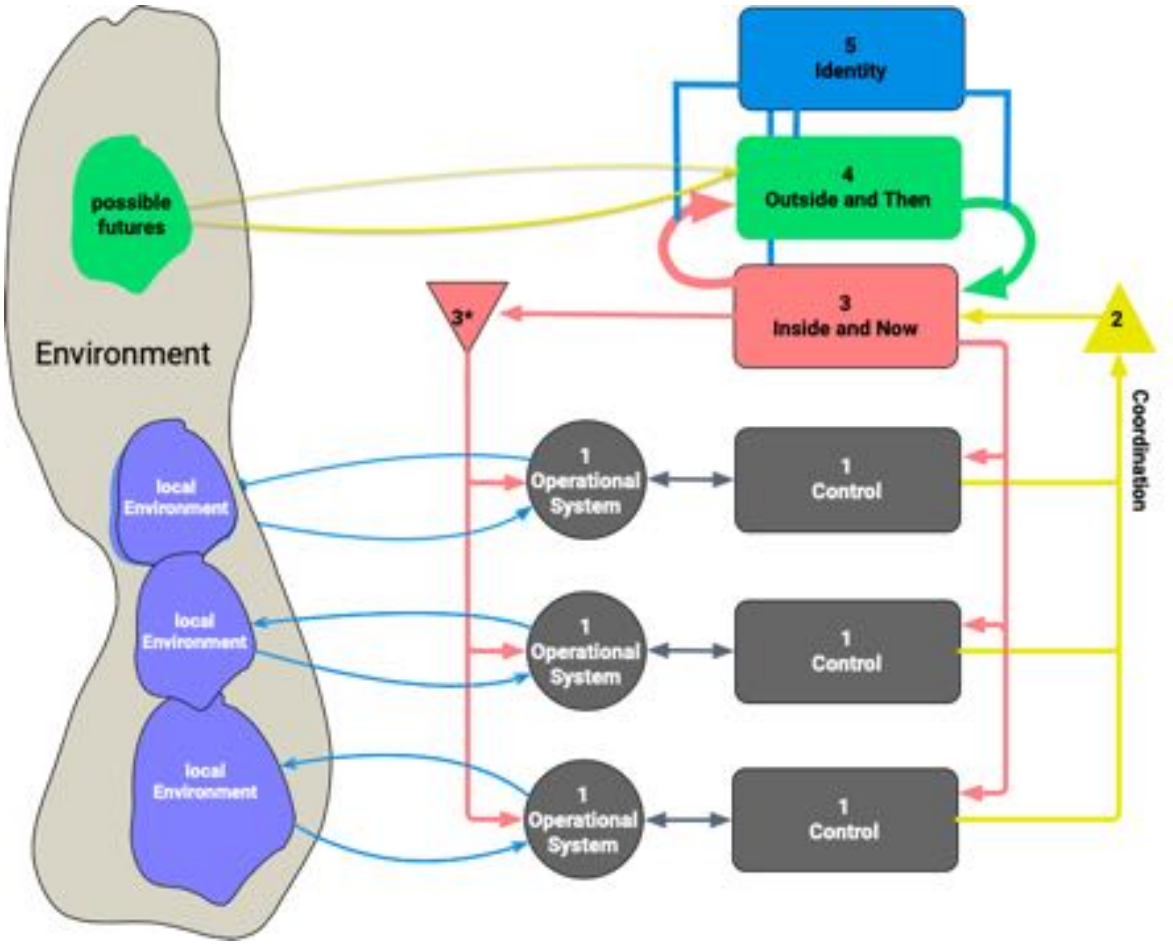

The Viable System Model

for Lean Agile practice

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Adaptive organizations
For the people and the future
August 8, 2023

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1 About the Viable System Model (VSM)

Introduction

The Viable System Model describes decision-making and communication processes in the organization. It brings a third perspective to the organization, in addition to the process and workflow organization.

We will find in the Viable System Model (VSM) a lot of the concepts that play a role in the Lean and Agile environment, it is virtually a parallel world for Agilists. However, the VSM is older: the VSM originated in the context of systems theory, more specifically cybernetics. It anticipates a lot of the principles that have been (re)developed in the context of agile development. As we will see, it has a broader foundation and some scientific grounding.

While there are many different variants of systems theory, cybernetics is the common origin . Cybernetics in general is the study of command and control. The key element of this is feedback, and since its development in the 1940s it has gained widespread use in fields ranging from biology to psychology, sociology to military engineering.

Stafford Beer had the idea to apply the principles of steering, feedback and control to organizations. In the process, the VSM was born.

The VSM describes the organization in interaction with its environment (analogous to an ecological niche) and the instances ("organs") necessary for it to function and secure its future.

Talking about systems

We talk a lot about systems here - occurring in different contexts and representing different focalizations:

- System as a non-decomposable unit, i.e. the system can only be understood as a unit and is more than the sum of the components
- system in interaction with its environment, or if you will, its ecological niche.

VSM applies cybernetic principles of governance to organizations. It improves organizational sustainability and viability. It provides a comprehensive framework that enables organizations to understand and optimize their internal decision-making and information processes.

Viable - Survival and Identity

Viable literally means viable. In the context of cybernetics, however, it means more. What is meant is that the organization (by analogy with an organism) as a whole retains its identity. An example of the opposite, "non-viable" would be a nation that disintegrates, leaving only a loose collection of bands and refugees. The people are still alive, they may even inhabit the same territory, but the common identity has been lost.

Therefore, conversely, we can say that a system wants to preserve its identity - and that in the case of organizations, we need to find an entity that is concerned with preserving that identity as well as evolving it as the environment (or niche) changes.

Viable - viable and sustainable

We said at the beginning that you have to look at a system and its relevant environment - or niche - as a whole.

That is, a system is only viable if its environment persists. By looking at the environment (or business ecosystem) in an integrated way, the term "viable" becomes synonymous with "sustainable".

VSM can indeed contribute to the assessment of organizational sustainability. This is not only true for the focus in which we are traveling here - it does not become much clearer when we consider the applications in public domains such as the design of health or education systems

As a consequence, we will closely integrate the consideration of the environment, especially the customers, but also the other stakeholders.

