GLOBAL UNIVERSITY ALLIANCE ACADEMIC RESEARCH & INDUSTRY STANDARDS DESIGN DEVELOPMENT

The method and process of academic research and the development of industry standards to increase the level of reusability, replication and standardization of standards.

Contents

What is the Global University Alliance

Founded in 2004, the Global University Alliance is a non-profit organization and international consortium of university lecturers and researchers whose aim it is to provide a collaborative platform for academic research, analysis and development and to explore leading practices, best practices and industry practices as well as to develop missing practices. The Global University Alliance currently consists of 450+ universities, lecturers and researchers from across the world and is growing rapidly in size and scope.

The Global University Alliance aims to align intellectual resources across the academic world to:

- **RESEARCH:** Address research concerns and questions that span around enterprise ontology and thereby the enterprise concepts, design, functions, tasks, information handling and governance and the relationships between those concepts within enterprise modelling and enterprise architecture disciplines.
- **UNIVERSITY CURRICULUM:** Develop university curriculums for both Bachelor and Master level (existing BPM, SOA, Enterprise Architecture, Sustainability, Information Management and Project Management).
- **DEVELOP STANDARDS:** Package applied academic research and findings into frameworks, methods and approaches that can be used by industries and universities alike.
- **COMMUNITY SHARING:** Share and publish the findings either in publications or to this open standard community.

The Global University Alliance (GUA) is an open group of academics with the ambition to provide both industry and academia with state-of-the-art insights into research and artefact design. The importance of research methods and design concepts within both academia and industry is not a new phenomenon. Knowledge exchange between these two parties is both mutually beneficial, as well as continuous, bi-direction and symmetric in the sense that although often different in nature contributions by practitioners should be valued as much as academic contributions to the knowledge base. As work everywhere becomes more collaborative, the need to develop concepts for the analysis and development of collaborative research and design between academia and industry is identified. This paper therefore, aims at presenting the knowledge gap in existing research and design methods and introduces a framework for analysing and developing Collaborative Research and Design between Academia and Industry". When academics build artefacts for practitioners, these artefacts need to be constructed rigorously to meet academic standards and need to be relevant for practitioners (von Rosing, Laurier, 2015). Construction rigour is typically considered to be the domain of academia, while practitioners have been acknowledged to create knowledge and artefacts relevant to themselves and others (Nonaka, Umemoto, & Senoo, 1996). As an revolutionized way of working between academia and industry, the Global University Alliance promotes an innovative way of thinking, working and modelling taking full advantage of a mutually beneficial collaboration between academic research and industry design through evaluation by practitioner through application of GUA artefacts in the real world. The GUA's structured way of working is based on both construction rigor and practical relevance of concepts and artefacts. To manage the size and complexity of the research topics addressed and to promote networking across universities, lecturers and researchers, the GUA has defined research responsibilities in key areas. In each of these key areas, research coordinators were appointed. An example of a collaborative Academic Industry Design their names and industry organizations can be found in this document. They are a blend of academics, standard bodies, governments and industry experts. The foundational thinking of this Academic Industry Design is the key research responsible's task to provide an international platform where universities and thought leaders can interact to conduct research on the key aspects of the overall research.

The Academic Industry Design as a collaborative process between research and industry

Many hundreds of people (academics and practitioners) have been directly involved over the many years in researching, comparing, identifying patterns, peer reviewing, categorizing and classifying, again peer reviewing, developing models and meta models, again peer reviewing, and at last but not least developing standards and reference content with industry. Through this iterative peer review process that involves both academics and practitioners as reviewers and contributors. As illustrated in figure 1, they do this through defining clear research themes, with detailed research questions, where they analyse and study patterns, describe concepts with their findings. This again can lead to additional research questions/themes as well as development of artefacts which can be used as reference content by practitioners and industry as a whole. What the GUA also does uniquely is the collaboration with standards bodies like:

- ISO: 'The International Organization for Standardization.
- CEN: The European Committee for Standardization (CEN).
- IEEE: The Institute of Electrical and Electronics Engineers is the largest association of technical professionals with more than 400,000 members.
- OMG: Object Management Group: Develops the software standards.
- NATO: North Atlantic Treaty Organizations (NATO's) with the 28 member states across North America and Europe and the additional 37 countries participate in NATO's Partnership for Peace and dialogue programmes, NATO represents the biggest non-standard body that standardises concepts across 65 countries.
- ISF: The Information Security Forum investigates and defines information security standards.
- W3C: World Wide Web Consortium - the W3C's purpose is to lead the World Wide Web to its full potential by developing protocols and guidelines that ensure the long-term growth of the Web/Internet.
- LEAD: LEADing Practice - the largest enterprise standard body (in member numbers), which actually has been founded by the GUA. The LEADing Practice Enterprise

Standards are the result of both the GUA research and years of international industry expert consensus and feedback on the artefacts and thereby repeatable patterns.

