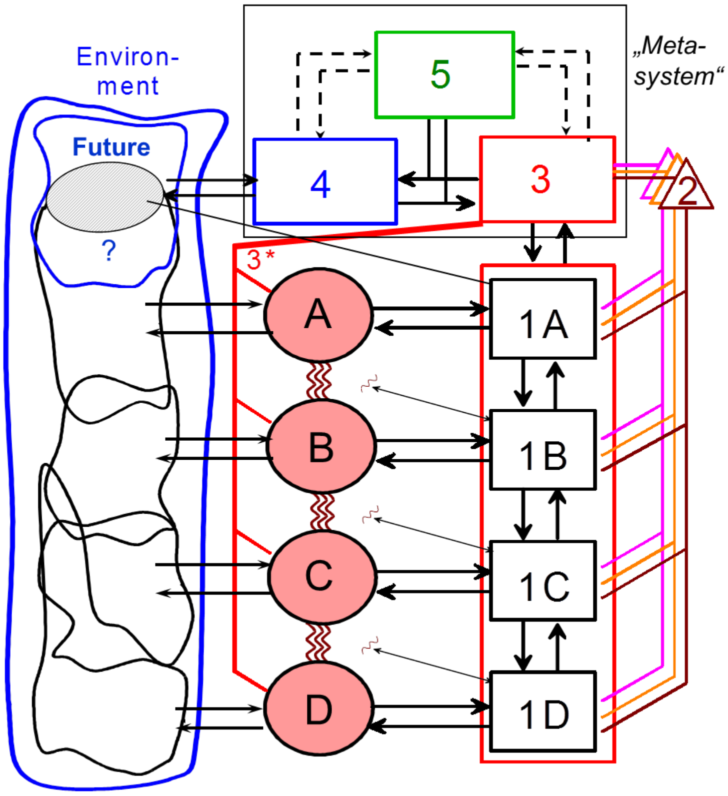

Figure 3: The Viable System Model – Diagram after Beer, simplified

Why do I take such a complex model? I am using it, because it is the only one that guides us straight to viability!

To sum up: *Systems* 1, 2 and 3 (including 3*) represent the Operative, System 4 (in interaction with 3) the Strategic, and System 5 Normative Management. 3, 4 and 5 together form the Meta-system.

The VSM is a tool of extraordinary power that I have used, with my team, many times to diagnose organizations of all kinds: big, small, public and private. Applying the model to a real firm brings diagnostic points to the fore, which can change its fate completely. By the way, the model is of neurophysiological origin.

It is homomorphic in relation to the human central nervous system (Figure 4). Humans are the best paragon of viable systems. What Stafford Beer discovered is an isomorphic structure for mapping both social and organismic systems.

[1] In addition, certain alert devices can always be identified in viable systems. Beer (1985, 133) calls them „algedonic signals“ (from Greek ‘algos’ – pain and ‘hedos’ – pleasure). These warning systems decide if signals of imminent danger have to be sent directly up to System Five. This component will not be analyzed further in the present contribution.

