Decision making practices in commercial enterprises: A cybernetic intervention into a business model

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Abstract

Business models are used by senior managers to evaluate and articulate trajectories through commercial space. Residing only in the highest echelons of the enterprise, these models do not permeate the business and hence effectively fail to engage its people. This paper presents a decision making framework and a technology that senior managers can use to steer the enterprise within a volatile and competitive commercial environment. The main aim of introducing such a technology would be to maximise the enterprise's value vector by ensuring that business objectives are consistently unfolded throughout the enterprise and used by all managers to make decisions that are consistent with the purpose and objective of the organisation. The paper illustrates how a cybernetic intervention into the business model of a large organisation can be used to achieve this.

Keywords: business model; context and information; cybernetics; organisational decision making; value vectoring; VSM.

1 Introduction

Modern businesses can be considered infinitely complex for all practical purposes. From Ross Ashby's (1964) view, for a business to be viable it needs to be at least as complex as the environment in which it operates. Ashby's stance is quite straightforward. If it is any less complex, then in some instances it will not be able to deal with some disturbances that may be incompatible with it. Complexity is a fact of modern life and we need to understand how we can manage it. Ross Ashby introduced the concept of Variety as a measure of this complexity and Stafford Beer (1979; 1981; 1985) provided us with a framework that shows how this complexity may be managed from a microscopic to a macroscopic level.

The overall vision of a viable enterprise comprising of self managed autonomous work groups and a Metasystem as a system of purpose, strategy and cohesion comes straight from Variety Engineering. It is the only means in which a complex entity can become viably engaged with its environment. Variety engineering provides the framework that is required to deal with high variety situations. This is the view Stafford Beer (1981) proposed resulting from the study of the human nervous system, which had evolved over millions of years by the apparent motiveless and mindless mechanisity of the genetic process.

As senior operations manager in the steel industry, Beer (1979;1981;1985) disillusioned with classical management practices, proposed a cybernetic approach to improving organisational effectiveness based around the information and control structures found in natural systems. Beers' focus concerned the adaptation of the entire system including the operational machinery of the business to fit the environment it is serving by concentrating on how these systems were able to adapt themselves to new information from its environment.

From a business perspective this means that the operational engine, the machinery of the business, which generates the revenue, is continually in balance with the environment it is serving. To maintain this balance we have to ensure that the capabilities of the systems, which regulate, are sufficiently complex to deal with the variety in the problems with which they may encounter. All of the crucial aspects of Viable Systems Modelling (VSM), which he proposed in diagnosing problems or in design of new systems come down into one inescapable fact - they are all involved with the way they manage variety.

Business models bridge the gap between where we want to be, the intention, the output and where we are we now, the input. They represent the context. It is therefore the business model that determines the ultimate meaning of the data and the business value of an action. It is the value propositions that the model is prescribing that survive. Businesses remain viable by continuing to provide value into a market place that continues to select it. The business model provides the ultimate context for decisioning, one of survival. Unfortunately these models are generally limited to senior managers within the business, monolithic and cannot dispose the information that they produce.

Indeed in large organisations, it is senior management that sets the direction and middle management that steer the course. However, the inadequate coupling between these levels results in middle managers feeling neglected, disillusioned and frustrated with their seniors, they believe they are kept in the dark and are unsure of the course they are meant to be steering while senior management cannot understand why their business plan is not delivering.

Recent research commissioned by Consultants CHA have identified that about a third of middle of managers are not aware of the company plans and up to two thirds do not clearly understand their roles. They highlighted five key areas of concern where middle managers believed significant improvements could be made. Their responses are given below:

- "Tell me clearly what the organisations plan is so I can understand it and feel able to pass on the message" (51% of respondents)
- "Give me time to do it" (50.5%)
- "Give me the mechanism so I can feedback employee's comments" (41%)
- "Coach me to make me more effective communicator" (25%)
- "Give me a toolkit with messages and questions and answers so I have the right information to respond to employee's questions and concerns" (24%)

Business models need therefore to be more pervasive and appropriately distilled throughout the entire organization if its people are to become effectively engaged and the issues identified above effectively resolved.

To achieve this, a cybernetic business model (CBM) has been proposed. The CBM uses a fractal-based approach to unfold business complexity based upon Stafford Beer's Viable Systems Model (VSM). VSM is predicated upon the human nervous system and provides the cohesion that holds the business together. It is a whole systems theory that has been applied in a variety of settings (see for example Espejo and Harnden, 1989; Snowdon and Kawalek, 2003; Espinosa *et al*, 2004; Sergeyev and Moscardini, 2006; Schwaninger, 2006; Stokes, 2006; Leonard, 2006).