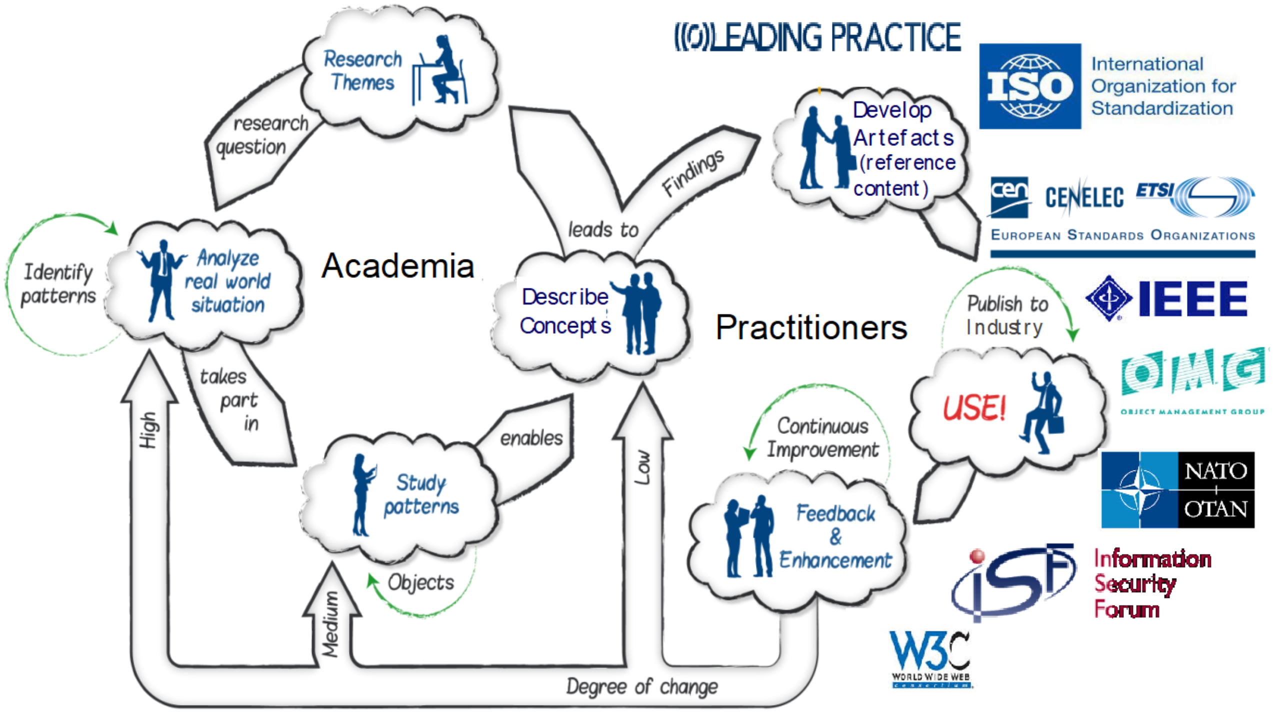

Figure 1: Overview of the Academia – Industry Concept process which is used in the GUA.

We in the GUA, do not only work with other standards developing organization (SDO) like ISO, IEEE, OMG, OASIS, NATO etc, but also work with various industry organizations and the standards setting organization (like governments). Among some of them are the US Government, the Canadian Government, German Government etc.. Most relevant is that the Academia and Industry process used in the Global University Alliance and the various collaborative industry practitioners has two types of different cycles. As is illustrated in figure 2, the one where Academia is leading the research and innovation, this is called the Academia Industry Research (AIR) process. The other is where practitioners from Industry describe concepts and develop artefacts and thereby they bring about innovation. This process is called the Academia Industry Design (AID).

