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Management Models for the Future

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Innovative Models for Steering Organisations: A Systemic Approach Within the Pharmaceutical Industry

The case of CILAG AG

Markus Schwaninger and Matej Janovjak

Abstract. The purpose of this chapter is to draw some lessons from an experience with the creation and implementation of innovative management models. The case in point is Cilag AG, one of the leading Swiss firms in the pharmaceutical industry. The demand for new and better management support has led to an organisational process whose emergence has been brought about with the help of management models at different levels of the business. These range from generic frameworks to detailed simulation models. We are focusing on core components of the Company Management Model. First, the Credo and Standards of Leadership, which provide the normative basis for corporate activities. Second, the Business Model, which includes a business simulation model with front-end cockpits for managers. Third, the Organisational Model, which contains the architecture for an overarching process-oriented design of the organisation. Finally, the Process & Product Model, which delivers maps and instruments as tools for management; quality, compliance and risk management in particular. The models have been created with a high level of participation from people throughout the organisation, under the leadership of the unit of Strategic Process Management & Methods (SPMM), which fulfils the role of an innovative turnplate and catalyst. The results of this approach are so remarkable that the managers are asking for more.

Key words: Model-based management, systemic management model, business model, organisational model, organisation design, management of complexity, System Dynamics

1 Introduction

The pharmaceutical industry is ever evolving and highly competitive. In order to survive, any company must be well aligned with the dynamic context in which it operates. Besides making needed product and process innovations in the company and introducing highly complex new products to the market, the management is challenged to develop new ways of organising and managing.

Cilag AG, located in Switzerland and embedded in the Global Pharmaceutical Supply Group of Johnson & Johnson, has evolved an innovative approach to management to enhance global supply chain excellence. The aim of this paper is to explore that experience in order to extract certain lessons from the case, but also to promote the exchange of ideas.

First of all we need to clarify our understanding of the crucial concepts. Here are our working definitions:

1. A **model** is a (simplified) abstract image or representation of a reality. It can be a replica, a paragon or a standard. Simplification is achieved via definition of the model objectives and focus. As a result, what we call the *model system* is formed in the mind of an observer (mental model) and on paper or in the computer of a modeller (formal model). Close correspondence of the *model system* to the *real system* of interest should be achieved.
2. By **management** we understand the design, (self-) control and development of complex systems, e.g. organisations and processes. We subsume "leadership" under that more general term. Management reverts to the support of management systems which are formal systems made up of components such as models and instruments to enable the design, control and development of a company (e.g., corporate charters, quality management systems, planning and information systems, etc.). The terms *management system* and *management model* are often used as synonyms.
3. **Management models** are models for steering organisations, i.e. models which help those in charge of managing to fulfil their task effectively. Today this group is not limited to managers in the narrow sense of the word. It includes the many persons who have to fulfil some managerial function as part of their overall task, e.g. as project managers, team leaders, staff members, etc.

Management models should support effective leadership and strong performance at all strata of a company. They include broad normative frameworks, which are qualitative, as well as the qualitative and quantitative models at the strategic, tactical and operational levels.

Why are management models so important? The answer is given by the theorem of Conant and Ashby (1981): "Every good regulator of a system must be a model of that system." To paraphrase this, the result of a management process cannot be better than the model on which it is based, except by chance. In other words, the models on which managers operate largely determine what managers can accomplish. Hence, the quality of models is a limiting, but potentially also an enabling, factor for the quality of management.

In the next section we will first introduce the company which is the object of our case study. Then the origins and evolution of the management model will be sketched out. In the ensuing section an overview of the structure and features of the model and two of its crucial components will be given. Then, the experiences with the use of the model will be assessed. The chapter closes with lessons and recommendations for practitioners.

2 Company background

Cilag is one of the major players in the Swiss pharmaceutical industry. It was founded in Schaffhausen, Switzerland in 1936 and became a member of Johnson and Johnson (J&J), the world's most comprehensive and broadly based manufacturer of health care products, in 1959. The firm's activity is deeply anchored in Johnson and Johnson's core system of values, which has characterized the corporation for more than 60 years and is documented in the corporate "Credo". It is focused on the company's responsibilities towards its clients, especially doctors and patients, to employees, communities and stockholders.

"The highest standards of Quality, Health, Safety and Environment friendliness" are pillars of the norms governing the company. Cilag's strategy is orientated toward supply chain leadership in a number of pharmaceutical blockbuster drugs, all of the high-technology type. That implies technological leadership in the new-product-introduction and manufacturing process. This orientation has been dominant since the foundation of the company. While changes in the core business or industry have not occurred, what has changed many times in the course of an evolutionary process is the process technology.