Over the years, several theories and tools have been developed to study organisations and model complexity (Anderson, 1999; Schwaninger, 2000; Yolles, 2000; Tsoukas and Hatch, 2001). Whereas most organisational theories think in cause and effect, VSM looks at the entire organisation in a holistic manner. It is often forgotten that all of the functions within an organisation are inextricably linked and for the model to work it must take all of this complexity into account.

The work provides a brief background to the application of a CBM-based framework. The framework can act as an invariant feature of every viable business. This is illustrated through the discussion of a cybernetic management intervention in a large telecoms company (referred to as Tele XY).

The paper also introduces a new paradigm of value vectoring that ensures the requisite unfolding of value vector by management through objectives. This approach prevents negative synergy (value erosion - where the sum of the parts is less than the sum of the parts) from occurring. This is helped by maintaining objective congruence by dimensionally consistent unfoldings throughout the value exchange space.

This article is structured as follows. Section 2 reviews cybernetics principles and viable systems characteristics. This is followed by a discussion of the business model properties of large organizations (section 3). Section 4 briefly describes the viable systems model. Business processes in telecommunications companies are discussed in section 5. A description of the decision making framework is given in section 6. Finally, section 7 provides the conclusions and insights of the study.

2 Management Cybernetics

" *if a lion could talk we could not understand him*"

(Wittgenstein, 1958; p. 223)

Words don't mean anything, for them to be meaningful they need to be specified in advance by the interpreter. Cybernetic systems are replete with information, they need to be, for they need to continuously action information in order to seek out, direct and steer themselves through viable spaces.

Cybernetics has brought forth structural models to enable businesses to do precisely this. Cybernetics, the science that studies the organization of complex viable systems, enables us to engineer such systems. It focuses on how systems manage information, apply models, and coordinate actions to achieve organizational goals and overcome difficulties (Heylighen and Joslyn, 2001). The theory draws from a range of disciplines (e.g. biology, psychology, IT and social sciences) to model and construct control systems through the involvement of human observers.

Cybernetics operates by an experiential epistemology (action learning). It was defined by the late Norbert Wiener as the 'science of control and communication in the animal and the machine' (Wiener, 1948). Wiener discovered that there are general laws that govern any control process. These laws extend from simple servo mechanisms to complex social systems. We can recognise such systems that are governed by these general laws because:

1. the system maintains coherence in the presence of external perturbations;
2. the system survives through time preventing its own dissolution; and,
3. the system is able to learn, adapt and evolve.

The study of cybernetics is tasked with finding out how such mechanisms work. What Weiner discovered was the ubiquitous nature of feedback present in these systems.

The role of management is threefold:

1. to set the criteria for stability (e.g. from 4 sigma to 6 sigma)
2. to detect instability and re-stabilise
3. to change the criteria

Although we talk about a business as if it existed as a single entity, we know in practice that even a medium-sized business can consist of a number of divisions providing value exchanges into different market segments resulting in multiple feedback loops. The usefulness of applying cybernetics theory in such situations has been highlighted in the literature over the years (see Cadwallader, 1959; Dooley, 1997; Morgan and Hunt, 2002). For example, setting the room temperature for the heating system (process), that would constantly check the ambient room temperature (i.e, the control information) signals the heating system to provide more heat. This kind of a feedback loop will be timely enough to stop the heating system to fix any flaws or boost the quality of the systems outputs or deliverables that are produced.

There are three basic characteristics of viable commercial systems that can be studied by cybernetics in terms of:

1. the processes delivering the external value exchanges must be under control i.e. we must know how to manipulate the system to produce the desired results;
2. the system as a whole must be stable otherwise this may lead to inventory fluctuations, surges in work and progress, daily fire-fighting interventions, stop-go policies in an investment and travelling and subsistence; and,
3. the system must learn to learn, adapt and evolve.

Simple feedback loops can easily be designed into a system with full knowledge to maintain stability within that system. In designing complicated systems without full knowledge however, we emerge with a new criterion that of ultrastability – the capacity of the system to withstand perturbations that had not been conceived by a designer.

Consider the ‘watt governor’, the process of going out of control brings it back to the control even though the reason for the perturbation may not be understood. This is achieved not by examining the generative mechanisms involved but by detecting changes in operating parameters which are directly used to take regulatory action. Similarly in businesses, we require management to carry out a similar role to that of the watt governor i.e. to dampen down production oscillations without necessarily identifying the root causes of a problem. However, due to the systemic nature of the world such an isolated phenomenon as ‘The Cause’ would rarely exist.