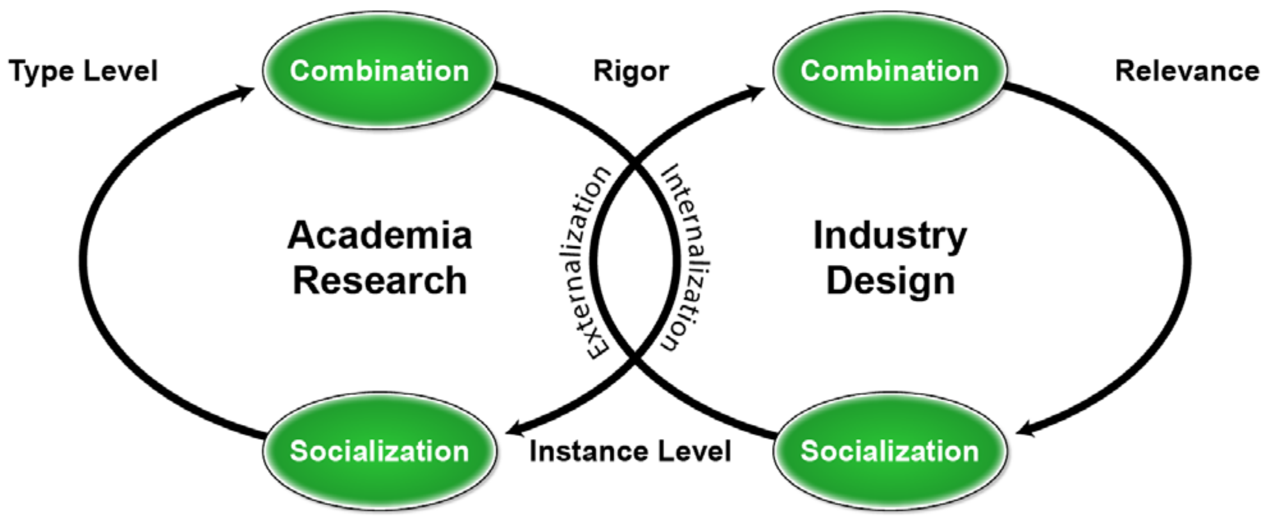

Figure 2: Overview of the Academia Research and the Industry Design Concept method.

The major difference between the two Academia Industry concepts AIR and AID, towards other existing models is the way knowledge is acquired and shared across both academia and industry. We have discussed erlier that industry practitioners typically rely on Experience and Induction, while Academia use research, analysis, deduction and the scientific method. Merging the Rigor and Relevance concepts in a flow together is what the Academia Industry Design concepts has implemented. Where the Academia does the Rigor components and the Practitioners do the Relevance components. Merging the worlds where each has the best expertice, but creating and allowing and ideal mixing of the worlds. Our research of the GUA way of working concludes that the Academia Industry Design interlink between academia and practitioners in the following ways:

- **Academia defines:**
  - At the Abstraction level the typical setup is that Academia typically designs the research themes with research questions and thereby the solutions at the type level (concepts and solution for a type of problem)
  - The knowledge creation processes in terms of analyzing real world situation and patterns as well as studying patterns interlinks between rigor and relevance, of which the rigor aspect can be analyzed in theory best and the relevance can be tested in practice best.
  - Thereby, combining explicit knowledge to develop new explicit knowledge. Academia typically combines explicit knowledge at type or instance level to create new knowledge concepts at type level.
- **Industry Practitioners:**
  - typically design solutions/artefacts at instance level (solution for a particular problem).
  - combine explicit knowledge at type or instance level to create new knowledge at instance level. Thereby creating an ideal interaction and loop between academia and industry practitioner around research themes and research questions.

The internalization, socialization as well as externalization happens in interaction between both the academic and industry practitioners, in the following ways:

- **Internalization:** Converting explicit knowledge (e.g. books, standards) to tacit knowledge (e.g. personal knowledge). Academia typically teaches explicit knowledge to be transformed into tacit knowledge of students (e.g. practitioners). Whereas practitioners typically study academic concepts and non-academic solutions to develop competencies (tacit knowledge).
- **Socialization:** Sharing tacit knowledge through interaction. Academia research share tacit knowledge in doing research and publications together. Whereas practitioners share tacit knowledge by doing things together (and learning from each other while doing).

- **Externalization:** The need to convert tacit knowledge into explicit knowledge. Academia study in this context, what practitioners do (at instance level) to create new knowledge at type level. Whereas practitioners sometimes document what they do, and sometimes share this content (e.g. industry standards, best practices)

- **Combination:** This is where internalization, socialization as well as externalization applies combined with academia and industry.

