# Moise & Desmìa
# Drawing the Structure & Flow of Healthy Organizations
# **draft-0322**

## Introduction

The purpose of this tutorial is to present insight into complicated organizations by drawing one special kind of diagram, in two stages. The first stage shows how to draw the invariant *structure* of any healthy organization, while the second traces the paths of *essential flows* through that structure. If you follow the ideas in this tutorial you will learn a *diagramming* convention for showing the key features of organizational structure and flow. The diagamming conventions are very simple, consisting of *nested rectangles*, with lines indicating essential flows and connections between the rectangles, that's it.

To make these conventions even easier to remember, I have identified four necessary structural diagram components with the letters MOISE and six essential interconnecting flows by the letters DESMÌA. These diagrams can be used to identify strengths and/or weaknesses in organizational structure and flow, so that you can see what needs improvement, revision, or inevitably, creation.

These structure and flow ideas derive from the pioneering work of Stafford Beer and his Managerial Cybernetics series (*Brain of the Firm* (1981), *Heart of Enterprise* (1979), *Diagnosing the System* (1985), *Decision and Control* (1966)). His major contribution to management science, based on Cybernetics, was to recognize the essential structure and operations of any viable system. He called his representation of that structure and organization the Viable System Model (VSM). What that means is: *if* an organization is fit to survive, is viable, then it will necessarily have the components and flows that Beer identified, no matter their outward appearance. (And just as importantly, if it doesn't have these components and interactions, it is severely crippled). He discovered what is unchanging about organizations that endure over time.

> As a background note: Stafford Beer's perspective on Cybernetics is: Cybernetics is the *science* of effective organization while management is the *profession* of effective organization. You might think of organization itself as a response to the need to regulate and control *Variety*, the incredible complexity associated with modern operations. Variety is a key concept discovered by Cybernetics, with its modern offshoot, Complexity Theory. Cybernetics comes from the Greek word kybernetes, and means steersman, governor, or pilot. Our word government comes from this. Learning how to design tools to manage complexity/variety is the essential job of the manager and Beer's work is specifically directed to that end.

I have modified and slightly extended part of Beer's work with the intent of making his results immediately useful and easy to apply. The modifications consist of reworking some of Beer's diagramming conventions, providing some memorable labels for structure and flow components, and, presenting diagrams illustrating these ideas. I am following the 80-20 rule here and hoping that presenting a selected small part of Beer's work may help you all out of proportion to your effort expended! For a complete account and compelling justification of *managerial cybernetics* though, go and study Beer's books, listed in the reference section.

This tutorial is in two parts:

Part I: Essential Structural Components - gives an approach to diagramming the essential structural components of a viable system using rectangles. The structural model of the organization you end up with is a MOISE diagram which is simply an annotated, nested set of rectangles.

Part II: Essential Flow Components - this extends the structural diagrams of Part I with six essential material and information flow paths, repeated at multiple levels. The flow/diffusion model of the organization that you end up with is the MOISE diagram augmented with flow paths. I use DESMÌA as a memory aid for these flows.

**Example I: An Elementary School - The MOISE Structural Model**

Here is an initial look at an organizational structural model. Think early school days, and go back in time to your elementary school days sitting at a desk inside your school building, an old brick one in my case. How can I show this school structure? That's my focus for this exercise. One way is to start off like this: simply draw a rectangle representing that school, Hillsborough Elementary in my case. How can I represent the grades offered by that school? Just draw inside rectangles representing those grade levels, 1st grade, 2nd grade, and so on. Looking 'up', along a 'school' dimension, consider that Hillsborough Elementary itself, is embedded inside a larger school system, Hillsborough County School District. So, to indicate that, I draw another, enclosing rectangle representing the school district. Why stop there? - I know that Hillsborough School District itself is an element of the state of Florida Education Department, so, to represent this, draw another enclosing rectangle. Your particular *purpose* will put a natural limit on how far you go with this!

The diagram below shows the nested, recursive set of rectangles I have so far. (This is what I call a MOISE diagram). The dotted rectangles are the environmental component of each solid rectangle, while the solid rectangles themselves represent the boundaries of the systems under consideration. To avoid more clutter, I have inserted the letters M, O, I&S, E just within sections of the Hillsborough District rectangle, although these same sections are part of every rectangle, up and down. The letters stand for the type of subsystems inside each rectangle: management, operations, infrastructure & support, and environment. These 4 subsystems will be found at every level of these kinds of diagrams as you will presently see. Remember, this is just an initial start, more detail is coming.

Let me point out that we have now represented this particular educational structure as a recursion of the same type of structure over and over again, along a consistent dimension, school systems. It is this similarity as you go from level to level that gives this kind of analysis its particular power- once you identify the proper components, you will see similar replications at every level.