Viable - Adaptive and resilient

Viable is found in a term field that includes several similar terms:

- **Resilient**: can respond quickly, deal with disruptions, and preserve its function. Resilient systems emerge from challenges changed. In contrast, resilient systems remain unchanged, but they can usually absorb less stress before they break.
- **Adaptive**: the system can adapt its function to new circumstances. In contrast to resilient, adaptive has an active component: the system actively changes to remain viable.

Resilience and adaptivity are two sides of the same coin, but in practice in organizations this is a constant challenge: If one translates "resilient" into "ongoing operations" and "adaptive" into "innovation", then it immediately becomes clear that we are dealing with goals (and to some extent people / functions) that on the one hand are both necessary for survival, but on the other hand constantly produce options for action that are in conflict with each other.

Both functions (and their interaction) are necessary prerequisites for sustainable survival and further development.

Adaptivity and resilience are part of a bigger picture:

- they ensure the organization's ability to learn.
- they need self-organization and are a necessary property of the environment for self-organization.

Again, we will go out and identify the functions they represent in the organization.

What does a viable organization need

> A learning organization is a co-evolving configuration of roles and tasks, which is mutually agreed upon and revised each time it is required, by its members, to adapt to a continuously changing environment
> -- Angela Espinosa

Now we have opened a huge barrel: adaptive and resilient, self-organization, stability and identity.
This could lead to the assumption that a large number of roles and tasks are defined in the VSM system. The fact that this is not the case contributes to the strength of the VSM: it does not require yet another adaptation of a new organizational structure, but rather checks which decision-making and communication functions are covered. Some of the functions are distributed across multiple roles or even departments, on the other hand, one role or position in an organization can cover multiple functions. We have already identified some of these functions:

- The added value: an operational system and responsibilities to deal with the environment and its variety
- The coordination between neighboring systems
- Operational management ("resilience")

- Securing the future ("innovation")
- Securing the identity

We will introduce these functions in the next chapter with their VSM-specific names and contribute examples from a Lean scenario.

The VSM is recursive

The VSM can be applied to different levels, at each of which it in turn consists of viable units. The levels do not mean the same as hierarchy, but levels of abstraction, e.g. team, value stream, portfolio, total company. The VSM can be applied to any of these levels, but one chooses one of these levels of abstraction for a given analysis. At this chosen abstraction level (in VSM-speak: "system in focus"), in addition to the system itself, the relationships to the neighboring and embedded systems are analyzed or modeled, as well as the relationships to the environment and the next higher abstraction level.

The VSM can be used for the system in focus for analysis or for design. An analysis or diagnosis of dysfunctionality uncovers problems in the organization, while a design involves a much deeper intervention.

With VSM, the choice of the intensity of the intervention and the system in focus can very well influence how large the "blast radius" of a measure will be. This means an important advantage for risk management in a change process.

Combination with existing methods

The VSM adds an additional view of the organization, namely the view of decision-making and communication processes. It draws from its cybernetic roots powerful conceptual tools that make improvement opportunities comprehensible.

The VSM uses these tools to help identify blind spots without claiming to overturn all existing structures or replace other models and tools.

The emergence of the VSM

The Viable System Model (VSM) was developed by the British cyberneticist Stafford Beer since the late1950s and is based on the principles of cybernetics.

The Viable System Model is based on the idea that an organization should function like a living system, capable of self-regulating and interacting with its environment.

The genesis of the Viable System Model began with Staffor Beer's work on management and organizational issues. He felt that traditional organizations were often inefficient, inflexible, and had difficulty adapting to an ever-changing environment. He

saw the need to develop an organizational structure that was self-regulating, adaptable, and able to deal with uncertainty and complexity.
In the 1970s, Beer conducted intensive studies of numerous organizations, including corporations, government agencies, and social institutions. He analyzed their structures and functional processes and realized that successful organizations had some common characteristics that helped them survive and thrive in a complex environment.
One of the most ambitious use cases was in 1971-1973 for the socialist government of Salvador Allende in Chile. Allende wanted to develop a functional control system for the country's nationalized mining and banking industries.
Since then, the model has been applied to a wide range of applications in extremely diverse organizations, from large corporations in crisis situations to healthcare systems to structuring social movements.[1]

[1] many of these case studies can be found at: (Espinosa 2022)

2 The vocabulary of cybernetics and systems theory

Analogy nervous system
The VSM uses - like so much in cybernetics - the human nervous system and its differentiated functions as an analogy.

2.1 Dealing with options

- In cybernetics, the central insight of Ashby's law[^1] of required variety: "The greater the variety (or options) of a system, the more it can reduce the variety (or amount of surprises) of its environment by control."
- that is: fast enough and enough options
- Self-organization locally and on site

Variety and Ashby's Law
In cybernetics, the concept of variety by W.Ross Ashby refers to the set of different elements of a system, e.g. states or messages. It is, casually spoken, a measure of how many different "surprises" can be expected. The higher this number, the larger must be the receiver's repertoire for reactions. In cybernetics parlance, this means that the receiver's own variety, i.e. the set of its components and resources, must be large enough to handle the variety of the communication channel.

> The greater the variety of a system, the more it can reduce the variety of its environment by control. Ashby's law

In VSM, we talk about the regulation of variety. This means, for example, filtering messages in a channel to limit the variety to a level that the receiver can handle. Variety plays an important role in cybernetics, both as a theoretical concept for understanding complexity, organization, and regulation in systems and as a useful tool for conceptualizing systems.

3 The VSM vocabulary

The subsystems

In the VSM vocabulary, there are different systems - systems 1 to 5 - and a number of channels or types of channels between these systems. The notation is confusing at first, because the individual systems do not always mean parts of the organization, but rather denote points of view or perspectives.

There is also more behind the channels than it first appears, we will elaborate on that as well.

