

IT Governance: Reviewing 17 IT Governance Tools and Analysing the Case of Novozymes A/S

Michael Holm Larsen
holmlarsen@gmail.com

Mogens Kühn Pedersen
Copenhagen Business School
mk.inf@cbs.dk

Kim Viborg Andersen
Copenhagen Business School
andersen@cbs.dk

Abstract

Complexity in information technology architectures and infrastructures, and an increasing need for executives to verify and secure value generation processes in private as well as public organisations, call for an increasing awareness and understanding of Corporate Governance in general and IT Governance in particular.

The paper investigates how IT Governance is adopted in the case company Novozymes A/S, which is a biotech-based world leader in industrial enzymes and microorganisms. Based on a review of 17 IT Governance Tools, the paper analyses the challenges of the adopted IT Governance arrangements and mechanisms. Finally, the paper point to future development directions in order to further unfold the potential of IT Governance at Novozymes A/S.

1. Introduction

The Information Technology Governance Institute defines IT governance as “the leadership, organizational structures, and processes that ensure that the enterprise’s IT sustains and extends the enterprise’s strategies and objectives”. Additionally, they state that “While governance developments have primarily been driven by the need for the transparency of enterprise risks and the protection of shareholder value, the pervasive use of technology has created a critical dependency on IT that calls for a specific focus on IT governance” (ITGI 2003:1). IT Governance reflects broader corporate governance principles (OECD 2004). Corporate Governance and IT Governance both pursue an ongoing questioning of the organisation’s governance model’s sufficiency in minimising risks and maximising returns (Hamaker & Hutton 2004). IT governance may also be defined as specifying the decision rights and accountability frameworks to encourage desirable behaviour in using IT (Weill & Ross 2004:2).

Aligning business and IT objectives has been debated for decades among academics and practitioners (e.g. Sambamurthy & Zmud 1999, ITGI 2001), however, discussions has been intensified within the last 5 years (e.g. Robbins 2004, Weill & Ross 2005, Brown & Grant 2005) due to corporate scandals like WorldCom, Enron, Arthur Andersen, etc. Based on the cited literature in this paper, no similar comparison of IT Governance approaches are available. Further in positioning the research, it is concluded that research into in-depth case studies as well as providing an overview of IT Governance tools are needed. The research question in this paper is: what is an appropriate tool for IT Governance case analysis, and what is the status of IT Governance in Novozymes A/S? This leads to an analysis of the applied IT Governance at Novozymes A/S pointing to relevant development issues.

The structure of the paper is as follows. The second section is a methodology section evaluating different IT Governance tools and identifying the tool to be applied for the case analysis. The third section contains the analysis of IT Governance performance at Novozymes A/S, and the fourth section evaluates the alignment of the IT Governance practice with strategy, organisaiton, behaviour and relevant metrics using the IT Governance Design Framework for structuring the analysis. Section five concludes the paper and draws up a set of recommendations to further development of IT Governance at Novozymes A/S.

2. Methodology and Selection of an IT Governance Tool for Case Analysis

As the paper is a case analysis of IT Governance at Novozymes A/S, the paper will address the following issues:

- Select evaluation criteria
- Review of potential IT governance tools.

- Assessment of potential IT Governance tools.
- Case evaluation applying the selected tool.
- Development of recommendation derived from the analysis.

Each of these issues will be dealt with in separate sections. In this paper there will be no demarcation between methods, methodologies, techniques, and tools of IT Governance, and all will, though simplistic, be referred to as tools.

The data collection rest upon a presentation and interview with IT manager Lars Refslund, Novozymes A/S, and secondary data from annual reports and Novozymes A/S' corporate website in addition to that the researchers have been acquainted with the organisation for more than a decade.

2.1. Evaluation Criteria

The final selection of an IT Governance tool depends upon which tool provides the better framework for evaluating the alignment of the IT Governance structure with the business. Therefore, it is of great importance in any management discipline in scoping a project or activity that appropriate tools for appropriate business problems are applied.