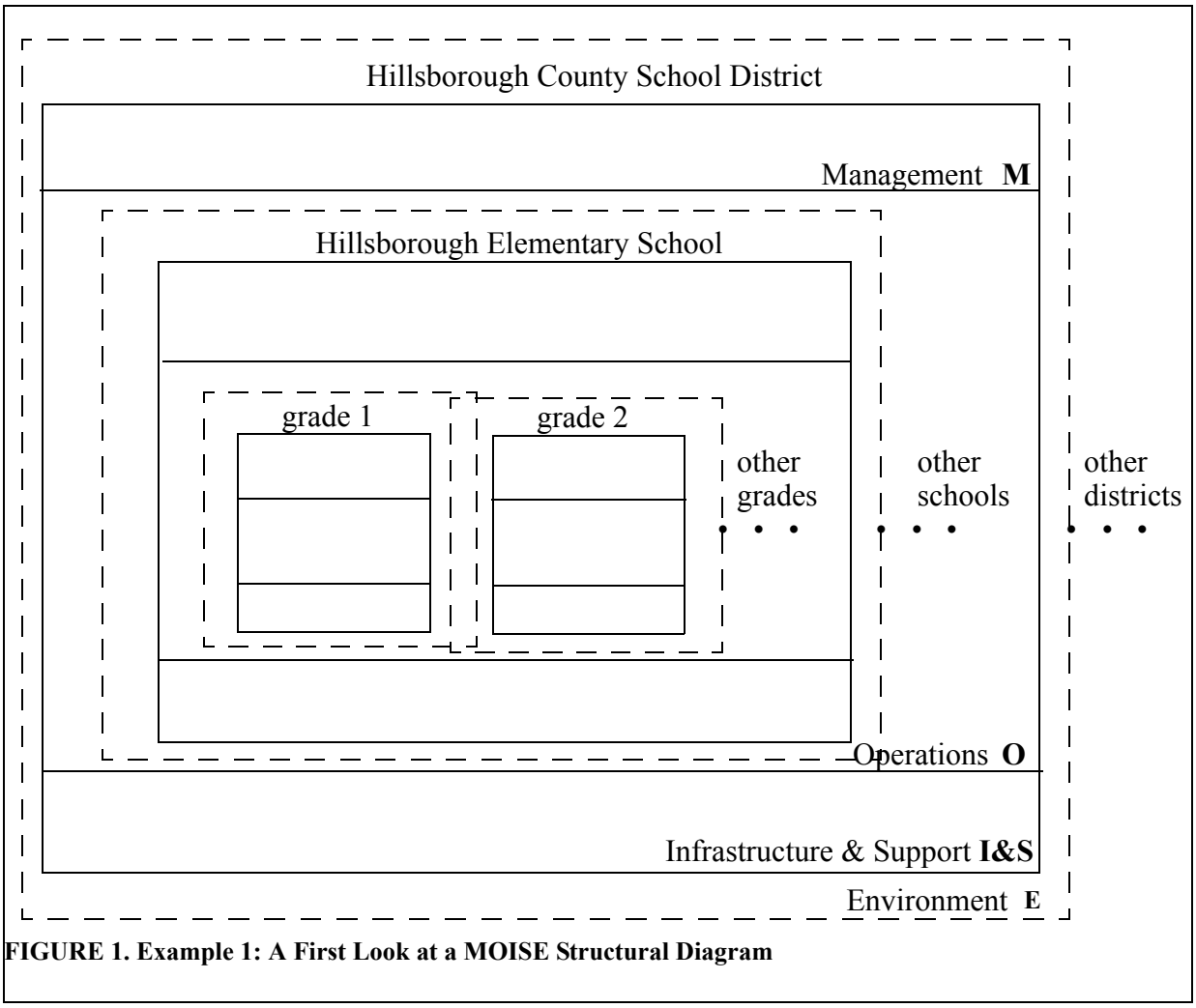


**FIGURE 1. Example 1: A First Look at a MOISE Structural Diagram**

# Part I Essential Structural Diagrams

In Part I only the *structure* of an organization is considered. I haven't gone into its multiple operations, processes, products, or services, but for now, just concentrate on structure. Think of structure though, not just in the concrete way of bricks and steel girders, but additionally along the lines of how the membranes of living cells, or human skin for that matter, help to support the organism's structural integrity, yet allow the passage of multiple kinds and amounts of flows. Systems and organizations are like that, having some rigid components but still allowing many many in and out flows of information and materials. For a more extreme example, consider online businesses where their boundaries are of an especially permeable (virtual!) kind but, still can be drawn, given an agreed convention.