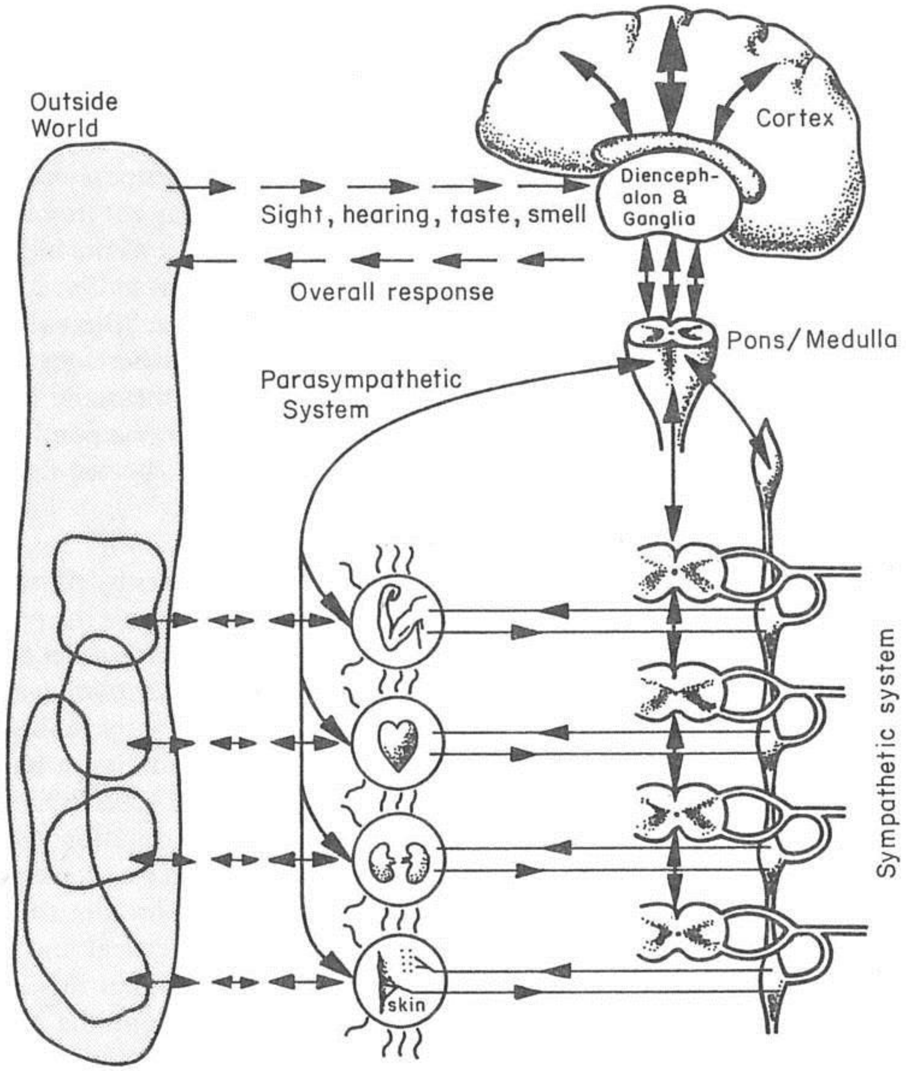

Figure 4: The Neurophysiological Basis of the Viable System Model (Beer 1981, 131)

4 Two Principles: Autonomy and Recursion

The viability, cohesion and self-organization of a social body depend upon these functions being recursively present at all levels of its organization.

A recursive structure comprises autonomous units within autonomous units. Moreover, a viable social system, e.g. a company, is made up of viable units and is itself embedded in more comprehensive viable units (Figure 5). Each unit, inasmuch as it is producing the organization's task rather than servicing or supporting this production, replicates - in structural terms - the totality in which it is embedded.

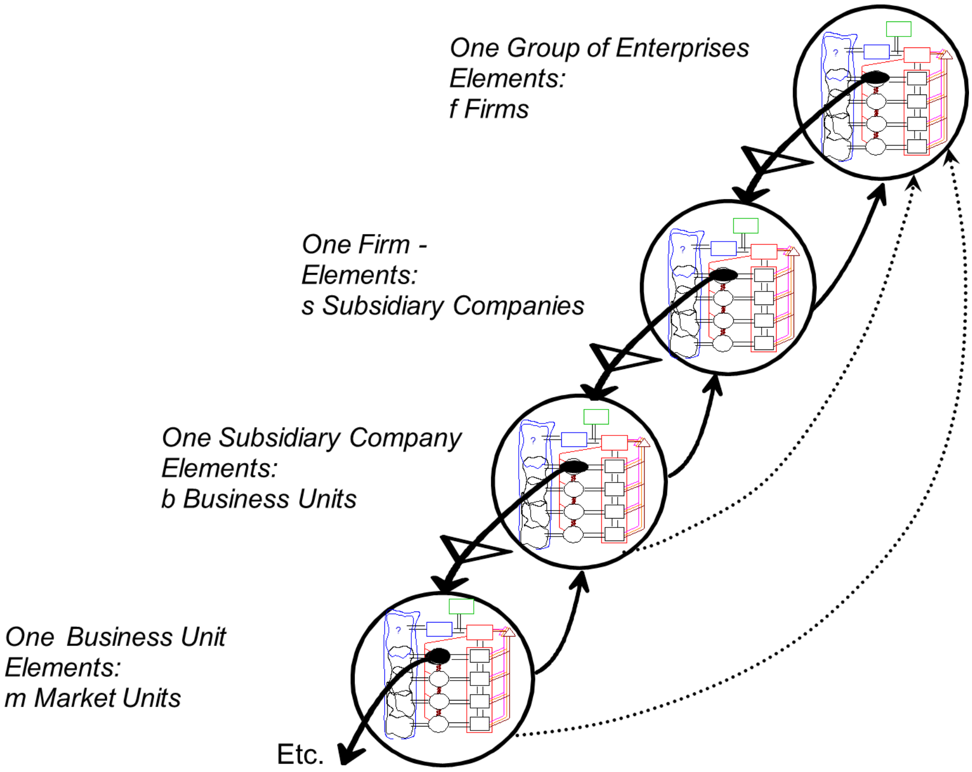

Figure 5: Recursive Structure of the Viable System Mode - Examplel

So we meet the same structure over and over along the levels of the organization.

