

How to go about Enterprise Standardization

Case Study: Applying and Testing the LEAD Enterprise Ontology to develop a shared standard within Novozymes A/S

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Abstract

Developing a shared standard within an organization is a time consuming and difficult undertaking. This paper discusses and tests the claim of the LEAD Enterprise Ontology (von Rosing & Laurier, 2015), that is applicable to develop standards within an organization and independent of industry or complexity that it would add value to the enterprise. The case study is not only a theoretical test, but also a real practical use case which develops shared standards within Novozymes. This organization was chosen based on the fact that as the number one biotechnology company in the world, Novozymes is acknowledged as the trendsetter; not only within biotech science, but also in the enterprise business model and the setup for the operating model execution. With a very specific, highly unique and complex business context, the enterprise ontology can be applied to evaluate and prove that generic conceptual claim in a concrete context. The main focus of the research was to analyse and investigate if the enterprise ontology, can be a basis of creating a shared standard. And to test, both from an academic as well as a practice-oriented perspective, does indeed create value.

Key words

Shared Standard, Shared Structure, Shared Folksonomy, Shared Taxonomy, Shared Enterprise Layers, Shared Meta-Objects, Shared Enterprise Ontology, Ontology Testing, Enterprise Standards, Industry Standards, Academia and Industry Collaboration Framework.

Introduction to Novozymes

Novozymes is the world leader in bio-innovation. The company became an independent corporation in 2000 as the result of a demerger of the Enzyme Business division from the pharmaceutical company Novo Nordisk. The roots date back to the 1920s, when Novo Therapeutic Laboratory and Nordisk Insulin Laboratory were founded in Copenhagen. Industrial enzyme production began in 1941. Today Novozymes is the world leader within biological innovation. The core business is industrial enzymes, microorganisms, and biopharmaceutical ingredients (see figure 1). The company has a global market share of nearly 50 % within enzymes (see figure 2). With more than 700 different products used across an almost endless list of industries in every corner of the world, Novozymes' biological innovations improve industrial performance and safeguard the world's resources, by offering superior and sustainable solutions and alternatives across a variety of industries and applications. Novozymes' biological solutions enhance and promote a range of processes. The never-ending exploration of nature's potential is evidenced by over 6,500 patents, showing what is possible when nature, science, and industrial manufacturing technology join forces.



Market leader in industrial enzymes

With an estimated 48% of the global enzyme market in 2016, Novozymes reinforced its position as the world's leading producer of industrial enzymes.

Figure 2 - Novozymes market share - Novozymes' annual report 2016



Figure 1 - Novozymes purpose statement

Novozymes has more than 6,400 employees globally; a quarter of these are employed in research and development. On average Novozymes reinvests 14% of the turnover back into research and development. The current world market value in 2018/2019 is approx. \$ 6 Billion for enzymes. With Novozymes Market and business position, the expectation is that the future potential is many times bigger than the current value of the entire pharmaceutical world market. Recommended strategies point towards that service and performance modelling disciplines should be the main focus for the strategy and the business transformation and innovation (see figure 3).

Novozymes Market and business position

Degree of preference	Number of providers	1	2	One big and some small	Few big	Many	Commodity
Homogenous market (no preference)	Monopoly		Duopoly	Partial monopoly	Oligopoly	Competition	Full competition
Heterogenous market (some preference)			Differentiated duopoly	Differentiated, partial monopoly	Competition, but with differentiated oligopoly	Monopolistic competition	Head-2-head rivalry
Organization's market position e.g. rivals, complementors	Unique		Strong	Robust	Secure	Fragile	Weakest
Industry exposure to external forces e.g. macro-economics			Strongest	Most robust	Most secure	Delicate	Vulnerable
Organization's geographic exposure to recession/crisis e.g. demographics, environment		Low	Low		High	Low	High
Strategic situation:		Differentiation			Competitiveness		
Chosen strategy		Increase the revenue model by creating uncontested market space		Compete in existing market space, but stand out via services and performance		Compete in same market space	
		With value make the competition irrelevant		Differentiate yourself from the competition		Beat the competition	
		Create and capture new demand		Exploit current customer base to reduce attrition, drive loyalty and promote word of mouth		Exploit existing demand	
		Break the value-cost trade-off		Break the transactional market economy mindset, add service to exceed expectations		Make the operational-cost trade-off	
Business competencies		Core Differentiating Competencies		Core Competitive Competencies		Non-Core Competencies	
Business modelling discipline chosen		Revenue Model	Value Model	Service Model	Performance Model	Operating Model	Cost Model
Standards used		Leading Practices		Industry Best Practice		Best Practices	