In relation to the definition of IT Governance of Weill & Ross (2004) a specification of the decision rights and accountability frameworks are vital in determining IT Governance effectiveness. Hence, a crucial evaluation criterion is that a tool addresses decision-making processes. In addition to this, another important evaluation criterion is that the tool is used to the entire business system as the unit of analysis in order to avoid sub-optimisation. IT Governance tools may however also be related to other processes in the organisation. Core business processes and support processes are therefore added as classes. Moreover, tools may also be related to subsets of the business system. Procedures, activities and organisational units are therefore included as classes. Consequently, the dimensions of the evaluation are process type and organisational entity, resulting in a 3-by-4 IT Governance classification matrix.

2.2. Review of IT Governance Tools

At a very broad level, organizations can approach governance on an ad hoc basis and create their own frameworks, or they can adopt standards that have been developed and perfected through the combined experience of hundreds of organizations and people. By adopting a standard IT governance framework,

organisations may realize a number of benefits (Spafford 2003).

During the past two decades, a variety of standard IT governance frameworks and different assessment methods for evaluating IT impact and performance has emerged. In this section 17 tools are considered and evaluated. Some tools have developed into a set of guidelines, others into methods or best practices, and again others into *de facto* or *de jure* standards.

The reason for this listing and the subsequent evaluation is to obtain a comprehensive basis for assessing the case company's IT Governance. Also, the listing provides an interesting overview of implementation frameworks of IT Governance initiatives. Moreover, the listing shows the main differences between the tools and hereby how differently IT Governance initiatives may be pursued and adopted. Through a survey of literature the following 17 tools were found:

ITIL: Information Technology Infrastructure Library (ITIL) is the world-wide de facto standard in Service Management (Behr et al. 2004). ITIL provides a comprehensive, consistent volume of best practices drawn from the collective experience of thousands of IT practitioners around the world (Niessink & van Vliet 2001). ITIL focuses on critical business processes and disciplines needed for delivering high-quality services. Out of the ITIL framework, the British Standard BS15000 has emerged. BS15000 is the world's first standard for managing IT services. All activity is classified under two broad umbrellas, i.e. Service Management and Service Delivery. This approach defines IT quality as the level of alignment between IT services and actual business needs (Niessink & van Vliet 2000). As a result, organizations can mature their best practices without regard to specific technologies.

COBIT: Control Objectives for Information and Related Technology (COBIT) has been developed as a generally applicable and accepted standard for good Information Technology (IT) security and control practices (Lainhart 2000). The tools include: (1) Performance Measurement elements, i.e. outcome measures and performance drivers for all IT processes, (2) A list of Critical Success Factors (CSF) that provides succinct, non-technical best practices for each IT process, and (3) Maturity Models to assist in benchmarking and decision-making for capability improvements.

ASL: Application Services Library (ASL) is a collection of best practice guidance for managing application development and maintenance. It is the public domain standard for application management, separate from the IT Infrastructure Library (ITIL), but linked to it in terms of adherence to standards for

managing processes and providing a coherent, rigorous, public domain set of guidance (Bastiaens 2004, van der Pols 2004). ASL is a part of the IT Service Management (ITSM) Library. ASL recognises three types of control, i.e. functional, application and technical control. Where Information Technology Infrastructure Library (ITIL) is a generally accepted standard for organizing technical management, the Application Services Library (ASL) offers a framework for the organization of application management (Meijer 2003).

Six Sigma: Six sigma stands for Six Standard Deviations from mean. The Six Sigma methodology provides the techniques and tools to improve the capability and reduce the defects in any process. The Six Sigma methodology improves any existing business process by constantly reviewing and re-tuning the process (Hammer 2002). To achieve this (cf. Puzdek 2003), Six Sigma uses a methodology known as DMAIC (Define opportunity, Measure performance, Analyze opportunity, Improve performance, Control performance). Customer requirements, design quality, metrics and measures, employee involvement and continuous improvement are main elements of Six Sigma Process Improvement.

CMM/CMMI: The Capability Maturity Model (CMM) is a methodology used to develop and refine an organization's software development process. The model describes a five-level evolutionary path of increasingly organized and systematically more mature processes. CMM was developed and is promoted by the Software Engineering Institute (SEI), a research and development center sponsored by the U.S. Department of Defense (DoD). The CMM suggests 5 Maturity Levels of Software Processes (Mathiassen & Sørensen 1996), i.e. the initial, repeatable, defined, managed and optimizing level. CMM is through the years developed further integrating the different activities, i.e. CMM Integration (CMMI). Whereas CMM is based on the classical waterfall model, CMMI is addressing iterative development and is being more result-oriented.