Think of the diagrams you are about to see as the organized 'bricks and membranes', the structural semi-permeable boundaries within and between which, all the variety of the various organizational processes flow to produce goods and services. When I draw these rectangles with solid lines, I would like to think of them as representing part virtual boundary, part membrane, and part brick & steel, depending on the perspective adopted.

# The Basic MOISE Module

Below is a diagram of a single structural module of an organization (at one level of recursion) that consists of 4 components. We will see later that these 4 components can be decomposed further, but for now we treat them as units. The idea is that ANY organization that is survival worthy, has at least these components, no matter how complex and tangled together they are. This first diagram is the simplest one I could come up with that didn't do too much damage to Beer's representations. But lets start with just one of these rectangles along the general dimension of, say, organizations.

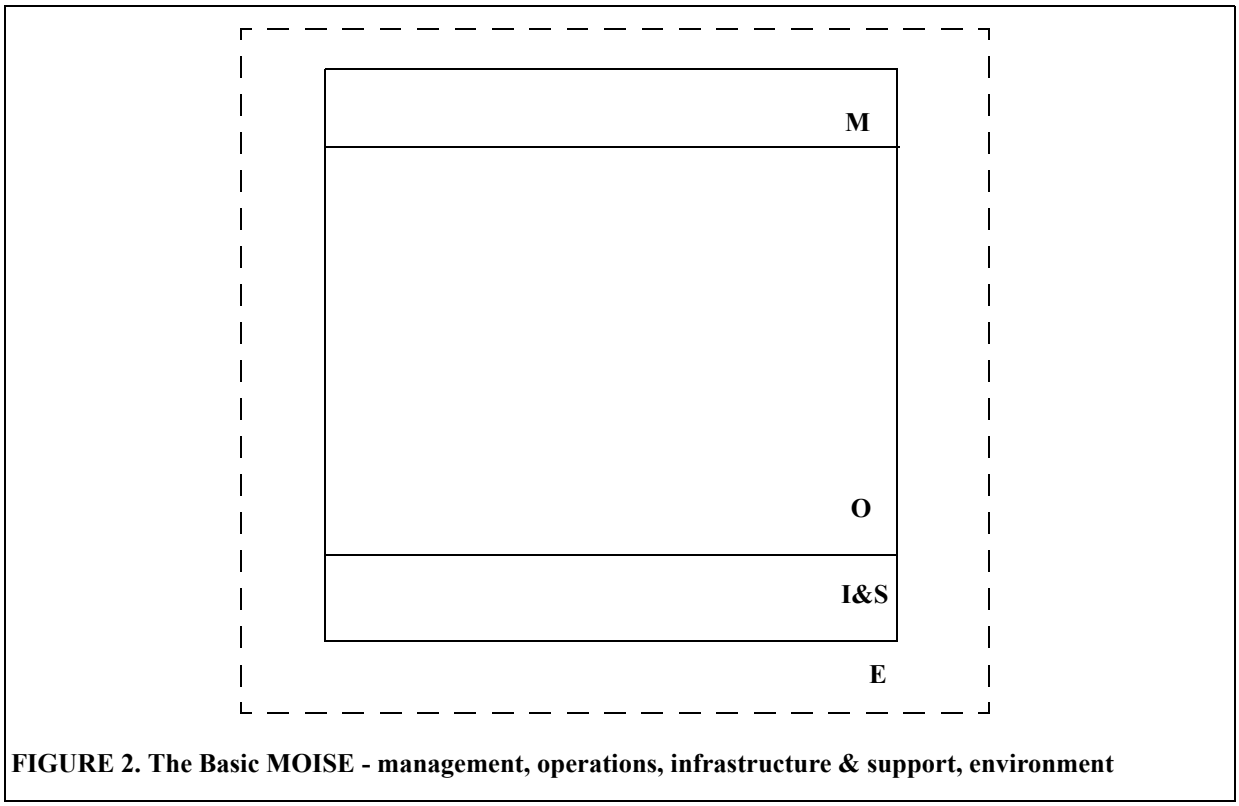


**FIGURE 2. The Basic MOISE - management, operations, infrastructure & support, environment**

> Pretty simple right? Beer's genius is that he was able to compress the fairly difficult mathematics of Cybernetics into sets of interlocking, comprehensive diagrams. Although my diagrams are much simpler than his, I still hope to convey something of his intent, even if only partially.

Notice that a memory device for these structural components is to see that the first letters spell out the name "Moise". (Moise is an actual name and means 'little Moses'). I will use Example I, the "Elementary School", to illustrate these components.