Figure 3 - Novozymes' Strategic Market position (LEADING Practice Strategy Reference Content)

Earlier the supply chain discipline in Novozymes was exclusively measured on a cost to serve premise. Novozymes former way of thinking was centred around the assumption that all value is anchored in the core products and their application. All other supporting factors (i.e. supply chain) represented nothing but a non-core cost driver. The former strategic paradigm and the overarching enterprise competencies have been conceptually placed in a LEADING Practice business competencies model. The diagram illustrates that all aspects of the operational manufacturing and supply chain performance were in the non-core competencies category.

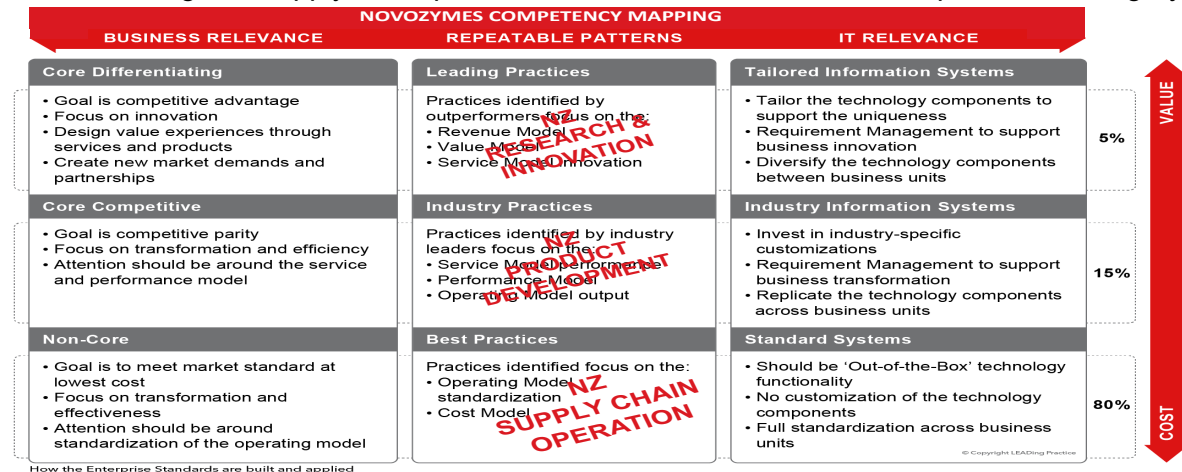


Figure 4 - Conceptual mapping of Novozymes competencies to the LEADING Practice business competencies model

