

## Chapter 2

# Diagnosis and Design of Organisations

Now that we have looked at the basic concepts of OC, I will go on to show how these can be applied in both diagnosing an already existing organisation and as a guide when designing a new one. In both cases, the fundamental line of the study is to assess the viability of the organisation or, should this be a new creation, to help it to start out with the right elements for ensuring its viability.

I will divide this study process into four main stages. *Firstly*, we will highlight the organisation's identity and purpose. In this way, we can have a clear idea of what the organisation is (and is not), and what its goal or purpose should (or should not) be.

*Secondly*, we will analyse how the organisation copes with all the complexity in its environment. In this second stage particularly, we will see how a vertical breakdown of both the environment and the organisation creates a vertical structure of smaller units in the organisation that reduce the complexity each sub-organisation must deal with, facilitating its activity in each case.

The *third* stage will involve an examination of the diverse vertical levels created in the previous stage, to provide us with a detailed introduction to each one. More specifically, at each level we will analyse the components which comprise it (the horizontal dimension), namely: the specific environment of the level chosen, the organisation assigned to the activity corresponding to this environment, the "management" corresponding to this organisation and, finally, a detailed description of the elements which the Viable System Model identifies as being necessary (and sufficient) for ensuring the organisation's viability.

In the *fourth* stage we will review the extent to which the different organisations (and sub-organisations) at the various recursion levels are linked, assessing the coherence among all the elements while mindful of the identity and purpose of the organisation as a whole.

The utility of the VSM for diagnosing and designing organisations goes back to the time it first appeared, when Beer himself used it for this purpose. Various later authors have added to the literature in this context, with contributions of varying importance, always endeavouring to facilitate the application of VSM concepts in practical cases.

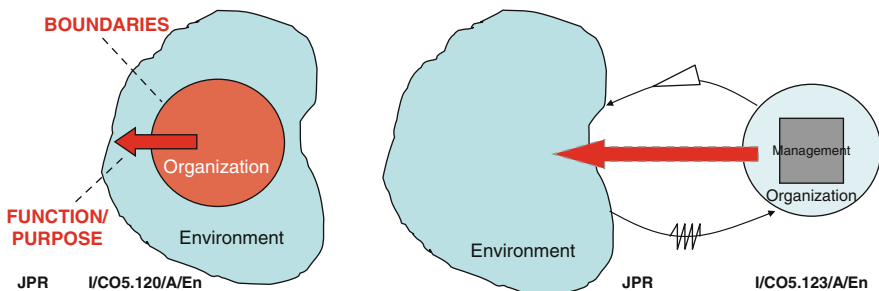
Among the many contributions we can highlight, apart from those by Beer himself (1975, 1979, 1981, 1985), are those made by authors such as Clemson (1984), Espejo and Harnden (1989), Flood and Jackson (1991), Espejo and Schwaninger (1993), Espejo et al. (1996), Yolles (1999), (Schwaninger and Pérez Ríos 2008b) and Jackson (See: Using the VSM for Diagnosis and Design, Jackson 2000, pp. 163–166).

Some developments have been particularly extensive, as is the case of the VIPLAN software created by Espejo et al. (1999), in which Espejo also differentiates the two ways of employing the VSM, either for helping to design an organisation or for its diagnosis (Espejo 2009, Espejo and Reyes 2011, Reyes 2001).

Apart from the authors we have mentioned, many others have contributed to providing guidance on the diffusion and application of OC and the VSM. Various scientific journals have dedicated several special editions to this issue. Among them we can mention: The Double issue “Cybernetics in Focus” by the *International Journal of Applied Systemic Studies* (Guest editors: Pérez Ríos and Schwaninger 2008); the Special Issue on “Action Research in Organisational Cybernetics” by the *Systemic Practice and Action Research* journal (Guest editors: A. Espinosa and A. Leonard 2009) and the most recent Double Issue on “Model-Based Management” by *Kybernetes* (Guest editors: Schwaninger and Pérez Ríos 2010).

## 2.1 Recognition of Identity

Obviously, the very first step to be taken is to identify the organisation we mean to study/create, in other words, to make explicit its *identity* and *purpose* (Fig. 2.1). The response to the question of exactly what the organisation or system (organisation/company) being studied in fact is may not be a trivial one. Giving a clear answer to this question also implies understanding exactly what the company or organisation is not (Schwaninger 2006, p. 151). Answering these two questions will help us to define what forms part of the organisation and what, on the other hand, belongs to its environment; in this way, we can shed some light on how to separate the organisation



**Fig. 2.1** The organisation in its environment. Interaction between the organisation with its management and the environment

from the environment in which it operates. In the area of the firm nowadays, where multiple activities (research, design, production, distribution, etc.) very often are decentralised and spread throughout the world, the question of establishing exactly what constitutes a company – that is, drawing the line between where the company ends and the environment begins – may not always be easy. The same may be said of clearly identifying the firm's purpose. Beer's well-known statement "the purpose of a system is what it does" leads us to diverse opinions on the firm's aim, depending on which observer answers the question. Different observers may attribute different "purposes" to the same firm or organisation. The studies made by Checkland (1981), Checkland and Scholes (1990), Espejo et al. (1999), among others, allow us to go deeper into these aspects.

Understanding as clearly as possible both the purpose of an organisation and its limits is critically important, as these two issues will determine how we design it or, if it already exists, how we diagnose it.

When we examine System 5, we will return to the question of defining the organisation's purpose and identity.

### ***2.1.1 Present and Future Environment***

The subsequent second step, once we know the limits of our organisation as well as its purpose, is to identify in greater detail the environment in which it operates. Understanding this environment, its components, the relationships involved, and the role of the organisation therein, will enable us to evaluate the most relevant aspects of this environment in relation to our company/organisation. Among these, we will distinguish between those which have to do with the *present*, namely, current aspects or agents (clients, suppliers, legislation, regulations, competitors, institutions, etc.), and those associated with the *future*. We will lay greater stress here on variables that might have a greater impact on the organisation we are considering (technological changes, new markets, competitors, legislation, regulations, ecological restrictions, etc.). All of this will form part of the whole environment, with the corresponding complexity (variety) the organisation must deal with in order to maintain its independent existence (identity) despite any changes it may face – that is, in order to go on being *viable*.

In relation to this phase, we will mention here certain elements that must be looked at in detail during the diagnosis or design.

1. Firstly, we will identify the fundamental areas to be considered in the environment. These areas will be associated with such aspects as the following:
  - Economic
  - Sociological
  - Political
  - Legislative
  - Institutional

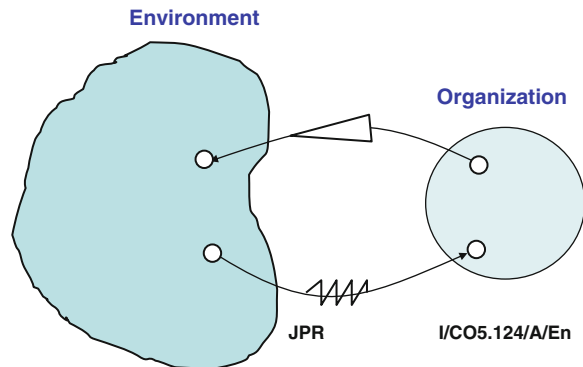
- Markets
- Suppliers
- Competitors
- Technological
- Ecological
- Educational
- Demographic

Obviously, in each particular case the most pertinent areas for the organisation may vary in both number and importance.

2. Secondly, in each of these areas it will be necessary to differentiate between information pertaining to both the present and the future.
3. Thirdly, we will define:
  - The “sensors” we will employ for continuous information-retrieval relating to the previous points.
  - The information sources to be used.
  - The rate at which information should be collected in each case.
  - The communication channels we will use to transmit both present and future information (Fig. 2.2).

Regarding this section on information capture and transmission, we should remember the eight essential components (Fig. 2.3) of any homeostatic loop and communication channel (in the sender-receiver channel: sender, transducer, channel, transducer, receiver, and, the other way round, the same but with the roles of sender and receiver reversed).

Another important point to bear in mind is the way to visualise/present the information. For example, in the case of Systems 3, 4 and 5 (and very often also in the other systems/functions), it is desirable whenever possible to combine numerical with graphic and visual information. A good option, apart from a computer, is to use large electronic and touch screens.



**Fig. 2.2** Organisation–Environment communication channels

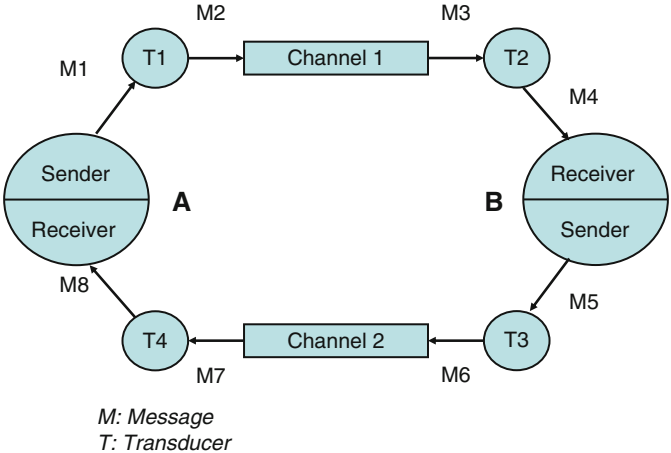


Fig. 2.3 Components of a communication channel

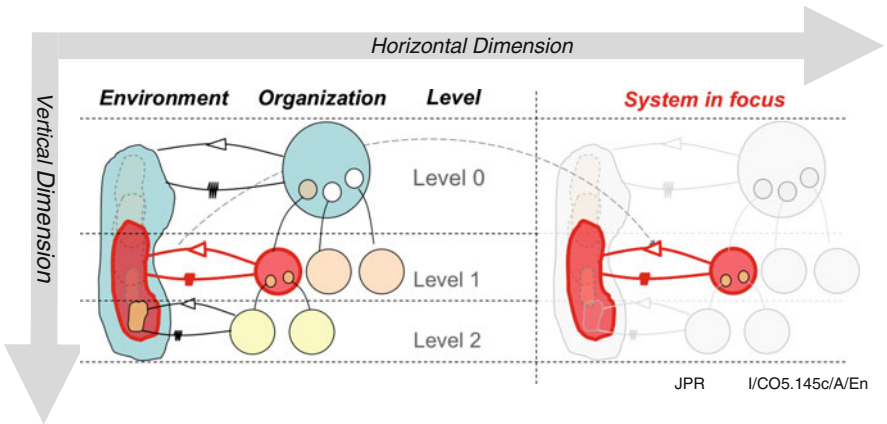


Fig. 2.4 Vertical and horizontal dimension of the system under study

Having identified the organisation, its limits and the environment (present and possible future) in which it operates, as well as having checked all the elements corresponding to the capture, transmission and presentation of information on relevant environmental aspects (*Residual variety*), we can now go on to study the organisation itself, assessing its capacity to achieve its goal or, if we are dealing with a new creation, designing it in such a way that this is ensured.

To assist us in carrying out this task, we will use two spatial dimensions that we will call *vertical* and *horizontal* (Fig. 2.4). In the *vertical dimension* our aim is deal with the amount of complexity facing the organisation in the whole environment, breaking this down into smaller environments inside the first, and these in turn into smaller ones, and so on. The reason behind this division is to design, whilst

identifying the different partial environments, the organisations to be entrusted with operating within them. Such organisations will likewise become smaller and smaller, following a similar division process. The aim of this action is to make it easier for each of these organisations and sub-organisations to handle complexity (variety), which will thereby be more approachable. Obviously, each one forms part of a previous organisation, the process continuing until we reach the complete organisation to which they all belong.

Regarding the *horizontal dimension*, this will let us position ourselves at each of the different levels into which we have vertically divided both the environment and the organisation, working with all of them. Once having chosen a specific level, we will identify its corresponding environment as well as the organisation responsible for operating there. The organisation selected for a detailed study at a given moment is called *organisation-in-focus* or also *system-in-focus*. By this we mean that it will be the focus of our attention either for its design or, if that is the case, for diagnosing whether it possesses the necessary and sufficient requisites for its viability. When we study this dimension, we will review the environment, the corresponding organisation, its management and the relationships among them.

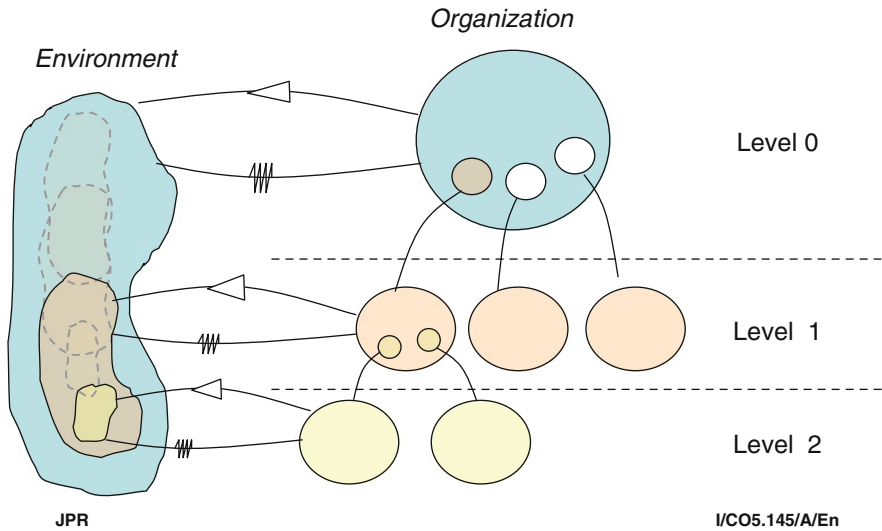
Here we will also investigate the inside of the organisation, to take a close look at quality and also the extent to which the necessary and sufficient functions for viability exist. Consequently, we will examine all the components that the Viable System Model indicates as being necessary and which must be functioning properly in the organisation.

In the case of each of these components (Systems 1, 2, 3, 3\*, 4, 5, Communication channels, Algedonic channels, components of each of the channels, present and future contents of the environments, or information capturing systems, etc.), we examine three main aspects. First of all, we see if it exists and is represented in the organisation; secondly, once its presence has been confirmed, we look for its quality, that is, the extent to which it has developed in acquiring the necessary elements to perform its function properly; thirdly, with all its necessary means for functioning in place, we observe whether performance in fact happens – in other words, we verify whether it works to achieve its goal (with efficiency, efficacy and effectiveness).

Now let us see how to analyse the organisation by means of both these dimensions, beginning with the *vertical dimension*.

## 2.2 Vertical Dimension: Criteria and Recursion Levels – Complexity Unfolding

As I mentioned previously, having considered the purpose of the organisation and the environment in which it operates or will operate, we can now deal with the two basic elements which are, the environment and the organisation. Once again, the complexity of the environment is much greater than that which an organisation can



**Fig. 2.5** Vertical unfolding of complexity

deploy in order to face all the possible situations that might occur in the environment, even if they are limited to those directly related to the organisation. In the section concerning complexity and variety, it was also seen that one potential mechanism to be used here is the vertical unfolding of complexity. This entails breaking the environment down into smaller ones which are contained in the initial environment; thus, the lesser complexity corresponding to these smaller environments will be the concern of similarly smaller organisations, which in turn form part of the initial organisation (Fig. 2.5).

### 2.2.1 Criteria and Recursion Levels

To unfold things in this way, we must choose one or more criteria for defining both the partial environments and the organisations they will correspond to when we design the organisation. We will call each level generated in this process of vertical breakdown a *level of recursion*. At each level will be an environment and the organisation which either should or in fact does correspond to it.

It is important to observe here that each organisation appearing during vertical unfolding is a complete viable system. We should not confuse this process with a simple increase in the degree of resolution of the organisation’s “image”, since such entities are not merely parts of the initial entity, functional or otherwise, but complete viable organisations, with all the characteristics established by the VSM to ensure such viability.

The recursion level which we select for detailed study at a given time is called, as I mentioned in Sect. 1.3, a *system-in-focus* or *organisation-in-focus*. To reiterate what was said there, in view of the fact that there may be several recommendable criteria for vertical disaggregation (recursion criteria), the system-in-focus will occupy an intermediate path in the descending chain of recursion levels according to one or more recursion criteria (unless it is the first or last of its corresponding chain). The image of the system-in-focus as the centre of a sphere with multiple dimensions (recursion criteria) allows us to visualize an organisation's global structure. Of course, in many cases this structure is not necessarily very complex, and it may be enough to use a few or only one recursion criteria. However, in certain organisations this structure may become quite complex, or even impossible to visualise with a two-dimensional image. For this reason, among others, it is particularly convenient to use the VSMo<sup>®</sup> software, as it permits a limitless inclusion of the required structural complexity.

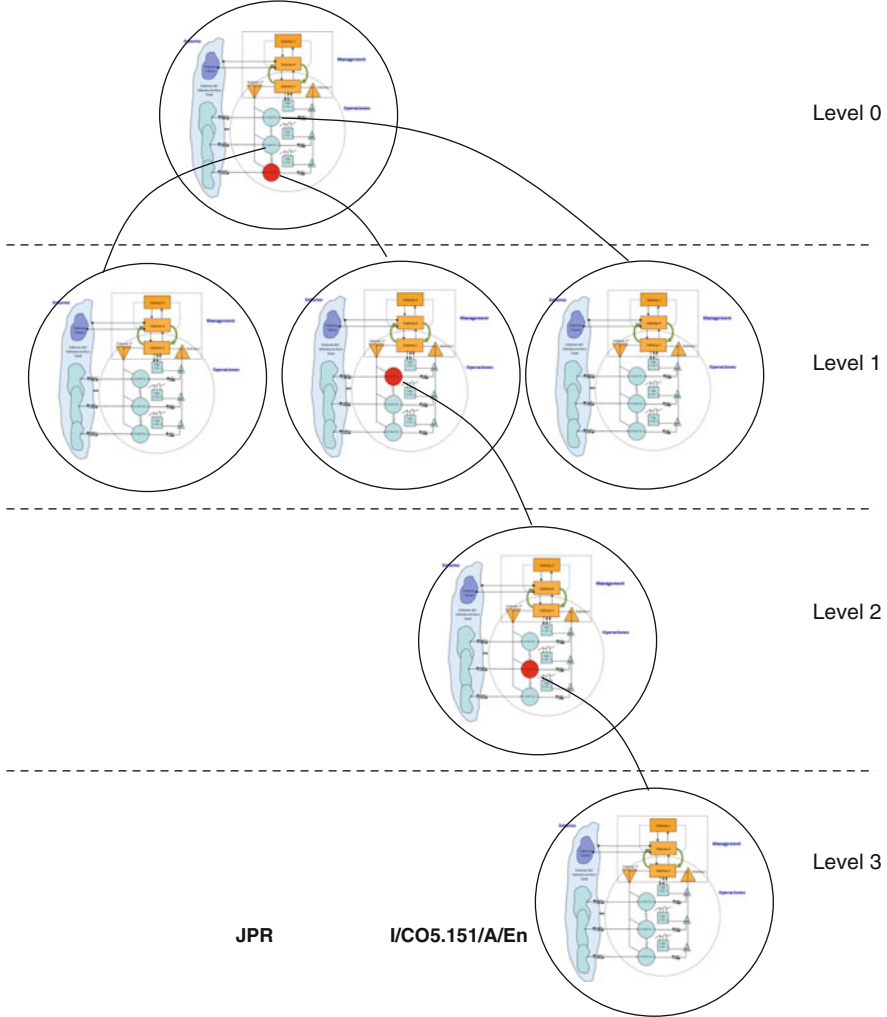
Figure 2.6 shows an example of the VSM's recursive structure: one can easily see how at level 0 (the convention is to assign the value 0 to the first level) an organisation comprising three elementary operational units (System 1) which appear to their full extent in *recursion level 1*. From these we have chosen the second (situated in the middle) to continue the vertical disaggregation two levels further down. Once again in this example, from the three elementary operational units also contained in this organisation, we select the first to show its full extension at *recursion level 2*. Similarly, from this organisation (which in this example also has three elementary operational units) we select the second of these to show full extension at *recursion level 3*.

In this way, we can observe the four levels of recursion within the organisations we have selected for visualisation. Obviously, we could have done the same with the first and third organisation of recursion level 1, thereby showing the corresponding vertical disaggregation. This has not been done here so as to simplify explanation. Once again, it is easy to appreciate how difficult it is to provide a graphic representation of the whole structure, that is to say, all the organisations to be found at all levels and in accordance with all possible recursion criteria. Hence the need for software like VSMo<sup>®</sup>, which facilitates visualisation even of the complete structural map (Criteria-Levels-Organisations).

Another example is shown in Fig. 2.7, of an organisation at Level 0 of the disaggregation chain according to Recursion Criterion 2. But at the same height another two organisations can be seen in two vertical disaggregation chains corresponding to Recursion Criteria 1 and 3. In those three organisations we find that (in this example) the first elementary operational unit of the first organisation, the second elementary operational unit of the second organisation and the second elementary operational unit of the third organisation are the same organisation, which is the one fully represented at recursion Level 1. In this example, the disaggregation chain only continues downward (recursion Level 2 and recursion Level 3), following Recursion Criterion 2.

If we went on disaggregating vertically from the organisation shown at recursion Level 1, but still continued the disaggregation chains in accordance with

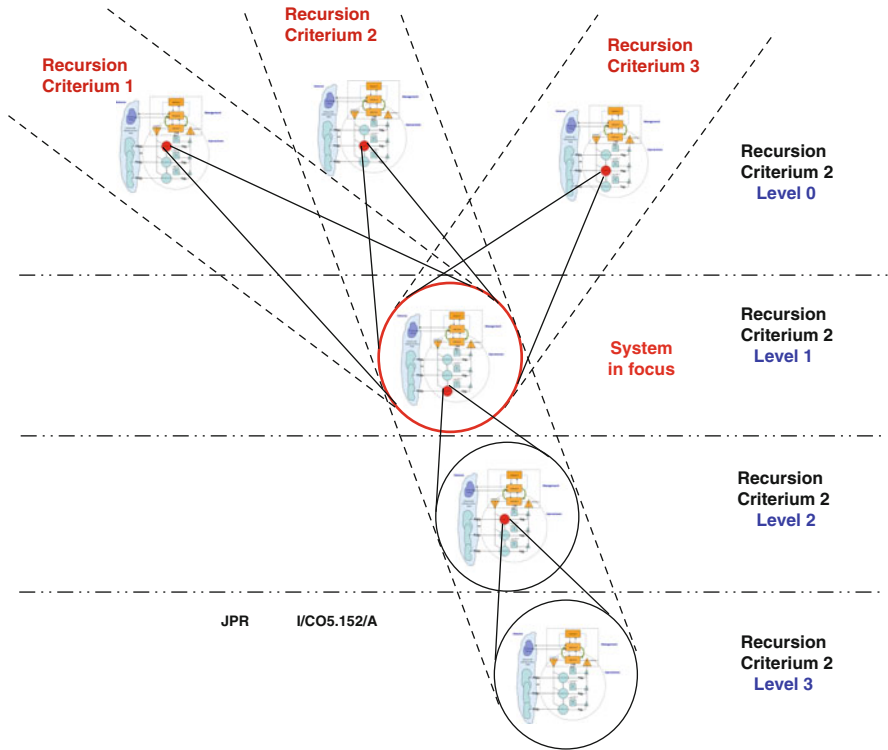




**Fig. 2.6** Recursive structure of the Viable System Model (Adapted from Beer 1979)

Recursion Criteria 1 and 3, we would find the organisation located at recursion Level 1 to be the centre where the chains cross. Here the image of course must remain two-dimensional, but were there to be multiple recursion criteria, we could apply a three-dimensional representation. Figure 2.8 shows the system-in-focus or organisation-in-focus we have selected for hypothetical analysis in this case. On the left of the figure we see a three-dimensional representation of the system-in-focus which occupies the central or intersecting space of criteria and recursion levels.