## What Do These Letters Mean?

Look at the diagram above as well as the school example, and then check out what MOISE stands for. Note that since these subsystems occur in the same form at every nesting level, learning these general features will apply throughout the model, a considerable savings of effort!

**M**: management system- this is the management component of the module that does whatever is necessary to 'manage' or 'run' the operations system. Think of the departments and people that actually have these 'director/management' titles attached to their names: CIO, CFO, COO, 'CXO', Director of Sales, Director of Marketing Research, Director of R&D, Production Director, Mem-

bers and Chairman of the Board. (If you are thinking that several different types of management are being mixed together here you are right - pretty soon you will see that the management section itself is composed of three related but distinct subsystems.

For the Hillsborough Elementary school of example I, overall management would be the administration consisting of the school board, the principal, assistant principal, dean of students and various other office workers. It could include the PTA as well as various advisory councils.

**O**: operations system - this is the operational component and consists of operational elements (generally more than one) that produces the organization, produces the 'wealth' for the organization, does what this organization 'does', and implements the purpose of the organization, Think of the assembly line that turns out automobiles, or the farm that produces food crops, or the volunteer who solicits donations, or the Buddhist monk in contemplation. These are the elements that carry out the purpose of the organization, that actually "produce" the organization.

For the Hillsborough Elementary school of example I, operations, *for my purpose*, consists of the grade levels, 1st, 2nd, 3rd, and so on. If I moved up a recursion to the district level, then Hillsborough Elementary itself would become an operational element from this encompassing level's perspective. If I went even further up the recursive chain, the Hillsborough District would now become an operation element of *its* encompassing system, the Florida State Education Department.

**I&S**: infrastructure & support - this is the support component, the Infrastructure and Support component that provides general services to both management and operations. Although actually managed by part of the management component, it plays an important enough role to be broken out separately (this perspective deviates from Beer's representation but I have found this a useful additional subsystem). As an example of the kinds of subsystems found here, think of the company computer network and its IT staff, serving both management and operations, think of the company cafeteria, or exercise room, think of accounting and maintenance. These all belong in the infrastructure and support logical component.

For the Hillsborough Elementary school of example I, infrastructure and support are all the functional elements such as custodians, nurses, accountants, cafeteria, grounds keepers. From another perspective, I can look at the physical environment inside the posted boundaries of the school such as the capital infrastructure: buildings, and their contents such as air-conditioning, lighting, and classroom furnishings.

E: environment - This is the environment, beyond the posted school boundaries, within which the other 3 components are embedded. Every organization is embedded within its own environment that provides both support and constraints. In other words, the environment is just as integral and crucial as any other component of the organization. Thinking both local and global, here is where your customers, clients, supply chains, regulators, competitors, supporters, enemies, and, in general, all of the stakeholders of your business reside. The environment of each level of recursion, provides the context for the flows into and out of that level of the organization.

For the Hillsborough Elementary school of example I, the environment is not only the physical environment past the school yard, but the housing and shopping centers that surround the school as well. Depending on your purpose, you might want to consider, say, competing charter schools, other public schools, vendors of school supplies, other cooperating agencies, potential students as well as potential teachers. I could even include the climate and weather (temperature, humidity, pollution, snow days or tornado frequencies) in which the school exists, again, depending on the purpose of the analysis.

Note: In the real world, these MOISE components are pretty well tangled together, which is why I earlier used a "membrane" metaphor or even a 'virtual' boundary. In general, management is em-

bedded within operations, which, in turn, is embedded within the environment. Diagramming them separately though, helps to get one's head around the logical subdivisions long enough to be able to form some idea of their interactions.

## Conclusions to Draw From the MOISE Module

The primary message is: just start drawing rectangles to represent your organization, being careful to distinguish the 'wealth' producers from their support components. The secondary message is: carefully draw the enclosing organizational systems as well as included ones. Drawing these chains of rectangles, requires you to stay consistent along the same dimension. The idea of a *consistent dimension* is illustrated by nesting on the dimension of schools as in example I or along the dimension of governing bodies such as: local governing bodies nested within state governing bodies, nested within federal bodies, within international bodies. That is, in the middle of this chain you wouldn't throw in a rectangle that represented a zoo, no matter how interesting. Another dimension for example, might be actual land regions themselves, with the nesting criterion corresponding to actual physical containment. That is, Phoenix Arizona is nested within Arizona is nested within Southwestern U.S. is nested within the U.S. and so on. These nests of consistent dimensioned rectangles are called *recursive chains*. Just as an exercise, starting with yourself as a focal system, how many chains are you a part of? (Hint: family, social, legal, cultural, political, . . . I'll bet you found lots of them!)