3 The Business Model

Modern businesses have to cope with ever increasing amounts of complexity and thus more information. Helping managers to deal with this complexity so as to achieve strategic objectives is essential. Subtracting the content and adding more context enhances the role of a manager. What is needed is not more data, but rather technology that helps make sense out of the endless data collected from different sources. Such a technology could help managers take decisions and behave in ways that are consistent with the purpose and objective of the organisation.

The concept of customer engagement is changing the business landscape today. What we need to develop is a transdisciplinary model (Schwaninger, 2001) that is enterprise conscious which will enable businesses to survive long-term in the competitive marketplace. Such a model can guide the enterprise through any hazardous pathways in the commercial space that are survival worthy. The business model is not a supplement but rather it should mirror the business itself. "For a business to dispose requisite action, it requires a body map that is capable of representing the anatomical parts of its enterprise so the actions it disposes can avoid pain and seek pleasure" (Brewis, 2004).

Managing a complex business system or social system can be achieved by constructing a model of the system inside a regulator. How and where to implement such a regulator however, remains a challenge. The construction of the model hinges on Conant-Ashby's theorem "Every good regulator of the system must be a model of that system" (Conant and Ashby, 1981). The model must be able to match the variety of the business. In order to fulfill this requirement, a fractal-based approach has been adopted. This approach enables the business to be unfolded into autonomous value production units and remain cohered through the information and action channels as prescribed within the VSM model. This approach enables a large amount of variety to be absorbed but also removes any residual variety resulting from non standard practices which proliferate within large organizations.

The requisite unfolding of the business is based upon the value exchanges between the operational machinery of the business (i.e. the technology model) and the environment. However, in a complex organisation this value may need to be brought together from a number of sub-organisational units. In order to ensure that the unfolding process does not reduce enterprise value, we have to ensure that the unfolded objectives remain congruent (or dimensionally consistent). To achieve this, we have introduced a term called value vectoring that will prevent negative synergy from occurring i.e. the aggregate vector is greater than the sum of the component vectors.

Our value vectoring approach applies a mathematical tool called dimensional analysis (Huntley, 1958) to reduce the analytical complexity of the model, to ensure the equivalence of the measured variables and to expose relationships among them. Dimensional analysis appears to be analogous to the decision analysis principle of preferential independence (Keeney and Raiffa, 1993). It significantly enhances the quality and reduces the time taken to analyse the model. This helps unfold the business

by eliminating one variable at a time in a given problem thereby, making it easier to evaluate complex problems. Applying value vectoring and dimensional analysis to modelling complex organizations could help identify significant system variables and attain formalised results.

4 The Viable System Model (VSM)

Beer's Viable System Model (Beer, 1979, 1981, 1985) has been applied in various settings to diagnose organisational structure and communications so that the necessary and sufficient conditions for viability can be met. The model (see Figure 1), which was originally based on functions of the human nervous system, is a model of wholes – whether individuals, organisations, or communities. Although these wholes may, and usually are, recursively embedded in larger systems, the criterion of viability is that they could operate in their own right providing goods or services to the customers in their environments.

[Please insert Figure 1 here]

The VSM consists of a set of five profoundly interacting subsystems, which must support any successful organisation. The roles of these subsystems are as follows:

1. to perform operations which meet the needs of the "customers", however constituted in their environments (system 1);
2. to co-ordinate those operations and to damp their oscillations (system 2);
3. to make executive decisions on behalf of the operations as a whole (system 3) and audit operations (system 3*);
4. to plan for the future (system 4); and,
5. to represent the whole system so as to steer the business (system 5).

It is a characteristic of the VSM that these subsystems and their relations are recursive; that is, each independent viable system is embedded in other more comprehensive systems. For example, the plant is embedded in the division which is embedded in the company which is embedded in an industry. In turn, there will probably be subsystems in the plant which produce different goods or produce similar goods in different shifts. Any complex viable system will be embedded in more than one set of recursive relationships. The plant, for example, is also embedded in its community: it may be one of several in a region whose employees are represented by a labour union, it may be part of customer supply chains or be one operating under license. Recursive relationships such as these are not necessarily hierarchical in the usual sense. There may be little or no formal authority or formal authority that is strictly limited, such as reporting on regulatory compliance.

5 Monolithic Management

Businesses try to maximise value in the commercial marketplace by seeking out trajectories through spaces that are survival worthy. The business model of a commercial enterprise consists of business functions such as managing relationships with customers and suppliers as well as controlling services, investment and resources. One of the challenges that businesses are faced with today, is not only to formulate strategies, but also to dispose strategies through the operating plan.