3 The normative framework of the company

The normative framework is essentially condensed in two components, the corporate "Credo" and the "Standards of Leadership". The corporate Credo is the fundamental reference system. It is a condensed expression of the identity and spirit of the organisation. It fulfils a coordinating function bundling all efforts across the company. The corporate Credo is centred on the responsibilities of the company to its stakeholders – first and foremost "to the doctors, nurses and

patients, mothers and fathers and all others who use our products and services". The responsibilities also extend to "our employees, the men and women who work with us throughout the world". Here, the Credo adds: "Everyone must be considered as an individual". Furthermore, the responsibilities extend to "the communities in which we live and work and to the world community" (with the imperative "We must be good citizens"), and finally, "to our stockholders" (quotations from Johnson & Johnson, Our Credo).

Based on this Credo, the Standards of Leadership have been established as a second reference system bringing the crucial principles of leadership into focus. They provide a guide to the mastering of complexity. The guide does not elaborate on operational details, but is limited to essentials. It brings into the minds of employees the imperatives of dealing effectively with complexity, innovation, customer and marketplace focus, organisational and people development and interdependent partnering. And it provides advice on how to abide by these principles.

Both the corporate Credo and Standards of Leadership are the most basic models for the orientation and coordination of all employees (at Cilag roughly 1,000, in Johnson & Johnson over 100,000 altogether). In practice, they have a strong impact. They provide a "mental coordination" of the members of the organisation. At a deeper level, they substantially coin the corporate culture, and they enhance cohesion and organisational energy.

As far as the models are concerned, their design is affected by both Credo and Standards of Leadership, as we will show. The basic principles and values propagated therein are reflected in the different models in use; for example, the organisational model refers to different stakeholders. The process and product model has a strong quality and risk orientation. Finally, all models are focussed on coping with complexity.

4 Evolution of the company management model

Over the years, a variety of management systems and models have been developed and used. As far as the conventional management systems for planning and information, accounting, personnel management, etc., are concerned, Cilag has always been well-equipped. These systems were successively improved over the years to a level comparable to the standards of the best-managed companies.

Around the turn of the millennium a "paradigm shift" – to be elaborated on later – occurred. Therefore, we shall focus on a generation of management models which have emerged since the start of this decade, in the wake of both growing complexity on the one hand and progressively increasing requirements from regulatory institutions such as the Food and Drug Administration (FDA), USA. on the other. In such a context, the leadership perspective of managers

and also of specialists had to switch from a functional or specialist to a generalist approach which concentrates on the whole reference system rather than on segments or single events. That approach calls for understanding the causal structures and generative mechanisms which induce patterns of behaviour and ultimately produce daily events. It must also be based on a dynamic rather than a static view, and must be not only analytical but also, and even more so, synthetic. Altogether, this new image of management was subsumed under the notion of a *systemic management*.

These new needs triggered a strong movement towards the development of new management systems, models in particular. The quest here was not to improve the accounting system or the information systems, which – measured by the needs – were nearly perfect. Rather, the new demand was for management models which would enable their users to employ a systemic management as envisioned above.

Under the leadership of the unit for Strategic Process Management & Methods (SPMM) the pertinent developments were taken in hand. This unit has understood itself to be a servant of managers which helps them solve their managerial issues and problems, not by intervening or explaining, but rather by knowing managers' "customer problem" and providing them with conceptual and methodological solutions which are "universally valid" in the sense of being widely applicable. The solutions offered by Strategic Process Management & Methods are not advice about what to do or interferences in the discretion of managers. The approach instead is a) to convey new concepts to managers enabling them to evolve their understanding and b) to make available management models which reinforce their managerial abilities on the basis of those concepts. That is, the management models are the vehicles for putting new thinking into practice. That way, in a process of effective learning, managers acquire new abilities while they improve the performance of the organisation.

5 Overview of the company management model

The company management model is embedded in the company's normative framework and embraces several management models on the strategic, tactical and operational levels. Figure 1 gives an overview, without any claim to completeness. On the strategic level are located business, quality and compliance models, on the tactical level the models which reflect organisational and methodological aspects, and on the operational level the models for the technology and manufacturing part of the company.

We shall describe only one characteristic management model for each level. To elaborate on all management models in use would take us beyond the scope of this contribution.