The prevailing paradigm was to produce and supply products as efficiently and effectively as possible: Supply Operations produced the core products up against a defined standard, and since products are the focal point in Novozymes, operational accomplishment was defined and measured as quantitative product characteristics. Therefore, Lean had become the preferred and prevailing tool in that paradigm. This thinking and way of working was also highly reflected in the former supply chain performance management system, where performance was measured on three main KPIs: Cost to Serve, Shipped on Time, and the number of supply chain related customer complaints. All improvement and optimization efforts were aimed at enhancing these business performance drivers. The immediate conclusion to the analysis of the previous strategy for Novozymes operational customer interfaces was therefore, that the company was trapped in a cost model deadlock. Novozymes assumed functionality versus cost as the correct and rational paradigm for evaluating any business development initiative, and since the value of supply chain service cannot not be precisely assessed and justified in a traditional business case model, Supply Operations ended up on an endless quest for making the existing mode of operating more efficient. The way to optimize business contribution could only be justified through continuous cost reductions and productivity gains. This led to a spiral where all the optimization effort was used to make the already established but undefined service concept more cost efficient. Optimization gains were capitalized. This way of thinking turned every proactive service development into a discussion of internal cost, which took precedence over any consideration of the possible external market value and opportunities. The consequence was that Novozymes assumed a reactionary mode in its operational service. Service standards and models were only improved once the demands (expressed as, for example, level of complaints) from the customers had reached a business threatening level.

The Issue at hand

Being a recognized market leader creates expectations. However, lacking a defined supply chain service strategy, yet having a corporate strategy with a primary objective of customer partnering, the organisation—especially in the operational customer facing interfaces—struggled to serve customers in the very best possible way. This led to a lot of dissimilar interpretations and often self-invented standards. Over time these grew into myriad variations in offerings, prioritizations, and customer specific solutions. Ironically, *variation* became the only *standard* feature of the standards. All the performance symptoms of low maturity could be found in the internal workflows. The lack of defined standards led to increased friction and complexity, which again drove higher cost compared to the generated value. *Customer Service was overall at a good level but might be bought with internally high costs* (McKinsey & Company; study of Novozymes, 2015). In the benchmark, Novozymes presented with four times higher cost to serve in the Customer Service Functions, as compared to similar benchmark industries. This outcome was totally counter to the prevailing lean business model thinking. Viewing and managing supply chain as a non-core competency in a cost model without a strong governance caused high complexity, leading to high cost burn in processes that should be governed and operated by simple standards. Novozymes used a lot of resources to deliver a supply chain service that (in terms of the value to the customer) was at best mediocre compared to the industry standard. What was beginning to show as increasing symptoms of daily frustrations in Novozymes, manifested fully when the various meta-objects were combined in a consolidated matrix model (LEAD-ES20000LA). Both essential objects and many relationships were missing. This is not necessarily bad, but in the absence of a communicated intent, it risks creating a lot of frustration and friction in the form of duplication, ineffectiveness, and inefficiency. Novozymes had reached a size and complexity where the lack of deployed enterprise SBO and line of sight presented as a threat to performance, and to the continuous healthy growth of the company.

Clearly, there were missing elements in the application of the corporate (enterprise) Partnering for Impact strategy to the functional area strategies. The individual layers were all looking upwards towards a very abstract intent rather than a clear direction. They therefore tried to design their own strategies (with more tangible goals). This resulted in:

- Siloed thinking and structure (very low End-to-end maturity)
- Siloed performance and budget deployment
- Programs/projects being started and worked on only within silos; mainly to enhance efficiency of existing ways of operating. (Everything required negotiation between areas—there were none or very few cross functional initiatives.)
- The entire workflow being based on siloed functional groups (neither strategic progress, nor daily performance was linked or synchronized).
- Processes, Services and Information flows being siloed and broken in the internal interfaces
- Duplication of work everywhere, and worse, decentralization of information, despite one corporate End-to-end SAP ERP system
- Directional work being siloed (strategy deployment was, as described, conducted from the bottom up)