As I have just pointed out, if we select more than one recursion criterion, then we will have several vertical disaggregation routes. But there is also the possibility that, descending in line with a specific criterion and reaching a certain point

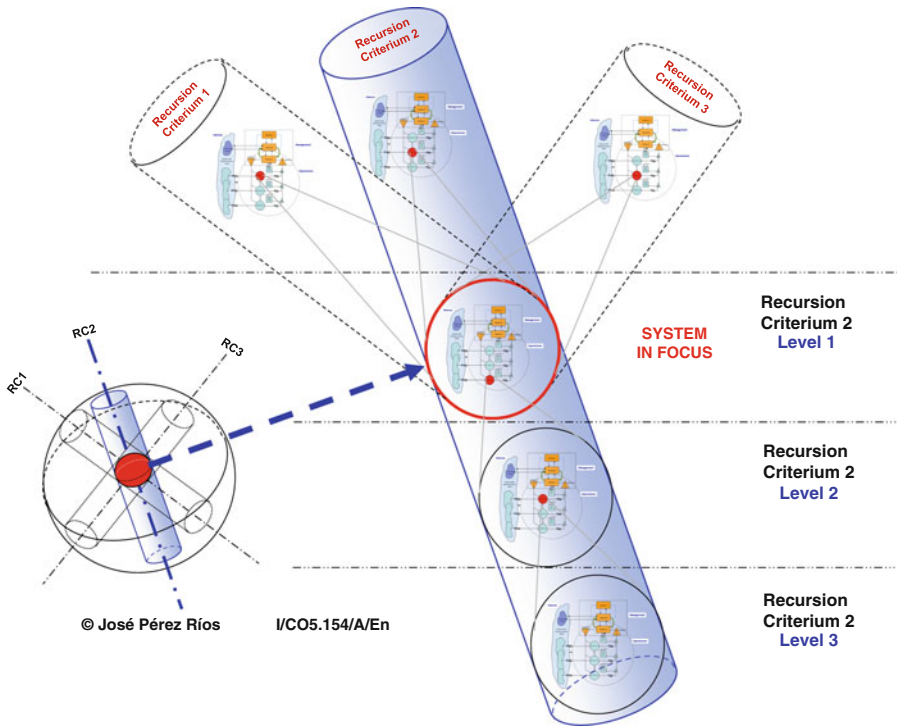


**Fig. 2.7** Vertical dimension: Several recursion criteria (Pérez Ríos 2008e)

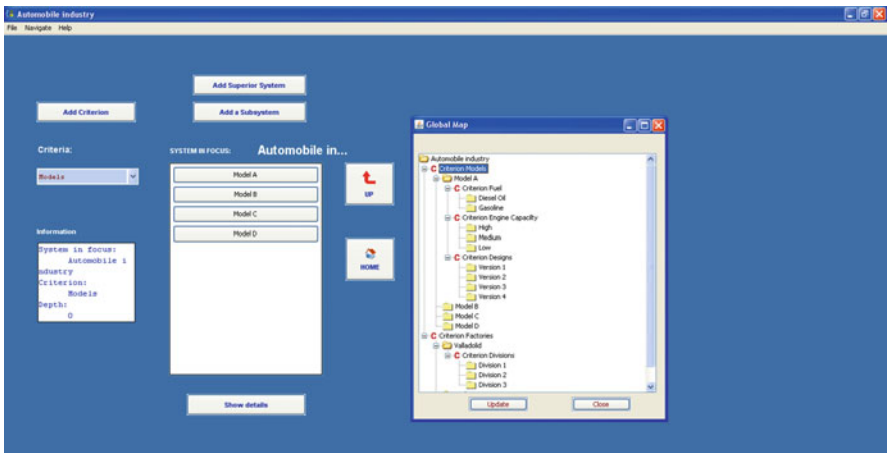
(a recursion level), we would be interested in using a different criterion to continue unfolding the process of complexity. This would mean that at such a point we change the “dimension” (the new recursion criterion selected) and continue with vertical disaggregation along a different route. This step could be repeated indefinitely at any later stage. It is not difficult to appreciate that, should the organisation be large and the number of criteria substantial, our study will become very complex. Hence our insistence on the suitability of employing specialised software such as VSMo<sup>®</sup>, which allows us at all times to have access to the global map of the complete system with which we are working, as well as all the information relating to how the vertical breakdown is being generated.<sup>1</sup> The three navigation maps (Global Map, Map 1 and Map 2) incorporated in VSMo<sup>®</sup> provide such information (Figs. 2.9–2.11).

On the right of Fig. 2.9, we have a representation of the Global Map of a VSM application exemplifying the automotive sector. The purpose of the image is to

<sup>1</sup> In Chap. 4 of this book we give a detailed description of the main characteristics of VSMo<sup>®</sup> software and of its development since its creation in 2001.



**Fig. 2.8** The system-in-focus as the centre of multiple dimensions (criteria and recursion levels) (Pérez Ríos 2008e)



**Fig. 2.9** Global map showing the complete structure of a model (VSMoD<sup>®</sup>)

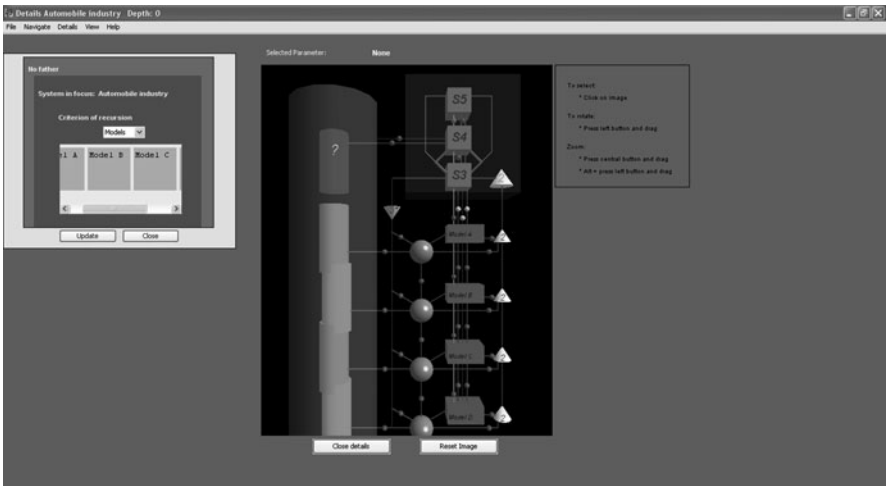


Fig. 2.10 Map 1 showing three levels of recursion (VSMoD®)

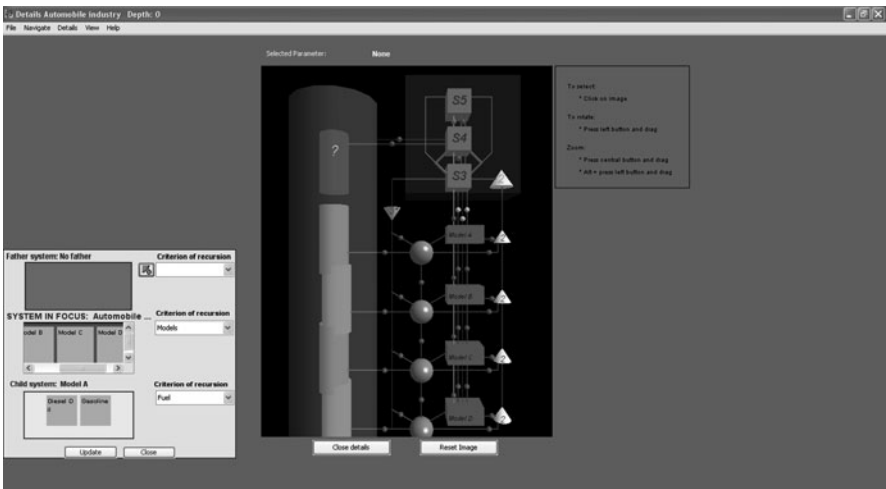


Fig. 2.11 Map 2 showing three recursion levels (VSMoD®)

enable us to see the complete structure of the organisation being studied, which in this case is an automobile company. We can see the recursion criteria, the recursion levels for each criterion and the organisations (or systems) at each level of recursion. As the figure reveals, VSMoD® makes it possible to visualise the whole structure, regardless of its complexity, in just one image.

Figures 2.10 and 2.11 represent the other two navigation maps (Map 1 and Map 2) provided by VSMoD®. These show only three levels of recursion, namely, the level corresponding to the system-in-focus (organisation-in-focus), the one preceding this (parent level) and the following one (child level). The difference between Map

1 and Map 2 lies in the degree of detail for the information included, which is more complete in Map 2, showing as it does all the systems (organisations) at the three levels together with the possible recursion criteria for each.

For many VSM applications, it may be advisable to operate at all times with these three levels visible (Fig. 2.12). In fact, this way of working with the VSM is the one proposed by Beer in his last book relating to this model: *Diagnosing the System for Organizations* (Beer 1985).

Figure 2.13 represents a VSMod<sup>®</sup> screen shot in which the three navigation maps are seen simultaneously.

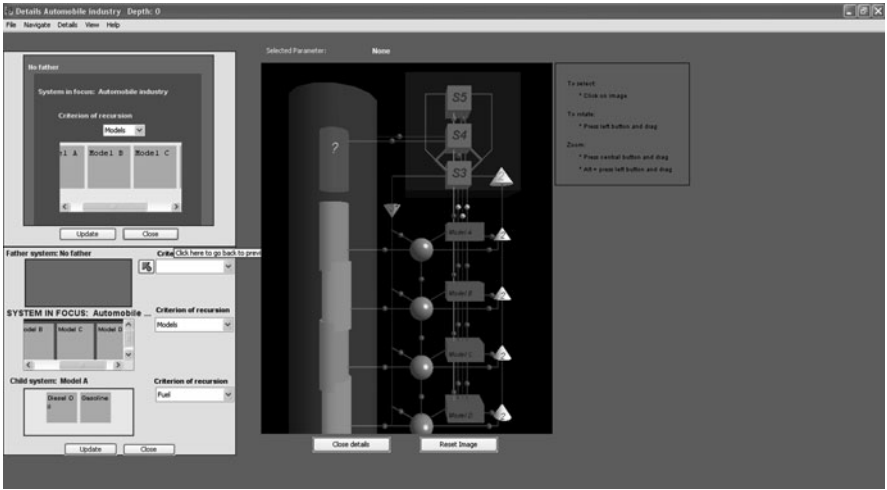


Fig. 2.12 Maps 1 and 2 showing three levels of recursion (VSMod<sup>®</sup>)

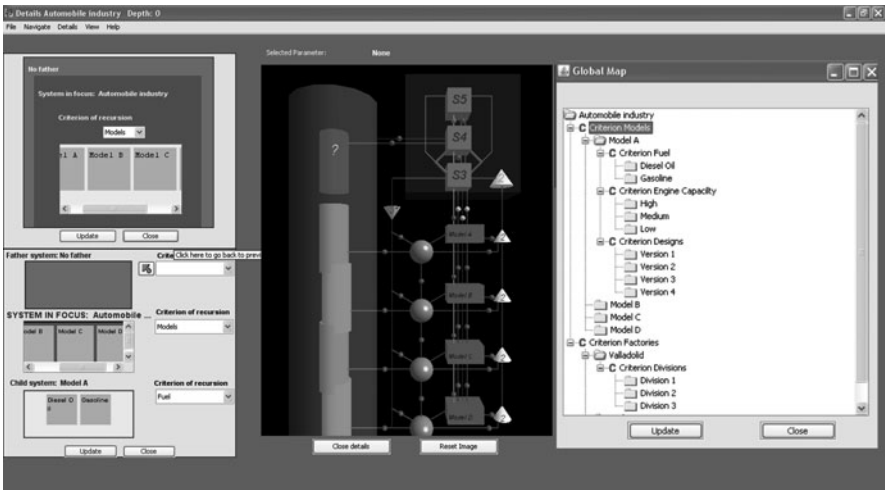


Fig. 2.13 Maps 1 and 2 and Global Map (VSMod<sup>®</sup>)

### 2.2.2 Recursion Levels–Critical Factors Matrix

Having performed this vertical breakdown, our next step is to identify the fundamental elements to be taken into account at each level of recursion. In order to achieve this, we select the recursion criterion we wish to use and construct the matrix (Fig. 2.14) which I call the *Recursion Levels–Critical Factors Matrix*, in which the *rows* are formed by the different levels of recursion and the *columns* contain the main relevant points to be considered at each level.

In the following list, I show some of the aspects that must be included frequently as components of the columns in the *Recursion Levels–Critical-Factors Matrix* (which as an aid to the application of the VSM we may regard as an orientative decalogue):

1. Identification of the level (number and description).
2. Identification of the specific environment corresponding to each level.
3. Particularly relevant aspects of the specific environment that must be considered, with an explicit description of the purpose of the specific organisation for each level. Obviously, this description must be congruent with the purpose of the global organisation. However, there may be particular aspects for each of the levels.
4. Identification of the particular organisation that, as part of the global organisation, operates in the specific environment indicated at each level.
5. Identification of all the relevant “stakeholders” in each level. Depending on the level, some may have more significance at certain levels than at others.
6. Identifying the “external agents” whose decisions might have favourable or adverse consequences for our organisation to carry out actions we consider pertinent for meeting the objective of the organisation at each level. In this group, besides individual actors or agents, we will include institutions, firms or organisations in general which have the capacity to influence the organisation.

	Horizontal Dimension									
Vertical Dimension	1. Recursion Level	2. Spatial scope	3. Relevant Issues/ Purpose	4. Organization	5. Stakeholders	6. Influential Institutions/ Organisms	7. Applicable Legislation	8. Actions Formulated	9. Means	10. Communication Channels
Level 0										
Level 1										
Level...										
Level n										

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Fig. 2.14 Recursion Levels–Critical Factors Matrix (Pérez Ríos 2008e)

7. Individualisation and description of the norms, legislation or regulations, etc. which establish and regulate the activity framework at each level.
8. Describing actions to be undertaken at each level. Here we must specify if we are using the cybernetic study for the design, in which case these actions will be chosen and shaped to achieve the aim of the organisation, or if our intention is to diagnose the organisation, in which case we would evaluate the on-going actions and their adequacy for the outcome of the organizational diagnosis.
9. The description of the action must go hand in hand with all the necessary components for it to be successful (what, who, how, when, where, with what means, at what cost, with what requirements/specifications, etc.).
10. Description of the main communication channels to be utilised to connect with the environment. In this context, we should remember that it is necessary: (a) to clearly identify the content of the information to be transmitted (b) the means by which this is to be done (c) to check that the communication channels exist, and (d) to make sure that each one has the essential elements required by all such channels to perform their functions properly.

We should not forget that each of these elements must be designed so that it can perform its function, and that, in the case of transducers, this means converting the amount of information required per time unit from one format to another, whereas for communication channels it is a question of transmitting information without loss of integrity.

Similarly, we should bear in mind that as regards communication channels there may be “noise” and distortion of information. As I mentioned above, one way to prevent an alteration in the transmission process is to provide each of the components with more than enough capacity to compensate for this, and another is to have a certain degree of redundancy when transmitting data (for instance, by using different channels to send the same information).

Finally, and in relation to the *Recursion Levels-Critical Factors Matrix*, I should point out that the one given in Fig. 2.14 is obviously two-dimensional. In the rows as shown, we can appreciate the levels of recursion for a single recursion criterion (not shown in the figure), whilst the columns refer to a single organisation at each level. Nevertheless, in a real, more complex case, we may come across situations which are much more difficult to represent:

- (a) One of these would be the case where there is more than one organisation at one or several recursion levels. In that case, the matrix would have a “depth” for these levels that would correspond with as many layers (matrices) as organisations or sub-systems existing at the level in question. The problem of two-dimensional representation could be resolved by introducing sub-elements within the level, with several embedded organisations.
- (b) Another case would be the one in which we employ diverse recursion criteria. Here the solution would be to construct a different matrix for each recursion criterion. A more complicated variant would start from a vertical disaggregation in accordance with a recursion criterion RC1 and allow us to find several levels, one of which is interesting for us to continue this disaggregation process, but

now using another recursion criterion RC2; other recursion levels would then appear in this second dimension or recursion criterion. Needless to say, a two-dimensional graphic representation becomes complicated in such a situation.

I mention these cases in order to show the necessity of using the right tools for dealing with the complexity we wish to represent, in this case the *Recursion Levels-Critical Factors Matrix*. Once again, the VSMoD<sup>®</sup> software (in its 1.4 version) accomplishes this aim. It has been developed to make it easy to visualise the matrix structure on the computer screen without any restriction. Changing the recursion criterion, or visualising organisations belonging to a specific recursion level, is done by simply clicking with the mouse on either one on the screen itself, which allows the matrix we wish to visualise and feed with fresh information to appear.

### 2.2.3 Structural Pathologies

Apart from allowing us to identify the pertinent environmental levels associated with our organisation and its operational scope, which we can visualise in the previous matrix by means of the rows, vertical unfolding can also be useful for diagnosing “holes”, that is to say, the level at which the organisation taking responsibility for dealing with the corresponding complexity and problem areas either does not exist or, if it exists, is insufficiently embodied.

In Chap. 3 of this book, entitled “Pathologies of Organizations”, we describe some of the typical pathologies related to the vertical unfolding of complexity. The three groups of *pathologies* that normally affect organisations are: *Structural*, *Functional* and those concerning *Information*. Structural pathologies are those in which at certain levels organisations do not exist, and are directly related to the vertical unfolding we are looking at here. Pathologies identified as structural are:

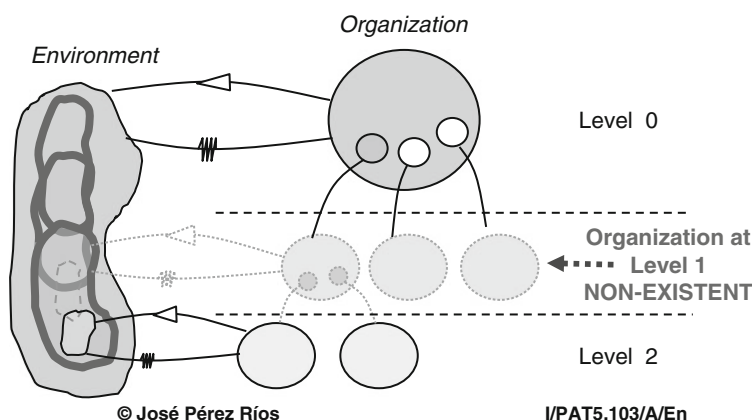
1. Non-existence of vertical unfolding
2. Lack of recursion levels (first level)
3. Lack of recursion levels (middle levels) and
4. Entangled vertical unfolding. Various interrelated memberships

By way of example, let us now look at the third of these *Lack of recursion levels (middle levels)*:

This particular pathology occurs when areas of relevant environment for the organisation in question meet up with no corresponding organisational element exists. Consequently, the problems in that area of the environment are not dealt with in a specific or focussed way by the organisation. Such matters are addressed rather inadequately by organisations from either the next or previous recursion level or, as is more likely, simply go unaddressed, remaining unresolved (Fig. 2.15).

A typical example of this pathology may be encountered in supra-municipal transport systems, or in problems associated with the provision of services such as the water supply or waste disposal, etc. Such services usually extend beyond





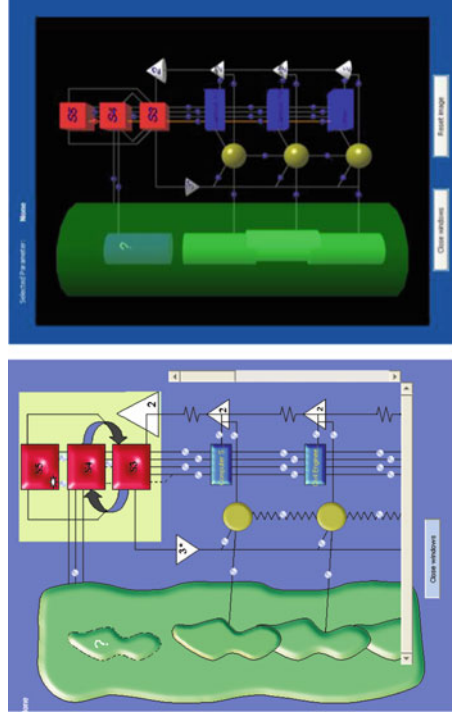
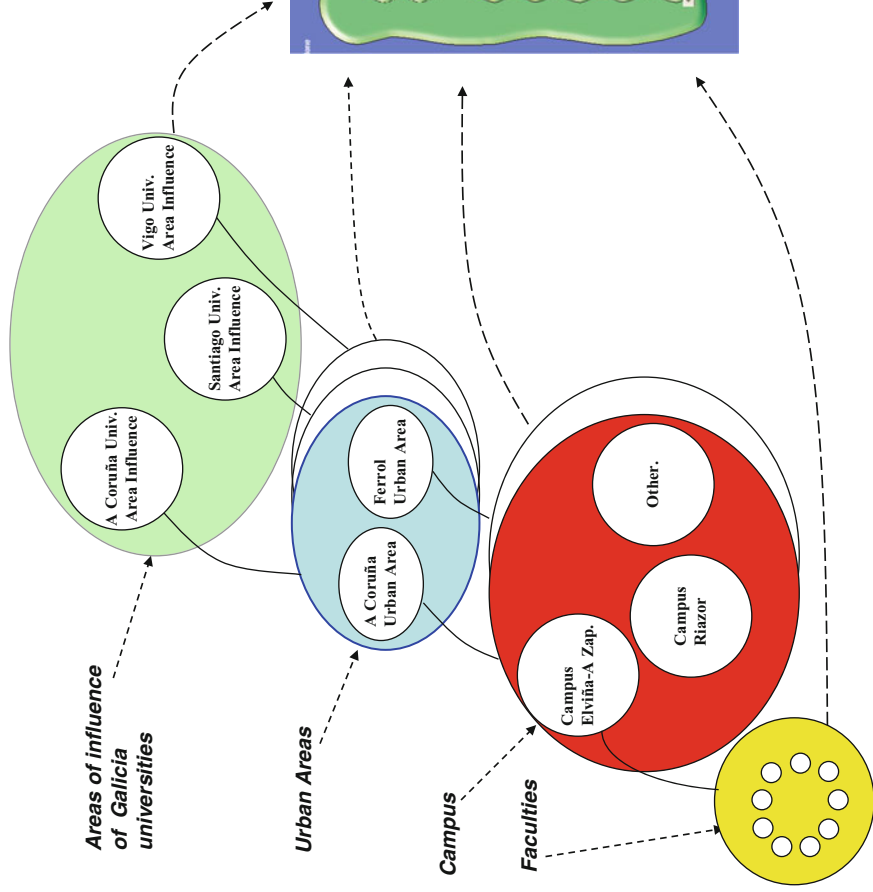
**Fig. 2.15** Pathology P1.3. Lack of recursion levels (middle levels) (Pérez Ríos 2008b)

municipal boundaries. Dealing properly with these supra-municipal necessities requires the setting-up of organisations corresponding to those recursion levels. However, these organisations do not usually exist, and if they are created they tend to be made up of mere groupings of nearby municipalities. However, the issue to deal with may implicitly require that we consider a different spatial and institutional framework. Current issues relating to metropolitan areas, or to rivers that cross a large number of provinces, towns and other administrative and even national boundaries, are examples of this problem area.