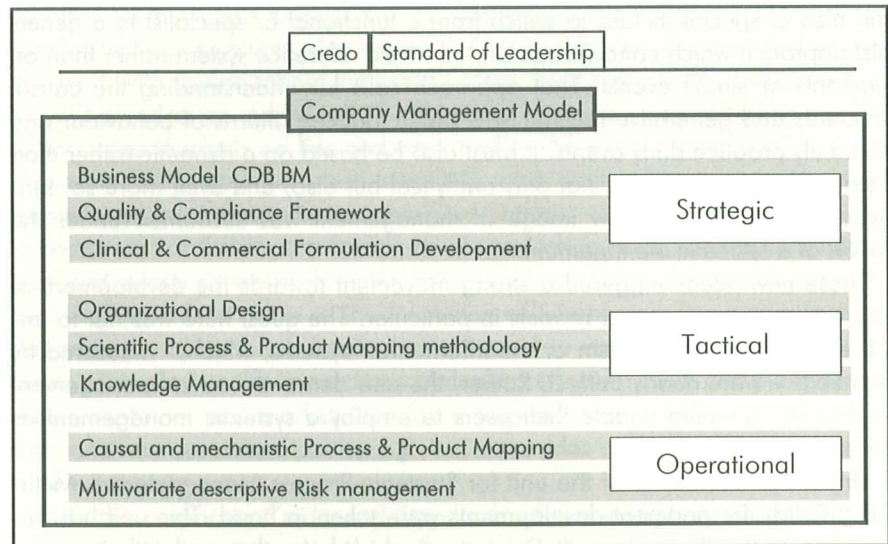


Figure 1. Components of the company management model (extract)

To ensure dynamic devices for management support and to achieve knowledge synergies, all of these models have been developed using the System Dynamics (SD) methodology.

System Dynamics is a widely used methodology for the modelling and simulation of complex systems, which was developed by Professor Jay Forrester at MIT-Massachusetts Institute of Technology. System Dynamics models are made up of closed feedback loops. Feedback is about circular causality: A signal is fed back into itself, i.e., the outcome of a process returns to change the input consequently influencing the process itself.

The systems modelled are simulated as continuous processes, i.e., the mathematics of the models is based on differential equations. System Dynamics is particularly apt for the discernment of a system's dynamic patterns of behaviour, which may be "counterintuitive" (Forrester, 1971). The dynamics are a function of the structure, made up of closed loops as well as delays in the process, and therefore, generally, are non-linear (see also Sterman, 2000).

5.1 The business model

The overarching goal was to create a high-level description which adequately captured the complexity of the business so as to provide managers with a comprehensive decision-support tool.

The Business Model was supposed to be able to simulate the dynamic system behaviour, based on the cause-effect relationships inherent in the business

processes and reflected in the company's key performance indicators (KPI's). The model in fact enables managers to deal with complex issues in a proactive, circumspect and balanced way.

The model was developed in cooperation with external consultants, but the main momentum came from inside the company. Altogether, about 30 experts and Cilag managers were involved in the model development and validation. The purpose of the participative approach was both a) to achieve a buy-in of the representatives of the organisational functions and b) to arrive at a realistic and relevant model. The realism of the model had, in addition, to be warranted by a sophisticated validation procedure by which, among other tests, sensitivities to parameter variations were examined and simulation results were compared to real-world data. The modelling and implementation process has been documented elsewhere (Schwaninger, Janovjak, Ambroz, 2006). Here we shall concentrate on describing the model as such.

The Business Model is made up of two components, the Causal Dashboard Business Model (CDB BM) and the Management Cockpit. In the CDB BM the whole company is represented by means of four kinds of variables – drivers, process measures, outcome measures and business results. These are linked by causal relationships, expressed in formulas (Figure 2).



Figure 2. The logic of the CDBM BM

The software used was Vensim, a user-friendly and powerful modelling and simulation tool. The Causal Dashboard Business Model is composed of 56 drivers (e.g., leadership, training, knowledge management), 60 process measures (e.g., yield, overtime rate, asset utilization), 50 outcome measures (e.g., cycle time, cost of goods produced, diversity index) and 12 business results (e.g., customer satisfaction index, capital efficiency, profit). These are connected by 280 causal relations and 32 main feedback loops resulting in a complex model.

The model's benefit is that it gives its users the opportunity to ask "What-If"-questions, also of the complex type. It may be consulted about what would be the impact of a certain action or set of complementary actions. Conversely, a user can trace what has to be done and how, i.e., which policy variables to use and how to calibrate them in order to reach a certain set of goals. In this way scenarios can be explored and strategy options examined. Ultimately, if this

kind of model is applied strategy design can improve substantially and decisions become more robust.

The Management Cockpit is an interface between the Causal Dashboard and its user. It provides a decision environment for managers or whoever wishes to explore the model. It gives users the possibility to view the company's model from any point of view. An example of a screen from the cockpit is shown in Figure 3. The values of external parameters (e.g. factors which impinge on the company) or internal drivers (e.g., investment in training) can be changed and the impact on any variable of the model ascertained. Scenarios can be explored. Features such as sensitivity analysis, parameter optimization, etc., which are standard components of the simulation model, can be leveraged by easy and effective visualization. Sable, the software supporting the cockpit, is easy-to use so that users can customize their decision environment. Extra screens can be added, extant screens adapted, new structural features explored, etc.