Building unique knowledge with the Academia Industry concept

Applying the AID and AIR arrangement in the GUA over 15 years has facilitated the acquiring and building of a unique set of knowledge on patterns and practices in industry. Already after 5 years of working in the AID setup, in 2004 the GUA started to formally represent their knowledge as a set of concepts within a domain, and the relationships between those concepts. The GUA choosed to used the concept of ontology as their basis for categorizing and classifying all their concepts (von Rosing & Laurier). It thereby provides the basis for both a shared vocabulary and the very definition of its objects and concepts. It is quite common to use the notion of ontology for the categorization as well as classification of concepts, both in academia(Gomez-Perez et al. 2004; von Rosing & Laurier, 2016; Borgo 2007, Lassila and McGuinness 2001; etc) as well as in industry OWL, OMG MOF, Zachman Enterprise Ontology etc.. Each of them have a specific purpose, therefore the categorization and the classification is focused on the expressivity and formality of the specific languages used/proposed: natural language, formal language, etc. The other more general applicable categorization as well as classifications of the ontologies, is centred around the scope of the objects described by the ontology. (Roussey, C., Pinet, F., Ah Kang, M., and Corcho, O. 2011). Since the enterprise ontology of the Global University Alliance, is and should be generally applicable within any organization. The more general applicable categorization and classifications of the ontologies, was chosen. Thereby the Ontology classification is centered around the sphere, filed and level and the categories is grounded on the scope of the objects described by the ontology.

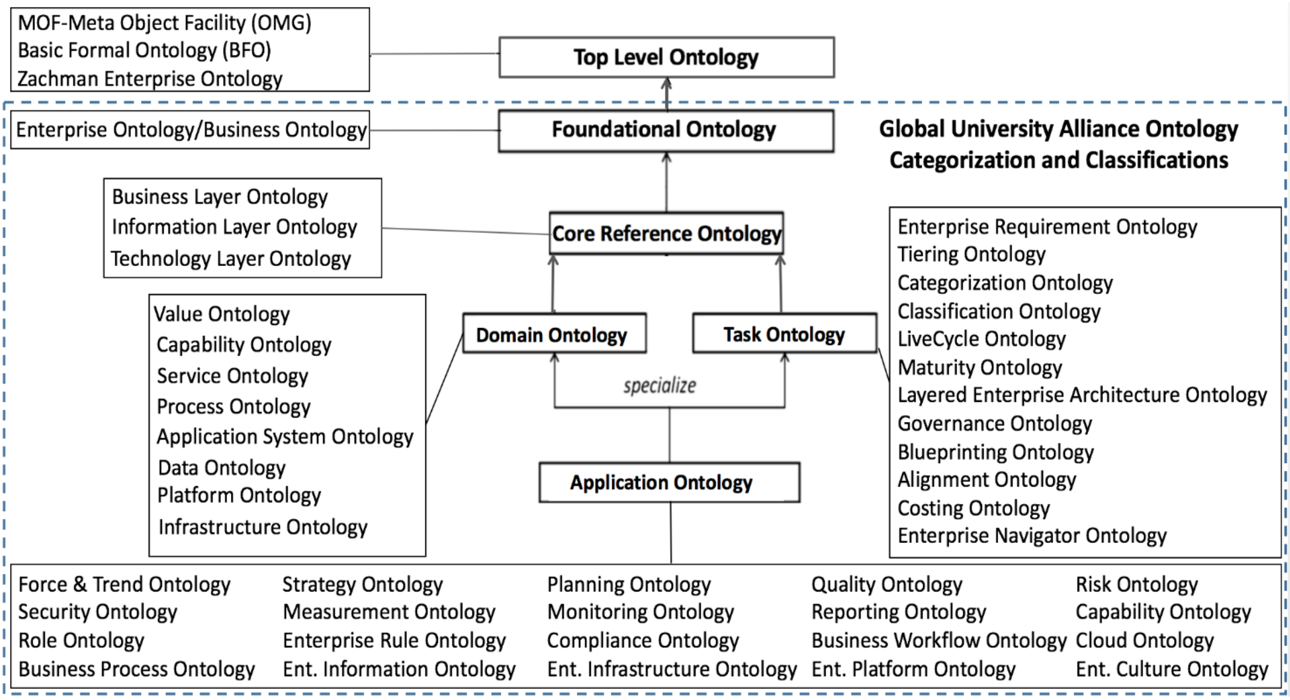

Figure 3: Overview of the AID developed Ontologies and their Categorization and Classification.