The different subsystems are:

- **System 1**: The operational system, productive work, value creation
- **System 2**: day-to-day coordination of the individual systems 1. This includes things as diverse as secretarial services, standards of conduct, or software version management.
- **System 3**: Planning and organization of work. This includes the stabilizing aspects (in VSM-speak: "inside and now") such as controlling, compliance, marketing, which can be called operational management.
- **System 4**: New development, market research, new developments. These are the future-oriented aspects (in VSM-speak "outward and future", "Outside and Then":) that help the organization to prepare for future challenges
- **System 5**: Identity, prioritization: the ultimate boss. Maintaining identity moderates between the conflicting demands of the aforementioned subsystems. System 5 keeps the overall system in mind. This is the ultimate goal of the organization, and with it, System 5 can act on the other subsystems in case of emergency.

In addition

- **System 3*** (three star): Interventions and active information gathering

Channels

The communication paths between subsystems and with the environment are called channels.

In cybernetics, a channel is a fundamental concept that refers to the transmission of information between systems or components. The term "channel" originates from communication theory and describes a path along which information is transmitted from a sender to a receiver.

A channel can be physical or abstract and can take different forms depending on the type of communication. In cybernetics, channels can be found in different contexts, such as:

- Human-machine communication: In this context, the channel represents the path through which humans communicate with machines or computers. For example, a keyboard is a channel through which users can enter information to a computer.
- Machine-to-machine communication: In complex systems, machines or components can communicate with each other via specific channels to exchange information and work together.
- Organizational communication: In organizational cybernetics, channels can represent the ways in which information is transmitted from one part to another within an organization. This can include informal communication between employees or formal reporting channels in a hierarchy.
- Information processing: Channels can also be used in an abstract context to describe the flow of information or data between different parts of a system.

Channels are not only the physical connections or media through which information flows, but also how that information is encoded, transmitted, and interpreted. Cybernetics is concerned with the analysis and control of communication processes and examines how information flows through channels in a system or between different systems to influence the behavior and performance of the system.
The channels occur as

- Vertical channels between the metasystem and the operational units
- horizontal channels between parallel operational system
- Channels for communication with the environment

System and meta-system

> "Any sufficiently powerful, recursively enumerable formal system is either contradictory or incomplete." - Gödel[2]

Gödel's theorem is virtually hard-wired into the VSM: a system cannot fully describe itself, so there is a meta-system that contributes the self-reflection: systems 1 and 2

[2] ("Gödel's incompleteness theorem - Wikipedia" o. J.)

represent the operational work, while systems 3 through 5 form the meta-system or senior management.
When looking at the individual systems, one must always keep in mind that they are functions, not roles or persons. The VSM diagram should not be read as an organizational chart, but instead as a network of decision-making and communication paths.A better metaphor than organizational chart would be to compare the VSM diagram to a nervous system.

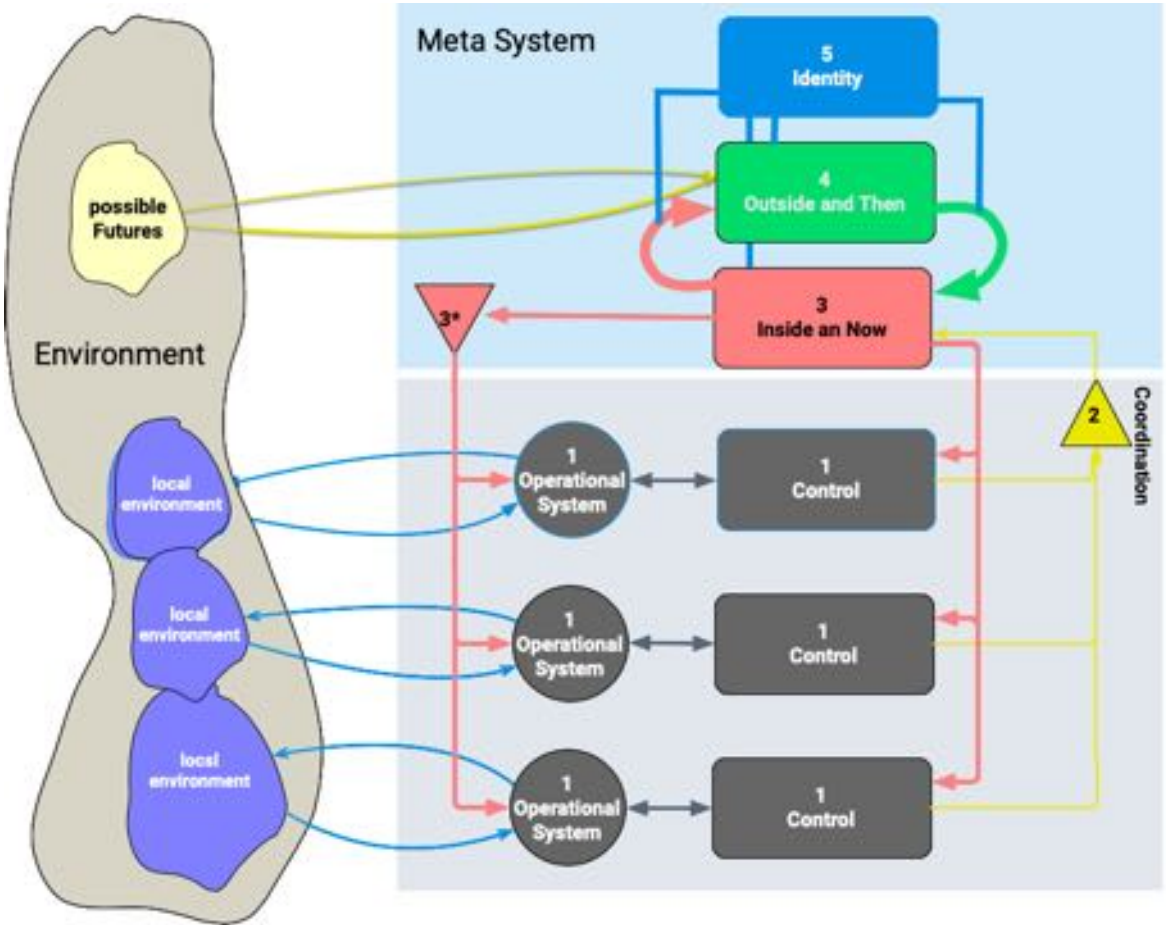

Fig 1

Each suborganization is viable
We have already introduced that the VSM is **recursive, meaning that** the principles can be applied to both the overall organization and that for an analysis or design you need to focus on one entity, the **system in focus**.
The VSM requires that the entire system must be a viable system as well as the individual parts. This would apply, for example, to a company, the various value streams and, in turn, the various teams that make up the value streams.