The strength of the cockpit must be seen in the context of the Causal Dashboard Business Model. That model is grounded in a feedback perspective which focuses on causal relationships in general and which in particular identifies loops of circular causality (e.g. Production asset capability $\rightarrow$ Productivity $\rightarrow$ Profit $\rightarrow$ Funds $\rightarrow$ Investment in production assets $\rightarrow$ Production assets capability $\rightarrow$ etc.). Consequently, accurate explanations of results, causal tracing of errors, detection of relationships, etc., are enormously facilitated.

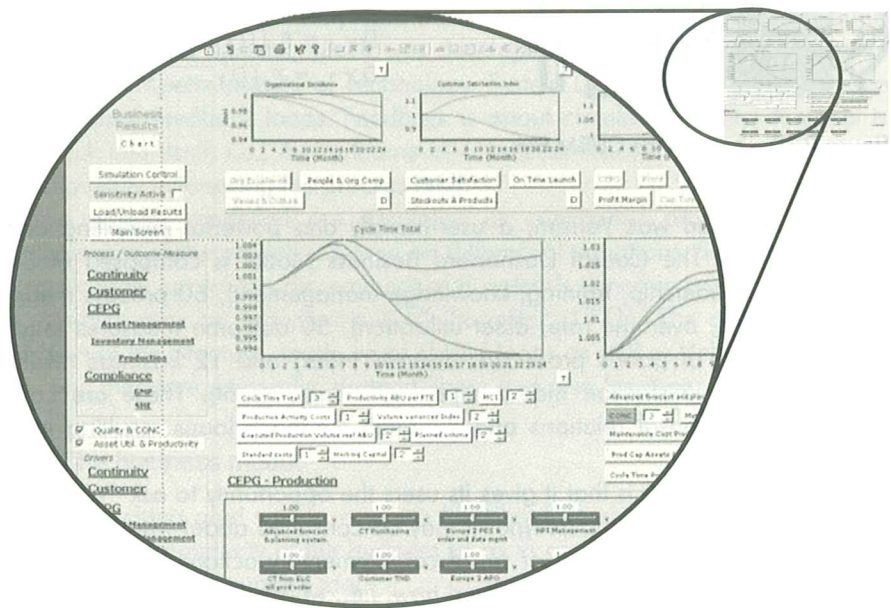


Figure 3. Screen from the cockpit of the Business Model (example)

In other words, the feedback view can indeed make a difference. The model and the cockpit should enable a new way of learning which established management systems have not provided. Playfulness is a feature of utmost importance here. We know that most of the important discoveries of humanity can be traced back to playful exploration. That is exactly what the interaction of humans and computer models is about: a playful approach to the understanding of an utterly complex reality. We expected that understanding would be achieved at a much faster pace than with other known approaches to describing and explaining complex issues. We trusted that, via the interaction of individual or team with the model, decision capabilities would be greatly improved and human intuition might even be sharpened. We knew that experiments with scenarios and even with new model versions are powerful vehicles for learning and developing managerial capability. The point, apart from the strategy of playful experimentation and exploration, is that in the new environment learning would be self-directed.

5.2 The organisational model

In the highly competitive environment of the pharmaceutical industry, companies are facing challenges such as faster expansion into new markets through highly complex new product launches and licenses, in order to obtain the required competitive advantages. Other key challenges are the global alignment of operations as well as the improving and leveraging global product and process knowledge within the steadily increasing complexity of new technologies. Coping with such issues is at the heart of management and leadership in organisations that operate globally.

The key requirement in our case was to create an overarching process-oriented organisational design of globally operated technology platforms within Johnson & Johnson's Global Pharmaceutical Supply Group Europe-Middle East-Africa (GPSG EMEA). The focus here was on key business processes (capacity planning and asset management, manufacturing, new product introduction, etc.). The organisational design has to ensure, among other things, the process-oriented integration of stakeholders into processes and the construction of technology platforms to support and enhance strategic changes in the manufacturing network. As the technology platform serves a group of manufacturing units involving similar technologies and products, knowledge management becomes a key aspect of operation.

The basic structure of the Organisational Design Model consists of four components and their relationships as sketched in Figure 4. The components are:

1. *Processes*: Thirteen key macro processes were identified whose viability is to be maintained, e.g., Technology & Innovation, New Product Introduction, Process Engineering, Asset & Capacity Management, Technology Platform Performance Management.
2. *Stakeholders*: Seven main organisational units were defined as "stakeholders" – Pharmaceutical Technology Services, Marketed Product Services, Business Unit, Human Resources, Quality & Compliance, Technology Platform Engineering, European Logistic Center. The term "stakeholder" refers to the stakes of these units in the success of the firm and their legitimate claims for organisational support.
3. *Knowledge management*: The creation of product and process knowledge, a crucial resource of the firm, has to be boosted through the new Technology Platforms, enhanced through key processes and fostered by focused organisational efforts and measures.
4. *Organisational Excellence*: This is mainly about capability and competence orientation with regard to organisational processes. Process design and leadership are considered as aptitudes with long-term implications, and are at least as important as product-related capabilities. Therefore, they must be cultivated and enhanced systematically.