The GUA, has found that there is a benefit of categorizing and classifying the ontologies around the scope of the objects described. For instance, the scope of an application ontology is narrower than the scope of a domain ontology; domain ontologies have more specific concepts than core reference ontologies, which contains the fundamental concept of a domain. Foundational ontologies can be viewed as meta ontologies that describe the upper level concepts or primitives used to define the other ontologies. (Roussey, C., Pinet, F., Ah Kang, M., and Corcho, O. 2011, von Rosing, Zachman 2017).

We use MOF-Meta Object Facility (OMG), Basic Formal Ontology (BFO) and Zachman Enterprise Ontology as some of our Top-Level Ontologies. The Top-Level Ontology describes primitives that allow for defining very general concepts like space, time, matter, object, event, action, etc. (Adapted from N. Guarino, 1997) Provides the foundation for the formal system that allows for developing meta-meta-models, of which the completeness and clarity needs to be guaranteed trough a mapping between a top-level ontology and the formal system's primitives (MOF). (von Rosing, Zachman 2017). Using for example MOF to structure the academic research by the various industry design artefacts is found in figure 4.

The Enterprise/Business Ontology is the Foundational Ontology. It is a generic ontologies applicable to various domains. It defines basic notions like objects, relations, structure, arrangements and so on. All consistent ontology should have a foundational ontology. (Roussey et al, 2011) Foundational ontology can be compared to the meta model of a conceptual schema (Fonseca et al. 2003). It is a system of meta-level categories that commits to a specific initial-view. We use the foundational ontology, to provide real-word semantics for general conceptual modelling languages, and to constrain the possible interpretations of their modelling primitives. As such, we map our meta-meta-model (M3) to our foundational ontology. Both to certify its comprehensiveness and clarity. It also ensures that all can and will relate through our Enterprise/Business Ontology.

The Business Layer Ontology, Information Layer Ontology and the Technology Layer Ontology are our Core Reference Ontologies. They are the standard used by all our different groups of users. These type of ontology are linked to a specific topic/domain but it integrates different levels and tiers related to specific group of users. We know from theory that core reference ontologies as well as domain ontologies based on the same foundational ontology can be more easily integrated. (Roussey et al, 2011).

Our layered enterprise ontologies are the result of the integration of the sublayer domain ontologies. However, they are a formal (i.e., domain independent) system of categories and their ties that can be used to construct models of various domains, and not one of a specific domain. Our core reference ontologies are built to catch the central concepts and relations of the specific layers. They provide the foundations for a (generic) modelling language trough a mapping between the core reference ontology and the modelling language's meta-model (M2).

The Domain Ontologies of Value, Competency, Service, Process, Application, Data, Platform and Infrastructure, describe, the context and vocabulary related to their specific domain by specializing the concepts introduced in the core-reference ontology. In the Enterprise/Business Ontology, the domain ontologies are linked to a specific core reference ontology layer. In terms of the MOF tiers, they provide the foundations for a domain-specific modelling languages (M2) trough a mapping between the domain ontology and the modelling language's meta-model. Each specific domain ontology is only valid to a layer with their specific view point, however the layers relate through the semantic relations, captured in the foundational ontlogy. Therefore, the individual viewpoints, ensures the ability to engineer, architect or model across multiple sublayers. That is to say that the viewpoints defines how a group of users conceptualize and visualize some specific phenomenon of the sublayers. The domain ontologies could be linked to a specific application. (Roussey et al, 2011) They provide the foundations for a domain-specific modelling languages (M2) trough a mapping between the domain ontology and the modelling language's meta-model. (G. Guizzardi, 2005).

The Tiering Ontology, Categorization Ontology, Classification Ontology, LiveCycle Ontology, Maturity Ontology, Governance Ontology, Blueprinting Ontology, Enterprise Requirement Ontology as well as Layered Enterprise Architecture Ontology are all a part of the Task Ontologies. They provide the basis to the generic tasks relevant to both the domain ontologies and application ontologies. They do this by specializing the terms introduced in the core-reference ontology, therefore ensuring full interoperability across the various task ontologies and the core reference, domain and the application ontologies. The task ontology contains objects and descriptions of how to achieve a specific task, on the other hand the domain ontology portrays and defines the objects where the task is applied. In terms of the MOF tiers, they provide the foundation for a task-specific modelling language (M2) trough a mapping between the task ontology and the modelling language's meta-model.

The Application Ontologies describe concepts of the domain and task ontologies. Often the Application Ontologies are specializations of both the related ontologies in order to fulfil the specific purpose of a specific use, function, purpose and thereby application. In terms of the MOF tiers, they provide the foundation for a model (M1) trough a mapping between the application ontology and the model.