Autonomy is basic to the VSM. From Greek “autos” (for self-) and “nomos” (for law) this term refers to the primary unit as a whole being ‘a law unto itself’, as Beer defined it (Beer, 1981). The autonomy in question is therefore both a system’s freedom and the responsibility to regulate itself. This is the pivot of an organization’s adaptation and learning.

In case the challenges confronted exceed the capability of such a primary unit, joining forces becomes necessary. In many cases this can be achieved by a horizontal cooperation. However, it can indicate the necessity of jointly constituting a new unit at a higher level of recursion. For example, municipalities form states and states form nation states.

However the formation of a new organizational unit is not necessarily linked to a merger of all aspects of the activities of the Systems.

For example, two or more units can join forces to deal with the ecological challenge in a more prolific way than if they go on their own (Figure 6).

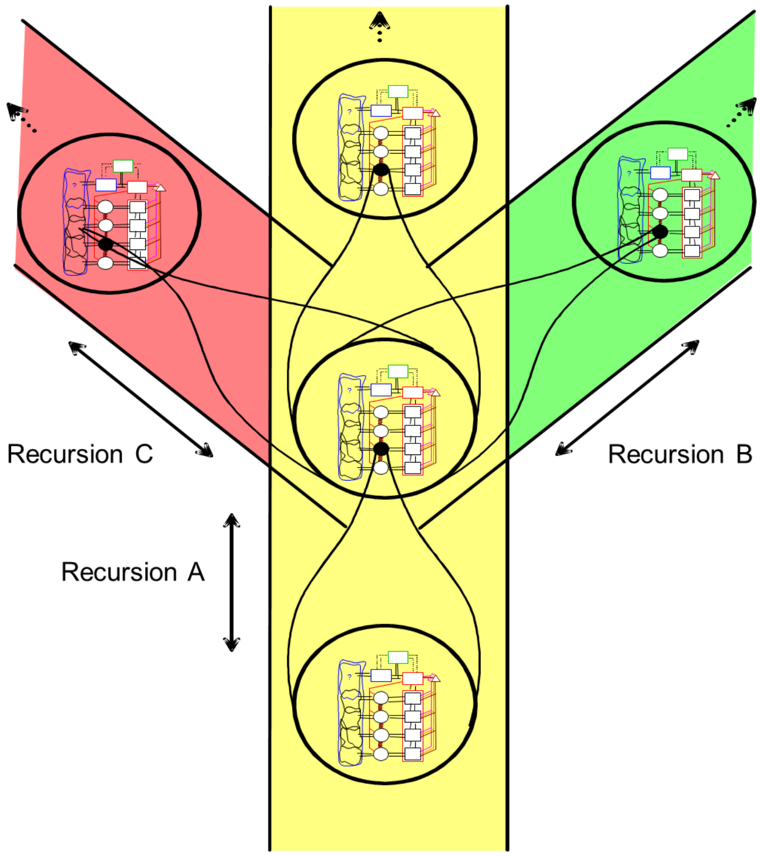

Figure 6: Recursive Structure, multidimensional

With this structure we were very successful in bundling the ecological effort – of a large division in a company of the chemical industry - in a critical and life-threatening phase.

The structure outlined here shows that one and the same organization can function simultaneously both as a sub-system and a super-system within the framework of different recursive organizational dimensions: Recursion is a multidimensional concept.

The division in focus is part of that large corporation and is itself composed of several Business Units (Recursion A). In order to cope with the ecological challenge, the division joined other enterprises from outside, to form an association for that purpose (Recursion B). Additionally, this company was a member of a consortium for research and development (shown in Recursion C).

5 An Organizational Framework for the Pursuit of Sustainability[2]

We can now apply the VSM in support of ecological sustainability.

Instead of starting at the global level, we shall begin with the individual agent. One often hears that sustainability starts in the head of the individual that acts according to ecological principles. However, agents exist at different levels, if you look at the world from a system-theoretic perspective. For example, we can identify a whole company as one agent: Let us take Interface, leading producer of carpet tiles, a company that excels by its

2 Based on Schwaninger, 2008.

ecological commitments: Closed loop products, zero environmental footprint, and a restorative approach just to name a few. Ray Anderson, whom I interviewed a few years ago, was the initiator of this orientation[3].