An instance of the benefit of creating organisations at these intermediate stages, as well as a consideration of problems on territorial scales different from the municipal and lower levels or from provincial levels, may be seen in the work done by Pérez Ríos and Martínez concerning the application of these concepts to spatial treatment in a supra-municipal university context (Pérez Ríos and Martínez 2007). Figure 2.16 highlights the levels of recursion identified in this study and the images corresponding to the graphic representations of the VSM in two and three dimensions by means of the VSMo<sup>®</sup> software (Pérez Ríos 2003, 2006b, 2008c and 2008e). We should mention that the recursion criterion used, and shown in the image, is one of space (this is a town planning project in a university context).

In addition, in Fig. 2.17 we are shown an example of the *Recursion Levels-Critical Factors Matrix* used in the afore-mentioned study by Pérez Ríos and Martínez. We can observe both the different rows (levels of recursion identified in the study as pertinent) and their corresponding description, as well as the columns with the factors for which relevant information has been obtained. Similarly, in the matrix elements we can appreciate the type of data deemed necessary throughout the study. As this is an on-going project, the diverse matrix components will undergo enrichment in line with its development.

This study reveals the enormous capacity of the VSM for diagnosing the main problems (and also opportunities) at each recursion level, by means of the vertical disaggregation process I have just commented on and with the aid of the *Recursion*



**Fig. 2.16** Levels of recursion in the UDC and image of the VSM in two and three dimensions taken from the VSMMod<sup>®</sup> software (Pérez Ríos 2008c)

1. Recursion Level	2. Spatial Scope	3. Relevant Issues/ Purpose	4. Organization	5. Stakeholders	6. Influential Institutions Organisms	7. Applicable Legislation	8. Actions Formulated	9. Means	10. Communication Channels
0	Galicia.  Territorial Scale 1	-Social Function of the universities. -Relationship with the urban policy.			-Xunta de Galicia. -Consellerías: Education, Territorial Policy, Housing, Environment and sustained development. -Universities: A Coruña.; Santiago de Compostela; Vigo.	1. Act 10/1995 on Town and Land Planning of Galicia. 2. Ground/Buildin g Act of Galicia (December 2002). 3. Act 11/1989 on Galicia University System Planning. 4. University Act 6/2001 5. UDC standing Rule.	-Contribution of the UDC to the Town-Planning Guidelines in Galicia (in progress)  -URB 16. (Campus Elviña) University Residential Area		
1	Urban Region A Coruña Ferrol  Territorial Scale 2.	-Accessibility. -Range (number of potential students) -Visibility of the UDC in the cities, small towns and villages. -Economic and social development of the urban region. -Connection with the business network.			- RENFE (Spain's Railway System) -Cities: A Coruña Ferrol and all the rest in the Urban Region. -UDC. -Xunta de Galicia. (Commuting)		-URB 1. Territorial Accessibility: shire Public Transport Suburban Trains, and coach network. -URB 12. Parking Lots -Parking Lots at Railway Stations. -URB 13. Bus, Train Station Campus Elviña. -URB 15. Research Area. Creation of new enterprises.		
2	a) Urban A Coruña.  b) Urban Ferrol.	-Accessibility. -Integration University/city -Cohesion university/city. -Structuring of public equipments and urban services with the university.			-Cities of A Coruña. -UDC.  -City of Ferrol.	Urban Master plan of A Coruña (1995).  Urban Master plan of Ferrol.	-URB 2. Enlargement of Urban Coaches network. -URB 17. Bicycle lane pedestrian Path from the city centre to the campus.		
3	a) Campus A Coruña	-Adaptation to the European Union directives on Universities degrees. -Urban attraction -Urban and architectonic referent (model of sustained development).			-UDC -City of A Coruña.	-Urban Plan for Elviña A Zapateira Campus (1991) and its modification in 2002. -Environment Plan.	-URB 11. Campus Center -URB 10. Area 30. Elviña Campus coach. -URB 8. Redesign of Zapateira Square -URB 9. Scientific Technological Park. Botanical Park. -URB 16. University Residential Area (Campus Elviña).		
4	Single Buildings.	-Functionality. -Comfort and Environment Managing. -Optimizing spaces.			-UDC -Institution Board		Actions at each particular centre.		

**Fig. 2.17** Recursion levels-critical factors matrix (Pérez Ríos and Martínez Suárez 2007)

*Levels-Critical Factors Matrix*, Above all, it shows how useful the VSM is for identifying the need to create organisations that cover the relevant areas, in this case spatial ones, for the main organisation (in this case a Spanish public university and its geographical area of influence). Application of the VSM made it possible in this case to identify 17 specific actions related to urban planning issues. Several of these had an impact not only on that dimension but also on other aspects related to questions such as the purpose of the university (e.g., attracting more students, providing more services for the community), the transformation (sociological and

demographic) of a part of the city where this university is located, the modification of various systems of transport (bus, inter-municipal railway and a bicycle lane), the increase of supply in student accommodations, the likely impact on a reduction in the price of rented flats by increasing their supply as an indirect consequence of some of those actions, and the transformation of the university into a reference point for sustainable development. These are only a few of the examples of the wide-ranging effects this study has brought about (and is continuing to bring about at the time of writing this book).

It is appropriate to emphasise that thus far, within the process of applying the VSM, we have employed only the phase of vertical disaggregation of complexity. No reference has yet been made to the implications of a study with the VSM in its horizontal dimension, that is to say, the one associated with each and every one of the existing organisations in the structure in question (with their diverse internal components).

### 2.3 Horizontal Dimension: Choosing the System-in-Focus: The Complete System and Its Functions

In the previous section, we saw how to go about absorbing variety (complexity) in the environment by breaking it down in a *vertical dimension*, allowing us to identify, in line with the selected recursion criteria, the pertinent levels of recursion for each, as well as existing organisations or, in the case of designing a new organisation, those to be recommended at each level. We have also seen that each level corresponds to a row of the *Recursion Levels-Critical Factors Matrix*, in whose columns we find the factors or aspects that are essential for studying the organisation.

After creating or diagnosing the general structure of our particular system (organisation), and having identified the different relevant levels of recursion, we can now proceed to analyze each organisation involved in the various environments. As previously stated, we will call the one selected for this detailed study the *organisation-in-focus* or *system-in-focus*.

This *horizontal dimension*, which now centres attention on the components in the matrix row corresponding to *Level/Organisation-in-focus*, is the one that allows us to continue absorbing the environment's variety (complexity), albeit restricted now to just one part, namely that of the *Level/Organisation-in-focus* chosen. Essentially in this dimension, we will analyse the following three elements: the specific environment of the organisation-in-focus, the organisation-in-focus and its management. In Fig. 2.18 we can see on the left an outline of the environment with the embedded organisation and, in turn, the latter's management forming part of it. In the centre of the figure the same features are shown but now the organisation together with its management are separated from the environment in which it operates; in this way we can better visualise the channels attenuating and amplifying variety, which permit the organisation to approach the particular variety

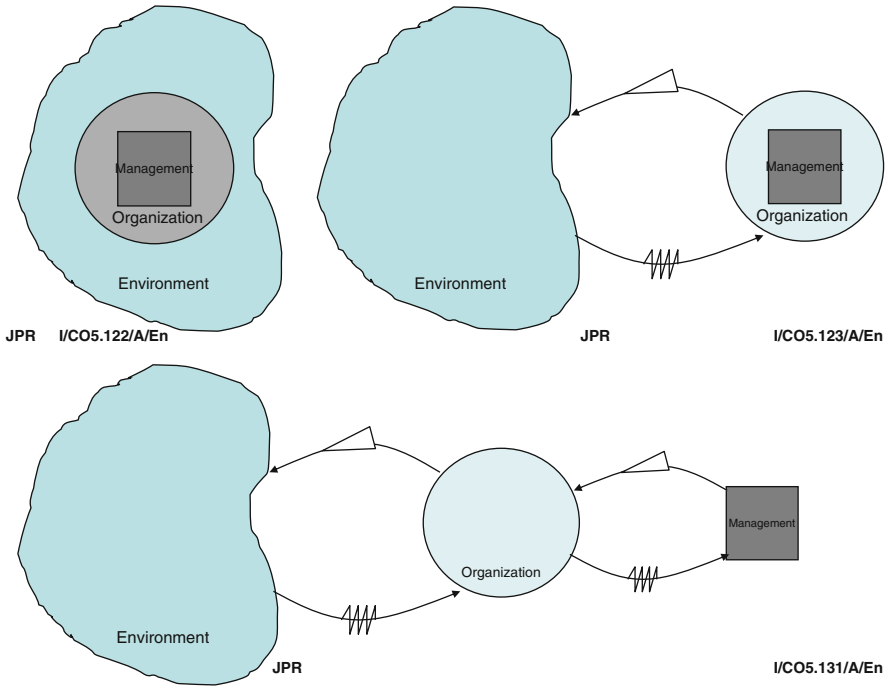
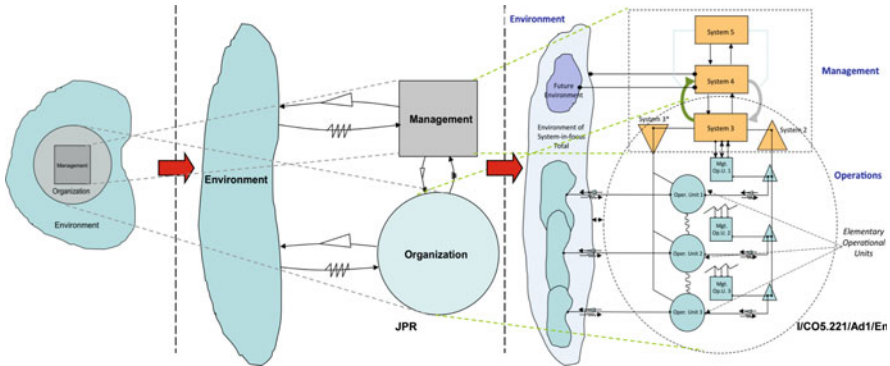


Fig. 2.18 Horizontal dimension (Environment-Organisation-Management)

of the environment in accordance with the afore-mentioned Ashby’s Law. On the right side of the figure we now separate management from the organisation which it directs in order, once again, to reveal the attenuating and amplifying channels that will enable management to deal with this complexity.

Now that we have identified the three essential components corresponding to the recursion level selected and, within this, the organisation-in-focus, the next step will be to study the latter’s structure. In this way, we will be able to assess the actual presence and development of the five previously mentioned systems or functions deemed necessary and sufficient according to the VSM, as well as the network of communication channels feeding them.

On the right side of Fig. 2.19, we can observe the content of each of the three essential components (environment, organisation/operations and management, also referred to as environment, system and meta-system). The whole of the VSM can be viewed, with all the vital functions or systems (System 1, 2, 3, 3\*, 4, 5), the present Environment, the future Environment and the Channels of communication. One may appreciate how, inside the circle representing the operations/system, there are three components which in turn have their own operations and management. They are the elementary operational units making up System 1. There are three in the example shown, but obviously there may be any number. Each would be the organisation-in-focus if we were to go down to the following level of recursion.



**Fig. 2.19** Horizontal dimension (Environment-Organisation-Management) and MSV of the system-in-focus (Pérez Ríos 2008a)

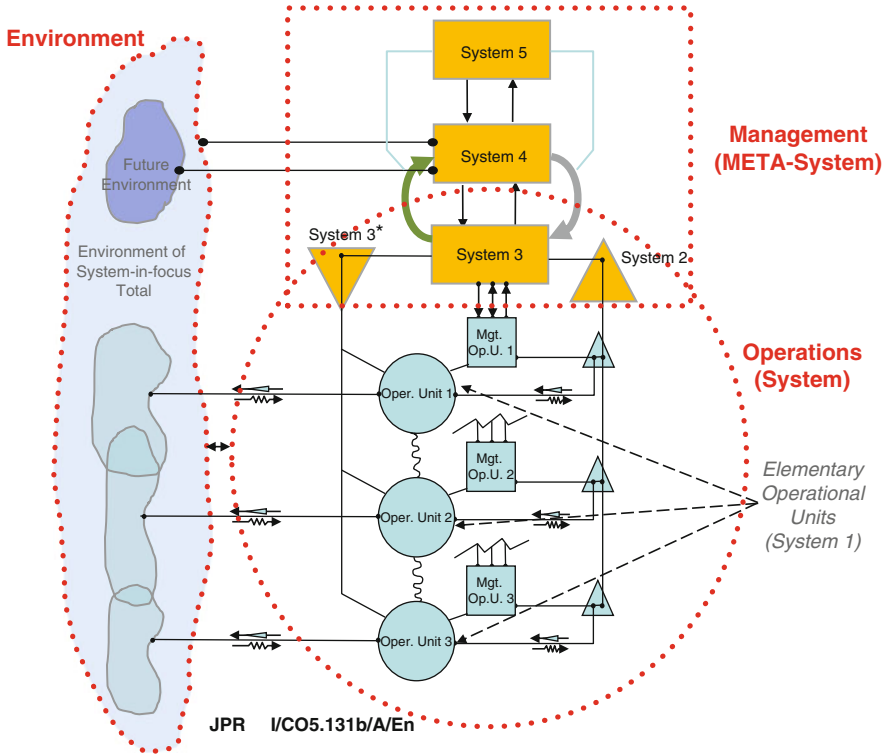
Having understood, then, what the components of the horizontal dimension are, and how they lead us to the VSM of the organisation-in-focus, we will now move on to consider each particular element of the VSM, that is, the functions or systems which according to the model should be suitably represented and operative within the organisation.

Centering our attention on our *organisation/system-in-focus*, the sequence of analysis will be as follows:

- We will start by reviewing each of the systems or functions separately, with special emphasis on System 1, in view of its containing the diverse operational units that will, as explained above, embody the following systems-in-focus as we descend to the subsequent level of recursion.
  - Following an individual study of each component, we will complete our diagnosis with a look at the vertical connections of the organisation-in-focus.
- A consideration of the functions/systems of our system-in-focus (Fig. 2.20) will be based on the following outline:
- First of all, we will analyse the *Management meta-system* (System 5, System 4 and System 3) and its relationship to the environment of the system-in-focus.
  - Next, we will deal with the *set of operations* (System) of our *System-in-focus*, comprising Systems 1, 2 and 3, together with the special System 3\*.

The reason for inverting the study sequence, which would normally focus on analysing System 1 first of all, and then the rest in numerical order, resides in the fact that when designing an organisation it makes no sense to delve into the operational units if the nature and purpose of our organisation (system-in-focus) are unknown to us. The systems approach described at the beginning of this book clarified the sequence of steps for the study of any system: firstly, identifying the system in which the system-in-focus is subsumed; secondly, recognising the aim/purpose of our system-in-focus within the containing system; and, finally, looking at the particulars of either the design or diagnosis of the organisation analysed.

Let us begin, then, with a review of the Management Meta-system.



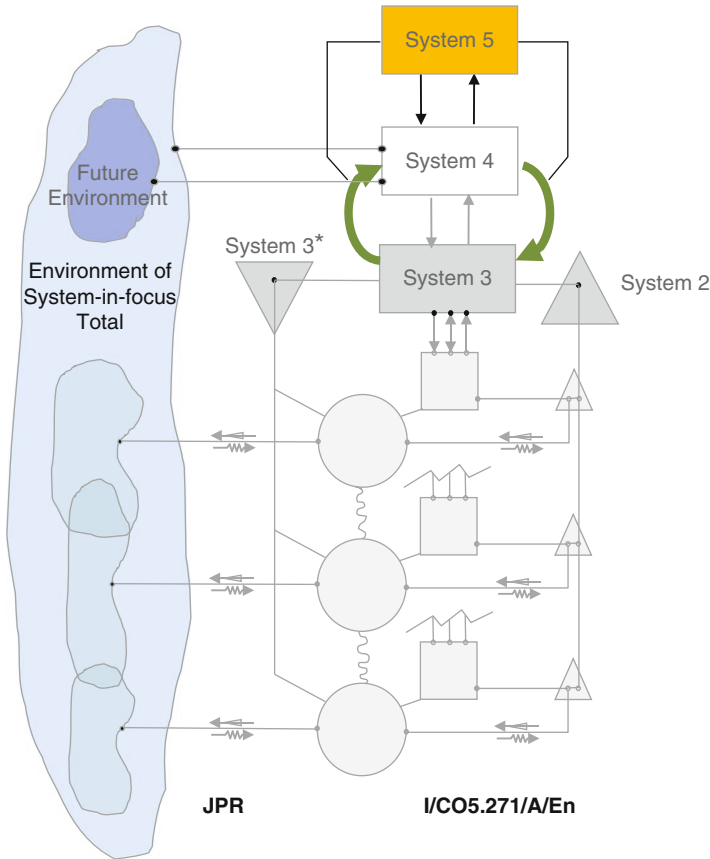
**Fig. 2.20** The system-in-focus (Environment-System/Operations-Meta-system/Management) (Pérez Ríos 2008e)

### 2.3.1 Management Metasystem (System 5, System 4 and System 3)

In all systems or functions that make up the VSM, we can consider two basic groups of questions. The first aims to determine the very *existence and constitution of the system*, in other words, to discover whether it exists and, if it does, to assess its embodiment in terms of its capacity to carry out the required function. The second group of questions tries to analyse, wherever pertinent, the system's *relations with the other systems and the environment*. In this context, there are also two main dimensions in which this relationship is encountered: one may be regarded as horizontal (above all with the environment or, in the case of Systems 3 and 1 with System 2) and the other vertical, referring to links between the different systems or functions.

#### 2.3.1.1 System 5

In Sect. 3 of Chap. 1, I explained the characteristics and goal of this system and its role as the “closure” of the organisation (Fig. 2.21). Consequently, when it comes to



**Fig. 2.21** System 5 (Pérez Ríos 2008e)

“diagnosing” both its presence and degree of development, we should take into consideration the most relevant questions regarding these aspects.

Not attempting to be exhaustive here, I will mention a few examples of questions that can be posed concerning various essential points:

#### In Relation to the Existence of System 5 Elements

- Is there a formal declaration (explicit or written) regarding the organisation’s inspirational vision?
- Is there a (written) formal declaration on the mission of the organisation?
- Are there documents recording the actual translation of this mission into strategic targets and objectives for the organisation?



### In Relation to the Quality of System 5 Elements

- Does the list of strategic goals and objectives cover all fundamental aspects of the organisation? As an example of these in the case of companies, we may mention those identified by Drucker: clients and target market; geographical area; issues relating to survival, growth and profitability; philosophy of the firm; and desired public image (Drucker 1954).

### In Relation to the Existence of Organisms/People with a Role in System 5

- What are both the personal and collective organisms with a function related to some of the previous points?
- Examples of organisms which have (or should have) particular System 5 functions are: a company's Board of Directors; a university Social Council; the Economic and Social Council in an Autonomous Community; the management team of a firm or organisation.

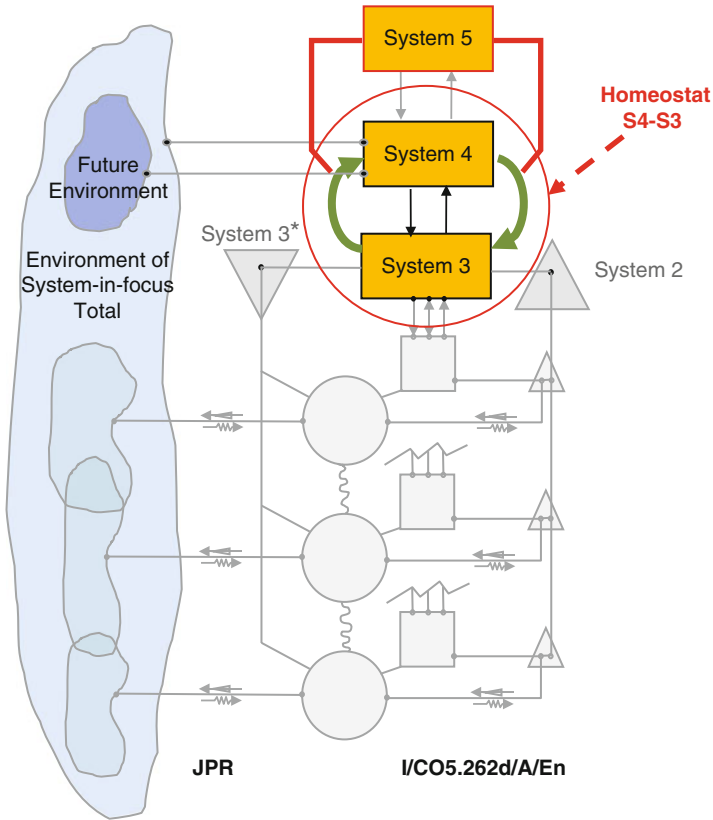
### In Relation to the Working and Efficacy of Organisms with System-5 Functions

- Is there consensus in each of these organisms regarding what the organisation is or intends to be (that is to say, its identity)?
- Are there adequate procedures for transmitting the information generated in System 5 to the rest of the organisation?

### In relation to the communication channels

- Which existing communication channels allow System 5 to be informed of events in the organisation concerning matters relating specifically to this system, and which ones transmit the precise information to the rest of the organisation regarding the Vision, Mission, Goals, Identity, etc.?
- Are there proper "sensors" to receive the information via the algedonic channel?
- Does the algedonic channel connect the appropriate points, and are its eight typical components of a communication channel suitably developed?

A second group of questions in relation to System 5 refers to the government of interactions between Systems 4 and 3, that is, the System 4-System 3 Homeostat (Fig. 2.22). As previously mentioned, System 5 is responsible for achieving an equilibrium between the present functioning of the organisation and its preparation for the future; these are functions fundamentally typical of System 3 and System 4, respectively. Therefore, other points to take into account are listed below.