Consequently, VSM can be used to describe the different levels of an organization with the same methods and to gain insights from them. This opens up an immense potential of sound analysis and design possibilities at each level.

Only systems 1 must be viable
An important note is in order here: only systems 1 must be viable and consequently can be represented again as a complete VSM in an "exploded view". This is especially not true for systems 3 to 5 or their functional elements such as marketing or controlling. On the contrary, if these functions develop a life of their own and their own objectives, this is a dysfunction in the organization and the various objectives will sooner or later come into conflict with each other.

3.1 System 1: Environment, Operation, Management

The operational system (System 1)
The most important aspect of a system is what it does. It is roughly equivalent to what the value stream or value chain is in Lean.

> The system is what it does. Stafford Beer

In VSM, we call this aspect system 1, the operational system. It describes the direct responsibility for the delivery of a specific service or product.
The system 1 is related to its environment and the system 1 needs some method to organize itself: its control system (or metasystem or management). We describe the connection between the system 1 and the environment or its control system in terms of communication channels.
Understanding and properly designing communication channels is almost more important than the individual systems, as they essentially determine the functioning of the system.

The products or services - or target groups, markets or other segmentations may each require their own operational system. Several operational systems can - and typically will - exist in an organization.

In the illustrations, one can also already observe the beginning of its own graphic language: in fact, the operational system is represented as an oval, the control, meta or

management system as a rectangle, and the relevant environment - or the niche of the ecosystem - as an amoeba-like shape.

First insights

One view of an operational system in it´s environment is as follows:

Fig 2 System1 in the environment

The elements in it are - The environment, e.g. the customers, competition or government regulations - The operational system as the determining view ("the system is what it does") - The control system or local organization. It means preferably self-organization, as far as that is possible, but in principle includes any kind of organization.

For a more detailed representation, the three aspects of a system 1 are pulled apart so that the channels between the elements can be represented.

It shows besides the relations - between the environment and the operative system, as two directed communication channels - between the operative system and the control system, also as two communication channels.

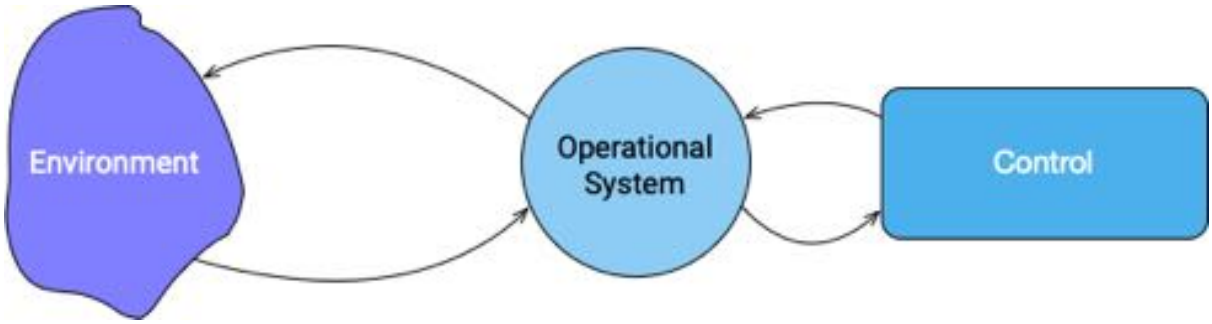

Fig 3 System 1 with channels

Application: a lean value stream

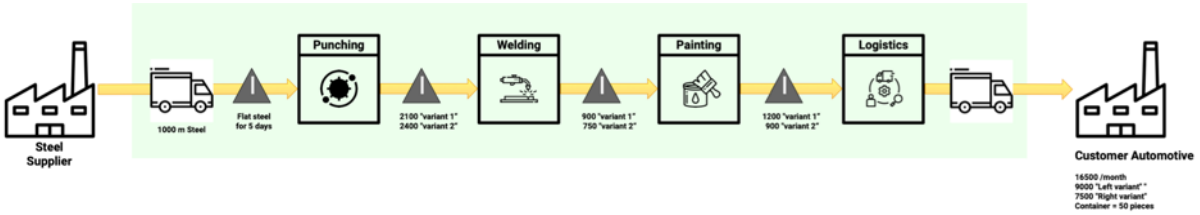

Fig. 4 A value stream forms system 1

We use a simplified value stream of a metal processor as an example[3] ; as presented in Lean Production.

The value stream shows the flow of the processed material through the individual processing stations. Between the stations you can see the stock.

Thus, we have the concrete system 1. Next, we introduce elements of the other VSM subsystems one by one.

3.2 System 2: Information and coordination

System 2: Daily coordination

The tasks of system 2 include coordination, i.e. avoiding ("damping") oscillations, ensuring coherence and settling, or better avoiding, conflicts while preserving the autonomy of the operational systems as best as possible.

System 2 is also committed to the goal of strengthening the individual operating units. Specifically, this includes the task of strengthening them in their ability to organize themselves.

System 2 is not an entity in the company, it is a whole set of things that support the operational units and ensure stability, for example:

Software systems

- Room booking

[3] Mark Lambertz and Kristian Schweitzer have created a representation of a value stream mapping from the VSM perspective. The images for the Lean example are derived from this.

https://www.linkedin.com/posts/mark-lambertz_vsm-valuestreammapping-viablesystemmodel-activity-7060984078346375168-oR3M/.