But today, when Interface announces its mission, that it wants to be "a corporation that cherishes nature and restores the environment"[4], it speaks with one voice, as one agent.

Also, the aggregated results of the strategies to make this vision come true will be measured and reported in organs of the corporation as a whole. On lower levels of recursion, different divisions, teams or staff members will develop their own views, values and strategies: Following the logic "What is my contribution to our mission?"

As we know, strong and viable organisations thrive on that mutual alignment of values, strategies and actions, from bottom to top and from top to bottom.

Hence, we conceive of agents as human or social units, acting as wholes, at different recursive levels of a human or social system. In the context of the quest for sustainability, we can now outline a structure of the multiple agents concerned (Figure 7).

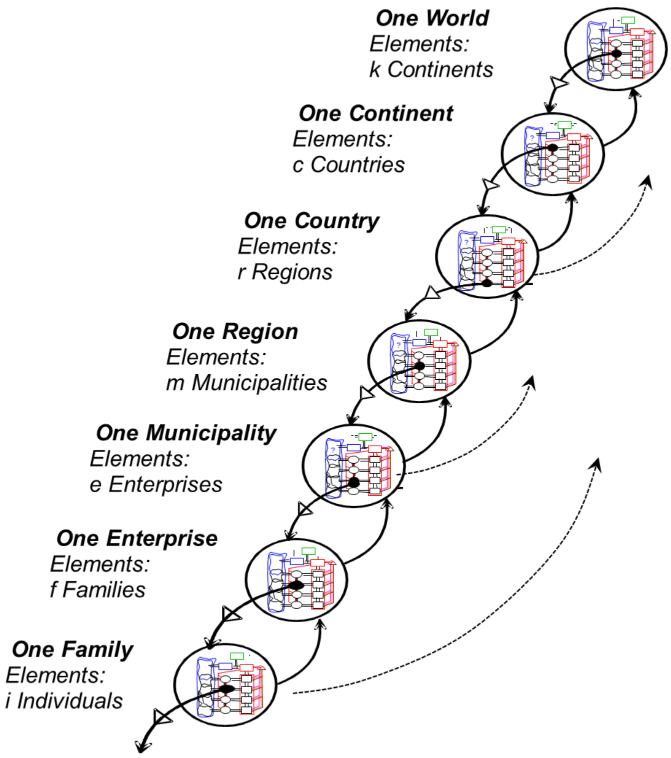

Figure 7: Structural Preconditions for Sustainable Development – A multilevel view

In this scheme, the structure reaches from the level of the individual to the level of the whole world. One might think that the multiplicity of agents forming the system at all of these levels is prohibitive to an endeavour of mapping all of them at once.

Why is this diagram so simple? Because it uses the recursion principle: Wholes at multiple levels absorb complexity along the fronts at which that complexity emerges. The reach of this structure is practically infinite. It visualizes that each level has its regulatory issues in their own right. To maintain viability, each agent has to deal with that task of

3 The path of Ray Anderson to ecologically committed entrepreneurship is documented in Anderson 1998.

4 Corporate homepage: http://www.interfaceglobal.com/Company/Mission-Vision.aspx, accessed May 22, 2014.

absorbing the specific complexity by which he or she is affected, in accordance with Ashby's Law of Requisite Variety: It says "Only variety can absorb variety".[5]

That is Ashby's advice and it is the instruction for the design which I am presenting. Requisite Variety is the nucleus of viability.

Issues of ecological (and social) sustainability arise everywhere, but they vary according to the planes. It does not make sense trying to solve the pothole problem at the global level, this is a task of every mayor, in each city or village. On the other hand, forbidding a toxic substance is often a national or international issue. But a company can be even faster by interdicting that substance in its own plant or creating an incentive for not using it (for example, a fine per kilo, as done in a Swiss company).

Most affairs can be regulated at the bottom, so that higher levels should only regulate what cannot be taken care of at the lower ones. This corresponds to the principle of subsidiarity.[6]

The lines drawn bottom-up symbolize the principle of subsidiarity as well as the participation, mainly in regulatory activities, of higher level bodies. The lines drawn top-down indicate the unfolding of viable systems along different recursive levels.

The principle of recursion multiplies the capacities of complexity absorption. It is applicable ad infinitum, and therein lies its tremendous power.

6 Systemic Environmental Management

Now, I would like to share with you some of the experience accumulated in my research team. We have studied and applied these theoretical foundations over decades and in the most diverse contexts.

My first example must be limited to one level of recursion only, just to avoid that I keep talking forever. This is an exemplar of a mid-sized industrial company in Switzerland from the chemical industry.