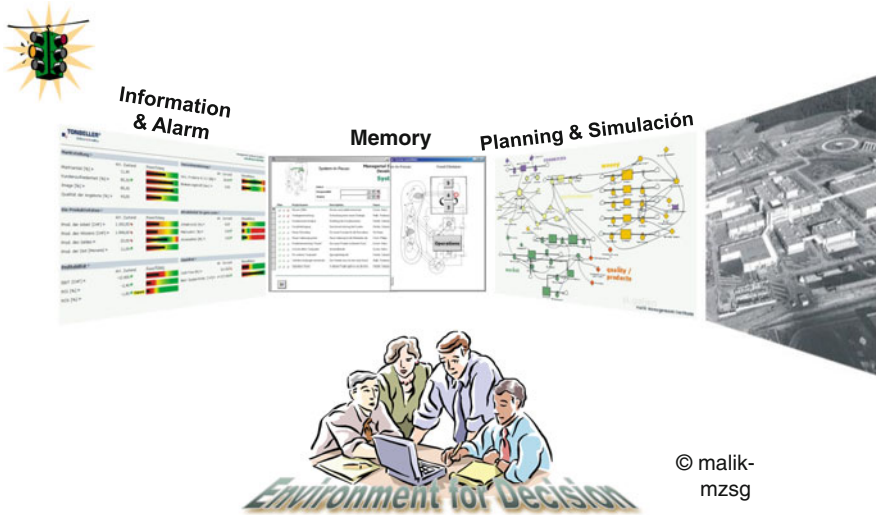


**Fig. 2.22** System 5 and System 4-System 3 Homeostat (Pérez Ríos 2008e)

**In Relation to Managing the System 4–System 3 Homeostat**

- Have procedures been drawn up (temporal cadence, adequate space, topics to consider) to facilitate interaction between representatives of System 5 and the essential components of Systems 4 and 3?
- Are there procedures or elements that warn System 5 of the need to intervene in order to resolve the issues that Systems 3 and 4 in combination are unable to resolve?
- Is there something similar to the “Operations room or decision environment”, described in Sect. 3 of Chap. 1, to assist the components of the Meta-system (Systems 3-4-5) in studying the given problematic situations (Fig. 2.23)?

Finally, a further set of questions concerning System 5 should be addressed toward assessing the extent to which the entire organisation shares the same vision and identity, etc. For this purpose, it is necessary to explore how such aspects are



**Fig. 2.23** Elements of an “Operations Room”. Courtesy of Malik Management Zentrum St. Gallen. Authorised reproduction

perceived both inside the organisation-in-focus and on the preceding and subsequent levels of recursion (Fig. 2.24).

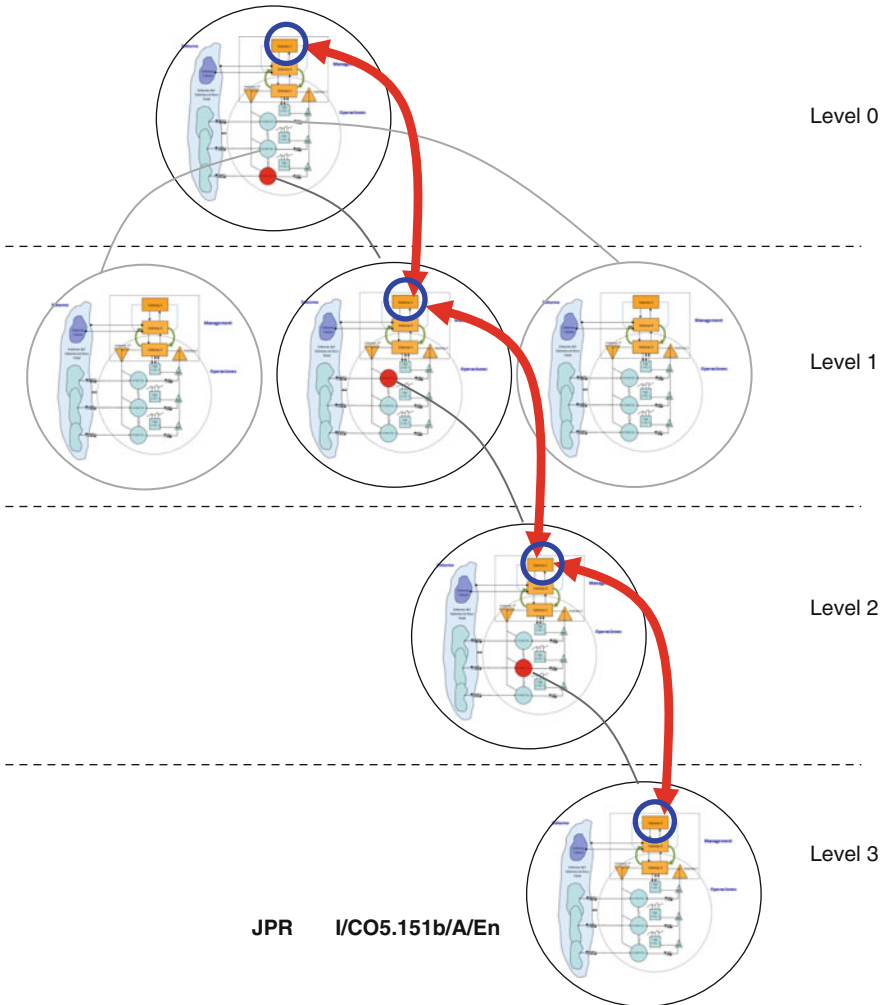
### Coherence in the Perception of Identity Among Different Recursion Levels

- Is the identity assumed in System 5 shared and understood by System-1 components?
- Is the identity assumed in System 5 of the system-in-focus coherent with that of the preceding recursion level?
- Do formal or informal procedures exist for communicating and sharing identity between System 5 of the system-in-focus and that of the previous level or levels of recursion?

Now that we have an idea of the organisation’s identity, and have also ascertained the types of diverse elements necessary for System 5 to perform its function, let us take a look at System 4.

#### 2.3.1.2 System 4

In Sect. 3 of Chap. 1, I described the main functions of System 4, so it is now appropriate to make an evaluation, on the one hand, of *the existence and composition* of this function in the organisation we are scrutinising, and, on the other, of *the quality of its performance*, and finally to investigate the quality of the

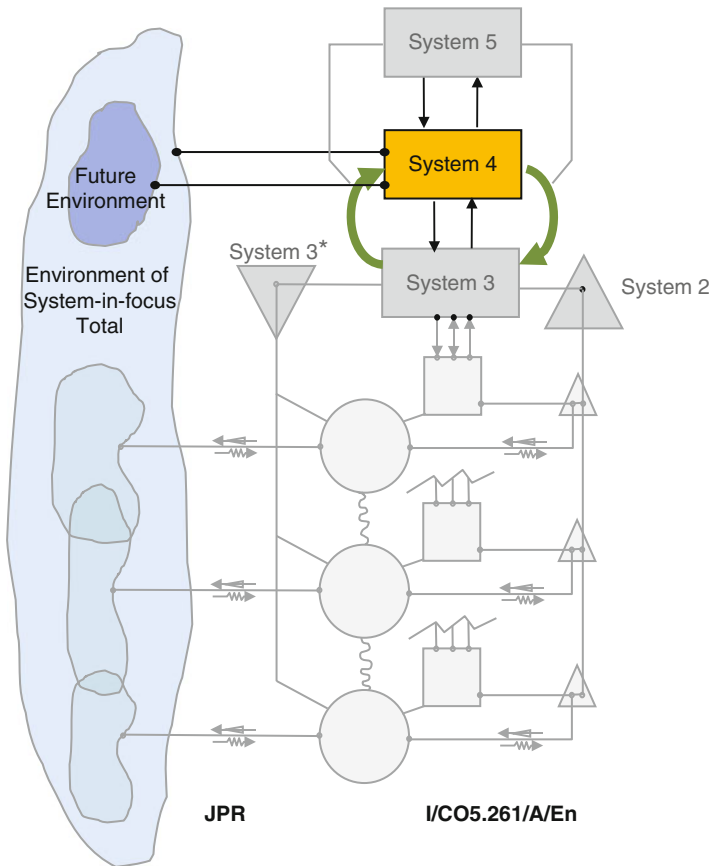


**Fig. 2.24** Connexions between Systems 5 of different recursion levels (Pérez Ríos 2008e)

*connection* between System-4 elements and the remaining systems or functions of the complete system in our particular organisation (Fig. 2.25). Some of the questions that should be raised, or points that should be made explicit, are now outlined.

#### Concerning the Existence and Quality of System 4

- A description of the management, individuals or organs (Departments, Sections, Units, etc.) whose activity is associated with the purpose of System 4.



**Fig. 2.25** System 4 (Pérez Ríos 2008e)

- An explicit description of the activities that each of the former undertakes, and which are related to the purpose of System 4.
- A description of the means employed by the organisation to help the System-4-related activities to the above-mentioned managers, individuals or organs. In this context, it should be ascertained whether, among other things:
  - (a) Simulation models exist (e.g., System Dynamic Models, or Simulation Models in general based on other methodologies).
  - (b) Tools are used for carrying out prospective studies (e.g., Delphi Method).
  - (c) Methods are employed to explore alternative decisions based on scenarios.
  - (d) Other methodologies, methods or techniques different from the former are employed. If this is the case, they should be described.
  - (e) There is something similar to the “Operations room” or “Decision-taking environment” previously referred to, the principal components of which are:

1. Element for visualising the current results of the critical variables, fed in real time;
2. Element for visualising the organisation's past data (evolution over time of the relevant variables);
3. Screens for visualising both the simulation models and their results, to provide information for decision making;
4. Screens for visualising the Viable System Model of the organisation in question and its various recursion levels;
5. Element/s for visualising information (numerical, texts, images, videos, etc.) related to the organisation and pertinent to feeding the decision-taking process.

#### “Horizontal” Relations: System 4: Environment (Present and Future) Homeostats

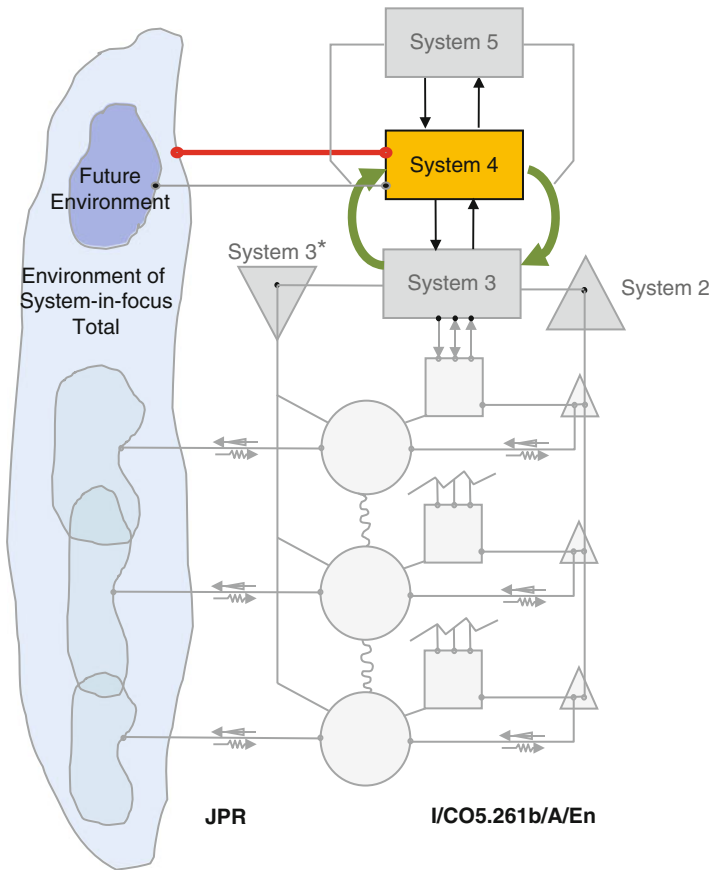
Given that the fundamental role of System 4 is monitoring what occurs or might occur in the environment, capturing pertinent information and channelling (including “transduction”) this to within the organisation, this function should be explicitly dealt with.

In Sect. 3 of Chap. 1, it was seen that some of the main dimensions in the environment to be taken into account were (among others):

Commercial  
 Social  
 Demographic  
 Technological  
 Political  
 Legal  
 Economic  
 Ecological  
 Educational

In this review section, when considering the “horizontal” axis we must take into consideration the development of:

- (a) The “sensors” installed or available in the environment. In this context, we must evaluate, on the one hand, the type of sensor employed or to be employed and, on the other, where these are located and to which dimension they correspond.
- (b) The “transducers” that will convert the information captured into an intelligible language for the various elements in the organisation.
- (c) The “channels for communication” currently used or which will be used to transmit this, with consideration given to both their “capacity” (e.g., Bandwidth) and their temporal cadence.
- (d) The “recipients” of this information (persons, sections, groups, etc.) and
- (e) The manner in which this information is or will be shown (e.g., by means of graphs, numerical data, texts, videos, etc.) and the support (written format



**Fig. 2.26** System 4 – Present Environment (Pérez Ríos 2008e)

or via personal computer screens or large-format screens in decision-taking rooms, etc.).

These fundamental aspects should be assessed in the two critical homeostats, the “System 4-Present Environment Homeostat” (Fig. 2.26) and the “System 4-Future Environment Homeostat” (Fig. 2.27).

Here are some examples of questions to be considered in each one.

#### System 4-Present Environment Homeostat

- Description of the “sensors” available in the environment for capturing information concerning elements of the present environment related to our organisation. By way of example, if the latter is a company, such elements may be associated with dimensions such as:

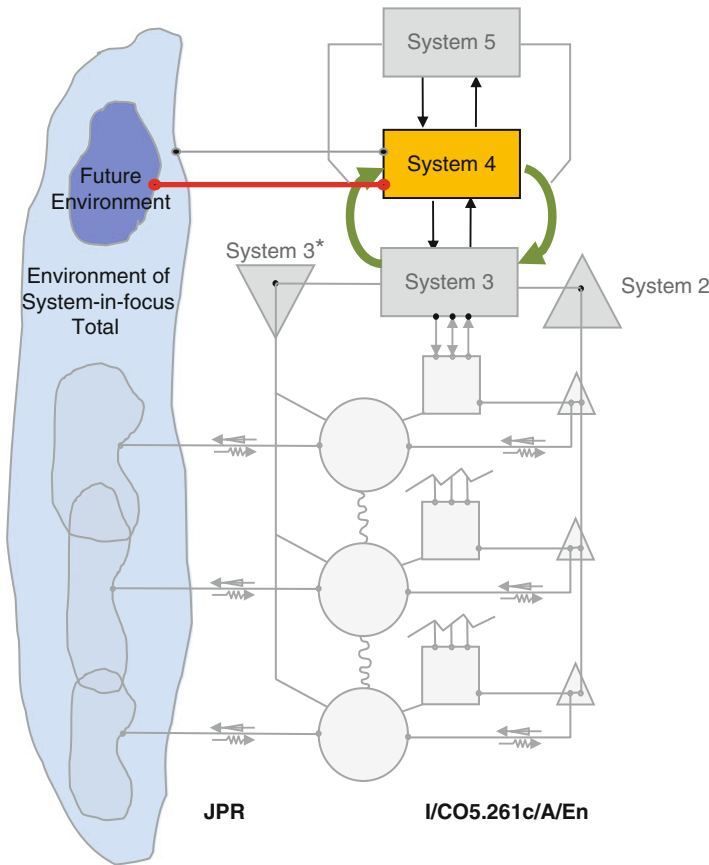


Fig. 2.27 System 4-Future environment (Pérez Ríos 2008e)

- Presence and behaviour of our competitors
  - Emerging markets
  - New technologies
  - Legal changes
  - Impact of globalisation
  - Modifications in the sector (mergers, takeovers, etc.)
  - Impact of current regulations relating to environmental issues
  - etc.
- Characteristics of the communication channels and of all their components.
  - “Recipients” of the information and how it is presented.

#### System 4-Future Environment Homeostat

Besides looking into the environment’s foreseeable trajectory in each of these fundamental dimensions, we must also evaluate the effect such changes may have on our organisation; as a result, we should undertake, among other actions:



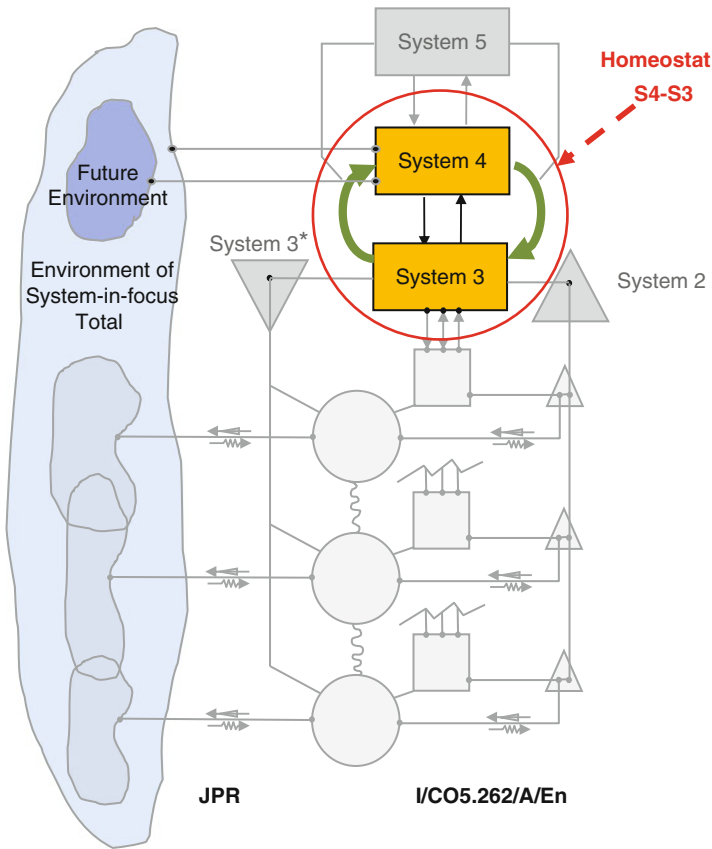
- A review of our vision
- A review of our mission
- A review of our objectives
- A review of our business model
- The chances of profitable growth
- An evaluation of the new challenges for our organisation (for example, for a company these may be: future potential competitors, technological changes, changes in market behaviour and other previously-mentioned environmental dimensions).
- The necessity and chances of transforming our organisation (market, products, structure, etc.)
- The necessity and chances of expanding internationally
- etc.

### Functioning and Communication

Following this evaluation of the degree to which System 4 is present in our organisation, what it comprises, the means at its disposal, its functions, its dealings with the (present and future) environment, and the actual development of the two homeostats connecting this system with the environment, it is now appropriate to consider how it is linked with the other systems/functions of the organisation under study. In particular, we should analyse its connection with System 3 and System 5, as well as with the other organisations belonging to different levels of recursion in our system as a whole, assessing the quality with which these relationships work.

### Relations with System 3: System 3–System 4 Homeostat

I said before that the main role of System 3 is to manage the organisation's "here and now", that is, the daily situation of the elements that make up System 1, with the help of System 2 and System 3\*. The organisation's viability depends on its adapting to the changes and needs determined by the evolution of the environment. Detecting and conveying these to the interior of the organisation is the mission of System 4. Therefore, we should make sure that there exist, on the one hand, communication channels between System 4 and System 3 (with all the components required for them to work properly) and, on the other, the means to facilitate dialogue between these two systems so that both of them are in a position to transmit necessary information to the other system. In the case of System 3, such information will be concerned with restrictions and specific timing constraints within System 1 for the appropriate (non-destructive) adaptation to take place. As for System 4, this will be data on the changes considered necessary to be implemented by System 1 if the organisation is to remain viable. This interaction between System 4 and System 3 is accounted for by the System 4–System 3



**Fig. 2.28** System 4–System 3 Homeostat (Pérez Ríos 2008e)

Homeostat; its proper functioning is critical for an organisation’s viability since, as we saw before, this unit is its adaptation organ (Fig. 2.28).

As a consequence, the questions or aspects which must be carefully considered are those such as:

- Describing the formal channels of communication between System 4 and System 3. Reviewing in each of them the eight typical elements of the homeostat (components, transducers, channels), temporal cadence, etc.
- Responding to the same question, but now in terms of the informal communication channels (meetings called, etc.).
- Describing the available resources for facilitating “conversation” between representatives of System 3 and System 4. In this context, one should check for the existence of the types of aids referred to in Sect. 3 of Chap. 1, such as:
- Methodological and functional: Simulation Models, scenarios, prospective studies, software tools for specific purposes (Interdelphi, Col-KCap, etc.).

- Related to physical support: visualisation panels, large-format computer screens, networked computers, etc.

Concerning this question, the availability of an “Operations Room” or a “Decision-taking environment” such as the one mentioned previously is fundamental for facilitating “conversations” between Systems 3 and 4.

In cases where the complexity and size of the problem requires it, the use of group decision techniques (Brainstorming, Nominal Group Technique, etc.) is to be recommended, or, if possible, Team Syntegrity. Chap. 5 of this book explains the fundamental nature and basic application protocols of Team Syntegrity.

### Relations with System 5

In the description of System 5's characteristics, an indication was given of some of its needs for communicating with the rest of the organisation. Consequently, we should simply verify:

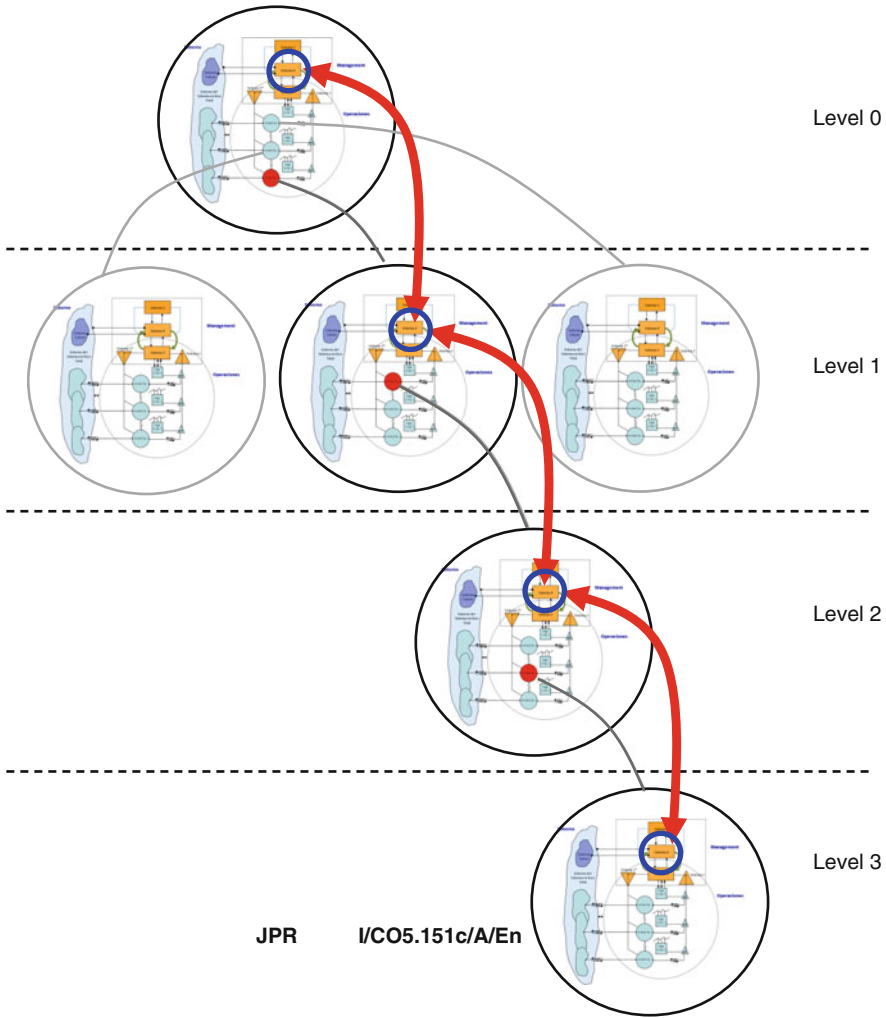
- The existence of both formal and informal communication channels between System 4 and System 5.
- The nature and composition of these channels. Once again, we should make sure that all the typical components of a communication channel are present, properly developed and working.
- In the line of communication between System 5 and System 4, we must check above all:
  - Its existence (the variety of lines of communication, formats, frequency, etc.).
  - The content of the information transmitted (aspects regarding the Vision, Mission, Goals, Instructions and commands regarding actions to take, etc.).
- In the line of communication extending from System 4 to System 5, we should check:
  - Its existence (variety of lines of communication, formats, frequency, etc.).
  - The content of the information transmitted (issues relating to adapting the organisation to present and future needs; questions concerning the Vision, Mission and Goals, etc.).
  - The existence of the algedonic channel warning of serious risks for the organisation's survival.
  - The make-up of the algedonic channel: connecting elements (where the “sensors” are installed and how information within System 5 is visualised, who receives it, how it is shown), transducers, and channel characteristics (capacity).