### Analyze Three Levels at a Time

A useful way to go about these analyses is to consider a sliding set of three levels of recursion. That is, focus on one level of recursion, such as Hillsborough Elementary, and then go down a level to model it's operational elements, the courses, then go up a level and model its containing level, Hillsborough School District. This lets you focus on one level of recursion while keeping in mind what it encompasses (its children) and what encompasses it (its' parent(s)).

This results in three levels. If you want to focus on another system further down, then you slide down until that level is the focal level with its contained and containing levels.

### A Note on the Environment of Any Recursion

The environment is the most versatile concept you can use in these models since it logically can include literally anything. You can use the environment to bring out multiple perspectives, depending on your modeling purpose: ranging from the physical placement of a classroom within a building, to the relation of this course to other courses, to programs of study, to market segments of potential attendees of this course now and in the future. Looking carefully at the environment of any recursion is a valuable exercise. This is simply a picture that says, pay attention to the context in which you are embedded. Management people do this all the time and often call it a SWOTT analysis - Strengths, Weaknesses, Opportunities, Threats, and Technology. (I added the Technology component since it seems to receive inadequate attention.)

## Looking Inside the Basic MOISE

Now that you have some idea of how an organizational structure could be diagrammed, let me go a little deeper using Stafford Beer's ideas, slightly extended. Knowing a little more detail will help us analyze more complex systems and suggest ways in which they are adequate or are in need of improvement/creation.

It turns out that Beer drew the features of his organizational models from a system that meets all

of the criteria for a 'viable system', a human being. I refer you to his books for the details, *Brain of the Firm*, especially, but it's enough to note that he identified his 5-level Viable System Model (VSM) based on how we, as humans, are organized. In the next diagram I lay out Beer's systems, slightly modified to emphasize the role of infrastructure and support. Here is the Basic MOISE diagram with its three components further broken down.