The following Generic Processes used within every commercial enterprise is used to form part of the functional aspects of the Cybernetic Business Model:

- *Concept to Market* (C2M). Coming up with the concept, designing, testing and then building a product or providing a new service.
- *Lead to Cash* (L2C). Converting a sales lead to cash and ensure that the customers are happy with the transaction.
- *Trouble to Resolve* (T2R). Customers are often faced with a range a problems such as broadband or telephone connection problems that need to be resolved.

A typical business process is that of fulfilling a customer order. A high level representation of such a process appears in Figure 2. When an order is received, an L2C process is instantiated and a number of activities are undertaken to satisfy the customer and complete the transaction. The T2R process is initiated when a customer encounters problems with the service or provider and completes upon satisfactory resolution of the problem.

[Please insert Figure 2 here]

Figure 3 illustrates the commercial space that enterprises traverse during the lifecycle of a product or service including the trajectory path. The model has three dimensions: inventory and operating costs, throughput (revenue generation) and value exchange. A start-up investment cost incurs prior to the launch of a new product or service. Following the launch, revenue is generated. Value is a function of investment, operating costs and throughput and provides an indication of how well the return on investment works. Even though revenue is an important business driver, the main purpose of an organisation should be to ensure long-term business viability rather to increase short-term profits. It is only by sustaining the value exchange between a commercial enterprise and its customers that a company will increase long-term competitiveness in the commercial space.

[Please insert Figure 3 here]

The challenge faced today with all telecommunication providers, including TELE XY, is that their existing service platforms are no longer fit for purpose, being unable to sustain the value exchange with their customers. These existing networks are based upon very expensive connection orientated technologies and cannot compete with the high levels of performance that can be achieved with the current IP connectionless technologies. The

problem that all operators are confronted with is to migrate their entire customer base across to this new technology without significant reductions in customer service and free cash flow.

Building a new platform, migrating customers across and closing down the old legacy platforms will create one of the most complex operational problems that telecom companies have ever been confronted with. If this is to be undertaken effectively, a number of critical issues need to be resolved:

- the amount of investment required to build the new network
- the business benefits to all stakeholders
- the resource volumes required to build the new network
- the resource volumes required to migrate customers across to the new network
- the resource volumes required to migrate customers across to operate the new network
- the timely withdrawal of resources from the legacy networks

This business dynamic is extremely complicated involving millions of customers and many billions of pounds of investment while at the same time providing the opportunity for significant cost savings. Such variety cannot be managed monolithically. A methodology is therefore required to structure the problem into a manageable framework using self organising principles, black box management, with the use of higher level logic to absorb the emergent behaviour generated by the peering layer.

6 The Cybernetic Business Model - CBM

A CBM (Cybernetic Business Model) framework has been developed to support decision making in commercial enterprises. Its main objective is to identify trajectories of commercial space that are survival worthy, set direction and steer the course (see Figure 3). It is populated with value production units (VPU) that seek to sustain their value exchange with their environment. The framework includes elements of the value chain model (Porter, 1985) which provides a means of aligning the business in terms of the value added by the business units to the product and services offered. The value chain forms part of the end to end value system that delivers the final product or service to the end user. Thus, the model provides an invariant view of the generic value chain.

The CBM, which is presented in Figure 4, is topologically consistent with the structures illustrated within Stafford Beer's VSM model. However, it has been redrawn to remove the hierarchy perceived through the current VSM model and to highlight that the raison d'être of the meta-system is given in logic and is not necessarily linked to financial rewards. The reason for the higher level logic is to absorb the emergent behaviour that arises from interactions occurring at its peering layer.

[Please insert Figure 4 here]

The CBM, whose structure resembles a snowflake, can be used to manage a range of activities and financial interactions such as inventory, quality of service, operational service, resource levels and cycle times. The model provides a non-hierarchical view of how the enterprise operates. The additional levels of recursion can be shown to provide a greater number of touch points into the environment increasing business sensitivity to environmental perturbations.

Dimensional analysis is used to provide objective congruence by ensuring that the value vectors produced by each VPU can be synergistically aggregated to maximise enterprise value. This method also enables tests for pathogenic autopoiesis to be carried out and identify negative synergy within the enterprise.

Management by objectives is not a new technique. Introduced as a management tool by Alfred Sloan in the 1950's and further reinforced by Peter Drucker, it has been widely used as a central management concept throughout the business world. As Drucker (1955) however, points out "we cannot start talking objectives until we know what they are… A management by objectives works if you know the objectives, 90% of the time you don't". Many implementations failed with the 'management by objectives' concept being challenged as a purely academic idea that cannot be practically applied to complex situations. It is our thesis that this failure resulted from the lack of formal framework for unfolding the objective. The CBM framework will be created by unfolding the technology model against the value exchanges with its environment.