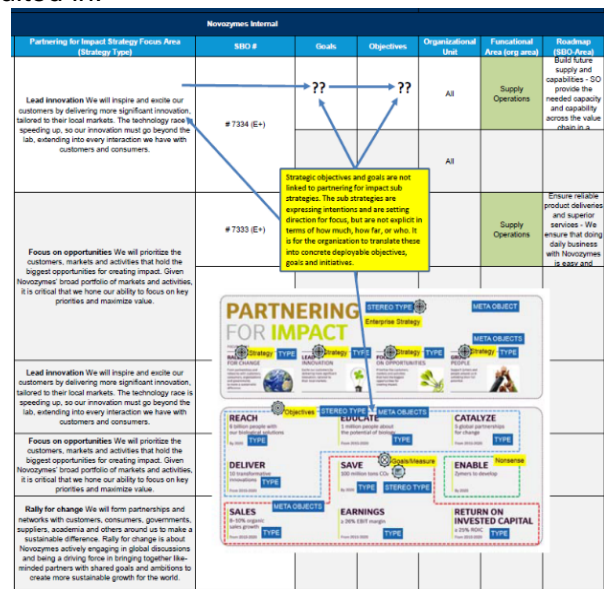


Figure 5 - Corporate strategy was not deployed in a stringent way downwards into the functional areas.

No foundational structure

Theoretically it is easy to comprehend that any enterprise consists of flows and layers. In any enterprise, a traditional physical flow will most likely exist, and there will always be both a service and an information flow. Lean had already provided Novozymes with the ability to optimize and streamline the physical flows using value stream mapping and other similar tools. Correspondingly, most enterprises are able to do data models and conduct information mapping. This is often with the purpose of making data management and systems perform more effectively and efficiently, to enhance data quality or simply to document systems for compliance, regulatory, or improvement reasons. The common denominator for many such optimization efforts is that the actual discipline of mapping, documenting, and categorizing has been secondary to the specific business project objective at hand in each individual case. This certainly proved to be true in Novozymes' case. Seen from an enterprise architecture perspective, there had been no deliberate coordination of foundational structure, neither for vertical nor horizontal alignment: the structure had evolved organically based on specific business needs. The actual functioning enterprise layout was, for the most part, an unplanned consequence rather than a premeditated undertaking.

The Solution: Developing a shared standard

Imagine how you can share your ideas, concepts, objects, views and so forth that you define in your projects in such a way that helps others align with your thinking, and theirs with yours.

Extend that thinking into aligning business and information concepts i.e. the SAP ERP system, or the technology concepts i.e. robotic process automation, or the optimization initiatives into flow.

Everything in an enterprise relates, but most often it is impossible to see how. Obviously, the different teams naturally want to work together to fulfil the goals and objectives of Novozymes. But all these parties get so immersed in their own projects that they start to articulate their own understanding using their own terms, concepts and views. Then they build their own processes in their own way around them. While these terms, concepts and views are obvious to the individual group, they cannot be communicated to other functions. The familiar problem of working in siloes then arises. Everybody optimises their own way of working with the best intent, but:

- It leads to siloed strategies and roadmaps.
- There is no common taxonomy in relation of terms and definitions
- Everybody uses different descriptors (for the same concept) as well as different symbols and signs for the same things
- There is absolutely no benefit from easy access to, and learning from, other teams in Novozymes and no sharing of best practices; no one asks, and no one requests
- The internal wheels are constantly reinvented because it is too difficult to take value from existing best practices, industry practices, or even leading practices
- It is impossible to take advantage of the business and information semantic relations, i.e. the IT and SAP capability that Novozymes has invested in, because SAP needs:
 - process, information, and service models that SAP can relate to
 - these models to be articulated in a unified way so that SAP brings advanced computer productivity to bear on our work

Put simply; sharing meaning across the business is a prerequisite for breaking the prevailing non-core paradigm for the supply chain organisational function. To achieve shared meaning, it was necessary to establish shared standard, which we in Novozymes called the 'shared structure'. The objectives were:

- a. Common defined objects
- b. Groups have shared meaning and definitions
- c. Documentation is stated and shared
- d. Business and IT are aligned
- e. It must be built on a best practice, from general industries to the Novozymes organisation
- f. Business and IT modelling techniques are integrated
- g. Common classification and categorization are developed

The following are the founding members of the Novozymes Shared Structure:

Global Planning (GPO)	Digital Transformations (RPA)
Global Supply Chain Management (SCM)	SAP Applications (NZIT)
Global Data Mgmt. (GPO)	Process Modelling team (NZIT)
Global Quality Control (GQC)	Business Architecture (NZIT)
The SOLEAN program (Supply Operations Global Lean Program)	Enterprise Architecture (NZIT)

Representatives from these teams met and did the following:

1. Established a common aspiration that the shared structure should be able to accommodate all three Business, Information and Technology aspects
2. Defined the primary areas of focus. It was agreed to consider the business perspective, the value aspects, the organizational competency aspects, as well as service and processes. The information perspective should include the application/information system as well as the various data aspects. The technology perspective should include the platform and

infrastructure aspects.

3. Aligned on conceptual project design based on decomposition principles. At this meeting all the point 2 defined areas and groups were broken down. The Enterprise Ontology class types were applied as a foundational model. It was discussed at all levels to determine what could and could not be integrated, and whether there were missing objects.

The output of the shared structure development workshop can be seen in figure 6 as a periodic table. The Novozymes shared structure can be used to describe all the elements in all our initiatives. The shared structure view is broken down from enterprise layers to sub-layers, and then to objects with notations. The elements (*meta-objects* or simply *objects*) make up the shared structure. There are three layers, eight sub-layers, and 87 objects in total. The shared structures layers, sub-layers, and objects are supported by Descriptions, Notations, and Modelling Techniques that together enable any project to be aligned and expressed according to the Shared Structure. This permits everybody to approach a given project from different angles and still align with shared objectives. Furthermore, the shared structure depicted by Figure 6 is drawn from leading and best practices from all industries in all sectors. Novozymes can draw upon these experiences thereby avoiding reinventing the wheel even in cases that Novozymes haven't come across before. This first phase started out with a manageable subset of 38 shared objects chosen and agreed upon in the workshop (see user testability). The rest of the 87 objects remain available for later implementation phases of the shared structure.