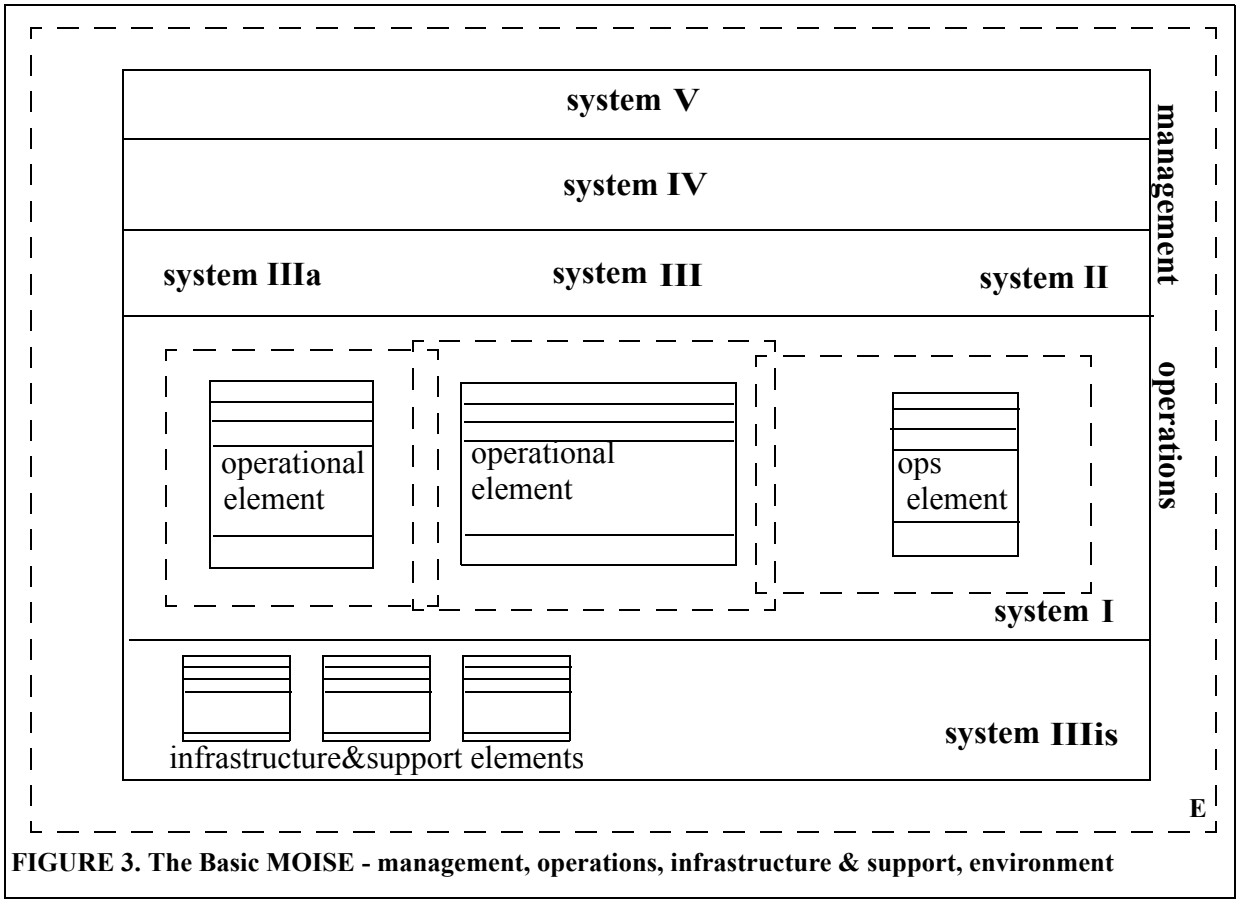


**FIGURE 3. The Basic MOISE - management, operations, infrastructure & support, environment**

After reading the explanations below, I would encourage you to pencil in your own experiences and observations on the MOISE.

## System V

This system is responsible for organizational cohesion, vision, and values. This is often represented as a 'board of directors' or a president, who is charged with promoting a vision, a mission, or what could be called the "*ethos*" of the organization. The board might say, "We are in the container shipment business" or, our charge is to "Reduce world pollution". These statements are possible answers to questions such as: "What Business Are We In?" or, "What does this organization stand for?", or, "Why are We In Business?" System V is charged with providing the answers. The board provides the (logical) identity of the company. Or in the words of the U.S. president Harry S. Truman, "The Buck Stops Here". In another sense, System V is the most diffuse of all since it must encompass all of the environment which includes all stakeholders of the organization. In another sense, System V provides the 'epigenetic' landscape within which behaviors are constrained.

## System IV

This is the R&D module, the Marketing Research function, and the generally outwardly, futuristic

looking function.In the somewhat sarcastic words of the System III folks, “These are the people who spend the money that System III makes”. This is the strategic planning focal point as this level must have a synoptic model view of all of the organization, especially the capabilities and transformative possibilities of System III and its’ operations. This group is charged with intelligence gathering as to what is “out there” and “when” it might affect the organization. This is one of the most vulnerable system of an organization (being the first to be ‘downsized’) and is often missing entirely, or is hopelessly fragmented

## System III

Here’s where the production occurs, both of goods and services as well as the organization itself. This is definitely a here and now system with putting out fires to handling down machines and striking workers. This is the inward looking component being concerned with the near term bottom line. The keyword here is *efficiency*, and initiatives and programmes to that end, such as BPR (Business Process RE-engineering), TQM (Total Quality Management), and Lean 6 Sigma, are managed from System III.

You should note that System III also manages System IIIa, System IIIis, and System II although the functions of these system are distinct enough to have their own subsystems.

## System IIIa

This is the audit module and performs the intensive investigations into the operational elements of System I. These audits are generally not continuous, and examples would be an equipment audit, or an energy audit and are not usually objected to be the operational personnel. An accounting audit is the most well known of these and is usually accepted, with some grumbling. as a necessary exercise. This is in contrast to direct orders coming down from management which are often interpreted as overly intrusive and constraining.

## System IIIis

This is the support module, labeled as Infrastructure & Support. I have denoted it as System IIIis. It is managed by System III and performs services for System III, System IIIa, System II, System I, and often Systems IV and V as well. Note that I have placed it in a ‘supportive’ graphical position to underscore its purpose.

## System II

This is the synchronization subsystem discovered by Beer that exists to damp down harmful oscillations within the system. It corresponds to actual groups in an organization such as production control in a manufacturing company, class scheduler at a university, standardized company logos and stationary, ‘do’s and don’ts in a family’, or even the implementation of a dress code at a high-school. This subsystem performs a balancing act between the System I elements and provides stability for the organization as a whole. After all, each System I element wants to maximize its own goals and is not explicitly concerned with those of other system I elements. System II has a large scale view of the organization that is not available to the individual elements of System I (unless they put on a System II hat), and therefore is in a position to mediate and allocate resources judiciously.

## System I

This is the collection of the operational elements, the wealth producers, the reasons for the existence of the organization, the implementors of the purpose of the system. This is the most important of all the systems since the other systems have no meaning if there is no System I! These are the elements that ‘produce’ the organization. There will usually be more than one of these elements

making up System I.

# Part II Essential Flow Components

Now I come to the part where we take a look at the flows interpenetrating and diffusing through a MOISE structure. This next part uses the structure constructed in Part I to indicate essential flows to be found within any viable organization. This is the behavioral match up to the essential structural components. Beer has identified six crucial paths through system structure that enables its cohesion and regulation.