The term 'objective' can also be emotive and often acts to reinforce false premises and the feelings of inadequacy. We often talk as if we are managed and controlled by objectives. From a cybernetic perspective, we do not serve objectives; it is the objectives that serve us. It is we, who are in charge. It is the role of the higher level logic to provide the unfolding context through the objective which is not accessible at the peering level.

These objectives should:

- be specific and dimensionally consistent
- not interfere with the inner workings of the black box of the peering layer
- represent ends i.e. they should be separated and distinguished from the means of achieving the objective, as 'the means' is not accessible from the higher level logic
- be measurable
- dynamically evolve rather than remain static

All aspects of the VSM are depicted on each VPU. The highest level VPU (i.e. the organisation), which is shown at the centre of the snowflake diagram, is broken down into several subordinate VPUs (e.g. lines of business) which are in turn broken down into

smaller VPUs (e.g. products and services), which are further decomposed into component VPU's.

An example of a VPU (e.g. XYZ line of business or division) appears in Figure 5. System 5 in the model is the XYZ line of business. System 4 is Concept to Market and Forward Planning and an instance of Forward Plan is system 3's Operating Plan. Another element of the model is the Resource Domain, which consists of Pay, Non Pay, overheads, accommodation costs and system costs. The direct labour workforce provides information about people and resources. The system is fractal and the view of the business never changes.

[Please insert Figure 5 here]

As it can be seen in Figure 5, the VPU model is broken down into vertical domains called Customer Management and Service Management. Links to the environment are established to provide services, enable customer transactions and generate value into the market place. System 1's represents the company's products and services that appear at the bottom of Figure 5. Other System 1 elements include the Lead to Cash function and the 'Trouble to Resolve' function. These processes deliver and co-ordinate value generated by the system 1's into the market place.

The system illustrates how an order coming into one line of business can then move into another line of business. It can then display information about demand, the cost of a transaction and the cost of introducing an IT system to facilitate the transaction

The system allows users to easily navigate through business units and products. Emphasis is placed upon the context rather than the content, which depends on the specifics of the domain. By clicking a node on the snowflake interface of Figure 4 (e.g. XYZ line of business) users can access the appropriate control user interface (e.g. the CBM of the XYZ line of business – Figure 5) to submit commands i.e. run a prediction/optimisation model or submit a query. Thus, the system provides a holistic perspective of how the organisation operates (for example, it helps users decide how to invest in different areas of the business) while facilitating the navigation to specific parts (for example, it helps users to take resource allocation decisions based on forecasts about specific products and services).

7 Conclusions

The paper proposes a model and a decision support framework, which applies cybernetic theory, to tackle the increasing context of system complexity and uncertainty. This is a control system that has been developed to model activities, products, resources and business demand. The system is designed to learn, evolve and adapt to solve complex problems by controlling the variety so as to facilitate managerial decision making.

The proposed model uses a single taxonomy. Different parts of the business are using different parts of the model, but there is no single business unit using the entire model. There is a very clear way of looking at the business, the enfolding based on the concept of 'Value Exchanges'. The product is the ultimate way of transacting this value into the market place. The model helps build the operational context of the business in terms of value transactions with the commercial environment. The components that are used to catalyse these value exchanges need to be continuously benchmarked to make sure they remain survival worthy.

The model provides oneness to a company such as TELE XY (one TELE XY) providing a virtual organization with physically distributed units. This is a highly pervasive model that can be unfolded, distributed and remain coherent.

Conventional business models represent the success plans of the enterprise. They cannot adequately deal with failure. Move outside of the plan and immediately the enterprise is in difficulty, lost in 'no man's land'. These single dimensional plans serve no other purpose than informing the stakeholders on how much return is going to be made on an investment. If the business gets into difficulty or if something goes wrong, these business models can seldom determine the cause. Yet, it is the business model that is the blueprint of the enterprise used to convince investors that their investments are safe with the company. It is this Blueprint that shows how the business will engage the competition; it is the war plan in anything but name that prepares the business for battles in the commercial space.

Conventional business models lack reversibility i.e. the business structure cannot dispose the information created by that structure. If the expected profits of the business are not manifesting from the deployed capabilities, the business needs to know what action needs to be taken. We need a reversible business model with enough information in the output to identify what actions need to be taken to restore the homeostatic states.