IT Service CMM: IT Service CMM is a maturity growth model aimed at IT Service providers (Niessink 2003). IT Service CMM is a development of the CMM for software development and incorporates similar maturity stages. Moreover, the IT Service CMM originates from the efforts to develop a quality improvement framework in order for service organisations to improve service quality (Niessink & van Vliet 1998). The model does not measure the maturity of individual services, projects or organisational units. Rather, the model measures the

maturity of the whole service organisation covering the service delivery process, i.e. including all activities involved in creating the result for the customer, starting from identifying the needs of the customer until evaluation the delivered services (Niessink et al. 2005). The model is delimited from covering the development of new services.

SAS70: SAS70 is an auditing standard designed to enable an independent auditor to evaluate and issue an opinion on a service organization's controls. Statement on Auditing Standards, No. 70 (SAS70) for Service Organizations, is an internationally recognized auditing standard developed by the American Institute of Certified Public Accountants (AICPA). A SAS70 audit (www.sas70.com) is widely recognized, because it represents that a service organization has been through an in-depth audit by an independent accounting and auditing firm of their control activities, which generally include controls over information technology and related processes. Organisations must demonstrate that they have adequate controls and safeguards when they host or process data belonging to their customers. Control objectives and control activities should also be organized in a manner that allows the user auditor and user organisation to identify which controls support the assertions in the user organization's financial statements, e.g. existence, occurrence, completeness, valuation, etc.

ISO 17799: The ISO 17799 or the counterpart of British Standard BS 7799 is a standard for information security including a comprehensive set of controls and best practices in information security. The standard is intended to serve as a single reference point for identifying a range of controls needed for most situations where information systems are used in industry and commerce. Compliance with ISO 17799 and BS7799 ensures that an organisation has established a certain compliance level for each of the ten categories covered (Ma & Pearson 2005), i.e. security policy, security organisation, asset classification and control, personnel security, physical and environmental security, communications and operations management, access control, systems development and maintenance, business continuity management, and compliance (ISO 2000, BS 2002).

SOX: The Sarbanes-Oxley Act of 2002 (often shortened to SOX) is legislation enacted to protect shareholders and the general public from accounting errors and fraudulent practices in the organization (SOX 2002). The legislation not only affects the financial side of corporations, but also affects the IT departments whose job is to store a corporation's electronic records. The Sarbanes-Oxley Act states that all business records (Alles et al. 2004), including

electronic records and electronic messages, must be saved for not less than five years. The consequences for non-compliance are fines, imprisonment, or both. Hence, Sarbanes-Oxley compliance induces significant implications for the IT function (Moore & Swartz 2003). The Sarbanes-Oxley requirements are increasingly integrated with enterprise risk management initiatives (Beasley et al. 2004, Sammer 2004).

SysTrust: The SysTrust service is an assurance service that was jointly developed by the American Institute of Certified Public Accountants (AICPA) and the Canadian Institute of Chartered Accountants (CICA). It is designed to increase the comfort of management, customers, and business partners with systems that support a business or particular activity (Pacini et al. 2000). In a SysTrust engagement (McPhie 2000), the practitioner evaluates and tests whether or not a specific system is reliable when measured against three essential principles: availability, security, and integrity.

PRINCE2: PRINCE, which stands for Projects IN Controlled Environments, is a project management method covering the organisation, management and control of projects. PRINCE was first developed as a UK Government standard for IT project management. Since its introduction, PRINCE has become widely used in both the public and private sectors and is now the UK's de facto standard for project management. Although PRINCE was originally developed for the needs of IT projects, the method has also been used on many non-IT projects. The latest version of the method, PRINCE2, is designed to incorporate the requirements of existing users and to enhance the method towards a generic, best practice approach for the management of all types of projects (OGC 2005).