Finally, I must add that the link between the System 3–System 4 homeostat and System 5 was dealt with when we analysed System 5.

Relation Between Systems 4 in the Different Recursion Levels

Given that System 4 has to be continually examining the possibilities of change and evaluating them with the aid of various tools such as Simulation Models, etc., and with the contribution of System 3, it is clear that assessments of both the diverse strategic as well as general options should be coherent between the different organisations situated at the different recursion levels in the global organisation (Fig. 2.29).

Certain tools like Systems Dynamics allow us to build models with varying degrees of aggregation; therefore, it is possible to make that the outputs of more



**Fig. 2.29** Connections between Systems 4 for different recursion levels (Pérez Ríos 2008e)

detailed models be the inputs of more aggregated models, with the result that the consistence and coherence between the different models can always be verified.

This check is especially necessary in the VSM, as all strategic planning processes are linked via the model's recursive nature. Each organisation is part of another at the previous recursion level, and so on and so forth. Thus, we should make sure that this coherence really exists.

As regards this point, we should ask such questions as:

- Do the models employed in System 4 permit the inclusion of different levels of aggregation which make it possible to connect aspects of the organisation that correspond to various recursion levels?
- Are there any formal or informal procedures for checking the coherence of the procedures for strategic planning, simulation, exploration of scenarios, etc., among the diverse levels of recursion?
- Are there any communication channels between the different Systems 4 at different recursion levels?

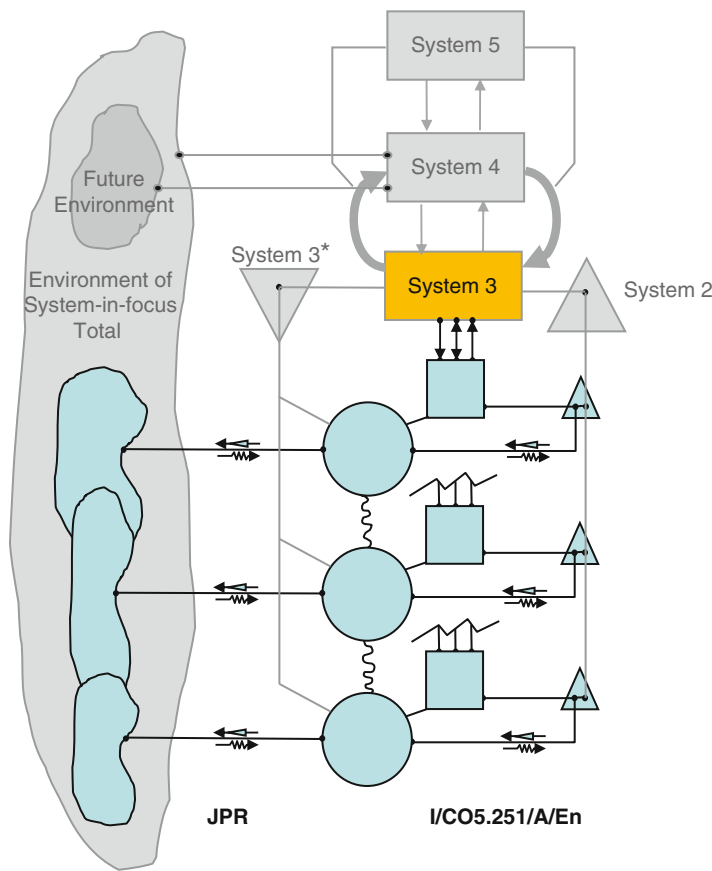
Having examined the components of the organisation-in-focus's Meta-system (Management), referred to as System 5, System 4 and the System 4-System 3 Homeostat, our next step is concentrate on the operations of the organisation or System. To recapitulate, this comprises System 3, System 3\*, System 2 and System 1, with all their corresponding communication links. Also, we have seen that System 3 has a dual role, insofar as it belongs to both the System and the Meta-system (together with System 4 and System 5), a point to which I will return at a later stage.

### **2.3.2 *System (Organisation/Operations: System 3, System 3\*, System 2, System 1)***

#### **2.3.2.1 System 3**

System 3 (Fig. 2.30) is the third component (alongside System 4 and System 5) of the organisation-in-focus's "meta-system", which is equivalent to the "Management" of the set of operations in the system-in-focus made up of System 3, System 2 and System 1, in addition to System 3\*. As we can see, System 3 is present in both components, that is, in the Meta-system and the System (or set of operations), which gives it a peculiar position. This has been studied by authors such as Yolles (personal communication, 2007), who in order to explain this dual role differentiate between System 3a and System 3b, depending on the type of activity in which System 3 is involved.

The basic function of this system is, as I have already pointed out, to manage the current functions of the organisation in order for it to continuously supply the environment with what its responsibility designates it to provide (goods, services, etc.). This function is generally referred to (when drastically simplifying Beer's



**Fig. 2.30** System 3 (Pérez Ríos 2008e)

intentionally broad term, implicit in System 3) as that of “Management and integration” or also “Implementation and integration”.

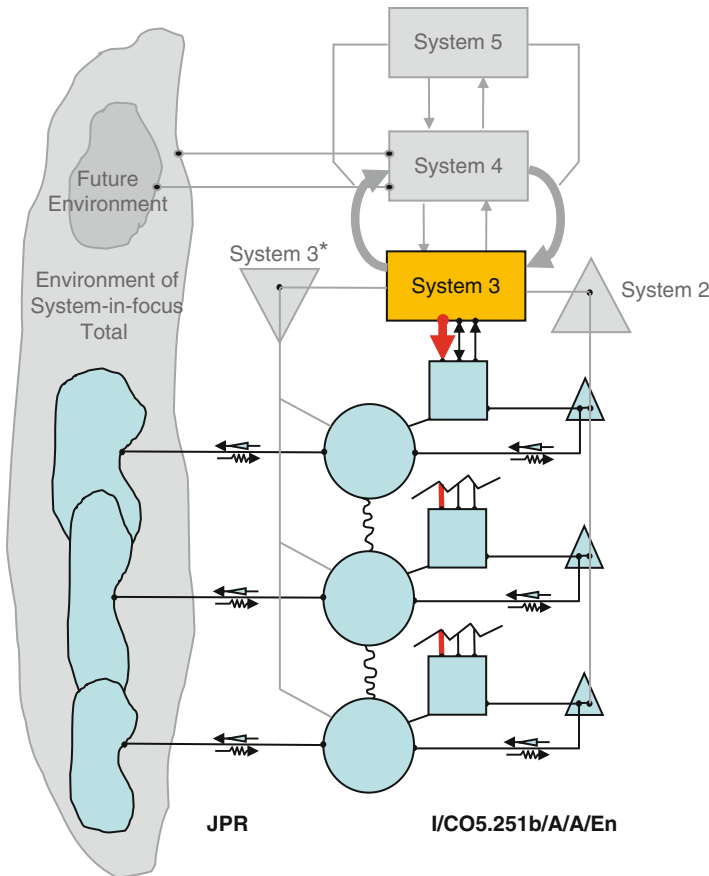
However, another function of this system is to continually transform System 1 so that, without putting its normal operations in danger of collapsing, it can incorporate the incremental modifications or even radical changes proposed by System 4 and agreed to by System 5 as necessary for viability (beyond survival). In this case, System 3 acts as a transmitter of downward information.

A further function of System 3 is to inform System 4 about the real “chances” of transformation in System 1, including information picked up by the elementary operational units that constitute the latter in their respective environments; such information may concern both the present and future environment, but at their most reduced level. In fact, when capturing this type of information, we could regard it as more typical of System 4, which strictly speaking is the case, since by descending to the following recursion level where the new system-in-focus would be one of those elementary operational units, we would be looking at functions corresponding to

System 4. These connections between recursion levels are somewhat intellectually complex, but this is perfectly manageable once the VSM as a whole has been mastered. Now System 3 acts as a conveyor of upward information.

Returning to the role of System 3 as an integrator of System 1 components and the latter's link with the Meta-system, it is appropriate to recall the three essential kinds of activities it performs in relation to System 1 and its components:

- (a) *Setting goals* for each of the units comprising System 1, as well as conveying information from the "Meta-system" regarding the translation to this level of the "Vision", "Mission", "specific Goals" and "Ethos"; in other words, the way the organisation should behave, its character and how it is hoped that it should be seen or perceived both externally and internally (Fig. 2.31).
- (b) *Negotiating resources*. In order to make it possible to meet its objectives and deal with the other issues mentioned, each elementary operational unit in System 1 must be supplied with the resources required for it to function.



**Fig. 2.31** System 3 (Transmission of instructions) (Pérez Ríos 2008e)

- This process of “negotiation of resources” is handled jointly by the “Management” of each of the elementary operational units making up System 1 and System 3 (manager responsible). Together they will reach an agreement on the available resources, bearing in mind that the only system which possesses a global vision of the whole of System 1 and the needs of each of its elementary units is System 3 (Fig. 2.32).
- The assigning of resources to each unit must be accompanied by a commitment from the latter to meet the specified objectives. In this context, I consider that techniques like “Management by objectives” may be helpful.
- (c) Finally, once the objectives have been set and the corresponding resources allotted, the *Accountability* procedure should be established. The “Management” of each elementary operational unit in System 1 should keep System 3

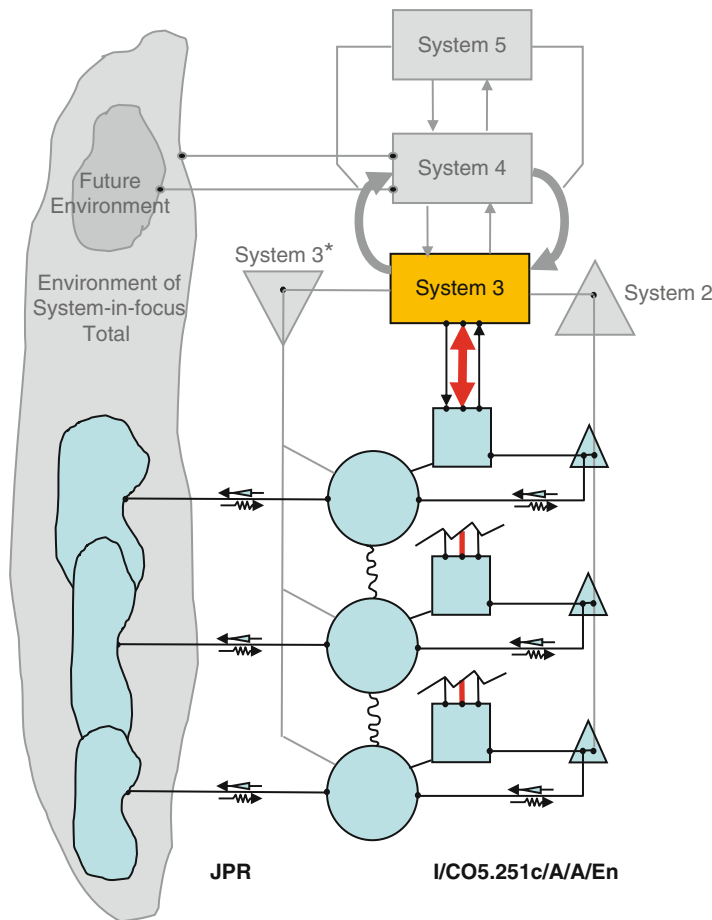


Fig. 2.32 System 3 (Negotiation of resources) (Pérez Ríos 2008e)



informed as to how far objectives are met within their unit. In addition, they should tell this System about any risk or aspect which may seriously affect compliance (Fig. 2.33).

Now that we have “identified” the main functions of System 3, we will go on, as we did when examining System 1, to evaluate, on the one hand, *the existence and composition* of the System-3 function in the organisation under study, and also to inspect the *quality of its performance*, considering finally the quality of the *connection* between System 3’s elements and the other systems or functions of the complete system of the organisation in question. Below are some of the questions to be asked or points to be made explicit.

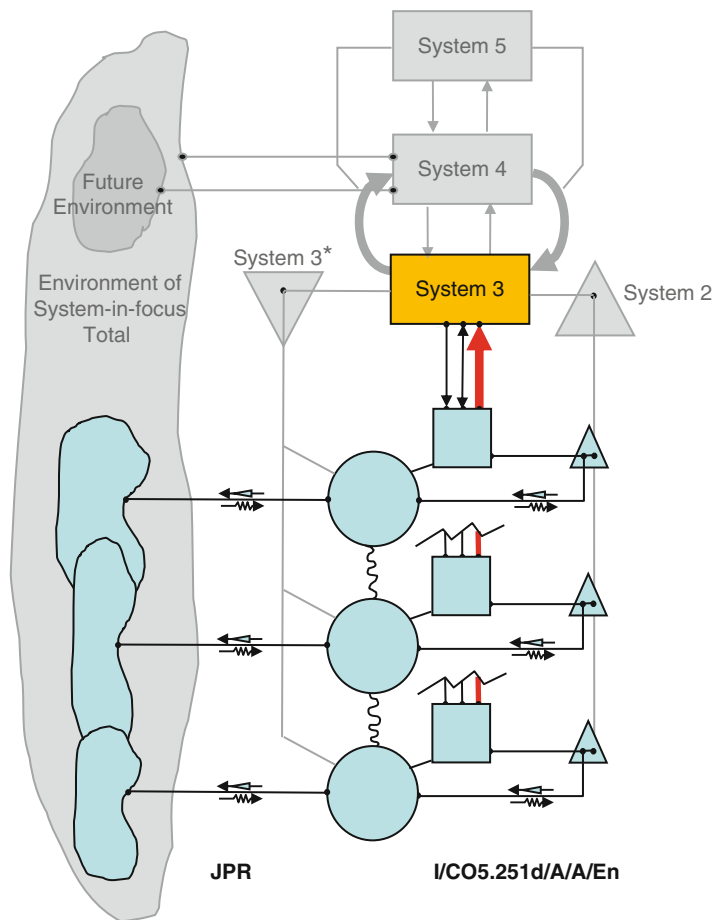


Fig. 2.33 System 3 (Accountability) (Pérez Ríos 2008e)

## Existence and Composition

System 3 is normally one of the five VSM systems that is practically always quite well represented, which is logical when we consider that, if it did not exist, the organisation-in-focus's operations unit would be formed by a set of components (its elementary operational units) that would attempt to achieve their aims individually, paying no attention to the effect of their actions on the rest. Chaos and "every man for himself" would predominate. Obviously, such a situation cannot be sustained for very long.

Consequently, the first set of questions should relate to questions concerning aspects such as:

- Identifying and describing the managers, individuals or organs (Departments, Sections, Units, etc.) whose activity is associated with the integrating aim of System 3.
- Describing each of the former's activities relating to the purpose of System 3. It is important to make a distinction between the two types of System-3 activity previously referred to, analysing, on the one hand, the one more related to System 4 and, on the other, the one more related to System 1.
- Identifying and describing the means employed by the organisation to help the managers, individuals or organs mentioned previously to perform their System-3-related tasks. Once again, a distinction should be made between the two kinds of System-3 activity, with a study made, on the one hand, of the activity nearer to System 4 and, on the other, of that more related to System 1; this is because some of the tools or aid elements to be used may be different.

The following examples may be cited as System-3-related activities for a company:

- First of all, as management functions characteristic of System 3 we will list those relating to the areas of:
  - Marketing and Sales
  - Human Resources
  - Productivity and Quality
  - Production and Operations
  - Engineering
  - Accounting
  - Budgeting
- Secondly, System 3 has the task of defining the units comprising System 1 (the complete operations unit of the system-in-focus) and their characteristics (Fig. 2.34). Here, System 3, with the approval of System 5, must define the components of System 1, the limits of each and the resources to be employed. At the same time, the purpose or aim of each unit should be specified, which concrete objectives underpin this aim, what resources are involved (human, financial, technological, physical, etc.) and, finally, what indicators are to be

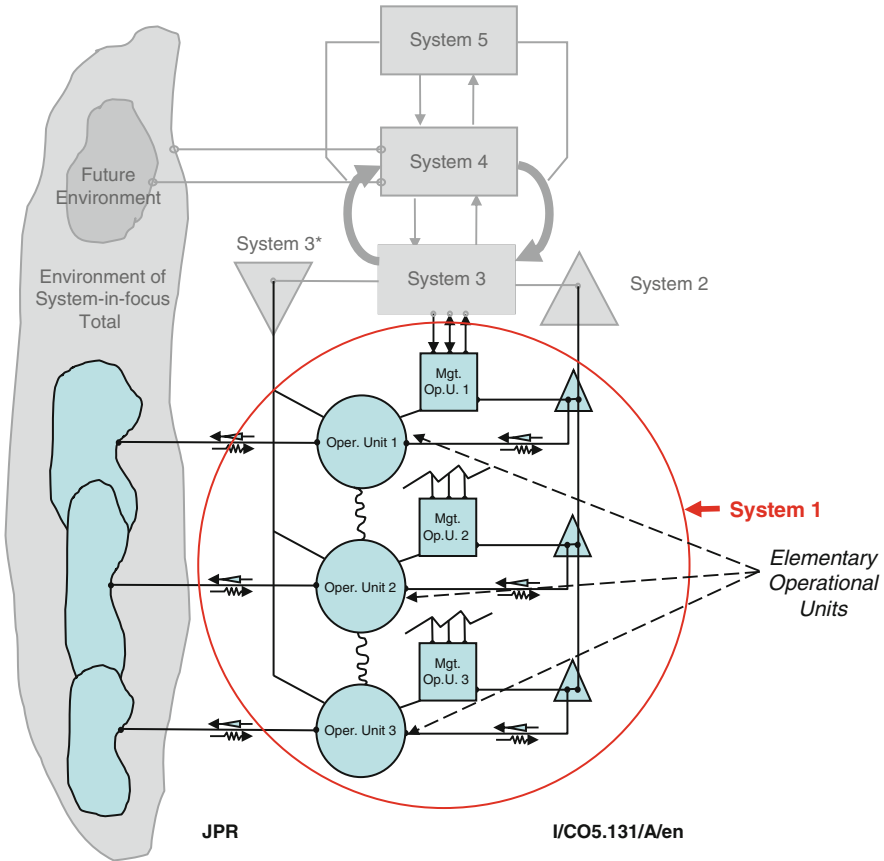


Fig. 2.34 System 1 (Pérez Ríos 2008e)

used in order to measure the extent to which each elementary unit meets these objectives. It is important to decide on indicators which are coherent with each area deemed critical for the organisation (see System 5).

- Thirdly, System 3 has to integrate the different elementary units that go to make up System 1. It must ensure that the various units work in harmony so that they perform their tasks in a coordinated and stable manner. For this to be achieved, System 3 also has the support of System 2 and System 3\*, which we will examine later in greater detail.
- A further activity of System 3 is that of designing the components to include in System 2. It should not be forgotten that the aim of this system is to facilitate coordination among the elementary units, so that ideally these can work harmoniously and without any conflict. In order for this to occur, it is vital that System 3 supply all the information on both the whole of System 1 and on each of its units (goals, resources, etc.), to enable the construction of the coordination

mechanisms that make possible an “automatic” functioning without the necessity of direct control by the only system that could do this, namely, System 3.

- At the same time, System 3 must intervene in designing the components to be included in System 3\*. Just as System 2 helps to create the means by which the elementary units work in a harmonious and coordinated fashion, System 3\* is responsible for contributing to the appropriate “behaviour” by both individuals as well as units or their parts.

### Quality of System 3 Performance

It is important to remember that this system should not normally intervene in the workings of the elementary operational units. An indicator of the correct design and functioning of the organisation is precisely that System 3 need not intervene directly in matters concerning these units. This is because they should be run by their own “management” with a high level of autonomy, since each of them in itself is a complete viable system (if we apply the “zoom” and focus on the following recursion level, we will once again be looking at Systems 1, 2, 3, 4 and 5, but this time belonging to the new system-in-focus at the next recursion level). See Figs. 1.40 and 1.41.

Direct involvement by System 3 should be limited to conveying information from the “meta-system” on aspects related to the aim of the organisation as fixing/modifying objectives, or to changes suggested by System 4 as necessary in System 1, and to the negotiation of resources. Using direct “authority” as a way of managing is, generally speaking, a sign of shortcomings in the organisation’s design. It is usually due to certain necessary functions (those we are describing) either not existing or not working properly. Use of the vertical line between System 3 and each of the units in System 1 to “impose decisions by authoritarian means” indicates that the organisation has been badly designed or is not working as it should. Among the reasons against employing this measure is System 3’s lack of detailed knowledge concerning the variety (complexity) within each of the elementary units. A manager acting in this way would most likely be drastically attenuating the variety of what he is endeavouring to “govern”, by taking decisions based on models of the problem without the requisite variety, with the corresponding harmful consequences. The impact on both the general performance of the unit affected and on the motivation and self-esteem of the managers concerned may be a very negative one.

The next point to consider when diagnosing the adequacy of System 3, or to bear in mind when designing a new organisation or system, is the relationship between that system and all the others. Let us have a look.