It has been shown that a re-engineered business model based upon cybernetic principles can significantly improve organisational effectiveness. These cybernetic business models have a fractal-based structure that has the propensity to engage every manager within the business. These fractal based structures are unfolded using a 'Value Exchange Paradigm' that articulate how people and resources interact to create enterprise value and provide the context that will enable every manger within the business to answer the most rudimentary of questions 'that faced with this predicament what should we do next'.

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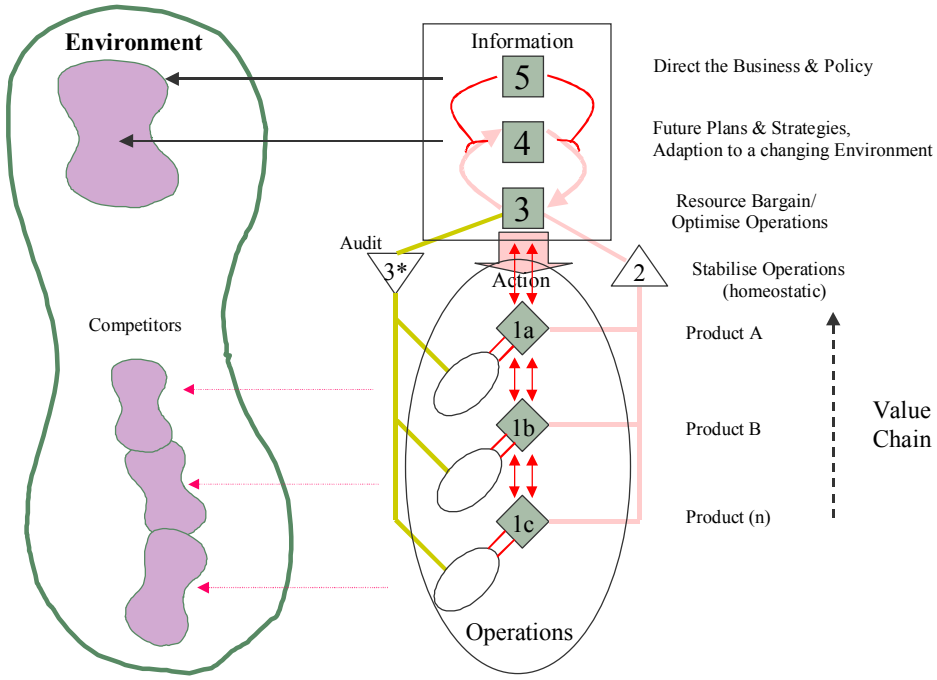