Let us now together walk through the sustainability-related tasks as they are distributed across the functions of the VSM:

- System 1: This is about regulation and optimization of ecological management, in the short term, of the basic units. I am referring to the general management provided by the business unit heads and factory managers, ensuring environment- and security-related direction and control.
- System 3: Here we have the overall responsibility for sustainable operations of the company. In charge is one of the three executives of the management board.
- System 2: Coordinates the ecological efforts across the basic units, provides educational programs, as well as planning and control of ecology-related programmes. The main agents here are a sustainability service unit of minimal size, and a "sustainability circle" with members of different sections. In his System-2-function, the circle is the prime diffusion-medium for ecological consciousness. The instruments used include an ecological accounting system, environment- and quality-related standards of behaviour and knowledge-bases.

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5 Ashby's original wording was: „Only variety can destroy variety" (Ashby, 1956). Beer inserted the more insightful verb "absorb" (Beer, 1979).

6 Subsidiarity is an organizing principle according to which a central authority should have a subsidiary function, performing only those tasks which cannot be performed effectively at a more immediate or local level (Oxford English Dictionary). In other words, "a matter ought to be handled by the lowest, smallest and least centralized authority capable of addressing that matter effectively" (http://en.wikipedia.org/wiki/Subsidiarity, accessed May 22, 2014).

- System 3*: is about the auditing and monitoring for ecological efficiency, through direct access to the basic units. Ecological audits and special environment-related investigations into the operations are important here, besides informal interactions of higher managers with workers.
- System 4: The long-term orientation concerning sustainability has several contributors, namely research and development and the sustainability circle (in its System 4 function), all coordinated by the sustainability staff. The latter does the systematic work on corporate development and strategy, such as investigation, and modelling. The top executives are part of the strategic management process, and all of these efforts are tied together in the hands of the CEO.
- System 5: determines the identity of the organization, its functions in the environment, incorporating the supreme values and norms, in short, the ecological ethos of the system as a whole (Normative Management). The CEO is the protagonist and main catalyst of the corporate values seconded by the board. Pertinent instruments are the corporate charter (with values and business mission), and a sustainability vision statement. The corporate charter was elaborated with the participation of employees from all sectors.

This setup gets close to the ideal-type of a VSM-based structure. No wonder, the company is one of the best-managed in the country, in ecological terms. By the way, empirical studies indicate that high environmental performance goes hand in hand with superior overall performance (e.g.: Meffert & Kirchgeorg, 1992, 190).

This was the structure for one recursion level, - the company as a whole. The same principles apply to the structures at other recursive planes. Let us just take a brief glance into this matter, and use the case of a larger company, - the Continental Corporation with whom I have been collaborating for many years. Continental is an organization dedicated to mobility and transport, best known for its tires and steering systems.

The management there is convinced that the effort for sustainability is more than environmental protection. It must go beyond end-of-pipe measures and be organized in a circular fashion (Figure 8). And it must be deeply ingrained in all domains: starting from research and development, supply chain, production, and the entire value chain.