- Software version management

Roles of groups and individuals

- Secretariat
- Steering Committees
- Moderators and coaches

Documents

- Guidelines
- Corporate design standards and templates

Meetings

- Planning and review meeting
- Retrospectives

Culture

- Language and manners
- Standards

System 2 is critical to the organization's ability to achieve an adequate degree of self-organization at the grassroots level. If mechanisms are lacking or do not function well here, this task falls back to management. This in turn leads to a high burden of high time consumption, which in turn leads to not enough time for the strategic tasks, the work on the system.

Coordination of the lean value stream

The various processing stations require a coordination function.

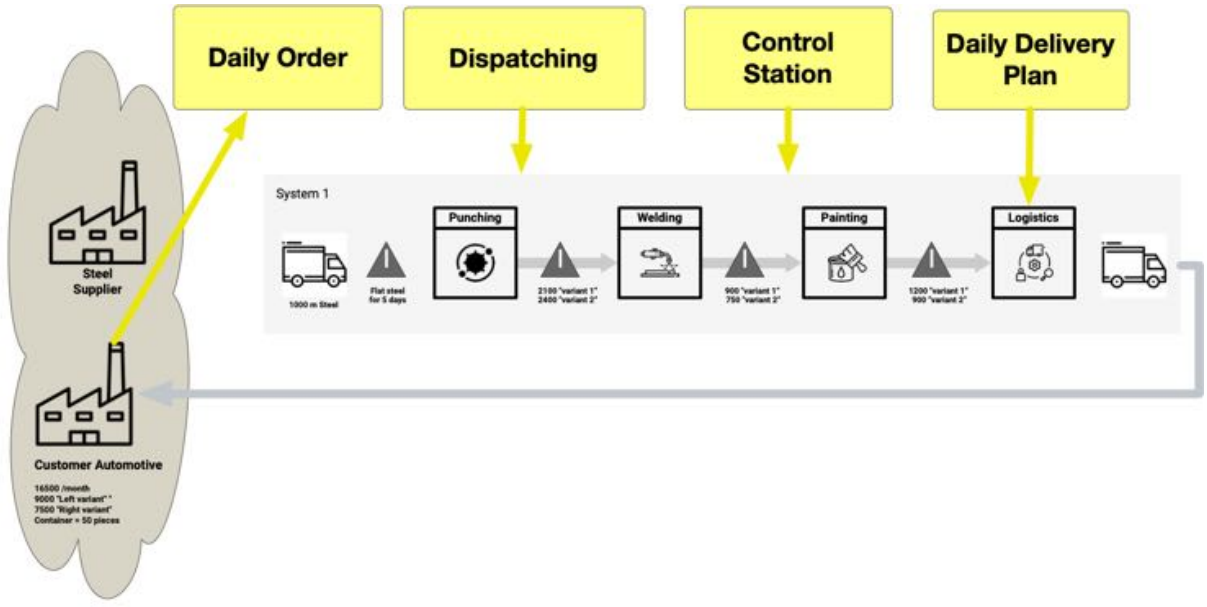

Fig. 5 The value stream with exemplary coordination functions

3.3 System 3: Optimization and auditing

Reflection, improvement, synergies
System 3 can best be described as operational management. It is based on the ability of the individual systems 1 to organize themselves and coordinate with the support of the mechanisms of system 2.
The task of system 3 is to provide an overall view and to initiate improvements from this overall view. To do this, it must communicate with system 2 and with the local control functions of the individual systems 1.
Stafford Beer describes this system as "Inside an Now": it takes care of the inner workings and functioning of the organization and drives improvements.
System 3 thus creates the environment and context for effective collaboration between the individual operational systems.

The channels between system 3 and systems 1
The operational systems organize themselves as much as possible and use the services of system 2 for coordination. This is the most effective way and one can derive this priority directly from Ashby's law. One can ask why then an overarching operational management is still necessary.
System 3 is necessary because pure self-organization between the operational systems is not always sufficient. When conflicts arise over resources or general policies need to be implemented, intervention may be necessary. For this purpose, system 3 has two vertical channels to systems 1: first, the resource negotiation and accountability channel, and second, the intervention channel.
Resource Bargaining **and Accountability**. This channel is used to discuss goals and agree on plans, and to allocate the corresponding budgets or resources. It is also used to demand accountability for the resources used.
Corporate intervention - centralized interventions. This channel can be used to restrict the autonomy of the operational systems. In other words, it is a channel for explicit instructions that is used only in exceptional cases - but it must be available for emergencies.

The functional organization of the company

In an organization there are many functions that strengthen the synergy in the organization and that embody a concrete implementation of the company's System 3:

- Finance
- Marketing Management
- Finance
- Controlling.

It seems obvious to classify these functions as a whole in system 3. However, if we take a closer look, the picture becomes more differentiated. For example, we will find functions for marketing in various places: in system 3, system 2, the communication channel with the customer, and more.

This is based on the fact that the cybernetic view with decisions, control and communication brings other structures to the fore than business administration with the organizational structure and process organization. This orthogonal view is an essential element for the strength that lies in the use of VSM.

Research and auditing: the system 3*

Another mechanism is the system 3* ("three star"). The system 3* is a pure research mechanism with which the system 3 collects direct unfiltered information about the operational systems 1 as close to real time as possible.

Examples of System 3* mechanisms include:

- Gemba or "managing by walking around
- Revision
- Direct contact with customers
- Surveys

The function of this system is twofold: on the one hand, it prevents the creation of blind spots for central operational management through the conscious or unconscious omission of information in reports. Second, it provides a richer context for interpreting facts when management has direct ground contact and a view out of its own silo.

Lean: production control

Here we see the normal elements of a daily production control. Some of these elements communicate with the environment - in this case the customer - while others

are for internal coordination, such as assigning employees to workstations when others are absent due to illness, for example.