In order to make the organisational complexity understandable, a cybernetic approach was implemented. Each one of the model's four components is supported

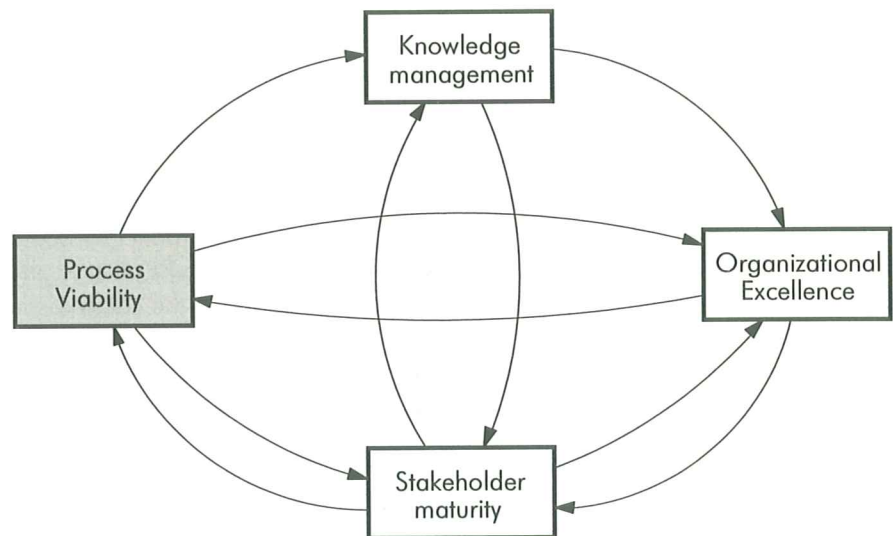


Figure 4. Schematics of the organizational design model

by heuristic schemas and causal maps on the basis of the System Dynamics methodology. These support or capture organisational decisions, e.g., about which processes have to be steered globally, which regionally, what degrees of standardization of the processes are indicated, etc.

Applying the Vensim software, a causal mapping and a simulation model of the relationships between technology platform, related stakeholders and defined key processes were developed. Figure 5 shows the core of the causal map, underlying the simulation model and Figure 6 a graph with simulation results. The different scenarios in the graph indicate the results obtained by working the different handles (expressed in the parameters of the model).

These simulations help actors in the organisation to develop effective and efficient action. The model also facilitates optimisation and provides a well-defined basis for the rollout of global implementation of technology platforms.