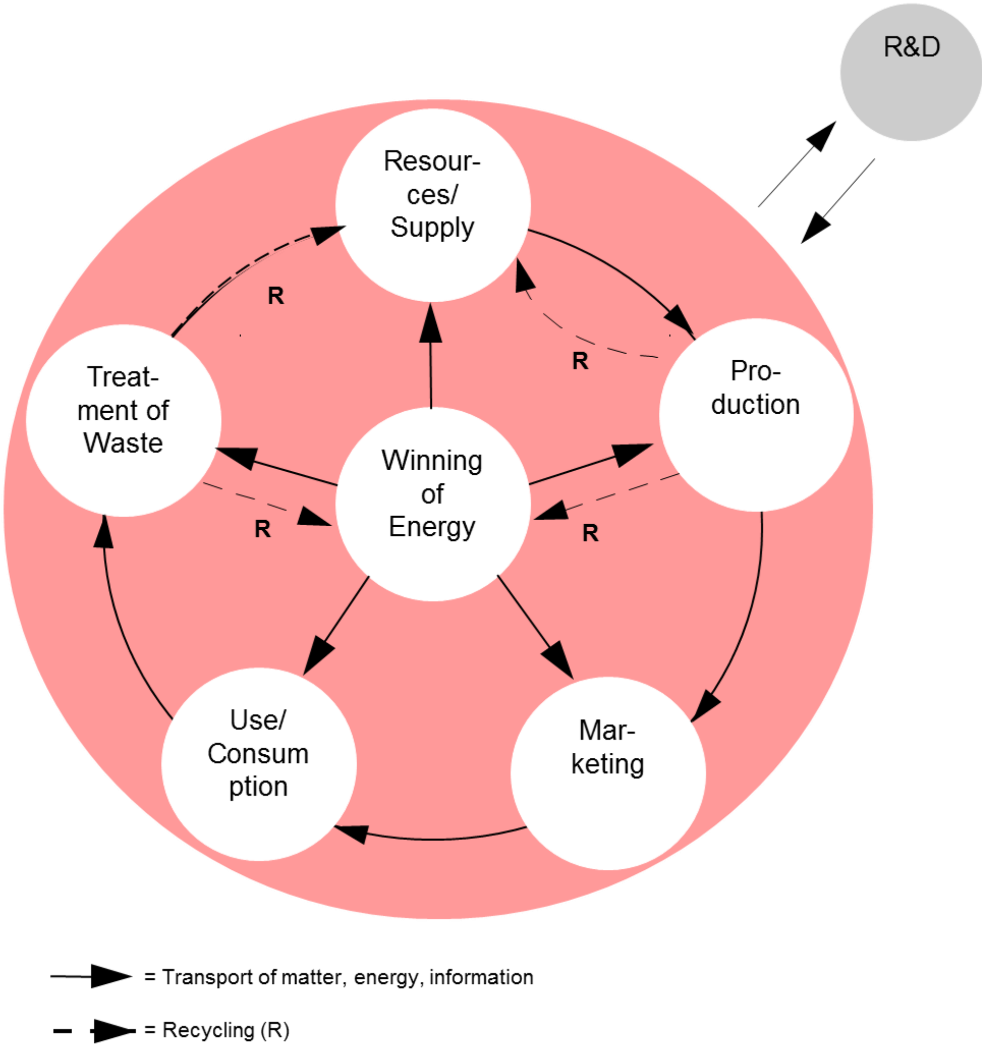

Figure 8: Circular Concept of the Value Chain

Therefore, Continental's approach is convincing: First, the quest for sustainability there is companywide considered a task of each member of the organization. This norm is contained in the leadership principles and practices.

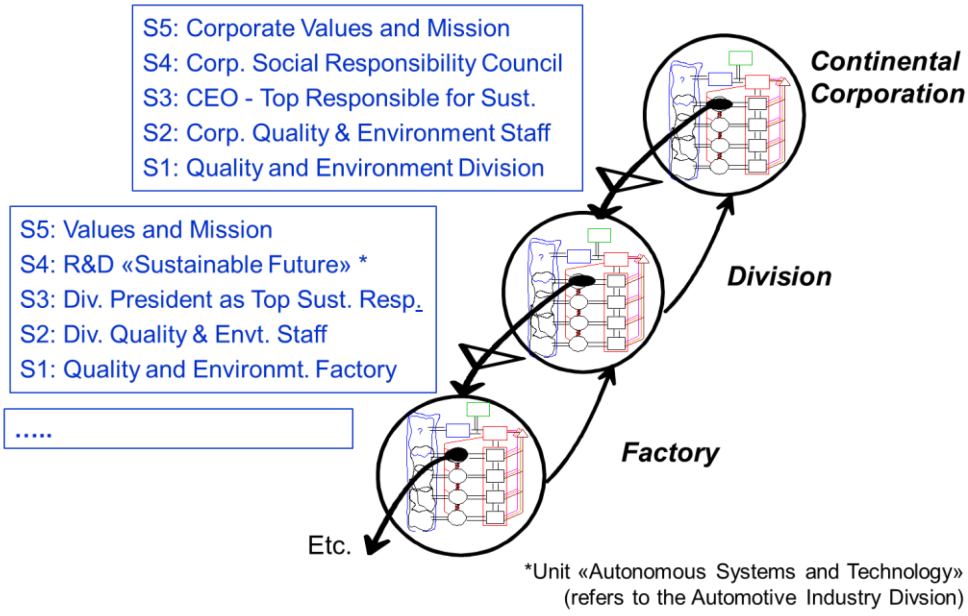

Figure 9: Ecological Management at Continental

Second, the responsibility for the greening of the firm is anchored throughout the line (Figure 9). At the level of top management to begin with: The ultimate responsibility for the sustainability of the company, in all respects, is with the chairman of the executive board ("CEO") together with the executive board as a whole. The CEO carries the line responsibility for quality and environment (System 3). At his side is a strong service unit called "Corporate Quality and Environment", which has very much a 2-3* function, in terms of the VSM. There is a second related line function for corporate social responsibility, - with the executive board member for human resources (part of System 3). There are also other mechanisms of coordination, such as rules and procedures, not only for quality and environment, but also for security, health etc.