## Memory Aids for the Flows

**D**: directives - these are the directives/commands from the logically higher 'metasystem'. In our case this will be directives from System III to each of the System I management elements. These take the form of directives as to legal conduct of the operational elements, accounting requirements, 'policy statements and work standards', resource directives, and requirements of return on resource investments. Beer calls part of this flow the "Resource Bargain" and is most concerned that this path not be used to *unnecessarily* limit the autonomy of the System I elements.

**E**: ethos - these are the set of messages and attitudes emanating from the System V metasystem that infuse the organization with values, vision, and mission. This is the propagation of messages that tell the organization what it is, 'what business we are in', and how it is to comport itself. Note that these messages go out to the environment as well as internally to the organization.

**S**: synchronization - these are instructions from the System II metasystem that insure that the System I element stay in balance, in synchronization, with synergy between elements of System I as the overriding intent.

**M**: materials - these are the physical materials/entity flows. These are the flows of actual boxes of napkins, or palettes of bricks, or student movement between schools.

**I**: intelligence gathering/generating - these are the flow loops that interrogate not only the present environment, but the *possible* futures the system will encounter.

**A**: audit - this is the audit function whose resultant flows are intermittent but of extremely high variety. These are the energy audits, equipment audits, disaster recovery audits, computer audits, employee satisfaction audits, as well as the expected accounting audits. These are directed to investigating some feature of the System I operational elements, in detail. To see how they are doing, to see if they are conforming to the organizations expectations.