IT Audit: Sisco (2002) argues that an IT review should contain three main areas to focus the evaluation, i.e.: (1) Technology: identifying capability to meet company needs, stability, capacity and scalability, security, and risks. (2) IT organization: expertise and depth needed to support the business needs, management, morale, capacity, and risks. (3) IT processes: change management, software licenses, project management, policies and procedures regarding technology, and tracking and measuring performance. As a technology organization has many functional parts, a quantification of the IT organisational structure will include (Sisco 2002): (a) Infrastructure. Networks, i.e. LAN, WAN, and desktop support. (b) Business applications. Research & development, and support, including installation services, professional services, help desk, computer center operations, technology assets, business processes and procedures.

IT Due Diligence: Sisco (2002b) states that the due diligence objective needs to be clearly defined. Sisco (2002b) suggests that an IT due diligence plan should be broken down to seven parts, i.e.: (1) Current IT operation, (2) Risks and risk avoidance plans, (3) Financial plan (expected cost and budget to continue operation), (4) Capital investment requirements, (5) Leverage opportunities and recommended plans, (6) Transition plan, (7) The due diligence report.

IT Governance Review: Weill & Ross (2004) suggest that an IT Governance review contains the following activities (1) Mapping the organisations current governance with the tools of a Governance Design Framework (GDF) and a Governance Arrangements Matrix (GAM). (2) Comparing the GDF and GAM, (3) Auditing IT Governance Mechanisms, (4) Designing the To-Be Governance Structure, (5) Transform to the To-Be version of the GDF and GAM of the organisation, and focus on communicating, teaching, convincing, refining, and measuring the success of IT Governance. Alternative mechanisms for design of IT Governance scenarios are proposed by Meyer (2004).

IT Governance Assessment: Weill & Ross (2004:119) suggest a framework for assessing IT Governance Performance. As IT Governance is defined as specifying the decision rights and accountability framework to encourage desirable behaviour in IT usage (Weill & Ross 2004), governance performance must then be assessed as how well the governance arrangements encourage desirable behaviours, i.e. how well the organisation achieves its desired performance goals. Hence, the framework proposes that IT Governance should address five important factors, which are: enterprise setting, governance arrangements, governance awareness, governance performance, and financial performance.

IT Governance Checklist: Damianides (2005) suggests a checklist for IT Governance containing a set of 44 diagnostic questions. For each of the questions the extent to which it relates to (a) IT Value Delivery, (b) IT Strategic Alignment, (c), Risk Management, and/or (d) Performance, is specified. The questionnaire contains 3 subgroups, i.e. to uncover IT issues, to find out how management addresses the IT issue, and to self-assessment of IT Governance practice with regard to the board and management.

IT Governance Assessment Process (ITGAP) Model: Peterson (2004) suggests a four stage process for assessing IT Governance. The Process contains the following steps (1) describe and assess IT Governance value drivers, (2) describe and assess the

differentiation of IT decision making authority for the portfolio of IT activities, (3) describe and assess the capabilities of IT Governance, and (4) describe and assess IT value realisation.

2.3. Evaluating the IT Governance Tools

The table below classifies the 17 IT Governance tools in relation to a specific process type and with respect to a certain organisational entity. Although, an IT governance tool may relate to more areas and processes, the dominating scope and process, respectively, is marked. Based on the review of the individual tools, the classification is the following:

Decision-Making Processes	• SAS70	• COBIT		• IT Governance Review • IT Governance Assessment • IT Governance Checklist • IT Governance Assessment Process Model
Core Business Processes	• ITIL / BS15000	• CMM / CMMI • IT Audut • IT Due Diligence	• Six Sigma	• IT Service CMM
Support Processes	• ISO 17799 / BS7799 • SysTrust	• ASL • PRINCE2		• SOX
Process Type / Organisational Entity	Procedure	Activity	Business Unit	Business System

Table 1: Classification of IT Governance Tools.

As the intention is to investigate decision-making processes in the entire business system, only the four tools with the “IT Governance” name are likely candidates for further evaluation. However, the IT Governance Checklist does not lead to a sufficient comprehensive analysis, but is valuable as an indicator for a pre-analysis of IT Governance. The ITGAP of Peterson (2004) is to some extent comparable with the IT Governance Assessment of Weill & Ross (2004). Although, Peterson (2004) states that the ITGAP assessment model has been used with more than 50 large multi-division companies, these studies are not documented in public material, which on the other hand is the case of the IT Governance Assessment tool of Weill & Ross (2004). Also, the empirical basis of the IT Governance Assessment tool is broader. Hence, only the difference between IT Governance Assessment and IT Governance Review needs to be clarified.