The long-term issues of sustainability (System 4) are regularly handled by the Corporate Social Responsibility Council. The supreme tenets and principles (System 5) are well documented in corporate values and mission statements. This system is carried down to the divisional recursion. Here again, we find the same structure, in all five divisions (Tires, three Automotive Divisions and Continental Technologies). And the same logic continues further down.

The arrangement of tasks, as outlined, shows what Ashby's Law already taught us: ecological and social responsibility must not be confined to a single person or plane. The issues of these domains transcend boundaries. Hence, coping with them calls for distributed intelligence.

Moving up the ladder of recursions, we could now assess and design the structures for sustainability at the levels of community, region, country, etc. At these levels some notable successes have been achieved. I would like to acquaint you with the case of a whole region. There, I realized an ecological study based on cybernetics, which turned out to be seminal.

The Gastein Valley in Austria is one of the most beautiful alpine valleys. Its three villages (Figure 10) have been much procured by tourists in winter and summer, since the Middle Ages. Around the turn of the millennium, the valley suddenly found its sustainability and viability heavily threatened.

Figure 10: Gastein Valley, Austria

A plan based on the treaties with the European Union envisaged a counter-systemic intervention: The construction of a heavy-duty, high-speed train connection throughout the valley (punctuated line in Figure 10). The level of emissions (mainly noise) would be capable of jeopardizing the traditional tourism and health industry, and the local socio-cultural web. Based on a local initiative, a mediation forum with authorities and all other stakeholders concerned was formed. This forum asked me for advice. The ensuing process of studies and negotiations led to a decision at the level of the Austrian Ministry of Transport, Infrastructure and Innovation, which averted the imminent danger from the valley. Our analysis, from hindsight, shows that, as the process went along, the Gastein Valley organized itself in view of the threat: It evolved a structure for sustainability and viability (Figure 11). A more detailed report about this case can be found in Schwaninger (2012).

The primary units here are the three villages, each one with its management. The metasystem 3-4-5 had not existed at all, and formed itself in face of the challenge: a management for the sustainability of the Gastein Valley a whole.

This enabled the creation of a concept that was far superior in ecological terms to the original plan of the ministry: More environment-friendly, less noisy, more sustainable. That new plan was incorporated into the overall transport policy of the Austrian Ministry of Transportation, Innovation and Infrastructure. This surprising outcome is vital for the valley as a whole. It resulted largely due to this enabling structure of viability and the culture that went with it.