Figure 1: The VSM Model

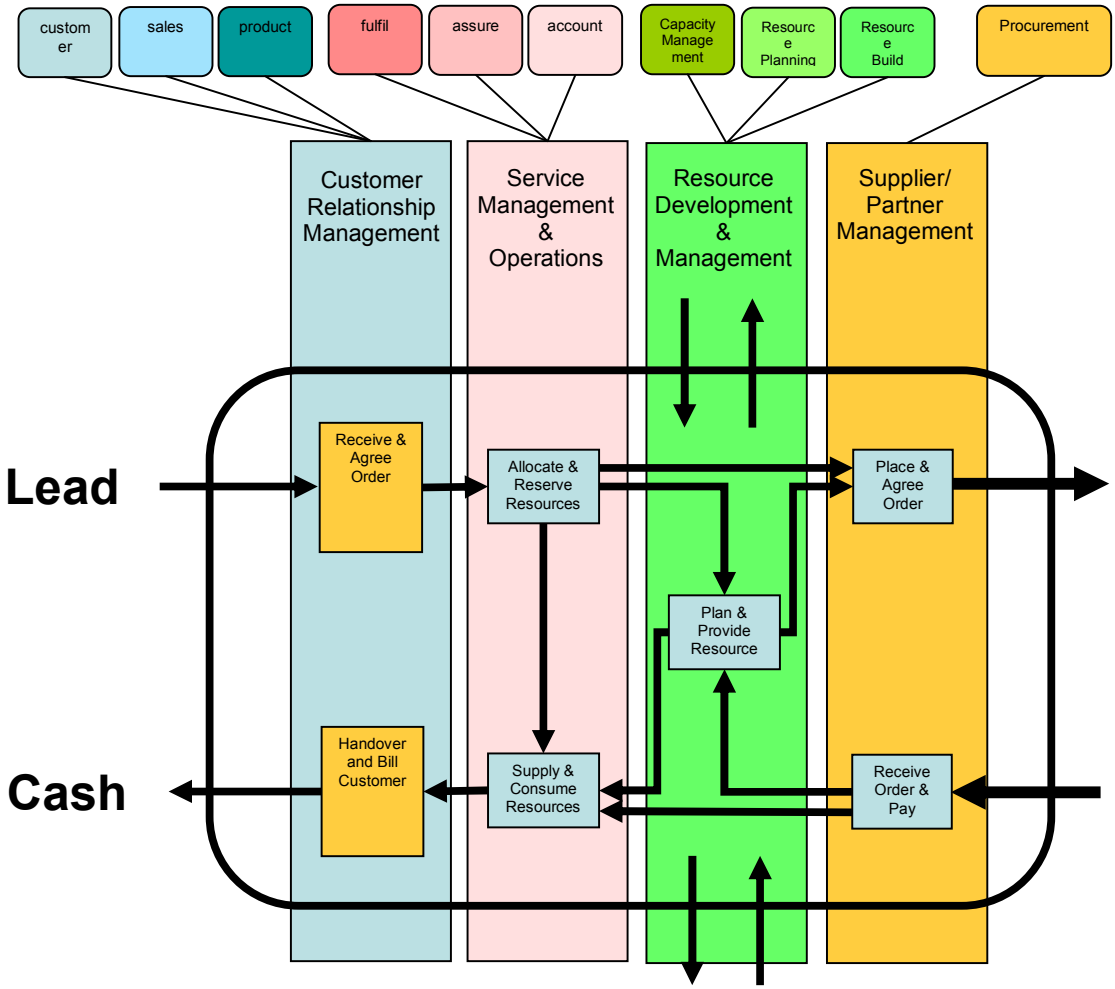

Figure 2: Fulfilling a customer order

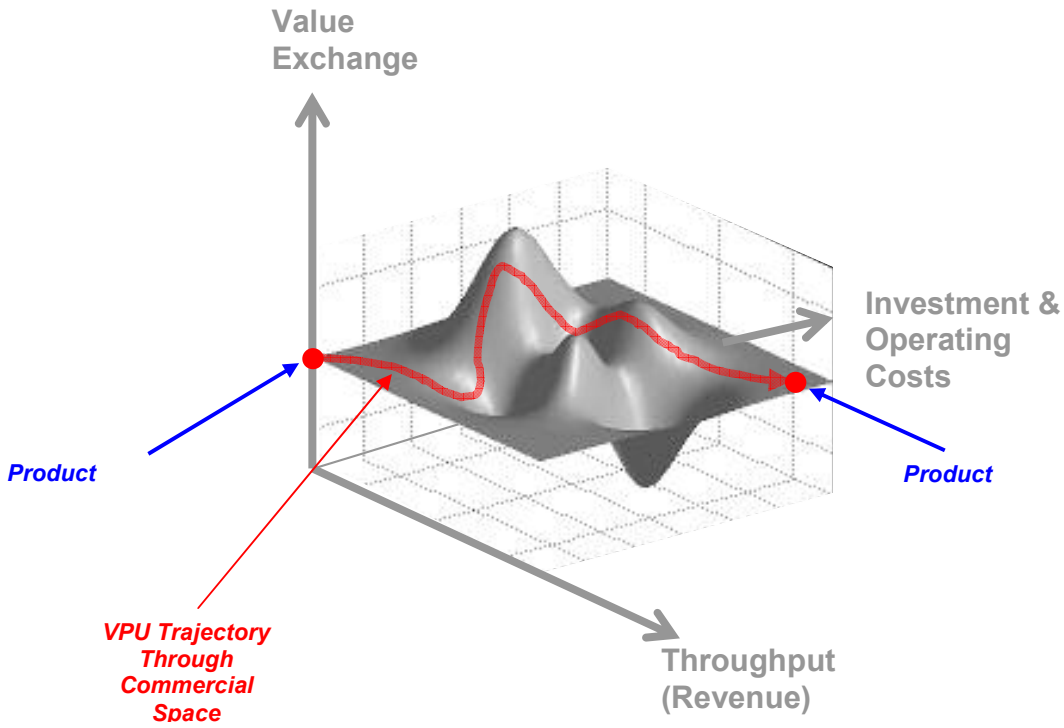

Figure 3: The value product lifecycle model