As the description of the two tools presented in section 2.2 shows there are some overlap between them. The IT Governance Review is a thorough analysis of the existing IT Governance arrangements and mechanisms in an organisation leading to a future

design of IT Governance by addressing the insufficiencies of the current IT Governance structure. The IT Governance Assessment is a measurement of the current state of IT Governance Performance – but without the design element. Also the IT Governance Assessment does not include a thorough alignment discussion as the IT Governance Review due to the GDF. However, the analysis is somewhat broader addressing e.g. the IT intensity, the IT Governance Awareness and relating these findings to the financial performance of the organisation.

Based on the above findings an IT Governance Review will be conducted in the following analysis, where the IT Governance Design Framework will structure an analysis of the degree of alignment of the IT Governance mechanisms in relation to the strategy, organisation, behaviour and relevant metrics.

3. Assessing IT Governance at Novozymes A/S

3.1. Company Background

Novozymes A/S is the biotech-based world leader in enzymes and microorganisms. Novozymes A/S has with a net turnover of 1 billion US dollar currently 44% of the world marked in industrial enzymes, which are used in industries such as detergents, textile, baking, etc. Novozymes A/S delivers enzymes and microorganism solutions to enable their customers to produce higher quality products more efficiently in 40 different industries and 130 countries. With more than 100 types of enzymes and microorganisms and not less than 700 different products Novozymes A/S has the largest product portfolio in the world.

Novozymes A/S employs approximately 4.000 persons, of which half are located in Denmark. Novozymes A/S has production sites in Denmark, US and China, and sales organisations scattered around the world. Novozymes uses the ambitious aspiration of “Unlocking the Magic of Nature” in relation to the corporate name.

Historically, Novozymes A/S was a central business unit in Novo Nordisk A/S called Enzyme Business. However, in November 2000 Novozymes A/S was demerged from Novo Nordisk A/S and became an independent company. As an independent publicity listed company, Novozymes A/S is still a part of the Novo Group A/S, which is a holding company containing independent companies with the same core values. Novozymes A/S has due to reengineering activities in the late 1990’ies become a process oriented company, cf. Larsen & Bjørn-Andersen (2001).

3.2. Governance Arrangements

The IT Governance Structure of Novozymes A/S is described in the following. The Executive Management (ExM) meets 4 times a year, half a day, to discuss information technology, and during these sessions they are called an Application Strategy Group (ASG), though it is the same people. Each IT project is headed by a steering group and a project manager, who is hold accountable for project delivery, deployment and follow up, and who is related to the Project Office (PO). The Project Management Office (PMO) may be classified as an advanced PMO integrating a comprehensive project management capability to achieve business objectives (cf. Hill 2005), based on a set of predefined criteria (Sherer 2004). On infrastructure and architecture issues, the Infrastructure Strategy Board (ISB) has the decisive power.

The governance arrangements describe which archetypes are used for each key IT decision (cf. Weill & Ross 2004) in Novozymes A/S. The findings are presented in the following figure.

IT Decision:	IT Principles		IT Architecture		IT Infrastructure Strategies		Business Application Needs		IT Investment	
	Input	Decision	Input	Decision	Input	Decision	Input	Decision	Input	Decision
Archetype:	Polities	ASG						ASG		ASG
Business Monarchy										
IT Monarchy				ISB		ISB				Program Office
Feudal										
Federal	LOB		LOB		LOB		LOB		LOB	
Duopoly										
Anarchy	Fundamentals									

Figure 1: IT Governance Arrangement Matrix (GAM) of Novozymes A/S.

Keys: Line of Business (LOB), Application Strategy Group (ASG), Infrastructure Strategy Board (ISB).

Inputs to IT principles come from the Line of Business (LoB) and from the corporate Fundamentals and policies, which are approved by top management. The Fundamentals was originally developed 10 years ago in the employees’ self-organised union, but although the Fundamentals were consolidated in a corporate context, the initiative is classified as an anarchy due to its origin. The proposals in the table are elaborated in the following section.