### The Relationship Between the Elements in System 3 and the Other Components of the Operations Set (System)

We will now, therefore, review the content of the relations between System 3 and the three remaining components of the operations set (or system), namely,

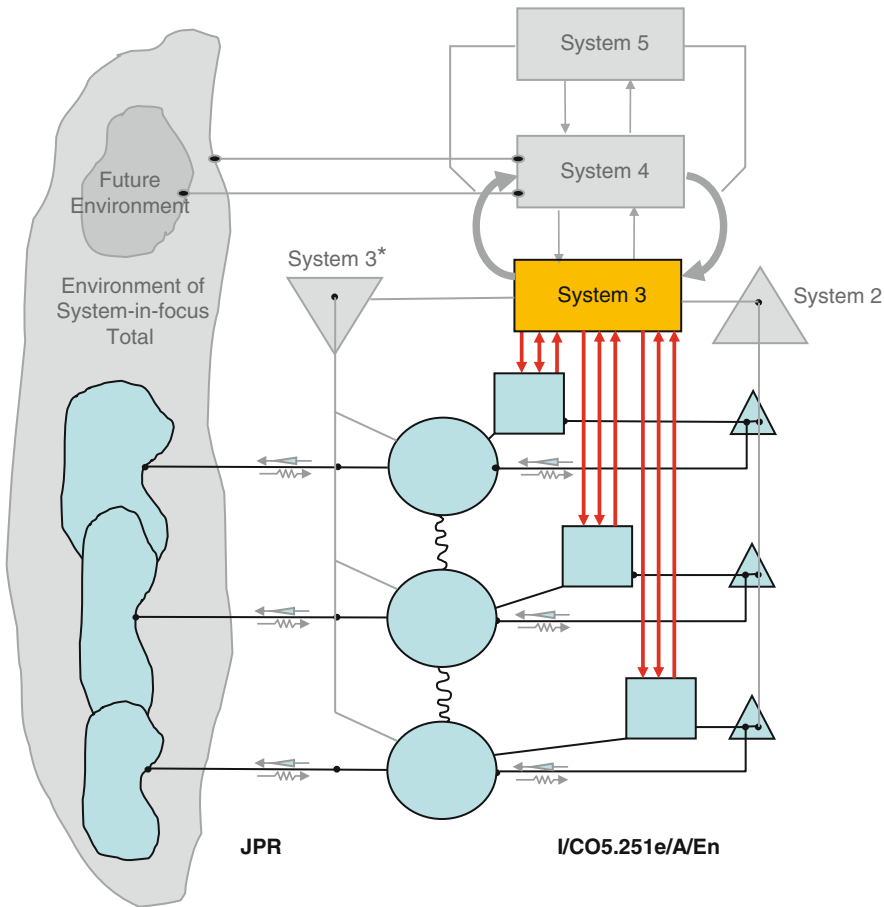


Fig. 2.35 Relationship of S3 with each unit in S1 (Pérez Ríos 2008e)

System 1, System 2 and System 3\*. We will begin by commenting on the relations, in this case vertical, between System 3 and operational units in System 1 (Fig. 2.35).

Vertical Relations with the Operational Units in System 1

The questions to be answered in connection with this set of relations concern aspects such as the following:

- Regarding the managerial style, that is, the manner in which System 3 relates to those responsible for the elementary operational units, there should be a response to questions like:

- How the objectives and planning are set out. Specification of the approach used (Top-Down, Bottom-up, Interactive, etc.). Explicit description of the management style.
  - Indicate if use is made of “Management by Objectives” or its variants.
  - Mention if an “exception report” system is used, which means that information is only requested/sent when something does not work as planned.
- Relating to issues handled in the *Resources bargaining* indicate if the following are included:
- Objectives
  - Means to achieve them
  - Deadlines
  - Rewards for each or all of them
  - Periodicity of negotiation over resources
  - etc.
- A description of how *Accountability* will be handled.
- Identifying and describing the information systems employed for providing information on how each unit is working.
  - Specifying whether this is real-time information. If not, indicating how often information is emitted for the diverse variables controlled.
  - Indicating whether warning signals are used to supply information on the seriousness of deviations from the objectives highlighted in variables considered critical.
  - Evaluating the extent to which the information to be conveyed (exceptional reports) is suitably selected, so that System 3 is not overloaded.
  - Indicating whether Score Boards suited to the specific operational units are used.
- Describing the method and means employed for transmitting the pertinent *information* in accordance with the System 3-System 1 vertical line.
- Indicating whether formal procedures are used for sending the information to the “Management” of the operational units. If so, specifying which type.
  - Explaining whether information is given to individuals or to groups.
  - Describing whether information is provided on a fixed regular basis or “depending on the necessity”.
  - Specifying the technological resources employed (E-mail, Intranets, etc.).
  - If the means are informal, explaining what they are, and how and when they are used.

### Horizontal Relations with System 2 and System 3\*

Having examined some of the questions to be considered in the relationship between System 3 and System 1, let us now review certain features of the relations System 3 has with System 2 and System 3\*.

Relationship with System 2

I said before that System 2 is a system supporting System 3 (Fig. 2.36), with the task of absorbing large amounts of variety (complexity) generated in System 1 as a consequence of the daily workings of the elementary operational units. A sound organisational design is one which, striving for the maximum degree of operational “automation” for these units, establishes systems for coordinating and resolving problems resulting from interactions among the operational units of System 1 and their competition for the available resources.

Given that the aim is make it easier for System 3 to integrate System 1 components, the former must intervene or at least participate in the design of these systems or coordination tools.

Therefore, responses must be given to questions such as:

- The extent to which System 3 is involved in identifying and proposing System-2 coordination systems.

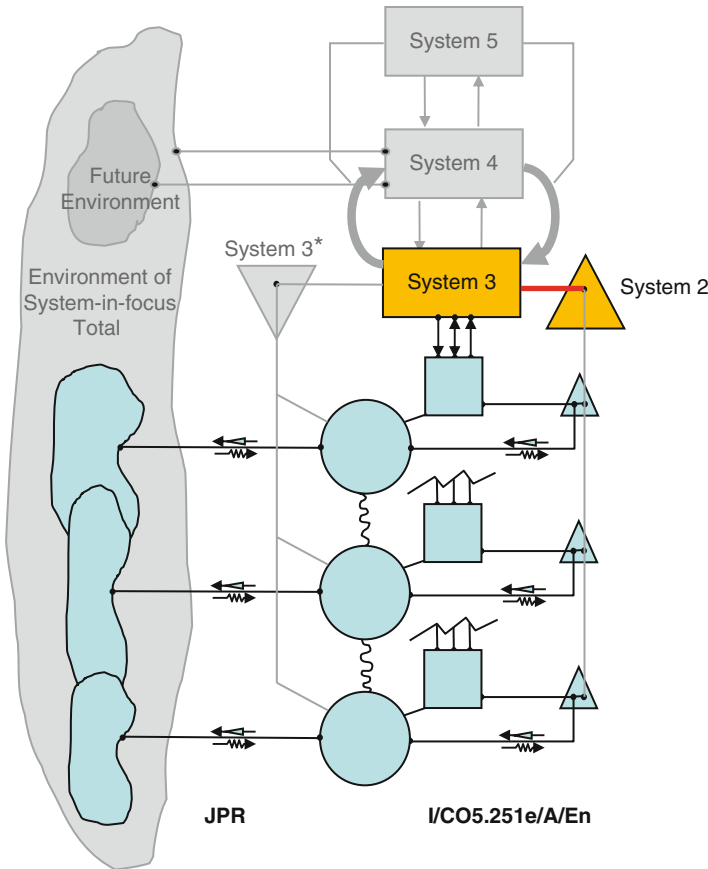


Fig. 2.36 System 3 (Relations with System 2) (Pérez Ríos 2008e)





We must, therefore, respond to questions concerning:

- The number and description of “existing channels capturing information”.
- The issues they attempt to assess.
- How we can be assured that the information captured is complete and arrives with the required temporal cadence for being useful to System 3.

### Algedonic Channel

As was seen in Sect. 3 of Chap. 1 when we reviewed the various communication/information channels, the algedonic channel (see Fig. 1.50) has certain special features. This channel’s sensors should be positioned at points critical for the organisation. It is a vertical channel transmitting alert signals which, originating in the elementary operational units when one of the variables deemed critical surpasses the alarm threshold, go vertically towards System 5. Of course, they first of all reach System 3, which should deal with the problem; if, however, this does not occur and the alarm is still activated, the message will go through all the systems until arriving at System 5 of the organisation-in-focus. That system, then, will be activated in this exceptional situation, and will intervene in response to the emergency warning from System 1.

These algedonic channels should be designed specifically for each organisation. In each case it is necessary to define:

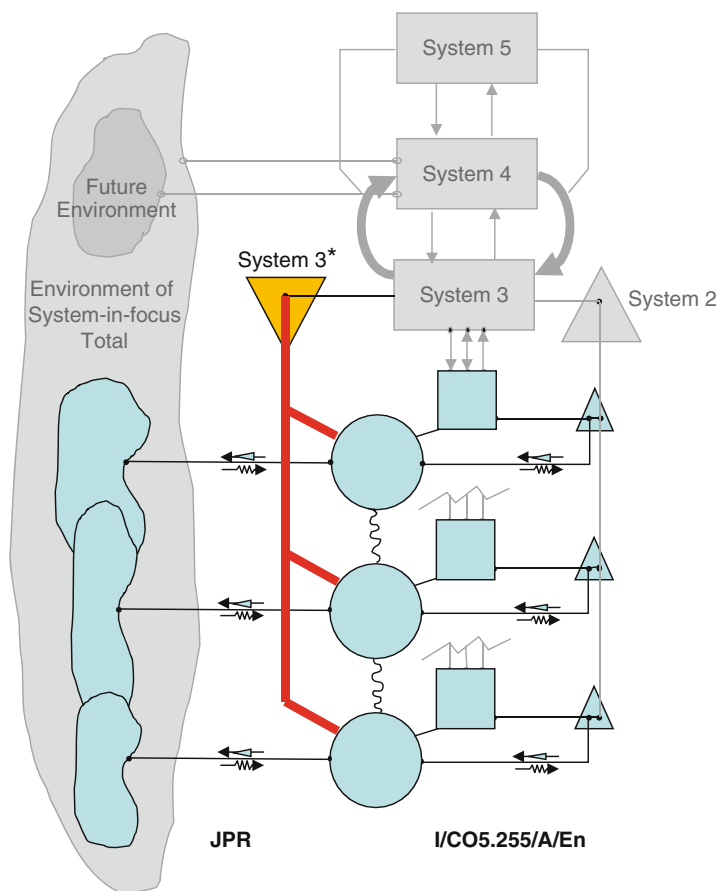
- Which variables are to be monitored.
- The nature of the “sensors” at the point where the problem may occur.
- The characteristics of the transducers.
- The design of the communication channel (capacity of the channel).
- The nature of the “activators”, that is, the “warnings” at the signal’s destination point/s.
- Where the “warnings” (signals by light, sound, images, voice, etc.) should be located.
- The individuals to whom these signals should be directed.

In the section we will see later covering the vertical dimension of System 1, algedonic channels will be described in greater detail.

#### 2.3.2.2 System 3\*

In addition to what was said earlier concerning this system (Fig. 2.38) and its relation with System 3, as well as to the description given elsewhere (Sect. 3 of Chap. 1), it is now appropriate to consider the existence of this system/function, its connection with the elementary operational units and the way it works. Among the questions to be dealt with are ones such as:





**Fig. 2.39** System 3\* (Auditing channel) (Pérez Ríos 2008e)

this case in the form of instructions, orders or the type of action the specific situation demands. All the same, intervention by System 3 will not necessarily take place via the above-mentioned vertical channel. In certain situations an analysis of the information generated by System 3\* may give rise to the design of a new coordination element (System 2) for tackling the problem detected, and as a result direct involvement via authoritarian means will not be necessary. We must remember once again that the use of this channel is, except in extraordinary circumstances, a sign of failure, in the sense that the organisation is not working as it should. If the organisation is well designed, according to the bases set down in the VSM, the very workings of the various systems/functions and the appropriate transmission of information by the many channels linking all the systems/functions and the organisation with the environment will make it unnecessary for System 3 to intervene via the authoritarian pathway.

This characteristic, implicit in the whole design of the VSM, has, among others, a justification related to the mechanisms I described at the start of this book when, in covering the framework of the “Variety Engineering” concept, I said that the so-called attenuators and amplifiers were necessary to attain the equilibrium in variety required by Ashby’s Law. One of the most powerful amplifiers an organisation possesses is the people of which it consists. If it is possible to get everyone to put all their effort into ensuring that the organisation works well, then we will be amplifying the capacity of its managers to an enormous extent. As a consequence, it is important that the organisational units are given maximum autonomy, allowing for the restrictions imposed by the need for cohesion of the system of which they are part, in order that they make use of all their potential to face the specific complexity affecting each one. This is the reason why we should try to prevent the direct intervention of System 3 in particular matters concerning the elementary operational units. If such intervention occurs, it will, on the one hand, bring about a restriction in the capacity for action by the management of the units, limiting at least in part such capacity, and, on the other, most likely generate unsatisfactory results, given the impossibility of System 3’s knowing all the details (variety/complexity) within the elementary operational units.

As a means of general amplification, therefore, the VSM proposes, to as large an extent as possible, the creation of self-organised and self-governed systems within a succession of self-organised and self-governed systems. In this idea resides one of the keys of its enormous potential for achieving efficient, efficacious and effective organisations.

### 2.3.2.3 System 2

The rationale of this system (Fig. 2.40) having already been discussed, it is now advisable to assess the degree to which it manifests, together with its functioning and relation with the other systems.

- In relation to its existence, that is to say, the quality of its representation in the organisation-in-focus, some of the aspects to analyse are:
  - A description of all the functions, tools, procedures, etc., whose function is related with coordinating, reducing chaos and increasing order in the organisation, in its System 1.
  - A description of the communication channels connecting System 2 and System 3. I have already mentioned that System 2 must filter the information generated in System 1 (within each of its elementary operational units), and convey to System 3 those aspects referring to situations of instability which the self-control mechanisms provided by System 2 are unable to resolve; in this case, direct intervention by System 3 is required.
  - An identification of the communication channels that exist between the “corporate” System 2 (by which is meant the one serving the system-in-focus’s System 3) and the System 2s of the elementary operational units.

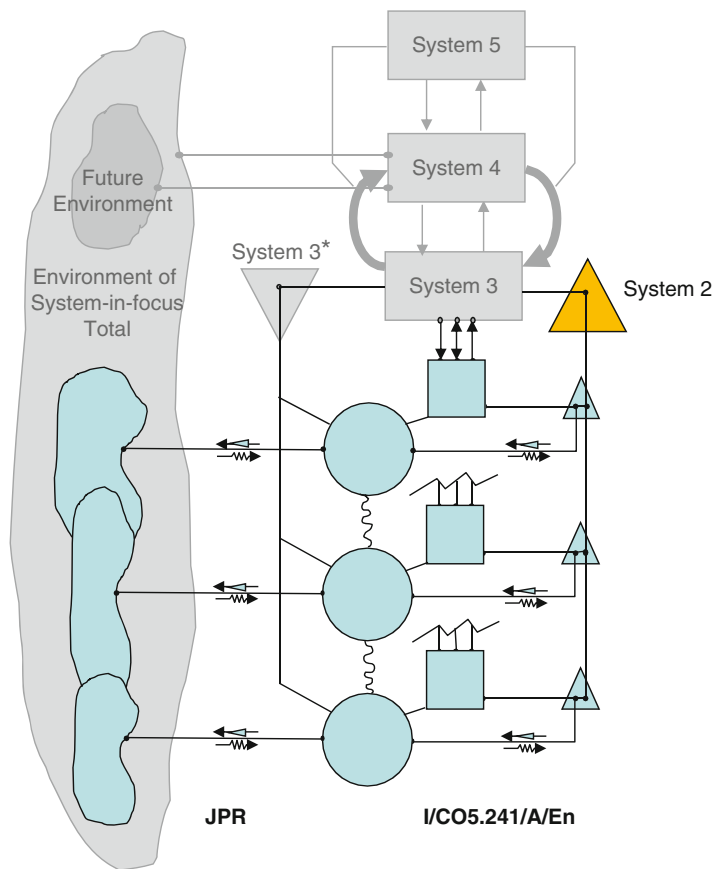
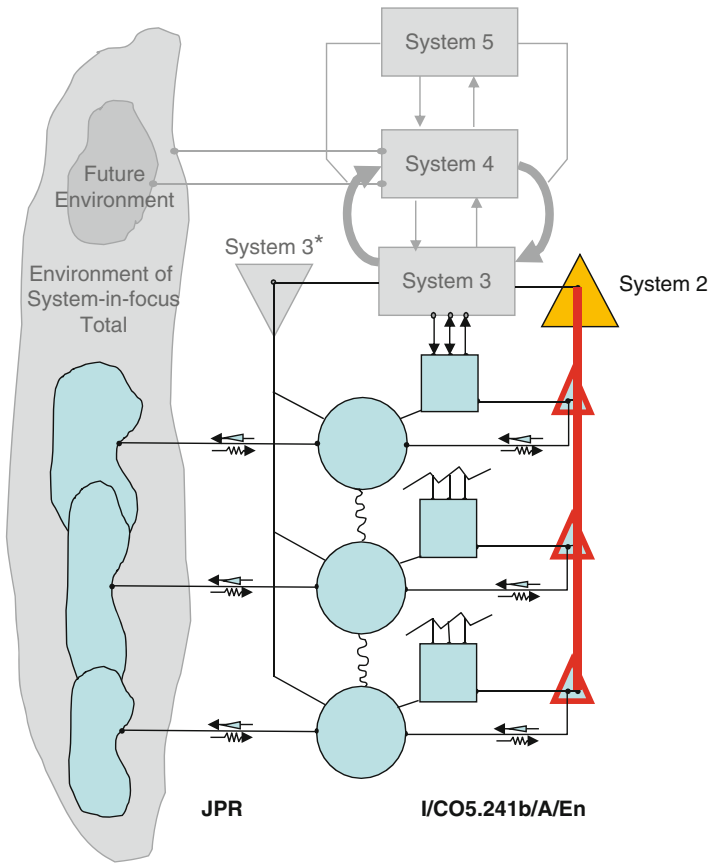


Fig. 2.40 System 2 (Pérez Ríos 2008e)

The “corporate” System 2 (Fig. 2.41) must act as a collector of the information transmitted by the local System 2s corresponding to each of the operational units constituting System 1, which provide information on unresolved conflicts affecting the different units.

In addition, the “corporate” System 2 is responsible for sending to the local System 2s of the elementary operational units the relevant information coming out of System 3 (new working norms, new programming, changes in style, new accounting and legislative regulations, etc.).

This dual channel of vertical communication linking the “corporate” System 2 with the System 2s of each elementary unit must also be well designed and monitored. Therefore, we must again check typical elements (elements to connect, type of information to transmit, transducers and characteristics of the channels).



**Fig. 2.41** System 2 (Coordinating channel) (Pérez Ríos 2008e)

- A final consideration concerns those who play a role in designing the procedures or tools, etc., pertinent to System 2. It is appropriate that this should obviously be done by the representatives of System 3, as only they have a global vision of the set of units comprising System 1. However, those representing the local System 2s belonging to each of these units, together with their local management representatives, should also intervene.
- This multiple participation is necessary to ensure coherence of procedures and other coordination tools employed among the organisation's diverse levels of recursion.

Consequently, questions relating to the following aspects have to be considered:

- Identifying the persons belonging to System 3 who play a part in designing System-2 elements.
- The same question referring to the management of the elementary units.

- Further questions looking more deeply into whether meetings are held to do this work and, if so, who is involved, how these meetings are called, where, when and what are the means and information used, etc.

2.3.3 System 1: The Operations Units

After this analysis of all the systems (Systems 2, 3, 3\*, 4 and 5) whose aim it is to contribute to System 1's doing what it is supposed to do in line with the purpose of the organisation, we must now check to see that System 1 (Fig. 2.42) has everything it needs in order to perform its function.

System 1 can be made up of several elementary operational units which, for example, in the case of a firm may consist of different product lines, or in

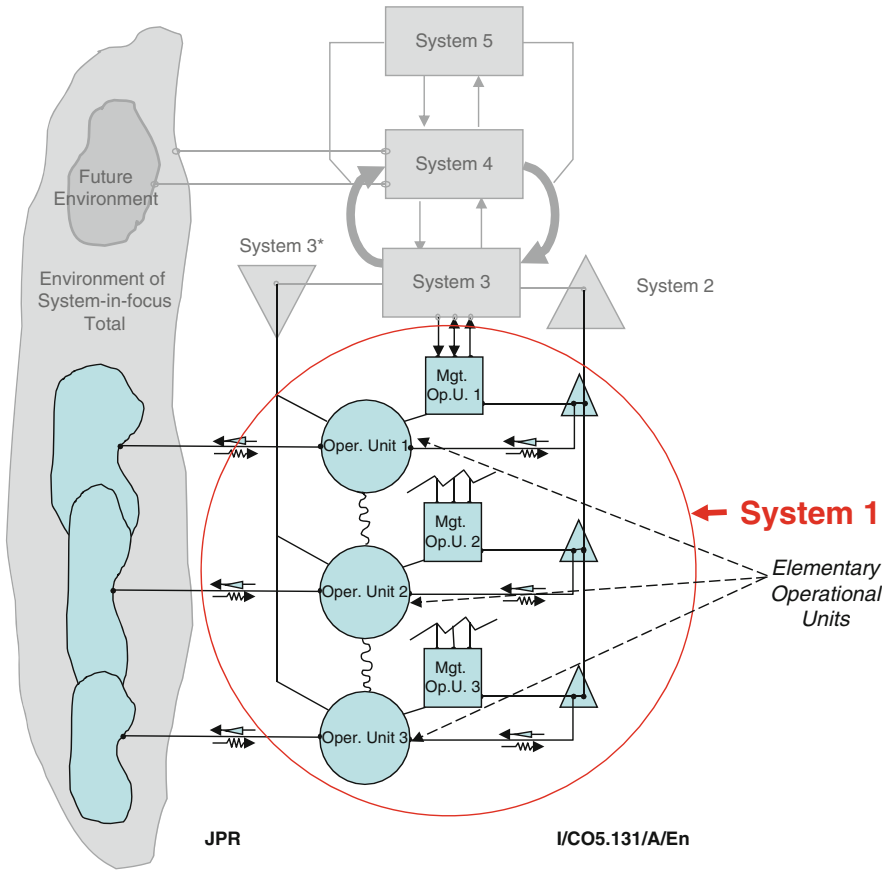


Fig. 2.42 System 1 (Pérez Ríos 2008e)

a university of the different faculties, or in a health system of the various health areas, or in a country of the distinct autonomous communities, etc. From the structural point of view of the VSM, the components of each unit are always the same and consist of: (a) the specific environment, (b) the operational unit in the strict sense (the operations), (c) the management of the operational unit and (d) the specific System 2 of each operational unit. These four elements are connected by information channels so that information flows continuously, guaranteeing a dynamic balance between all the components (see *Beer's First and Second Principles of Organisation*, Appendix II); the ultimate aim is to make sure that the operational unit provides the environment with the goods or services that constitute its reason for existing, and that all of these units provide the goods or services of the organisation-in-focus.

### 2.3.4 Horizontal Dimension of System 1

These four elements or components, with their connecting communications, constitute the set of relations in System 1's horizontal dimension. The relevant variety in the environment must be absorbed, in accordance with the stipulations of Ashby's Law, by operations, and similarly the residual variety of the operations must be dealt with by their management.

The questions to be raised are to a certain extent familiar. If we begin with the relationship between the specific environment and the operations, the questions for each operations unit making up System 1 (Fig. 2.43) are related to the following elements:

- Identifying the aspects in the environment thought to be relevant for the operational unit. A detailed description of each aspect (commercial, technological, competition, economic, demographic, legislative, ecological, labour, political, educational, etc.).