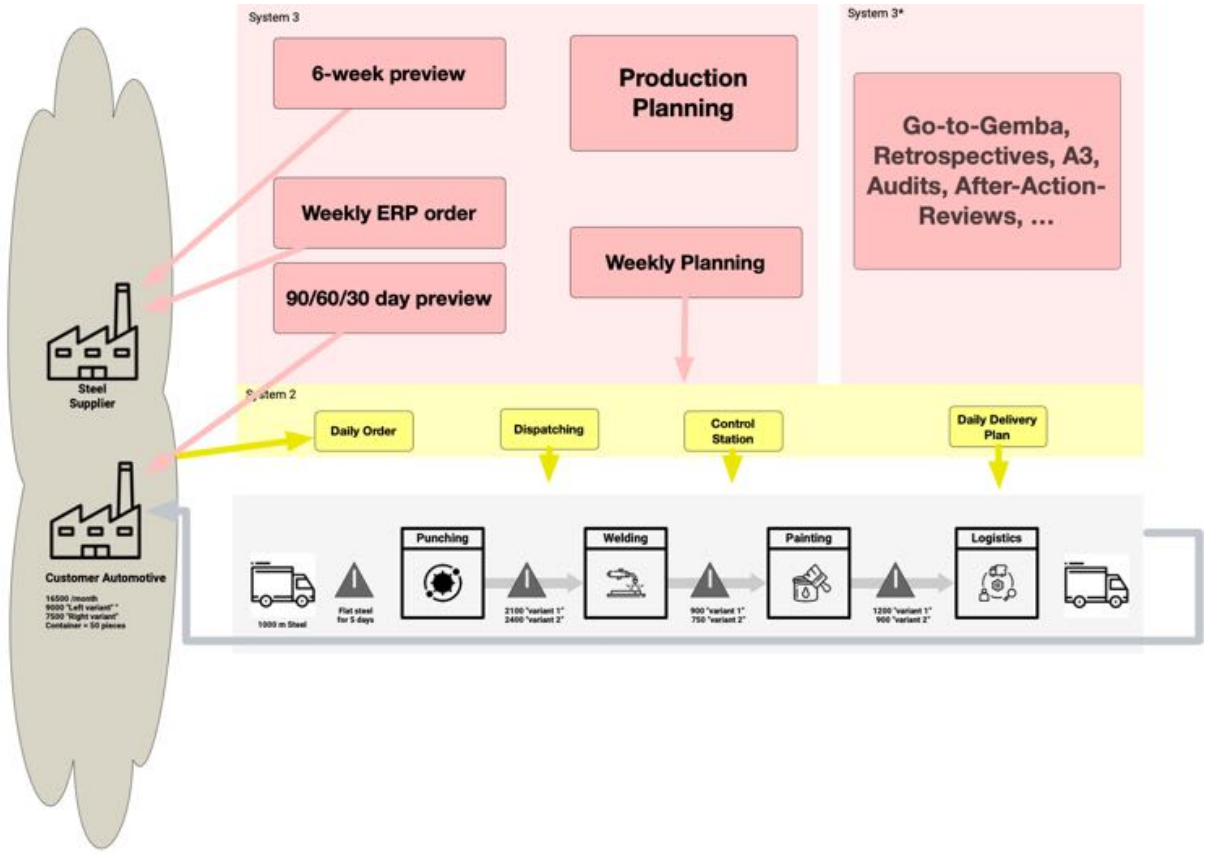

Fig. 6 Value stream with operational management

3.4 System 4: Reconnaissance

The function of the System 4

With the control systems discussed so far, we have a functioning organization - if there were no changes in the environment. Systems 1-3 provide the mechanisms to stabilize a company and keep it running. However, we have not yet seen provisions that respond to, or even anticipate and trigger, deep changes.

We find these provisions in system 4.

While system 3 turns inward and has as its focus the current activities and the existing organization, system 4 turns its gaze outward and into the future - in the words of Stafford Beer, it is the system "**Outside and Then**".

Examples of System 4 functions include

- Research and development
- Observation of the competition
- Strategic personnel planning

- Working in associations and networks
- Strategy development

At this point, at the latest, it becomes clear that each of these examples has both professional and financial consequences and thus represents a cross-cutting function through the typical division of labor in traditional organizations.

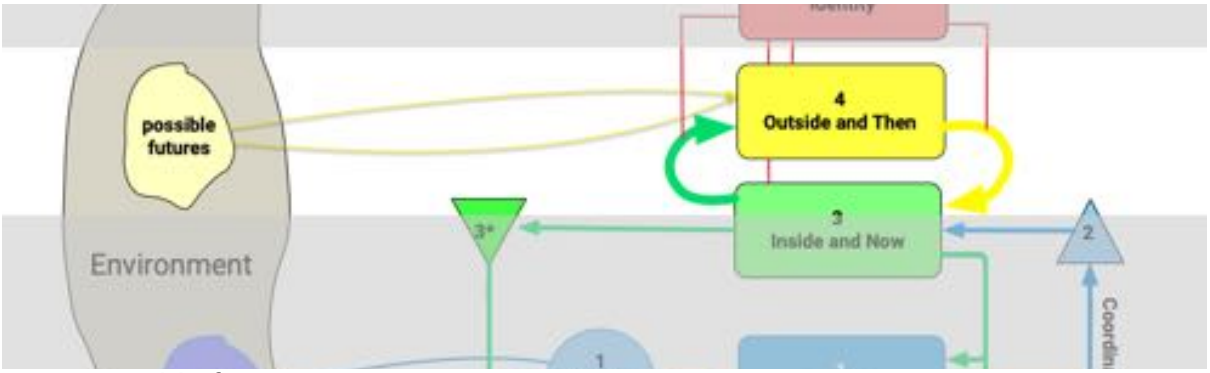

Fig 7 Possible futures

Possible futures

One specific concept is still worth mentioning: people talk about a specific extension of the environment, the "possible futures". This is similar to working in scenarios, but it is a useful perspective to explicitly put these futures in the context of the environment or ecosystem.

Conflicts and complementary views: System 3 and 4

The diagram shows the strong interactions between systems 3 and 4, which in a way represent complementary views: on the one hand, the forces of the existing that want to keep the organization running - that is the core function of the company and, on the other hand, the admonishers that something has to change because otherwise there is a threat of standstill and loss of significance.

The operational side - System 3 - points out that they ultimately make the money, and the changemakers' side admonishes that the others are sleeping through the future. Both have valid points, and the productive tension results in a healthy mix of stability and further development.