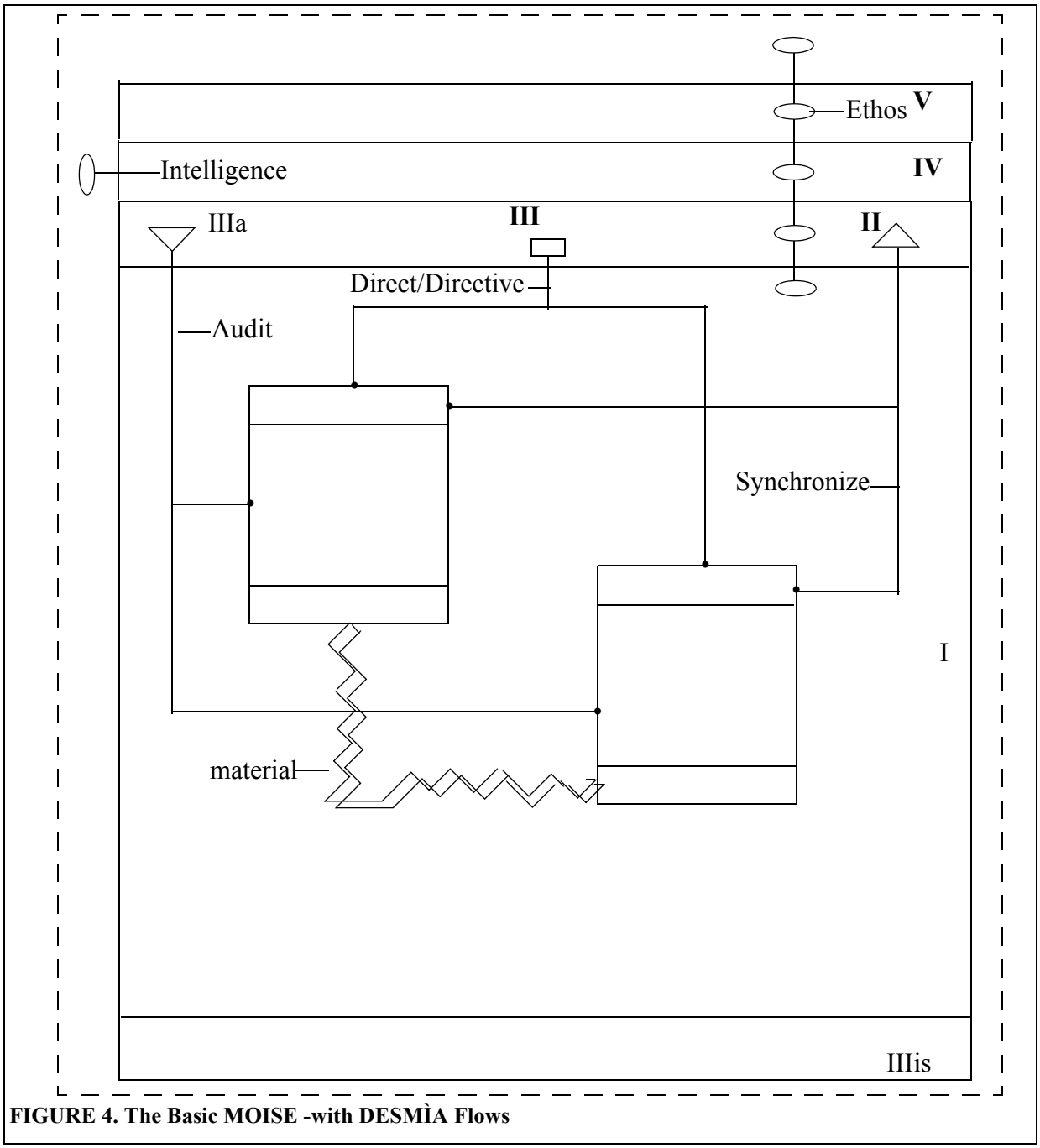


**FIGURE 4. The Basic MOISE -with DESMÌA Flows**

## Summary

In these few pages I have presented a useful (I hope) fragment of Stafford Beer's insight into organizations, by using simple diagrams. For the structure of an organization I have suggested using a model of annotated, nested rectangles that I have called a MOISE diagram. To indicate some of the essential flows of an organization, I have simply drawn in lines on the basic MOISE diagram.

Beer's comprehensive vision of the structure and flow of organizations is partially reflected in this tutorial by using diagrams rather than mathematics to illustrate the issues involved in the regulation and control of complex organizations. To simplify, if possible, is always useful, while of course

the danger is to over simplify.

By using diagrams pretty close to Beer's conventions I hope that you will be able to use these ideas to gain initial insight into your focus of analysis. The reader is strongly encouraged to consult the masters of Cybernetics, principally Beer, but also Ross Ashby is required reading as well.

Cheers

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## References

Ashby, Ross (1962) Cybernetics, *****

Beer, Stafford (1985) *Diagnosing the System*, Prentice Hall

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********** EXTRA STUFF **********

## Why Concentrate on Structure?

**[Want to use the membrane idea as the underlying substrate, but not saying it quite right yet.]**

**Just as in the biological sciences, engineering sciences, or managerial sciences, there needs to be a pattern, skeleton, framework, scaffolding, that holds and constrains the operations. So, I will start there.

Membranes, like systems or organizations, allow many kinds of flows into and out of their formally declared boundaries. the bounders are membranes that are permeable to different kinds of 'flows'.

*** RECURSION** here? In the text you will come across the term recursion. This is at the heart of Beer's ideas of structural invariants. An initial idea of recursion is to think about nested russian (chinese) dolls. These are the kinds of toys that when you open up one outer doll, you find multiple inner dolls and when you open one of those, you find yet more of the same kinds of dolls inside. Recursion is like this, it's a process of *** focus.

Example I. MOISE at the Course Level (from the Instructor's Perspective)

Let's take a first look at a university program of undergraduate study, say in the Bachelor of Science in Information Technology (BSIT). In a typical program there is at least a program chairperson, multiple course offerings, instructors to teach them, and students to attend them. Along with this, there are physical facilities like buildings, class rooms, electronic support, as well as other support functions of all kinds such as maintenance, administration of attendance, finance, payroll and so on. We will get to those, but first let's start slowly.

f I focus down and look at a single course offering, say "IT 380 Programming Fundamentals", from the instructors perspective, can I identify the management component, the operational elements, infrastructure and support, environment as suggested in the MOISE diagram above? Sure, take a look at IT 380 from the instructors's perspective.

Here, the operational elements are the student's themselves since they 'produce' the course,

**Example II - MOISE at the Program Level (from the Program Chair's Perspective)**

n is the purpose of the course. Also, they are most definitely the wealth producing elements!

Management is clearly a role of the instructor, while the infrastructure and support structures are clearly visible when you walk into a classroom or log on for an on-line session. Even for online, there is a great deal of infrastructure and support concerned with the technology inter-linking instructor, and students. Infrastructure and support can be seen to consist of both physical and informational features.

Now consider the system from the program chair's perspective. He now sees that the operational elements are now the courses (rather than individual student within courses) in his IT program.(I have just shown two courses, but of course there would be more). He could then draw a diagram as below to start to think about all the issues of managing multiple courses.

ments sequence, or perhaps the same student(s) attends both course, or the same instructorThis occurs at multiple levels such as being in a course requirevelopes of both courses.

**Example III - The Undergraduate Degree Level (from the Chief Academic Officer's Perspective)**

Now shift up a level and consider the perspective of the Chief Academic Officer for Undergraduate Studies. She could have another 'take' on the role of programs and courses, and might draw out the picture below, emphasizing the fact that her operational elements are now programs rather than courses or students. She manages programs rather than courses. Here, I have shown two programs, Bachelor of Science in Information Systems and Bachelor of Science in Management