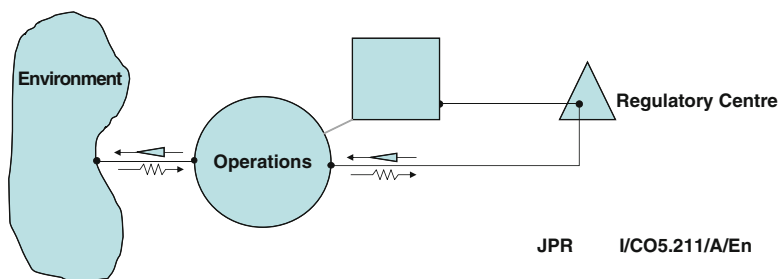


Fig. 2.43 Basic operations unit making up System 1



- Identifying the sensors at our disposal for capturing information associated with such aspects (what kind, where, how often information is captured, how it is transmitted, etc.).
- Describing the transducers converting this information into the proper format for being sent via the communication channels to those in operations who receive it.
- Characteristics of the communication channels (types, capacity, etc.).

We would ask similar questions to assess the quality of the communication channels from operations to the environment. Here we try to ascertain who is addressed by the information sent from operations. Again, we will need to check the characteristics of the transducers (for both operations/sender and environment/receiver) in addition to the channels employed.

In order to clarify these ideas, let us look at an example based on firms in the press sector. In this case, we would need to examine, in the elements of the channel between the target public and the newspaper publishers: (a) the position of the sensors, in order to receive information on how satisfied readers are with a particular paper; (b) the way in which information is captured and the format in which it is to be sent; (c) the channel to be used for transmission (e.g., via Internet or conventional mail, or by telephone, etc.); (d) the method for converting and presenting the information when reaching the newspaper, so that it can be consulted by those who are going to analyse and use it. In the opposite direction, that is, the channels between the newspaper and the readers (and supposing, say, that our aim is to enlarge our audience), we would have: (a) the format in which the message will be sent; (b) the channel to be used for maximum amplification (one such amplification channel employing current technologies of Web 2.0 would be to recommend to users/readers that they pass the message among themselves).

Obviously, in each particular case it will be necessary to consider the specific elements involved, but the structural components are always the same.

The next set of relations to explore has the task of connecting Operations with their corresponding Management. To achieve this, the latter has the assistance of its specific System 2. Once more, the particular questions to be raised refer to the existence of the communication channels needed for the information sought by Management in carrying out their task of running operations. That information needs to arrive correctly. Again we will examine: the type of information to be captured, the points where it is obtained, the frequency, the means of transmission, the transducers, the types of channel used and the format in which the Management of the unit receive it. In the opposite direction, we will need to explore how Management transmit both information and decisions to the action points within the operations they direct. Once again we will need to determine the convenience and design of the amplifiers required to increase management's capacity for influence.

Finally, and in relation to the interaction between the Management and Operations of an elementary operational unit, we must bear in mind many of the aspects referred to when we studied the relationship between System 3 and System 1, since this is the same as the relationship between the Management and

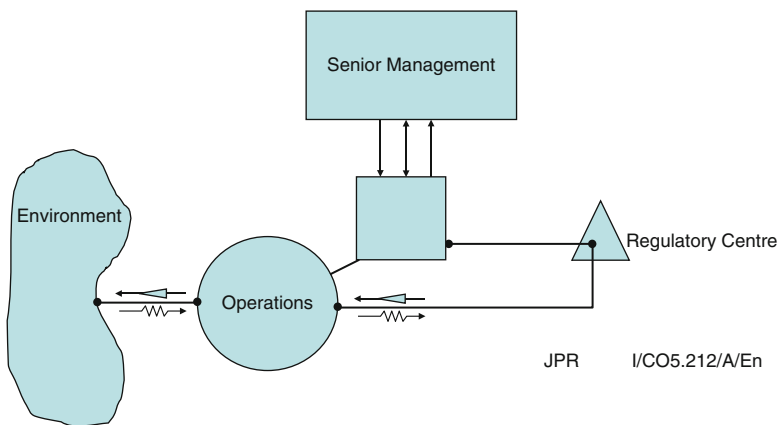
Operations of an elementary operational unit when we go to the next recursion level, in other words, when our organisation-in-focus (system-in-focus) is one of the elementary operational units of the current organisation-in-focus.

### 2.3.5 Vertical Dimension of System 1

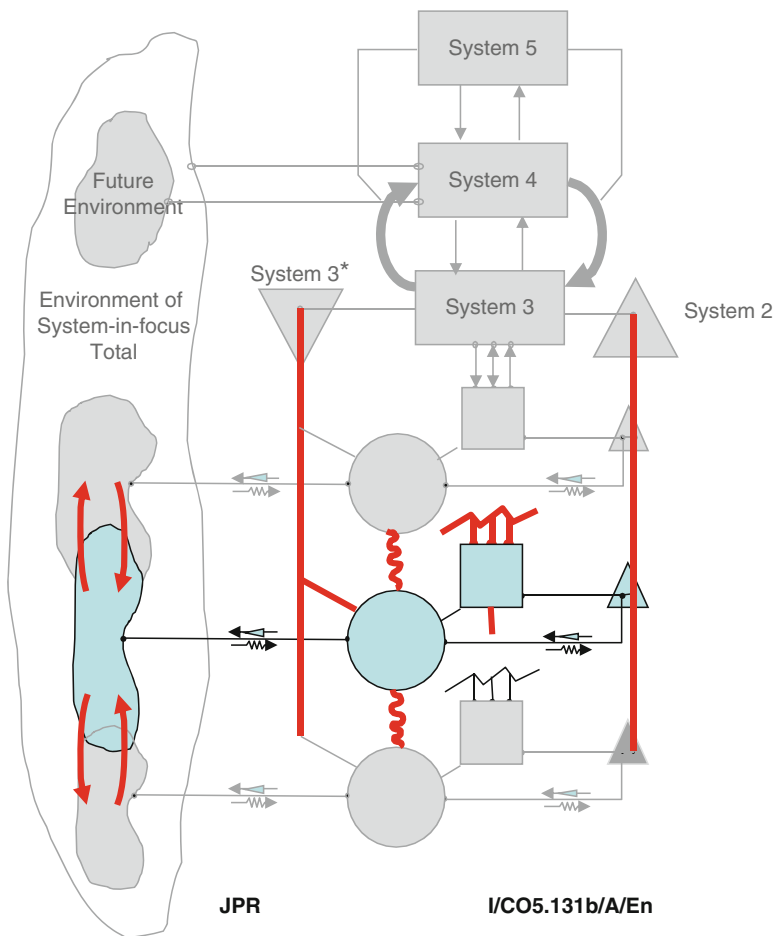
Having studied the *horizontal* relations of the elementary operational units' components, that is, their relation with the environment and the interconnection between management, the operations it directs and the use of System 2 as support for managing the unit, we must now turn our attention to those connections with the rest of the system-in-focus in which the operations units play a role. These are:

- (a) Relationship between the elementary operational units themselves.
- (b) Relationship between the "Managements" of each elementary operational unit.
- (c) Relationship between each "Management" of an elementary unit and System 3 (Fig. 2.44).
- (d) Relationship between the System 2s of the different operational units and "Corporate" System 2 (directly connected to System 3).
- (e) Relationship of each operational unit with System 3\*.
- (f) Relations between the specific environments of the elementary operational units.
- (g) Algedonic channel.

All the relationships I have just mentioned refer to *vertical* channels of communication and absorption of variety (complexity) which, taken together, must be capable of absorbing all the variety that, in the horizontal dimension, must be faced by the elementary operational units so as to fulfil their aim of providing the



**Fig. 2.44** Elementary operational unit of System 1 and relation with System 3 (Corporate or "Senior" management)



**Fig. 2.45** Vertical dimension of System 1 (in the VSM set) (Pérez Ríos 2008e)

environment with their products or services (Figs. 2.45 and 2.46). Ideally, all variety is equalised at this crossing (see Beer’s *First Axiom of Management* in Appendix II).

**2.3.5.1 Relation Between the Elementary Operational Units Themselves**

Beginning with the operational units, these may be related to a greater or lesser extent, either because they form parts of supply chains, in which the products leaving one unit then enter others (inputs), or because they deal with partial aspects of particular services, etc. (Fig. 2.47).

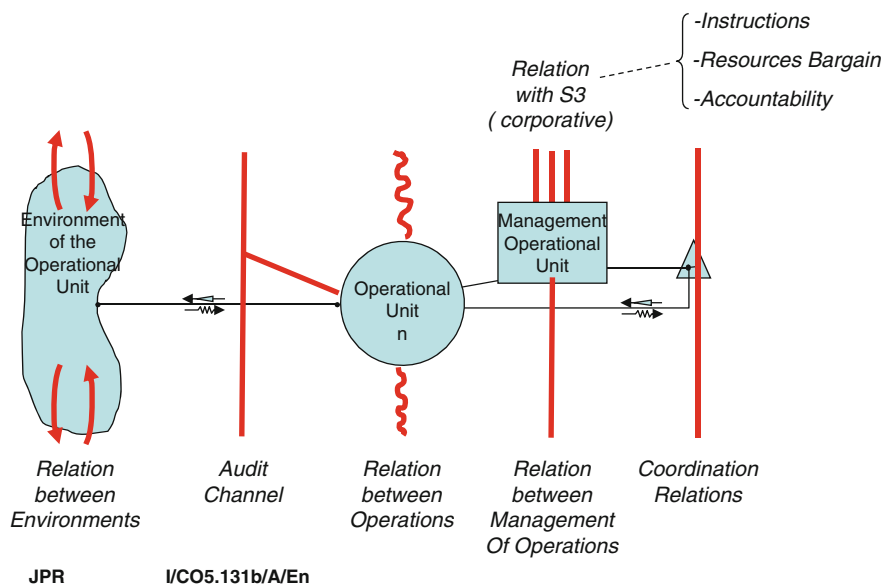


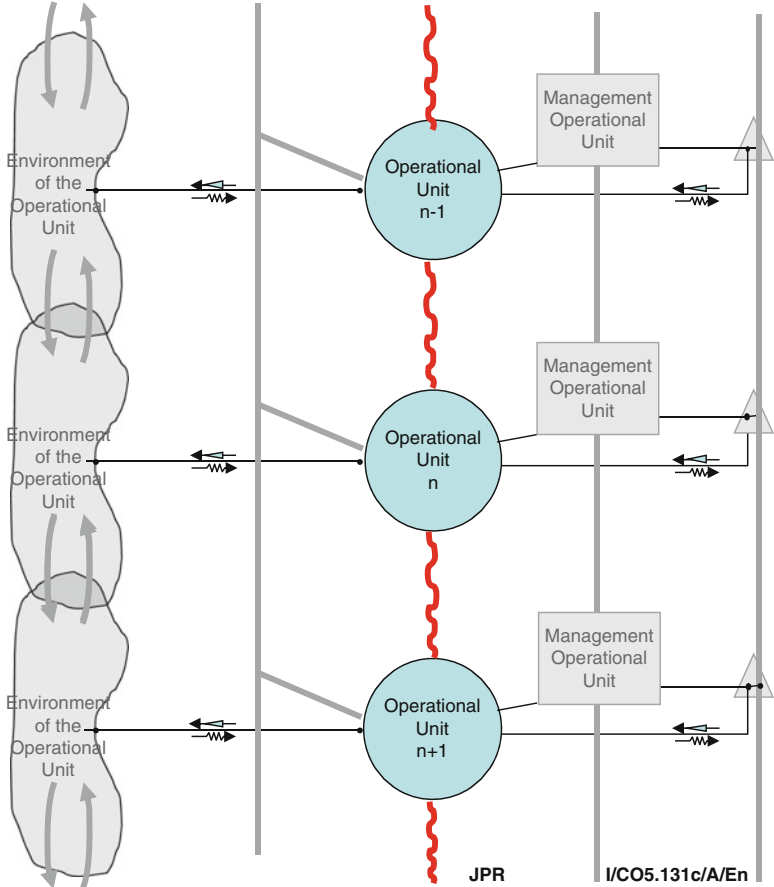
Fig. 2.46 Vertical dimension of a System 1 elementary operational unit (Pérez Ríos 2008e)

It is appropriate in this case to study the precise detail of such relations. Consequently, the type of connection that might exist (physical, personal, informative, financial, etc.) must be made explicit. Again, the ideal situation would be for incidences resulting from these connections to resolve themselves within the actual relation rather than conveying variety (complexity) to the Meta-system. Conflicts between the diverse operational units not resolved directly by these must be dealt with by System 2s. Finally, those which have not been addressed will, after passing through all these filters, reach System 3, which will then have to intervene and finish with the problem.

As we know, calling for System 3 to act must always be an exception. A smooth-running organisation should be able to resolve the endless number of problems that occur in its operational units within the framework of System 1.

The questions we should ask ourselves regarding this section for the organisation under study relate to:

- Whether there are relations between the operational units.
- A detailed description of each one of these relations.
- The communication channels between the operational units.
- The characteristics of these channels (a review of the eight typical components and the type of information circulating).
- The frequency (whether there is a permanent continual connection, or whether it is at fixed intervals, or sporadic and ad hoc).
- The linked individuals/organs belonging to the units.
- Etc.



**Fig. 2.47** Relations between elementary operations (System 1) (Pérez Ríos 2008e)

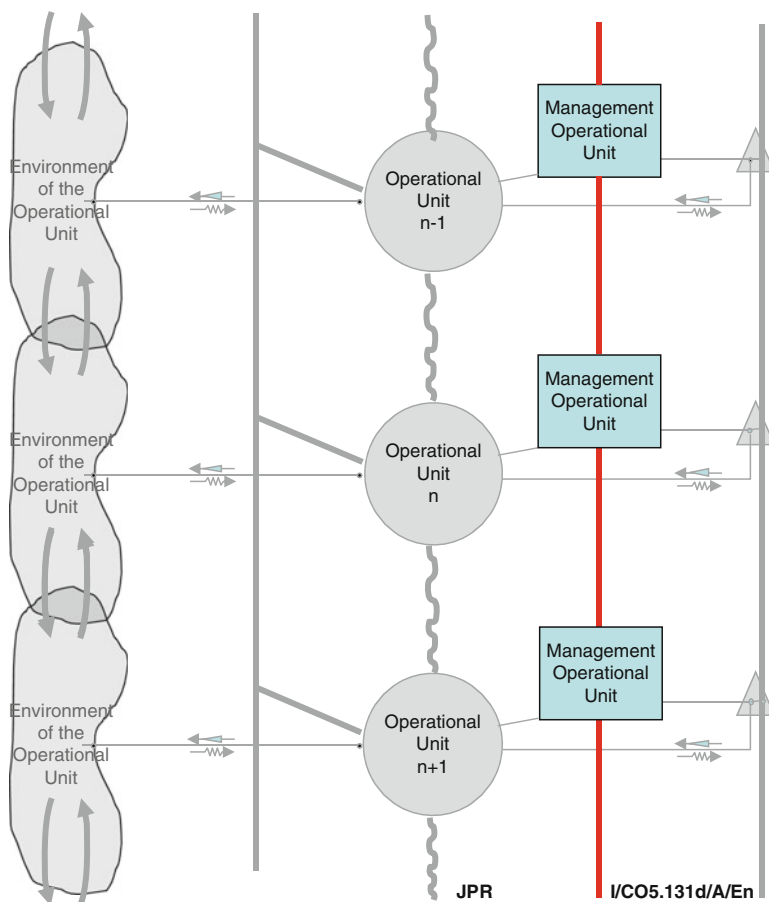
Here it must be observed that there may be multiple connections among the basic operational units and, as a result, a two-dimensional graphic representation would not serve. What is more, the content of these relations may be of quite diverse characteristics. Therefore, we once again stress the usefulness of possessing software like VSMo<sup>®</sup>, as it allows us to visualise the complete matrix of interrelations among all the elementary operational units regardless of their number, as well as to introduce in each relationship between units all the information required regardless of format. It permits the introduction, apart from texts, images or videos, simulation models representing either production or operations processes. In Chap. 4, which shows the characteristics of VSMo<sup>®</sup>, such possibilities are examined in greater detail.

### 2.3.5.2 Relation Between the “Management” of Each Elementary Operational Unit

What I dealt with in relation to the links between the elementary operational units themselves can largely be applied to the connections between the “Management” of each of them (Fig. 2.48).

In the previous paragraph, I have referred only to connections between individuals or units and sections, etc., within the production (operations) units of the diverse units, which permit the latter, directly linked, to deal with aspects pertinent to this relationship. I am now going to focus on the relation between the “Managements” of each unit.

This involves ascertaining whether such relations exist and, if they do, seeing how they are carried out (formal or informal meetings, tele-communication employing different technological means, etc.).

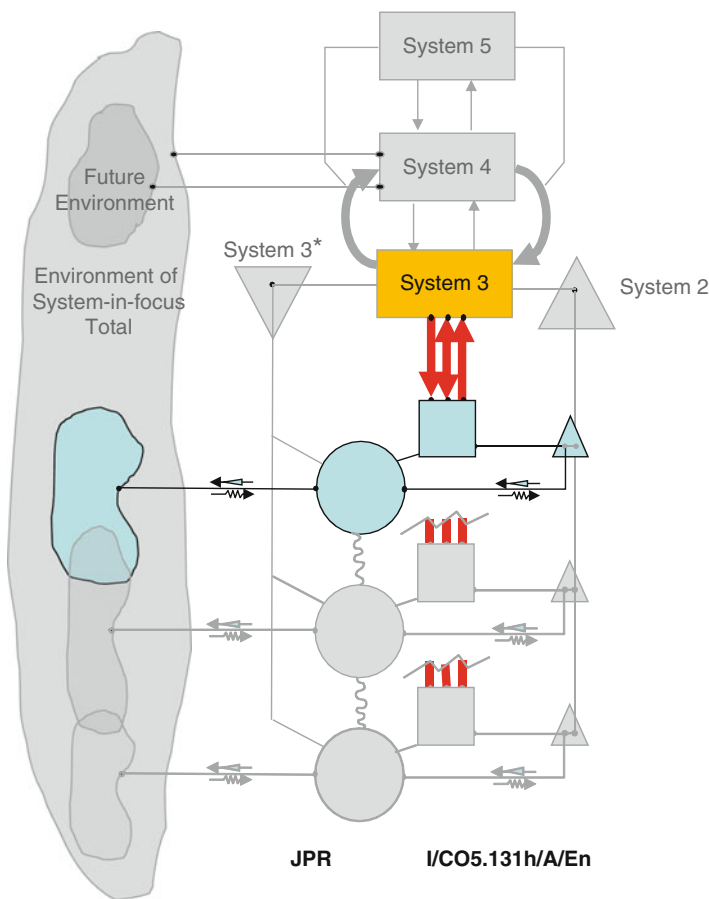


**Fig. 2.48** Relations between the “managements” of the elementary operations (System 1) (Pérez Ríos 2008e)

We again undertake a thorough exploration of each communication channel and check the following: what information is transmitted, which parties are connected, how the information is “transduced” at the points of both emission and reception, the capacity of the channel or frequency, etc.

**2.3.5.3 Relation Between Each Elementary Unit “Management” and System 3**

This relation was observed from the point of view of System 3 when we analysed that system. The kind of relations and their content are the ones described there although here, they are studied from the viewpoint of the “Management” of the elementary units (Fig. 2.49).



**Fig. 2.49** Relations between the “Managements” of elementary operations (System 1) and System 3 (Pérez Ríos 2008e)

Now, depending on the management style (“Top-Down”, “Bottom-Up”, Interactive, Management by Goals, etc.), we examine how the System 3 on which each unit “Management” depends is informed or consulted.

Apart from the aspect corresponding to the process of *Negotiating resources* (goals, means of achieving them, deadlines, rewards associated with each or all of these, or how often resources are negotiated), we should make an in-depth analysis of how *Accountability* is done (the information systems used to give information on how each unit is progressing, as well as the frequency with which information is transmitted, including details of whether this is continuous in real time, discontinuous at fixed intervals, sporadic (ad hoc), or only when requested, etc.).

In addition, we should specify the method and means by which the relevant *information* is transmitted through the vertical Elementary Operational Unit-System 3 line, checking, among other things:

- If formal procedures are used for channeling the information from the “Management” of the operational units to System 3. If so, which ones.
- If information is sent at fixed intervals or “according to needs”.
- What technological tools are employed (Email, Intranets, etc.).
- If methods are informal, specifying which, how and when they are used.
- If warning signals are employed to provide information on serious deviations from the assigned targets in variables considered critical.
- If the type of information to be sent (exception reports) is suitably selected in order to prevent System 3 from overloading.
- If Score Boards are used in the elementary operational units, and if they are connected with those of System 3.

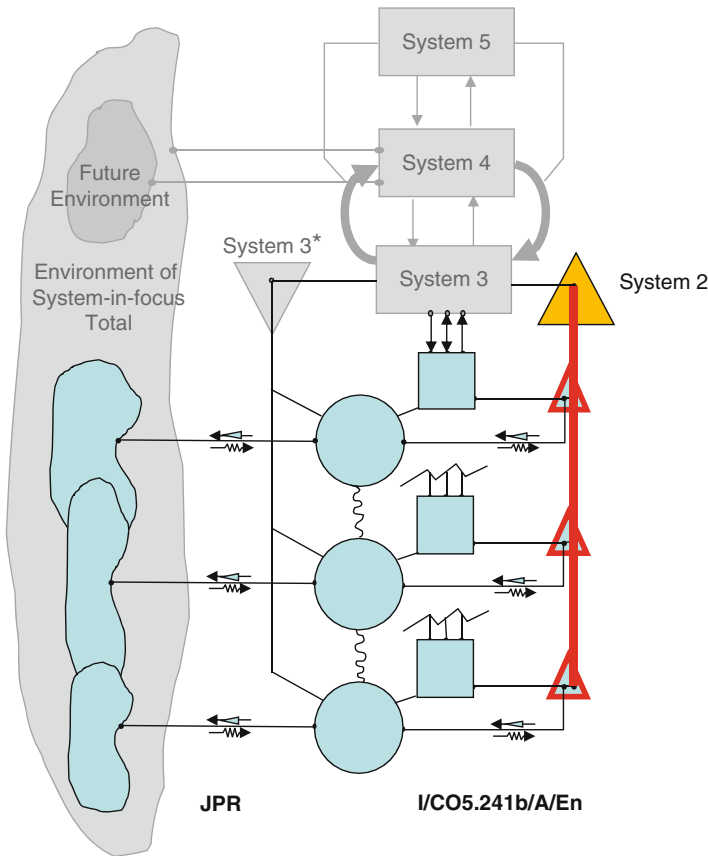
#### **2.3.5.4 Relation Between the System 2s of the Different Operational Units with “Corporate” System 2 (the One Directly Linked to System 3)**

As I have previously commented on the functions of System 2, what we should do now when considering diagnosis or design is to ensure that the vertical communication relations between the System 2s that serve the elementary operational units and corporate System 2 actually exist and work properly (Fig. 2.50).

It is via the ascending and descending channels connecting the System 2s of the elementary operational units and corporate System 2 that, on the one hand, information circulates from the former systems to the latter, giving corporate System 2 the opportunity either to adapt its coordinating elements in view of the information received or to consider creating new ones (together with those responsible for the elementary operational units and System 3). In a downward direction, we will have the flow of information between corporate System 2 and those of the elementary units, informing them of the new “programs” or of the new measures designed to harmonise activities, etc.