But it can also be that this conflict escalates or that factions form that dig in and no longer exchange ideas with each other. Then a moderator becomes necessary to balance the different interests. This is where System 5 comes into play.

Lean: Innovation, Strategy

System 4 takes care of the planning and the consideration of external factors.
We introduced a new element in the representation of the environment and explicitly mentioned competition as an environmental factor.

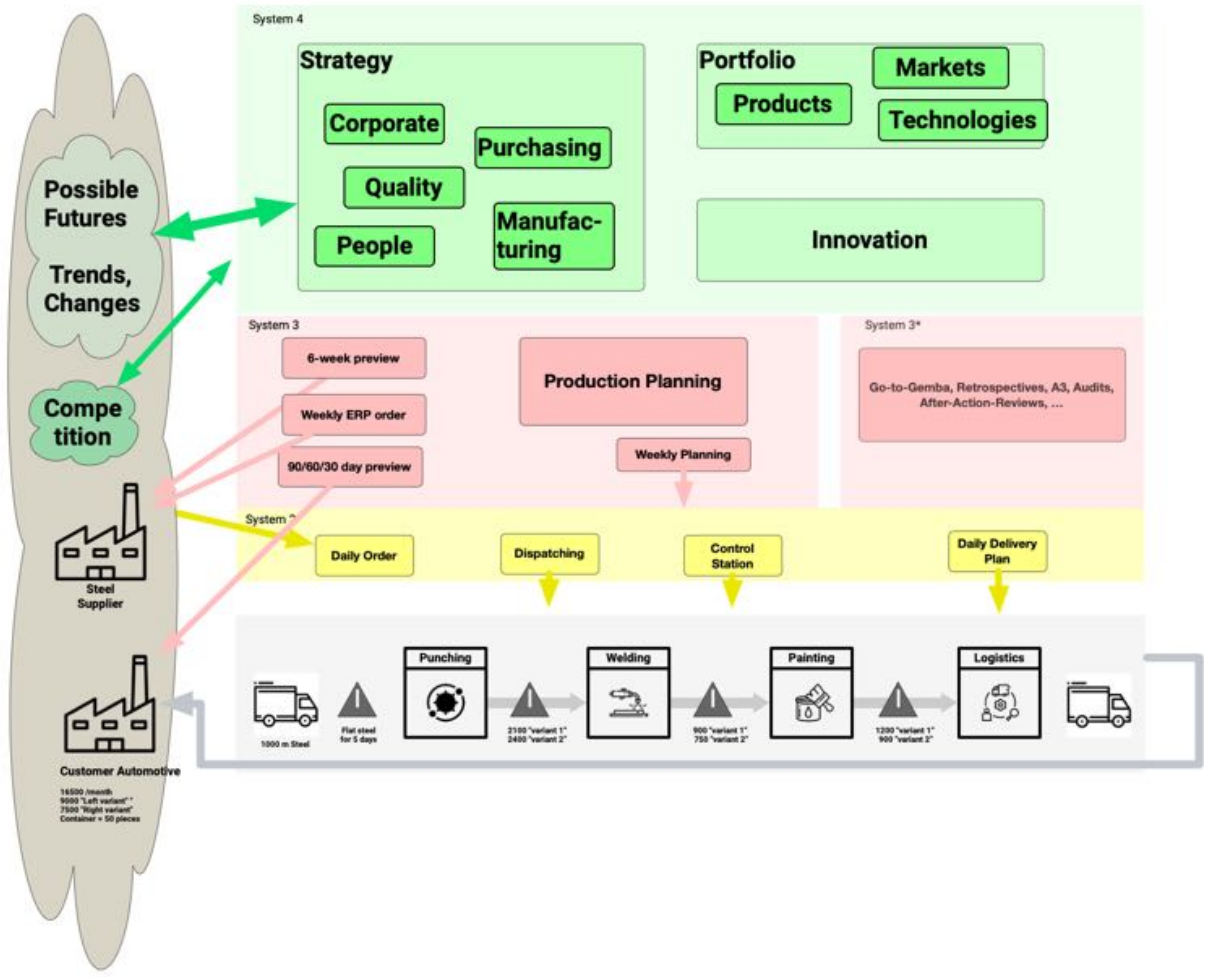

Fig. 8 Value stream with systems 1-4

3.5 System 5: Identity

Identity guardian

System 5 is the ultimate moderator, boss, decision maker.
Its function is to represent a north star, a general direction, an identity.
This then provides a basis for moderating conflicts, for example, between short-term goals of operational management, System 3, and longer-term goals, System 4.

If you look at the VSM diagram, you can see that system 5 has access to systems 3 and 4, and additionally to the channels that connect these two. It represents the logical fact that identity must resonate in all decisions.
The system also has an ultimate veto or instruction function to ensure that the global purpose is not thwarted by local decisions and actions. For it to safely perform this function, another channel is needed: the Algedonian channel.

The Algedonian Channel

Algedonic is an artificial word of the VSM and it is a mixture of pain and reward.
As an emergency channel, it ensures that threatening situations or extraordinary opportunities reach senior management in real time and that they can respond accordingly.

Lean: Identity

Finally, system 5 ensures identity: viable means not only surviving, but also maintaining an identity, pursuing a purpose.