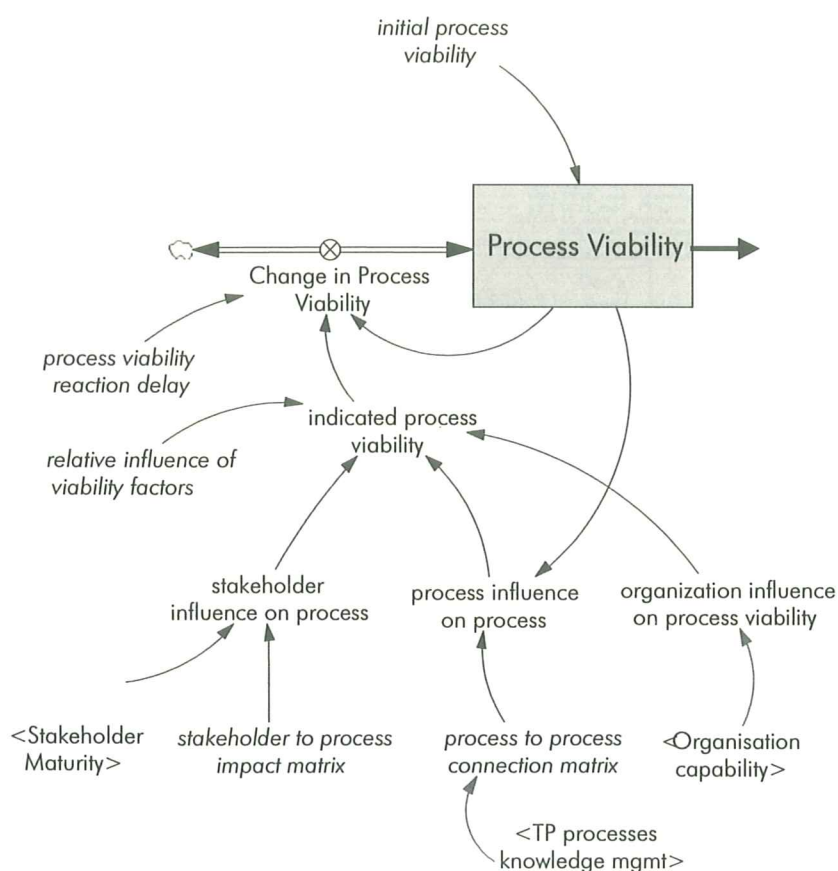


Figure 5. Abstract of the system dynamics model

should be modelled in conjunction. Second is the imperative of an overall view across all the steps of the process of value creation. The third idea is that a causal and mechanistic model on scientific grounds should be provided. Fourth, that the model should be available at a high degree of operational detail. Fifth, the model should be a device which allows a fine-grained steering of the process variables and product quality attributes. Sixth, it should be an effective instrument for anticipating risks. Seventh, the preceding should enable Quality Assurance to better understand and select from the possible process and product variations. Eighth, the model should enable prevention and improve foresight. These aspects are vital in pharmaceutical production where the quest for the health of patients, environment friendliness and compliance are absolute-must criteria. A showcase example of such a product and process mapping is shown in Figure 7.

This is only a conceptual overview of the model. Given the complexity of the process with all its ramifications for chemical or biological analytics, process controls, etc., the overall map would be too large to be reproduced here in a readable way. The diagram shows the conceptual design of the science-based Product & Process Mapping, and indicates links to specific management systems and instruments (e.g., QC-Quality Control, IPC-In-process Quality Control, PAT-Process Analytical Technology).

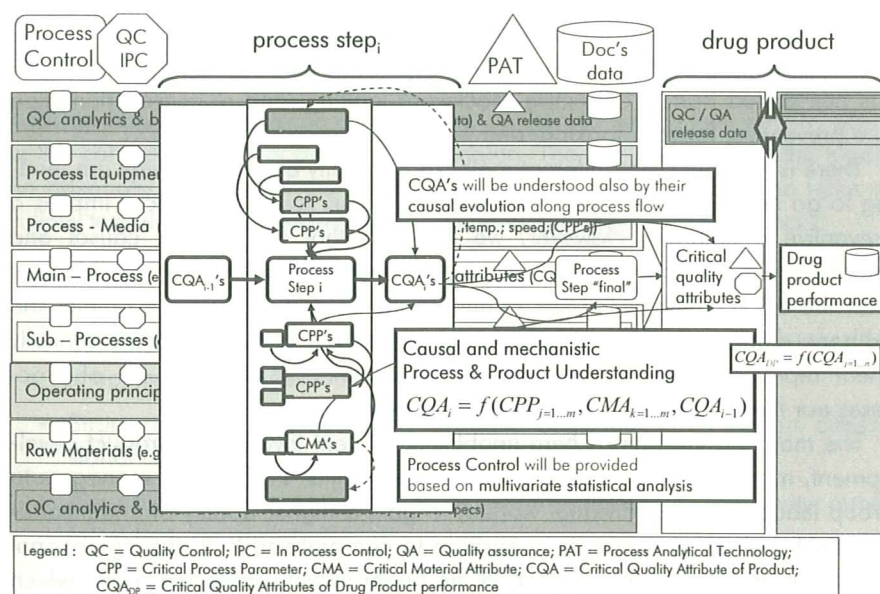


Figure 7. Conceptual design of the Process & Product Model demonstrating mapping structure, causalities, functions and links

This Process & Product Model visualizes, among other things, the cause-and-effect relationships between the critical process parameters, critical raw material parameters and relevant critical quality attributes of the product. Based on this capability, a deep and unambiguous causal and mechanistic understanding of the process and product phenomena is ensured. Hence, the model provides an adequate basis for multivariate risk assessment and continuous improvement. Also, the development and usage of the model enhance an effective and efficient knowledge management that overarches the processes.

As we expected, the kind of science-based Product & Process Mapping shown here, which is the latest component of the management model, is becoming standardized in the company at a fast pace. For example, all stakeholders on the Technology Platform have already deployed this methodology. Potential users can easily see that this new instrument provides them with enhanced analytical and diagnostic strengths. It was clear to us that it makes the detection and elimination of flaws easier and more effective, in comparison with traditional approaches. Furthermore new ways of improving product quality and process performance were within easy reach. Both process and product development as well as technology transfer could be designed with the help of the new mapping technique. Finally, the new approach implies that many can participate in the analysis, diagnosis and design – in principle, anybody who is part of the system modelled in the chart.

In short, at Cilag causal, quantitative Process & Product Mapping has become the key element of knowledge management. As a result the common focus has shifted from a corrective, backward-looking, and re-active orientation to a preventive, forward-looking, and pro-active one.