Consequently, the questions we should review are concerned with verifying whether:





**Fig. 2.50** Relations between the System 2s of elementary operations (System 1) and corporate System 2 (Pérez Ríos 2008e)

- There are both ascending and descending channels linking corporate System 2 with the System 2s of each individual operational unit.
- The representatives of each elementary operational unit play a part in designing System 2, in collaboration with corporate System 2 and with the assistance of System 3.
- The communication channels meet the conditions demanded for complying with their function as information transmitters (identification of the information to be transmitted, elements to be linked, transducers at the point of emission and reception, capacity of the channels and temporal cadence).

It is fitting to remember at this juncture the particular characteristic of these channels from the point of view of their routine nature. We should bear in mind that the routines they deal with are exclusively associated with coordination among the elementary operational units, that is to say, they help to soften any behavioural

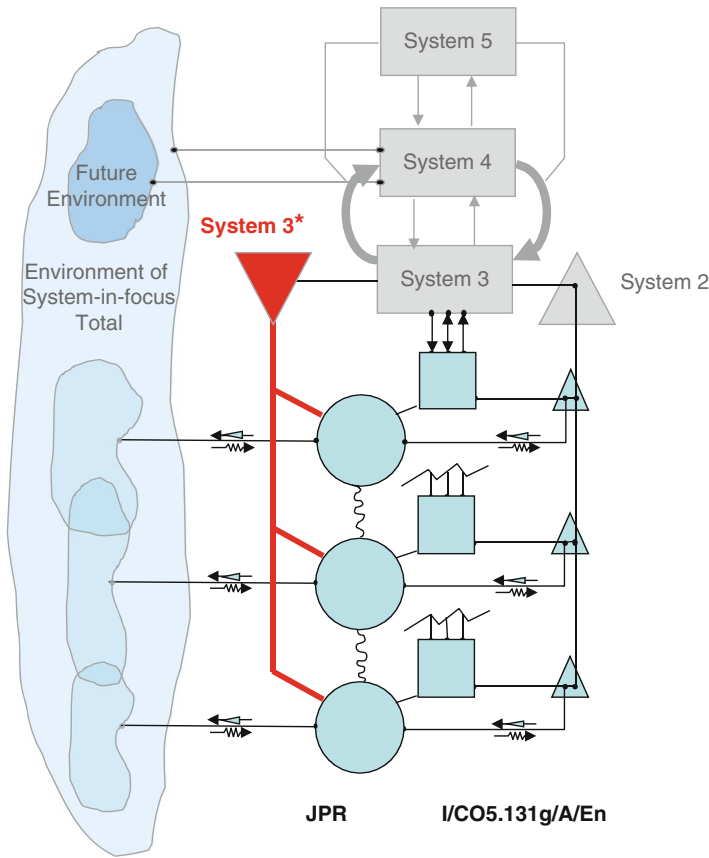
oscillations which might occur. I mentioned previously that other routines must be dealt with on the vertical System 3–System 1 axis.

This distinction is important, given the difficulty of recognising the nature of System 2 and its enormous capacity for absorbing the variety resulting from inter-relations between operational units.

2.3.5.5 Relation Between each Operational Unit and System 3\*

In the section on System 3\*, I explained the special characteristics of the information that this system must supply to System 3, and its important role as a generator of information which neither System 2 nor the vertical System 3 – System 1 channels provide.

Bearing in mind the function and special nature of System 3\*, what we must do for each of the elementary operational units is to ascertain (Fig. 2.51):



**Fig. 2.51** Auditing channel that links System 3\* and elementary operations (System 1) (Pérez Ríos 2008e)

- The existence of procedures specifically created for capturing information of this type, for instance, audits. These may relate to finance, accounting, opinion surveys, staff motivation, quality, industrial engineering studies, etc.
- The procedures used to capture the information (their quality).
- The means by which communication is made to members of the operational units, about both the need to carry out these activities and the ways they are put into practice,.
- The characteristics of the channels via which the information is transmitted (what information, where and how it is captured, transducers, the capacity of the transmission channels, who the recipients are, how the information is presented to them, etc.).

### **2.3.5.6 Relations Between the Specific Environments of the Elementary Operational Units**

One aspect which may appear to be outside the organisation being studied concerns the relations which might exist between the elements of the environment that are in some way associated with it. Such relations may arise spontaneously, or they may be occasioned to a certain extent by the organisation itself. Acknowledging the existence of these is crucial as, on the one hand, they can act as enormous absorbers of variety (complexity), which consequently does not need to be absorbed by the organisation, and, on the other, they may produce an effect on the diverse organisational units in System 1 or even among operational units of different levels of recursion. Let us clarify these aspects with some examples.

An example of the first case, in which variety is absorbed, would be the design of a customer assistance policy by firms providing maintenance services for a commercial brand of a particular organisation (for instance, computer equipment), or services for the sale of cars directly to the customer by car dealers. These activities absorb a great deal of variety, saving the organisation a particular task; in the case, for example, of car dealers, this involves the whole process of making a sale, such as dealing with the various visits made by a potential buyer, demonstrations or test drives, etc.

Examples of the second inter-relationship, in which knock-on effects are produced, may be the impact resulting from the sale of a particular product which replaces another from the same company. Here, an operational unit carries out its activity in its environment (market), but in doing so it enters the environment (market) of another operational unit. A study of the behaviour of these two markets is essential for the whole organisation, so that it can adequately evaluate its product and commercial policies.

Once again, in order to diagnose or design our organisation, we must ask ourselves (Fig. 2.52) these questions:

- What are the relevant environments for our organisational unit?
- Which other environments are they related to?



to others arising in the environment, will, if they get past the activation thresholds, reach System 5 and cause it to act.

This information system runs parallel to all the vertical channels we have looked at so far. Its function is to transmit alert signals regarding any event or circumstance that might seriously endanger the organisation.

This channel must have its corresponding filters, to prevent the flow of any and all kinds of signal, regardless of the seriousness of the situation generating it. The filters must exclusively permit only those signals deemed critical for the organisation's survival. In practice, statistical filtering techniques may be employed to detect values of the critical variables which appear outside the acceptable trajectory.

Given the importance of this channel (Fig. 2.53), we should ascertain:

- First of all, whether it exists. Obviously, there may be multiple channels, with each corresponding to any particular aspect considered vital for the organisation.
- The variables to be monitored.

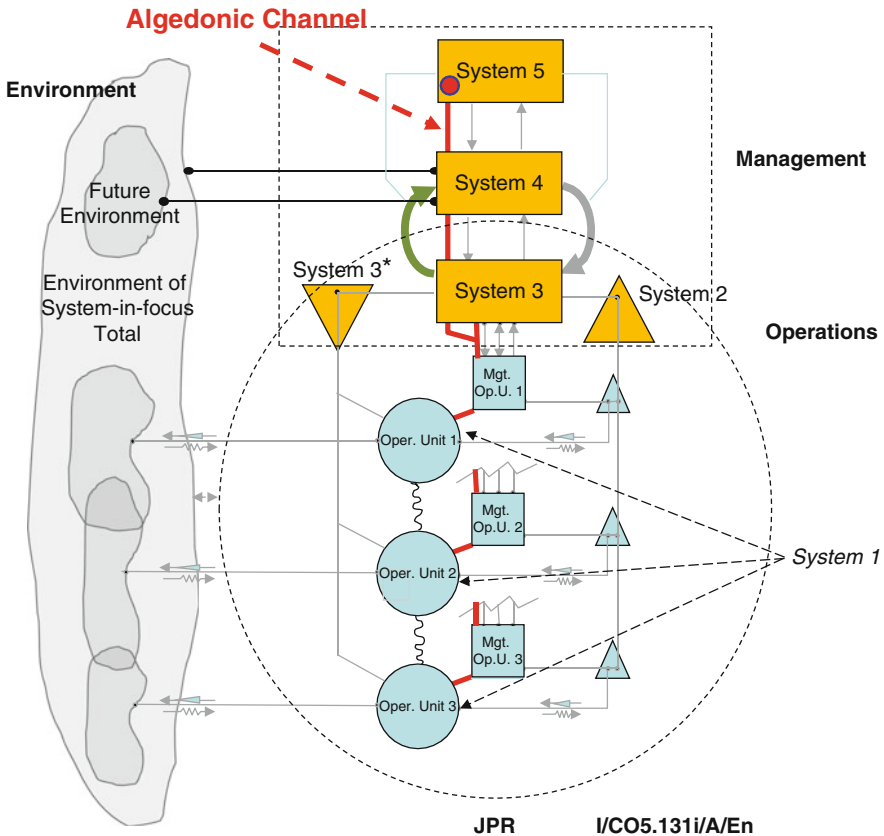


Fig. 2.53 Algedonic channel (Pérez Ríos 2008e)

- The location of the sensors.
- The activation thresholds, that is, the value at which the alarm signal is transmitted. Here it may be convenient to establish several alert levels depending on the progressive gravity of the situation.
- That activation must take place at the exact moment the diverse thresholds are exceeded.
- The channels via which warning information is to be sent.
- The characteristics of these channels (elements connected, transducers to be used, capacity of the channels for the amount of data per time unit, etc.).
- The existence of means for filtering information in order to avoid the circulation of irrelevant information and its unduly reaching the higher levels of the organisation.
- The elements receiving the alert information. We should specify which signal receivers in Systems 3, 4 and 5 are pertinent.
- In System 4, we must additionally have reception points for signals from the environment that are also related to critical information for the organisation's survival.
- This information combined with that coming up from System 1 and emitted by System 3 (after considering a possible resolution of the alerted problem within its scope of activity) will be elaborated and sent off to System 5 if thought to be critical.
- If System 5 considers that the gravity of the situation is such that it will apply the measures previously prepared albeit de-activated until actually required. These action plans cannot be improvised (they must not be) since, generally speaking, once an emergency situation has occurred, there is not enough time to analyse, model the problem, evaluate alternatives, choose the right ones, decide on action and finally act. By the time all these steps have been taken, the damage will undoubtedly have been done.
- The solution to this dilemma is to have drawn up beforehand the various plans of action for the different foreseeable emergency scenarios.

As regards this point, the cases in Spain (not to mention other countries) of the ship “Prestige” (the image of the decision-takers acting erratically, as clearly demonstrated by the ship's route, with the devastating consequences for a large part of the Galician coast and others), or catastrophic fires detected too late, etc., represent a painful indicator of the lack of suitable algedonic channels as well as of appropriate action repertoires (action protocols) for cases like these. Examples of reasonably well designed protocols are to be encountered in the public health sector (risk of epidemics, etc.).

The best intentions, however praiseworthy they might be, are unfortunately quite ineffective in vital emergency situations like those that algedonic channels are designed to detect.

A further reflection leads us back to System 4 and the Operations Room we mentioned when discussing this system. The existence of already constructed models (although, of course, subject to modification and updating) which permit an immediate simulation of the effects of an exogenous event on our organisation

and environment, and which allow us to evaluate in a very short time the “foreseeable” results of diverse measures to deal with this event, are to be wholly recommended in all organisations. It stands to reason that they are even more necessary when the risk of possible damage is greater as a result of their absence.

## 2.4 Coherence Among the Different Recursion Levels

So far in the first stage, we have defined or clarified the identity and purpose of the organisation under study. Then, in the second stage, we have identified the recursion levels with their respective environments and organisations pertinent for our organisation (to be diagnosed or designed) to deal with the complexity of the environment in the vertical dimension of unfolding complexity. We have also, in the third stage of the study, revised each of the components of the VSM corresponding to all the organisations belonging to the global one with which we are concerned. The final step, therefore, is to check on (or, if we are designing a new organisation, to ensure) the coherence and structural unity among all the different organisations, at their diverse levels of recursion and in accordance with the corresponding recursion criteria.

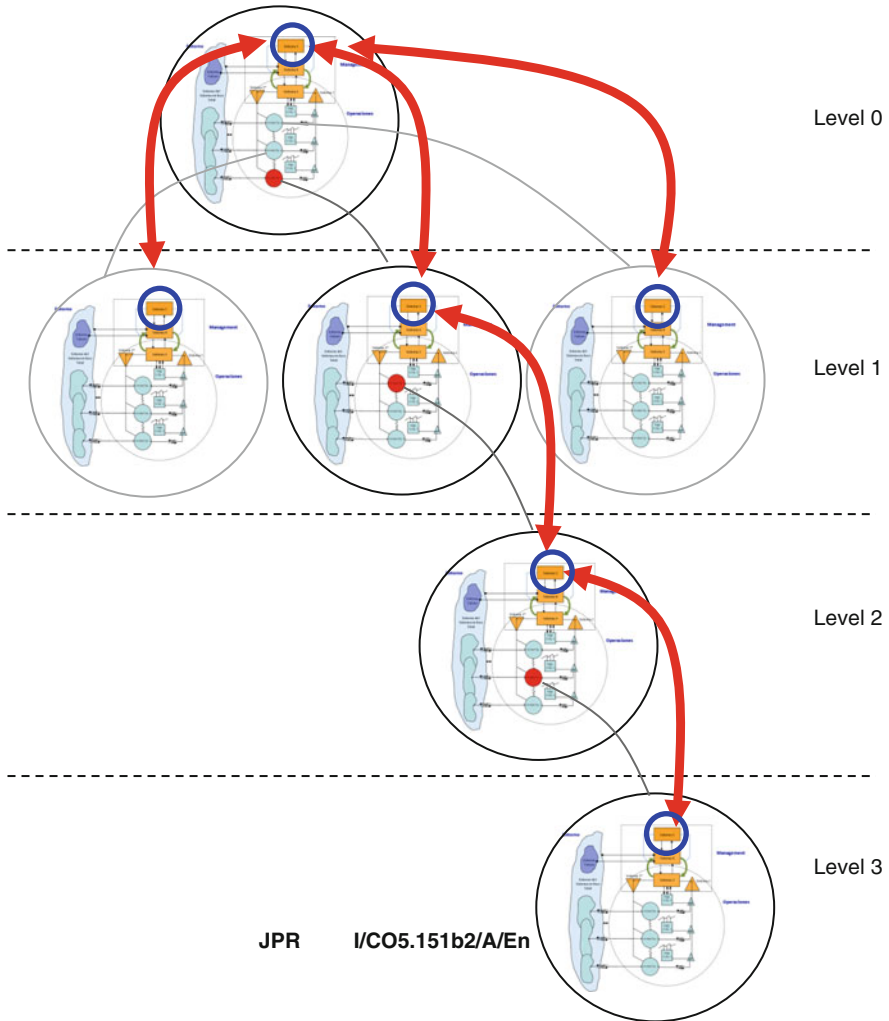
The idea, for instance, is to make sure that the identity and purpose of the organisation proposed at level 0 are shared by all sub-organisations at all levels, although obviously adapted in each case to the particular circumstances of each (products, services, markets, etc.)

Consequently, when it comes to verifying coherence among the organisation’s different System 5s (at their different recursion levels), we should assess aspects such as the following (Fig. 2.54):

- Is the identity attributed to the organisation as a whole at recursion level zero assumed and understood by all organisations corresponding to the various levels of recursion?
- Do formal or informal procedures exist for communicating and sharing identity among all the organisation’s System 5s?

Just as it is essential that the identity and aims of the organisation are shared by all its components, something similar occurs with orientation to the future and the adaptation of the organisation to necessary or recommended changes (Fig. 2.55). I have already said that the purpose of System 4 is to take responsibility for the outside and for the future of the organisation so as to transmit this information and, in conjunction with System 3 and with the approval of System 5, modify (adapt) System 1; in this way, the latter can remain viable over time regardless of the changes taking place in the environment.

This process of evaluating the scenarios, the impacts of the various strategic options and the implications of the different changes in System 1, must be carried out in all the organisations at all levels of recursion. Again, it is necessary to ascertain that the modifications being considered and planned at a specific recursion



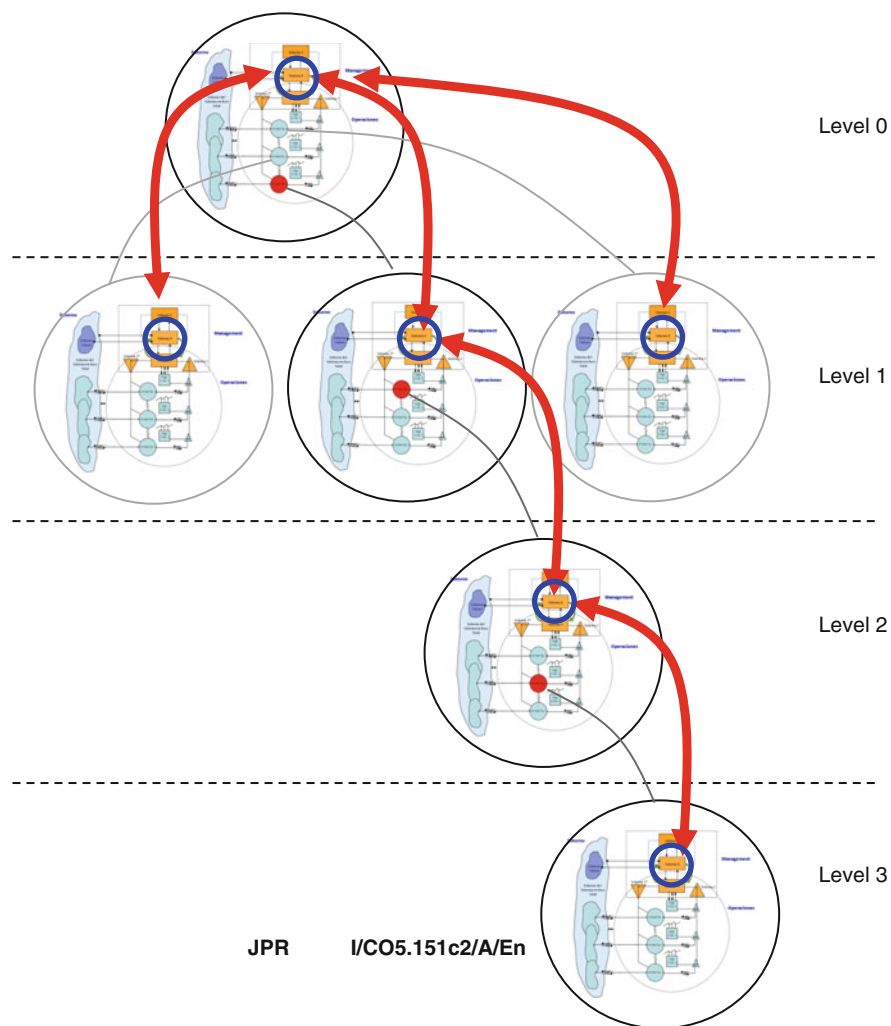
**Fig. 2.54** Coherence among the System 5s of different levels of recursion (Pérez Ríos 2008e)

level are compatible with those being attempted at other levels. As a result, checking that this is actually the case, organisation by organisation, is an absolute necessity.

The corresponding questions, therefore, will relate to reviewing the:

- Existence of formal or informal procedures for verifying coherence among the various activities (strategic planning) undertaken in the different organisations at the diverse levels of recursion.
- Identification of the tools available for putting into practice this evaluation (for example, simulation software allowing one to work with various degrees or



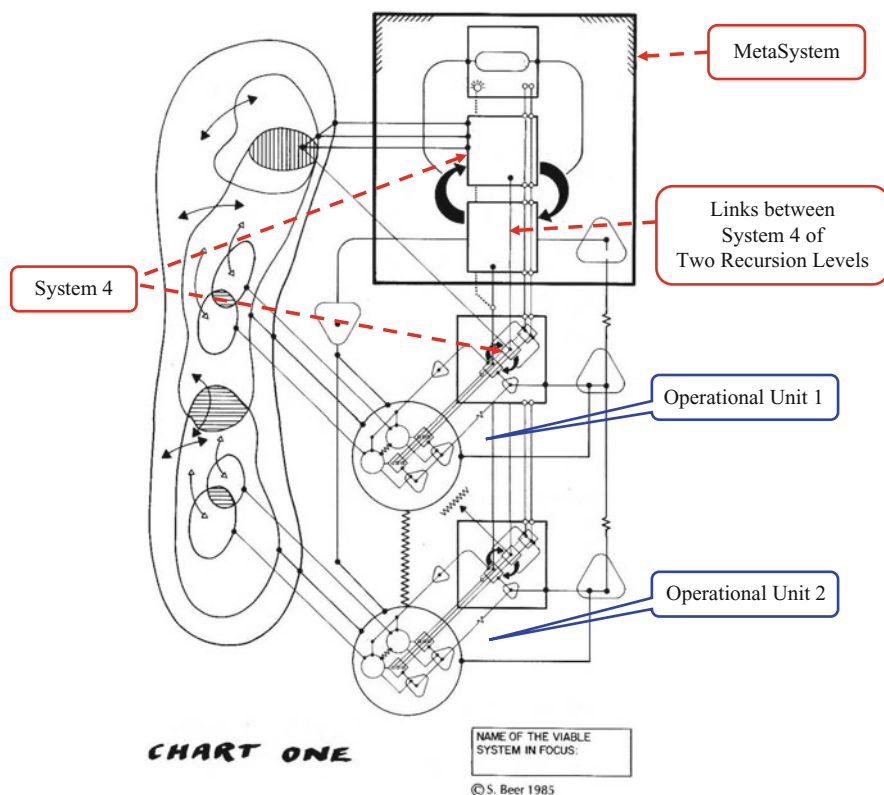


**Fig. 2.55** Coherence between the System 4s of different recursion levels (Pérez Ríos 2008e)

levels of detail, and embedding models so that coherence and consistency are to a large extent assured).

- Verification of the existence of communication channels among the different System 4s located at different recursion levels.

Everything we have said in relation to System 4 is likewise applicable to the System 4 – System 3 homeostat. Clearly, this point refers to issues involving a great deal of variety and extension, and these will have to be identified and dealt with in each particular case. The aim of this section is simply to draw attention to the need



**Fig. 2.56** Connections between the different systems or functions situated at different levels of recursion (Based on Beer 1985) (Pérez Ríos 2008e)

to guarantee coherence among the various activities across all the organisation's diverse levels.

Figure 2.56 offers a complete representation of the VSM provided by Beer (1985). With it, we can appreciate the connections among the various systems or functions situated at different levels of recursion. One of these is illustrated in the figure, in particular the link between System 4 of the Elementary Operational Unit 1 and System 4 of the organisation-in-focus. It can also be seen how the environment corresponding to System 4 of the elementary operational unit is contained within the environment corresponding to the system-in-focus's System 4.

A detailed examination of all the elements and relations contained in this figure gives us an idea, on the one hand, of the great complexity of the model but, on the other, of its "relative" simplicity, as a result of the same elements being repeated at the different levels of recursion.

In any case, what I want to highlight in this section is the deeply systemic nature of the VSM, that is, how each organisational unit (system) belongs to another which

encompasses it, and that this in turn forms part of an even bigger one, and so on and so forth, making up a single organisation.

The need for the functions and aspects involving organisations at their various levels of recursion to be linked and coherent by now should be more apparent, granted, of course, that we are talking about the same global organisation or system.

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