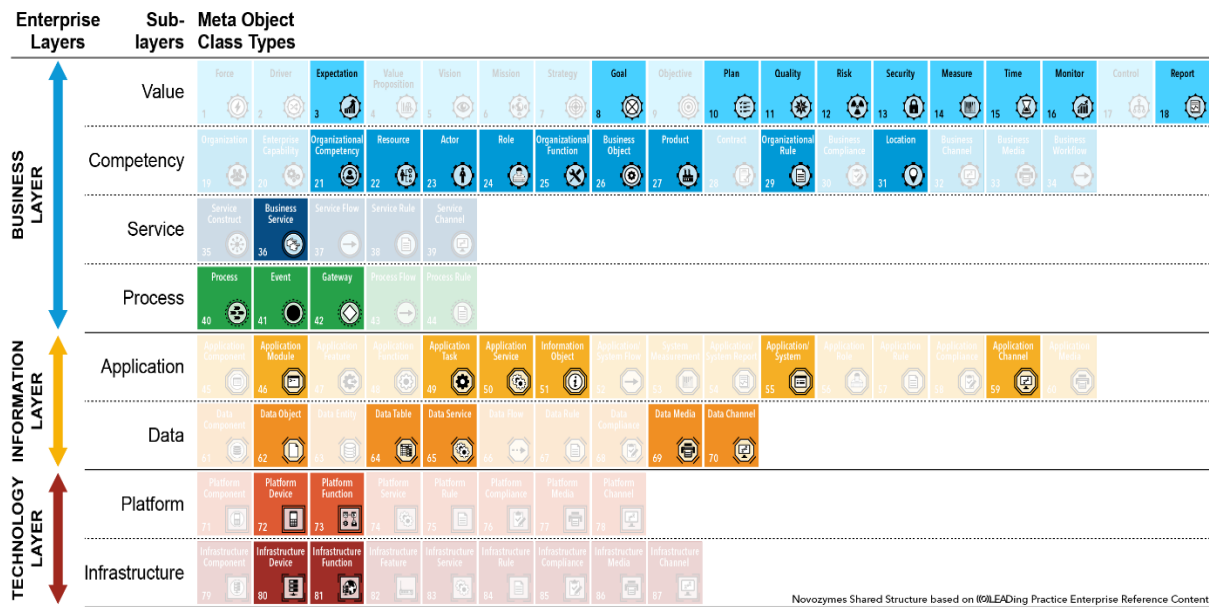


Figure 6: Overview of Novozymes Shared Structure - Phase #1

Conclusion

The conclusion of the research is that it can both be confirmed that the practical test of *applying the LEAD Enterprise Ontology to an organization enabled the development of a shared standard and that it enhances (creates) added value in an Enterprise*. The value of using the Enterprise Ontology to develop a shared standard within Novozymes has proven to be value adding beyond what the team had envisioned. All the parties involved at Novozymes currently show a high degree of engagement and passion. The project was not undertaken merely for the sake of having another academic project, and it has certainly not been perceived as such within Novozymes.

Implementing the shared structure across the entire end-to-end flows has not only demonstrated that superior service together with superior products can position Novozymes in a sweet spot in any industry and on any market; but the shared structure thinking itself has provided a framework that enables a much more mature discussion of how to work, particularly with the service dimensions of the supply chain performance. Novozymes still has a long way to go, but it is important to realize that ownership of the shared standard now spans multiple areas, groups and functions. It is accepted both in line of business and IT. It is applied across multiple modelling concepts from LEAN to enterprise architecture. The value and benefit from a shared standard based on a standardised and aligned ontology has been widely accepted. Now that everyone has been through the exercise, it is hard to argue against the proven logic that a common shared standard has improved collaboration and efficiency, increasing the maturity through standardisation of things that were siloed. There has also been a change in the driving motivations behind actions. It is now more of a burning desire (a trust that this will provide new opportunities and better and more mature ways of collaborating) than it is a burning platform (problem solving). Initiatives are goal driven, not pain driven. In particular, this has transformed Supply Operations from a reactive non-core competency role, to a much more proactive way of thinking, working and executing. Supply Operations is launching a high profiled action-learning leadership talent development program. High potential young leaders will be working in teams in a fast-paced case-driven program, building on the shared standard concept. The analysis proved that the shared standard called 'Shared Structure' had a great impact on a wide range of dimensions within Novozymes; in daily business, as described in the strategic dimensions, and even in the fundamental role and self-perception paradigm—most especially within Supply Operations. As an extension of our research, we would like to conclude with additional observable dimensions where Novozymes' has seen a value benefit from implementing the enterprise ontology for standardization and developing a shared standard provided that:

Groups have shared meaning	Templates simplifying use and understanding have been created
Common objects have been established	Standardization has become an aspirational term
Shared terms have been defined	Maturity can be assessed and discussed across layers and flows
Common descriptors are in place	Shared views increase the ability to develop and create useful models
Same symbols/notations are applied across functions and disciplines	The foundation for much stronger information and knowledge reusability has been laid
Documentation is stated and shared	Collaboration across disciplines and departments is already emerging in new forms
Business and IT are much better linked, and a forum has been established	The ability to link and connect models and maps have been significantly improved
It is possible to integrate Business and IT modelling techniques	The general level of enterprise documentation based on proven and acknowledged standards has been increased.
Common classification and categorization have been incorporated in artefacts	Getting new employees into the Novozymes way of thinking and working has been enhanced and accelerated.

The testing proves that the investment cost in the form of development, implementation and maintaining an enterprise standard based on the Enterprise Ontology is by far surpassed by the added value impact on the business performance. This is despite the fact that increasing the maturity of the enterprise self-awareness and increasing the ability to share meaning will not, in themselves, create any quantifiable value.

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