At Novozymes A/S all major business processes are supported by SAP. Moreover, Novozymes A/S has systems for internet sales (named E-Solution), customer relationship management (named Pivotal), projects and development (named Proman), etc. Novozymes A/S relies on 2 main suppliers, i.e. the sister company Novo Nordisk IT A/S and Siemens A/S. The collaboration with the long-term vendors are governed by service level agreements, but the relationships are though long-term not governed by further IT governance structures.

4. The IT Governance Design

The IT Governance Design Framework is a model for relating the IT Governance arrangements and mechanisms to enterprise strategy and organisation including the IT organisation and the desirable behaviour, and business performance goals including IT metrics and accountability, cf. Weill & Ross (2004). Designing a governance structure is to a large extent an alignment discussion, where the purpose is to align or harmonise all elements and assure that all linkages are valid and effective. It is therefore of interest to assess which and how harmonisation initiatives are implemented in stead of just describing the individual elements in the framework.

4.1. Aligning Enterprise Strategy and Desirable Behaviour

The Novozymes Touch, i.e. the Vision, Personality, Values, Commitments and Fundamentals of Novozymes A/S (see www.novozymes.com), is the timeless prerequisite for strategy formulation. Although, these statements are very abstract in nature, they also provide explicit and operational guidance on how desirable behaviour is expected within the organisational context of Novozymes A/S.

Examples of fundamentals that directly relate to governance of the organisation by addressing accountabilities, action plans for business performance, feedback mechanisms on performance, and reporting are:

- Each unit must have a clear definition of where accountabilities and decision powers reside.
- Each unit must have an action plan to ensure improvement of its business performance and working climate.
- Every manager requiring reporting from others must explain the actual use of the reports and the added value.

IT decisions are derived from the business strategy. The business strategy is here presented as a Strategy Map representing the four Focus Area Drivers (FADs).

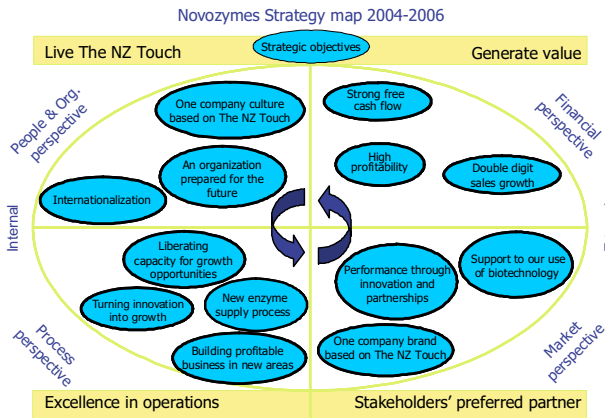


Figure 2: Strategy Map of Novozymes A/S.
Source: Novozymes 2005

The FADs represent the perspectives of people and organisation, process, market, and financials, and result in four IT documents, which are Strategy & Direction, Governance, Capabilities & Sourcing, and Products and Services.

Hence, the implementation of The Novozymes Touch and actions in the above mentioned four documents contribute to the alignment of Enterprise Strategy and Desirable Behaviour in Novozymes A/S.

4.2. Aligning IT Governance Arrangements and Mechanisms

Different IT Governance mechanisms are implemented in order to conform to IT Governance arrangements and the IT Strategy, i.e.:

- The predetermined structure of the strategy process (presented in section 4.1)
- The IT project approval process
- Project and resource planning and execution
- The project portfolio review process
- Production support

These issues are elaborated in the following.

The IT project approval process. The initiative to create an IT project originates primarily from the Line of Business (LoB) or secondary from the IT Department. Each IT project proposal is sent to the Project Office (PO) for further elaboration and analysis. For each proposal a detailed and standardised business case is developed and related to one or more Focus Area Drivers (FAD) in the Business Strategy. Based on an empirical study,

Marshall & McKay (2004) acknowledge this approach as good IT Governance practice. Moreover, the PO verifies that the proposed project supports the IT Strategy, and that IT resources and capabilities are available. Priorities of the proposals are then set by the ASG/ExM group resulting in a prioritised list of IT projects.

Project and resource planning and execution.