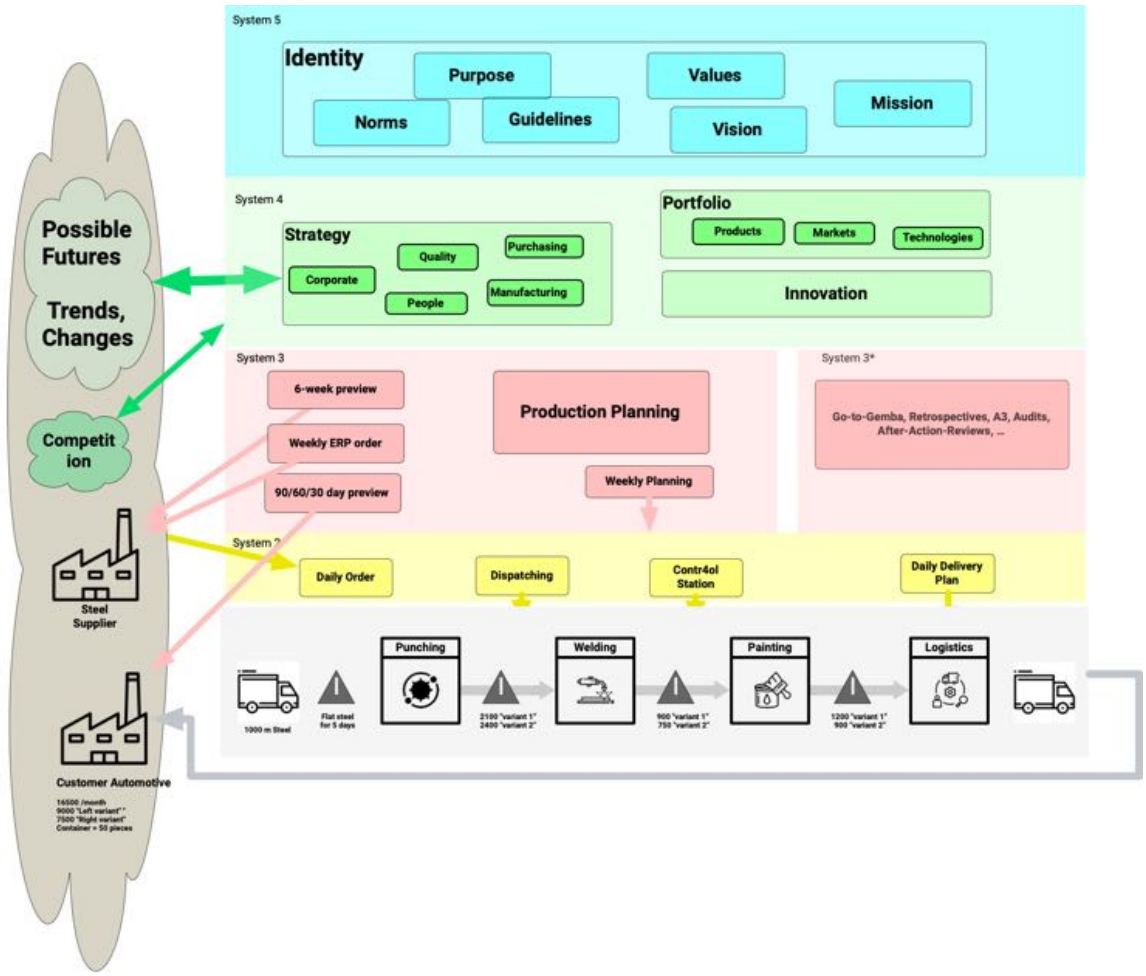

Fig. 9 Complete picture of the VSM for the value stream

3.6 Conclusion

You can see that the description of the value stream, which is the core of Lean, corresponds directly to System 1 of VSM. Both Lean and VSM offer a lot more details and tools.

One can very clearly see the difference in the focus of VSM to Lean: it has a different view and structures the various tasks that arise quite differently than they occur in the value stream view of Lean or in the company's organizational chart. This results in new insights and design possibilities and VSM uses these to provide precise diagnostic tools.

Mapping

In the mapping with the previous abstract model of a system it becomes clear how a concrete analysis of a company could look like. Do not forget: VSM takes care of decision and communication structures and thus offers an additional view on the structure of the company.

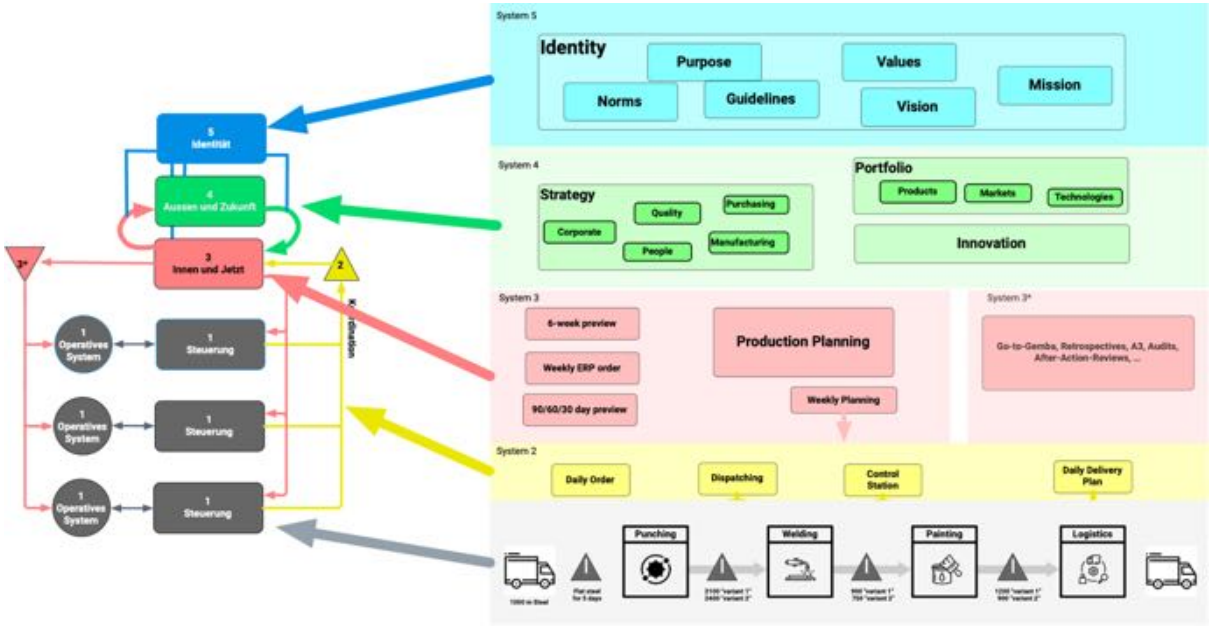

Fig 10 Assignment to subsystems

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