There is no doubt that different methods of quality assurance today are tending to go beyond corrections in hindsight. The very term "assurance" implies a preventive orientation. However, we maintain that the holistic, causal and quantitative modelling approach with a dynamic feedback view is more potent than the approaches which still dominate the field. To give an example, the fishbone diagrams, which are widely used in quality assurance, are essentially linear representations, which represent neither the dynamic features of processes nor the inter-linkages between the process steps.

The mapping introduced here enables any agent involved in product development, manufacturing, quality control and logistics, from higher managers to group leaders to the individual worker, to gain a higher quality of understanding. Each individual now is in a position to comprehend both the operational details of interest to him or her, and the larger system of reference into which they are embedded. The detailed understanding of product and process also strengthens the company's position towards regulatory institutions (FDA-Food and Drug Administration, etc.). That is a key to superior performance.

6 Experience with the application of the model

The management models established at Cilag offer a new overall perspective. The possibility to experiment at almost no cost, resulting in huge benefits in the form of knowledge and insights, is a great opportunity for managers, and ultimately for decision-makers at all levels. That opportunity, however, is not self-evident. The Strategic Process Management & Methods (SPMM) unit had to fulfil its important role as a deployment driver and catalyst to the understanding and use of the models before the overall picture for opportunity could emerge.

With demonstrations of small models and a dialogue by which model users were closely involved in their design, confidence in these new devices was built up. The interest in these innovations grew quickly. Pioneers adopted them early on. The top managers, as power promoters, soon saw the benefits of modelling and simulation, and some acted as role model users, which were then emulated by a larger number of employees. In the third quarter of 2005, i.e., about six months after the prototype of the Business Model became operational, the management models on the tactical level had been established (Organisation Design, scientific Process & Product Mapping methodology). In the first quarter of 2006, the first scientific Process & Product Mapping came out. No sooner was it presented to the middle and lower level managers in Product Development, Production and Quality Assurance, than the first demands for making the model available for day-by-day use arose. Also, a customisation of the model for their purposes was defined and executed.

The management models were not complete in the early stages and still had to undergo tests for the purpose of validation, i.e. tests to ensure their quality, which in this context refers to accuracy and precision. The question was: "Is the model an adequate reflection of the reality it is supposed to represent?" The types of validity tests embraced not only statistical testing but also qualitative checks.

Essentially, to decide on the validity of the model four types of tests were carried out:

- Behaviour reproduction (i.e., to check if the behaviour of the real systems is appropriately reproduced by the model)
- Structural fit (structure of causal relations, parameter confirmation, dimensional consistency)
- Plausibility and consistency of results (extreme-conditions, sensitivity, qualitative features analyses)
- Validity for application (if the model is appropriate for the domain in which it is to be used and conforms with purpose)

Testing in these four ways gradually built up confidence in the models among the users.

Experience with usage of the models has confirmed our expectations. Beyond that, however, surprising benefits also emerged. The model users, managers in particular, have acquired a new way of looking at events. Increasingly they have switched to a more systemic thinking – that focuses on dynamic wholes, and combines analysis and synthesis. Beyond expectations, they have gradually been learning new ways of managing. Learning takes place at an accelerated pace, because it is learner-centred and self-directed. This new learning proceeds not by instruction but by selection (cf. Olaya, 2007). In the learner's dialogue with the model many variants, e.g., of strategies, can be created; the most promising ones are then chosen and put into practice.

This learning process has not ended yet and probably never will. But a change towards innovative modes of running the business has become evident. Where decisions used to be taken with little analytical underpinning and essentially on the basis of gut-feeling, a new mode of decision-making is taking over. In the first place, people try to understand the system at hand and its workings. Then they go about building a theory – a theory of action which works. They explore the space of action possibilities, test potential measures with respect to vulnerabilities and robustness, and then decide upon a solid foundation.

One significant and promising new feature is that users of the models tend to adhere to a proactive design mode rather than to the traditional, reactive control and intervention mode. Also, an effect of multiplication is visible: The high level of participation has led to a diffusion of the new management style, because many members of the organisation are encouraged to adopt the new practices.

The most striking finding is that a fundamental transformation to a new logic of management has been taking place. This surprising transition has even been considered a "paradigm shift" – not only by the Head of the Strategic Process Management & Methods unit (author M.J.), but also by several line managers involved. It shifts paradigms because the management and staff are adopting a new, shared view on how to manage their company.

7 Insights and recommendations

An overall outlook on what has been achieved with the models discussed here calls attention to several results which are discernible in hindsight, but which reach beyond what had originally been expected. The original idea was to provide a set of models which would help the agents in the company to cope with the complexities they faced in more effective ways. However, as it has now turned out, the management practice at Cilag has undergone a "paradigmatic change". Managers and staff have learnt a new way of making decisions and of discovering new approaches to running their business.

Even though one must concede that not each and every manager in the company subscribes to the new "paradigm", one can see a generation of managers emerging for whom the work with the models is a natural feature of their daily practice.