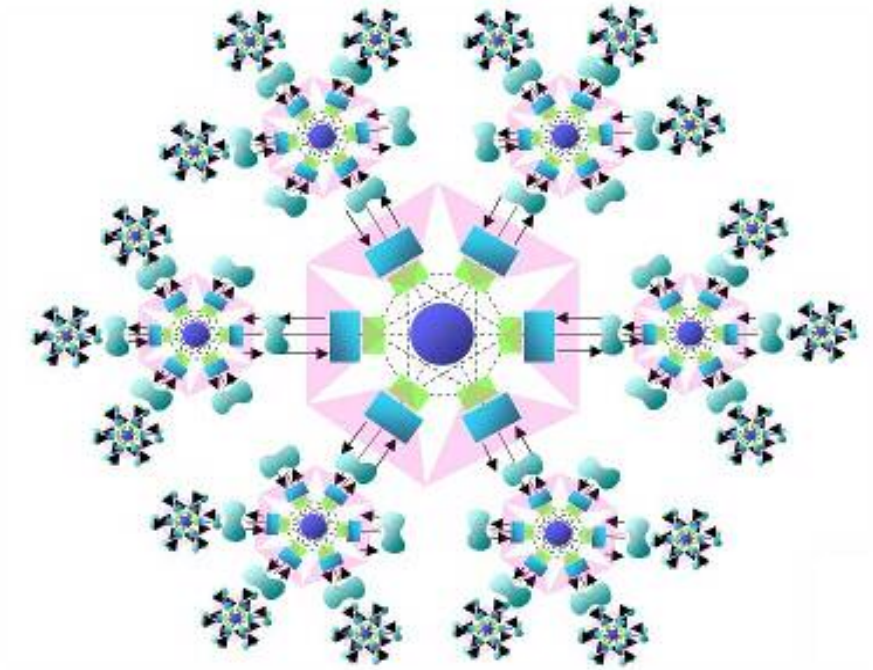

Figure 4: The CBM (Cybernetics Business Model) framework

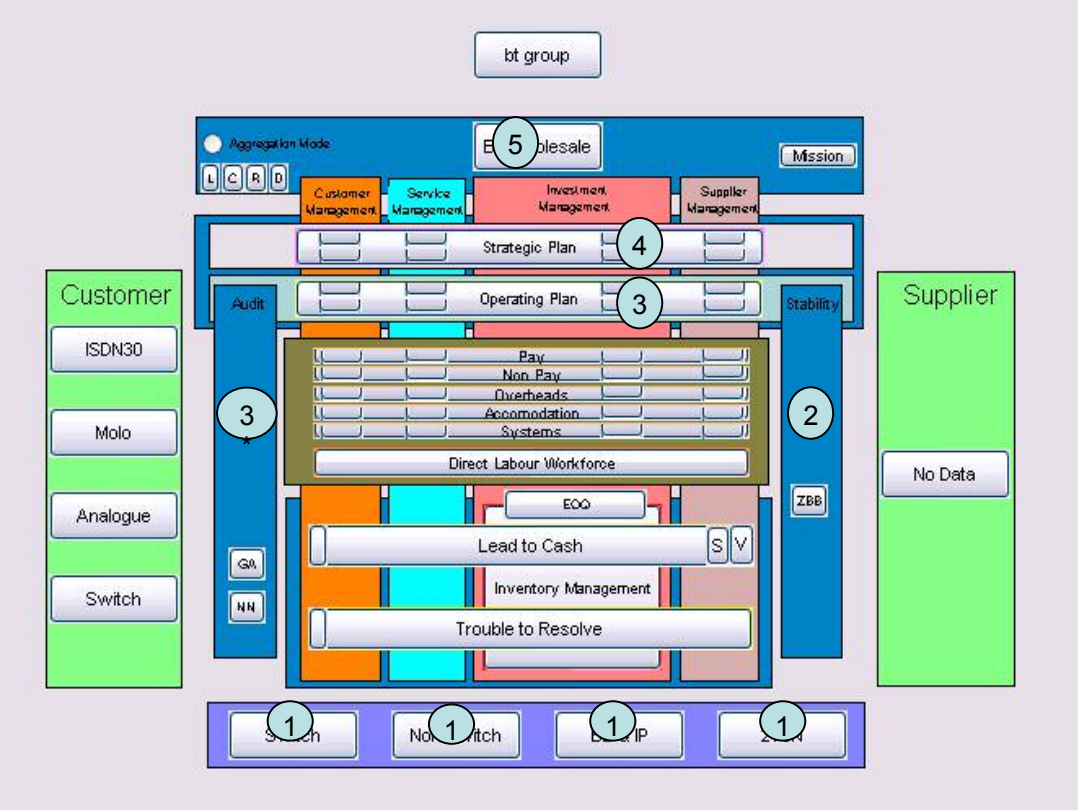

Figure 5: The VPU of a TELE XY division