The IT projects are traditionally planned by relating the activities to resources e.g. using GANTT charts. Simulation is used to obtain the best possible match. Moreover, these tools are used for following up on progress of execution and delivered results. Only projects larger than 2 mio. DKK are considered. Projects with a lower expected total cost base are addressed in relation to maintenance. Approximately, 80% of the Novozymes' IT department's resources are allocated towards projects. The remaining resources are allocated to maintenance and up-coming activities.

The project portfolio review process. The review process involves project managers, the Project Office (PO), and the ASG. For each review a standardised process is followed identifying, e.g. Scope, business justification, Compliance with IT strategies and standards, Time schedule and milestones, Cost-benefit and Risk analysis, Impact assessment, Vendor selection, and Software, hardware and architecture. An important task is the identification of project interdependencies in order to avoid overlap, waste of resources, and in order to identify synergies.

Production support. The production support and helpdesk assure corporate-wide maintenance of systems. The Line of Business (LoB) sets the priorities of System Investigation Requests (SIRs), and the SIR solutions are controlled by the IT department. The IT department has true 24-hours service. This is organised after the principle "Follow the Sun", meaning that depending on the time of day, SIRs are serviced by the IT people in China, Denmark or USA, respectively, and handed over effectively after normal office hours if the task requests an ongoing activity.

4.3. Aligning Business Performance Goals and IT Metrics and Accountabilities

How do metrics and accountabilities support business performance goals? Novozymes A/S has introduced the triple bottom line in 1999 with the purpose of not only focusing on the traditional financial bottom line, but to balance it against the social and environmental bottom lines in order to ensure sustainable growth.

Through several years, the Novo Group has developed and validated an internal management and control system that goes beyond financial reporting.

The system embraces three elements: Organisational audit, Facilitations, and Triple bottom line reporting. These internal management and control systems are elaborated in the following.

Organisational Audit. The organisational audit measures the extent to which the manning and organisation of a business unit are adjusted to present and future business requirements. Specific measures are:

- The extent to which market and technology changes are currently identified and incorporated into a unit's business strategy and into unit's goals and business plan.
- The extent to which staff qualifications and organisation of work are suited for implementing this business strategy and plan.
- The extent to which candidates are developed to take on key positions in the organisation.

Facilitations. A facilitation measures the degree to which a unit lives up to the individual elements of what is referred to as The Novo Way of Management, i.e.:

- Corporate core values.
- Corporate commitments to international standards and conventions.
- Corporate policies (e.g. with regard to communications and information technology).
- Corporate code of conduct concerning the way business is done.

Triple bottom line reporting. In the environmental and social reporting, the extent to which the individual unit locally and the company globally fulfil their declared goals in respect of environmental and social performance is measured. Examples of measures are: consumption of energy, water, and raw materials, amounts of waste water and solid waste, emissions to air, applied gene technology, extent and nature of animal testing, compliance with human rights, creation of working places, training and development of employees, and working environment (physical and psychological).

For all three management control systems, concrete actions are defined to improve the situation, and the implementation of actions is verified.

The Chairman of the Board of Directors at Novozymes A/S, Henrik Gürtler, assesses that the results of these three measurements and management reporting on operations as well as drafting of overall strategies for future periods combine to give a solid impression of where the business is today and of the credibility and soundness of future plans for corporate development. Hence, it is concluded that business

performance goals and metrics and accountabilities are aligned.

4.4. Aligning Enterprise Strategy and IT Governance Arrangements

The main tasks of the Board of Directors are to:

- Ensure the right executive management and organisation of the company.
- Supervise financial performance of the company, and supervise executive management's performance and integrity.
- Participate in managing the company by providing direction to executive management, and participate in determining the strategies of the company and approve major business plans and decisions.

As the board is ultimately responsible for corporate development, it has been decided that certain issues that were formerly pure management items, now are being dealt with at board meetings too. Consequently, these items are now discussed among board and management. Novozymes A/S has put their meeting frequency and contents of board meetings on the Internet for public orientation. The calendar and contents are structured in accordance with the three requirements of The Danish Public Companies Act, and showing that the intention is to spend an equally amount of time addressing each of the three requirements of management/organisation, operations/ financials, and strategy.

Novozyymes A/S strives continuously for more openness and transparency. This is also in line with what is considered as good corporate governance. Implementation of effective IT Governance is however time and resource consuming, cf. Rau (2004). Hence, it is concluded that Enterprise Strategy and IT Governance Arrangements are aligned.