What are the teachings of this case? The following points are not scientific principles. They are, however, a set of pragmatic recommendations which can help in finding paths toward more useful management models:

1. The quality of the model determines the quality of management.

This calls for powerful models, in other words models which give an accurate picture of the reality faced by those who use it. Such a model must open new spaces and enhance the repertory of behaviour (also called the "potential variety") of managers and staff. It must be integrative, dynamic, and sufficiently rich.

Don't work with too simple or weakly founded models. Illegitimate simplification and trivialization tend to lead to erroneous conclusions which may lead to disastrous consequences. At the same time, excessive complexity of models must be avoided as well, because their workings will prove to be untraceable and it will become more difficult to distinguish between what is important and what is not.

2. Design a holistic company management model. A company should have an overall framework which – like a genetic code – defines the identity and the spiritual architecture of the organisation, in particular its fundamental principles and values. It is essential to design the whole management system in a coherent fashion. The management models on the strategic and tactical levels should be holistic in that they integrate different dimensions, e.g. social, economic, technological and ecological. They should also help individuals orientate themselves in relation to the whole, i.e., the larger system in which they operate.

While embracing a holistic view, avoid a scattered approach: Fragmented and one-dimensional models proliferate short-sightedness and undermine the necessary co-operativeness which crosses borders.

3. Conceive management models for dealing with the crucial issues.

In our case company the number one challenge is growing complexity. The management models are fully concentrated on that issue. For example, the Business Model as well as the Causal Process and Product Model enhance the capability of actors for dealing with complexity more effectively: their behavioural repertory is amplified by them.

Don't try to model everything. Your model will lose both rigor and relevance. In other words, it will be neither good (valid, reliable) nor practical.

4. **Incorporate a dynamic view and make it operational.** In a complex environment, integrative and dynamic models are called for. These should be equipped with extensive simulation capabilities, and an interface that enables careful analysis. Such facilities should foster the learning and improvement of the dynamic view, the thinking in causal relationship and operational thinking of users. The thinking in feedback loops should become a routine. The feedback view makes a difference in that it helps to progress from mere analysis toward synthesis and understanding.

Don't get caught in the reductionist logic of open causal chains. These do not take into account the retroaction of the system you are dealing with. Avoid the trap of the misleading static models. Be careful to avoid the seductiveness of excessive abstraction, which is alienated from the functioning of the real world.

5. **Make modelling and simulation a widely used practice.** Let people discover the crucial relevance of good models, in both minds and computers. Support self-directed learning. Foster conceptual thinking through learning-by-doing, courses and modelling workshops. Dedicate enough effort to the understanding of the complexities in which the organisation and its individuals are immersed. Let theory-building for a better practice become a widely adopted routine.

If the people in your company do not like to use models, don't accept that attitude. Make sure that managers discover the importance of models in order to improve their decisions.

6. **Make management models focus on the long term.** Orientate yourself vis-à-vis the long term, and give the long-range perspective priority over the short-term viewpoint. This is not to forget about the here-and-now, but to be clear about the relative weights of the different imperatives. A long-term orientation can be difficult and costly in the short run but, if it succeeds, the dividends are high. This reflection is valid for all key business aspects (company development, outreaching compliance, new technologies, etc.).

Avoid the error of founding your strategic scenarios or plans on extrapolations from historical data only. Design your models in a way that lets them incorporate adaptations and new inputs.

7. **Design and implant the management models in a participative way.** Involve the future users of the management models in their design and deployment. Help as many people as possible to leverage the models for conceptualizing and understanding their business better. This way they should arrive at a more circumspect way of making decisions, thinking about and exploring options, and examining consequences of actions as well as the opening of new spaces for action. Last but not least, participa-

tion should enhance the results and robustness of the company. Ultimately it should catalyze the viability and development of the organisation.

Do not succumb to the specialist syndrome. In this constellation a few experts elaborate models which then are made available to "the rest". This way of proceeding is counterproductive – a source of weak models, and of non-acceptance, misunderstanding and indifference or conflict.

8 The challenges ahead

Trends in the pharmaceutical industry from 2007 – 2009 are characterized by the increased impact of generic pharmaceutical competitors, decreased R & D productivity, cost pressure and sustained high performance (in terms of growth and gross profit) of biopharmaceutical products.

From the perspective of management and organisation the following issues are among the challenges which might play a key role:

- The need to master more complex technologies and supply chains
- High requirements on leaders' capabilities in environments with increased complexity and accelerated changes
- Increased needs for superior organisational capabilities (e.g., development of core competencies and knowledge, innovation, process orientation).
- Compression of development time for commercial product design, to reduce time-to-market.
- Diverse changes of business environment (e.g., pressure on profits, extensive collaborations, merger integration).

Management models will help in coping with these issues, and they will have to be developed further as well.

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