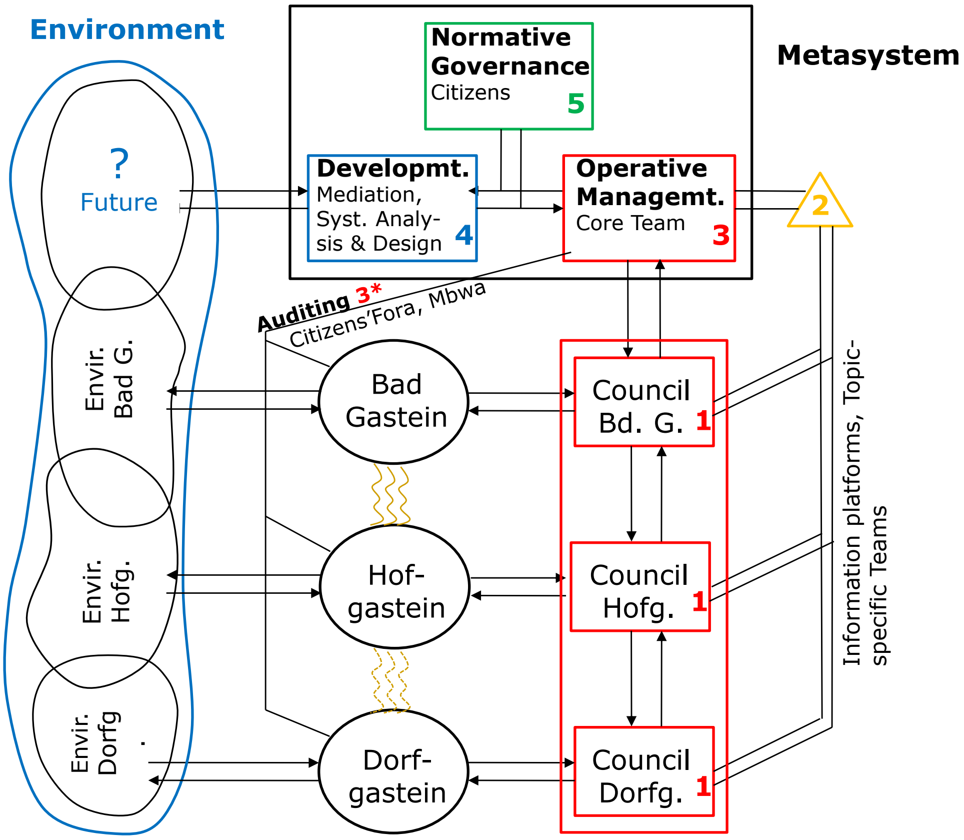

Figure 11: Regional Organization for Sustainability – Gastein Valley

So much for the regional level.

Carrying on, to the country level, we have at least two great analytical works: One is a design proposal by Stafford Beer (1989) for nations in general. The other is a careful diagnosis of the Swiss political system, by my doctoral student Maarten Willemsen (1991). His work analyzed some implications for ecology. But, a proposal for both a diagnosis and design for sustainability at the national level remains to be accomplished. What is needed in many countries is a transition to a more effective management framework, by which fragmentation and ineffective regulation are overcome.

If we move on to the last recursions, continental and global, we discern great ecological problems but low effectiveness in dealing with them. Namely at the level of the world, a large number of institutions try to regulate something, with mixed results at best. The VSM would be a powerful means for bringing about worldwide sustainability.

Sustainability will not happen if it is merely enforced from the top or exclusively pursued at the level of individuals. If we take a view of the overall recursive design, it becomes apparent that a multilevel approach is needed. The issues must be tackled at each recursive plane. None of these is unimportant or "less important".

Regulations must be focused on the needs of specific planes. A fragmentation of the efforts of regulation is an obstacle to ecological balance. We often hear that the environmental crisis results from a deficient consciousness of citizens. I agree. But the crisis is, in equal measure, the product of a structural deficit in the current organizational and institutional makeup.

7 Conclusion

This lecture has focused on a burning issue, - the ecological predicament of humanity.

Overwhelming complexity is the challenge, but our response is potentially powerful enough: It is a design for requisite variety along a recursive structure of autonomous units.

In practical terms, all planes from individual to world need their specific organization for "ecological management". This should be one of the foremost considerations of policy-makers when designing a framework for global sustainability.

Overcoming the current structural deficits calls for two things:

- First, better organizational and institutional frameworks for enabling agents at each level to make their contribution.
- Second, measures to enhance the ecological consciousness of citizens and their capacity for becoming environment-friendly (Last but not least, good frameworks as such should contribute to that environmental consciousness). But ultimately the success of the ecology movement will hinge on people’s love and compassion for nature.

Stafford Beer’s Viable System Model was inspired by Ross Ashby, - the two men were colleagues and friends.

The model makes use of Ashby’s Law of Requisite Variety: At each recursive level of the organization, the agents absorb the complexity as it unfolds. This principle is as powerful as it is simple.

The VSM has not been falsified yet. But that is not enough, it needs to be applied. It would be a sin not to use it for the betterment of the human condition. We need to work for the dispersion of that model. For example, I keep teaching people how to make good use of it. Hence, I am now looking, in particular, at the young people: **You will not run out of work!**

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About the Author

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Markus Schwaninger is a professor of management at the University of St. Gallen, Switzerland (emeritus since 2013). Born in Salzburg, Austria; double citizenship – Austrian and Swiss. His research and teaching are focused on the management of complex dynamic systems, with a methodological emphasis on System Dynamics and Organizational Cybernetics. Research projects are related to organizational intelligence, model-based management, the design, transformation and learning of organizations, and systemic issues of sustainability. His consulting and training mandates span all sectors, – industry, services, public and NGO, around the world. Markus is the author of ca. 230 publications, in six languages, including his latest book *Intelligent Organizations (Springer).* He has lectured widely, on four continents, and is involved in international, transdisciplinary research projects. His partnerships include projects with leading universities, e.g., the Massachusetts Institute of Technology, Cambridge, U.S.A.; Dartmouth College, Hanover, U.S.A.; Sustainability Laboratory, New York, U.S.A; The London School of Economics, London, U.K.; Fundação Getúlio Vargas, São Paulo, Brazil; Universidad de los Andes, Bogotá, Colombia; Universidad de Valladolid, Valladolid, Spain; and the Swiss Federal Institute of Technology (ETHZ), Zurich, Switzerland. Markus is also a director of the World Organization of Systems and Cybernetics, and a managing editor of the System Dynamics Review.