4.5. Aligning IT Governance Arrangements and Business Performance Goals

IT Governance frameworks rely on a dominant premise that the organisation to a large extent is stable and that all activities can be planned (Patel et al. 2002). However, most organisations find themselves – or at least parts of the organisation - as emergent. This fact needs to be addressed in the governance arrangements and mechanisms, measurements and detailed measures. Though some frameworks seek dynamic perspectives of the organisation, this is seldom sufficient to grasp the complexity of the modern business environment.

Novozymes A/S addresses this issue of the emergent organisation through evaluations. In order to improve the quality of the work between the management and the board, they have developed a more qualitative assessment of the work of the board, the management, and the interaction and cooperation within and between these two entities. In December 2001 it was decided to deploy a self-developed system to evaluate performance in board and management work as from 2002. The system entails that:

- the individual member of management evaluates his own and his fellow management members' performance in relation to the cooperation with the board.
- the individual member of management evaluates the board's performance in the cooperation.
- the individual board member evaluates his own and his fellow board members' performance in relation to the cooperation with management.
- the individual board member evaluates management's performance in the cooperation.
- management and board give a total evaluation of the cooperation between management and board.

The board and management evaluate the results and (if needed) agree on changes of work processes, course of board meetings, behaviour, performance, etc. that could make future management-board cooperation more constructive, efficient, challenging and forward-looking - to the benefit of Novozymes A/S. Hence, each year, concrete actions are defined to improve the situation. The implementation of actions is verified and documented in the minute book.

This evaluation is considered to be quite unique and to go far beyond what other companies' boards-management teams do to optimise their collaboration.

On an individual IT project level, projects are evaluated based on time and cost/resource measures. However, the final delivery of IT solutions is not evaluated based upon the solutions output quality and performance, cf. IT manager Lars Refslund. Consequently, the delivery model seems partial, and might be optimised based on these conditions. Therefore, IT Governance Arrangements to a large extent are aligned with Business Performance Goals, though the reviewing process might be optimised.

5. Recommendations

Recommendations for enhancing the current IT Governance practice at Novozymes A/S are:

- Develop and implement an IT Governance structure, i.e. arrangements and mechanisms, with regard to external business partners in general, cf. Larsen & Klischewski (2004), and long-term IT vendors in particular.
- Develop and implement a complete IT project delivery model containing assessments and follow-ups on outcome value and performance of delivered IT solutions in addition to the current time and cost assessments.
- Consider a combination of more IT governance tools, cf. section 2.2 and Niessink & van Vliet (2001), in optimising the IT Governance process.
- Cascade IT governance arrangements and mechanisms down through the organisation to embrace the emergent organisation, cf. Patel (2002) and Van Grembergen (2000).
- Coordinate and integrate IT Governance practice with other asset governance practices (i.e. HR, IP, facilities, etc.), and generate value from this multiple asset governance approach (cf. Classman 2000, and Weill & Ross 2004).

With implementation of these initiatives Novozymes A/S might be even more prepared to meet the challenges of generating value from "unlocking the magic of nature".

6. Conclusion and Future Research

The paper addresses the issues of optimising profits and reducing risks by focusing on decision-making processes and accountability frameworks. This paper reviews 17 IT Governance tools, and selects one assessment tool most appropriate for case evaluation. An IT Governance Assessment is carried out concluding that IT Governance Arrangements and Mechanisms to a large extent are aligned with strategy, organisation, behaviour and relevant metrics.

The study is a single case study, and therefore the findings will in principle only be applicable for the case organisation, although the findings may have a more general nature and broader scope of applicability.

The contribution of this paper is a) providing an overview of potential IT Governance approaches, i.e. a "toolbox", b) providing an evaluation method, i.e. a IT Governance tool screening framework, consisting of relevant classification parameters in order to address the variation and demarcations between the approaches, and c) providing a rich case study with potential general recommendations.

Learning from the case analysis shows that though the organisations is considered to be fairly mature with regard to adopting IT governance, several

development directions can be pointed out, which have practical as well as scientific relevance.

Future research may go into unfolding the IT Governance structures with external partners, in addition to investigating the implications for IT Governance arrangements and mechanisms in balancing the current versus the emergent organisation.

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