The Global University Alliance has the following Application Ontologies:

- Force & Trend Ontology
- Strategy Ontology
- Planning Ontology
- Quality Ontology
- Risk Ontology
- Security Ontology
- Measurement Ontology
- Monitoring Ontology
- Reporting Ontology
- Capability Ontology
- Role Ontology
- Enterprise Rule Ontology
- Compliance Ontology
- Business Workflow Ontology
- Cloud Ontology
- Business Process Ontology
- Information Ontology
- Infrastructure Ontology
- Platform Ontology
- Enterprise Culture Ontology

Academic Research: Identification of Repeatable Patterns across Industry Design concepts

As a part of the 2004 detailed academic research, which was the foundation of developing the Enterprise Ontology, we identified the most common meta objects, stereotypes, types and subtypes with all their definitions and over 10.000 semantic relationships that were common across all organizations, business units, departments and agencies. There were plenty surprises along the way, one of them was that despite being independent of size, product or service when the objects existed within the organization, they had the same semantic relationship. It surprised us, because were these findings really true? We analyzed 10 different industry sectors, namely the Financial Services, Industrial sector, Consumer Packaged Goods, Consumer Services, Energy, Public Services, Healthcare, Utilities, Transportation, Telecommunication and the High Tech sector organizations with the same output and results. The semantic relations were the same. Even when analyzing and researching the 52 sub-industries we came to the same conclusion.

While certain industries had specific meta objects with types and subtypes relevant for their industry, all the industries had the meta objects listed in publication “Using the Business Ontology to develop Enterprise Standards” (von Rosing, 2017). All the industries also had the same semantic relations. The findings led to a lot of questions in our research team, so we decided to analyze what differentiated the organizations in their way of working with the objects. In order to understand the behavior, we decided to examine the activities of the industry leaders (financial outperformers in each industry). In order to do that, we examined data from the Standard & Poor's archives during a period from 1994 to 2004, and later again from 2004 to 2014. As part of the GUA research, we scrutinized the differences between the responses of financial outperformers and those of underperformers over a 10-year period. For organizations with publicly available financial information, we compared revenue and profit track records with the average track records for those in the same industry.

We analyzed and cross-referenced the findings to other existing research that have proven that there is a connection to organizations approaches and their overall performance (Malone, T.W., Weill, P., Lai, K, D'Urso, V., Herman, G., Apel, T., Woerner, S., 2006). MIT (Malone, 2004), Accenture Research (Accenture, 2009), IBM Institute for Business Value (IBM, 2008, 2009, 2010, 2011, 2012), Business Week Research (BW, 2006), and The Economist Intelligence Unit (Economist, 2009). Throughout the analyses, there was gathered information and conclusions, based on these top- and bottom-half groupings of the organizations that outsmarted and outcompeted their peers.

The analysis confirmed that the outperformers and underperformers both had the objects identified as well as the same semantic relations. But there was a difference between how the outperformers versus the underperformers worked with the objects. We identified that the outperformers did the following, which the underperformers consistently didn't do.

They identified which objects were:

1. Important to develop the **core differentiating** aspect of the organization to outthink, outsmart and outcompete other organizations. The outperformers converge on the revenue model and value model to strengthen the competitive advantage with emphasis on innovation. It was less than 5% of the organization that was core differentiating in terms of adding to the value model and the revenue model. The objects relevant to the core differentiating aspects are the foundation for design thinking and innovation.
2. Relevant for **core competitiveness**. Contrary to general thinking, it was less than 15% of any organization's aspects that was relevant for the core competitiveness, and thereby head to head industry competition of the organization. The outperformers focused on performance model and service model to improve the competitive parity with emphasis on efficiency, innovation and transformation.
3. Significant for the **non-core** aspects of the organization. In the organizations analyzed, it was more than 80% of the organization that was non-core, and thereby do not add to the differentiation or competitiveness of the organization. In those areas the outperformers focused on the cost model and operating model to standardize, harmonize, align, optimize and thereby enabling cost cutting.

A notable difference was that the underperformers in general didn't identify their core differentiating, their core competitive nor their non-core aspects. So while they worked with the relevant objects, such as identifying the disruptive industry forces and trends, developed their enterprise strategy, specified their critical success factors etc., they did not realize that the concepts they applied them to needed different ways of working and modelling. In figure 4, we have illustrated the patterns that we identified. Exemplifying the connections between the business context researched and the repeatable patterns identified (i.e. best practices, industry practices and/or leading practices). Additionally, how the patterns should be automated within the technology perspective.

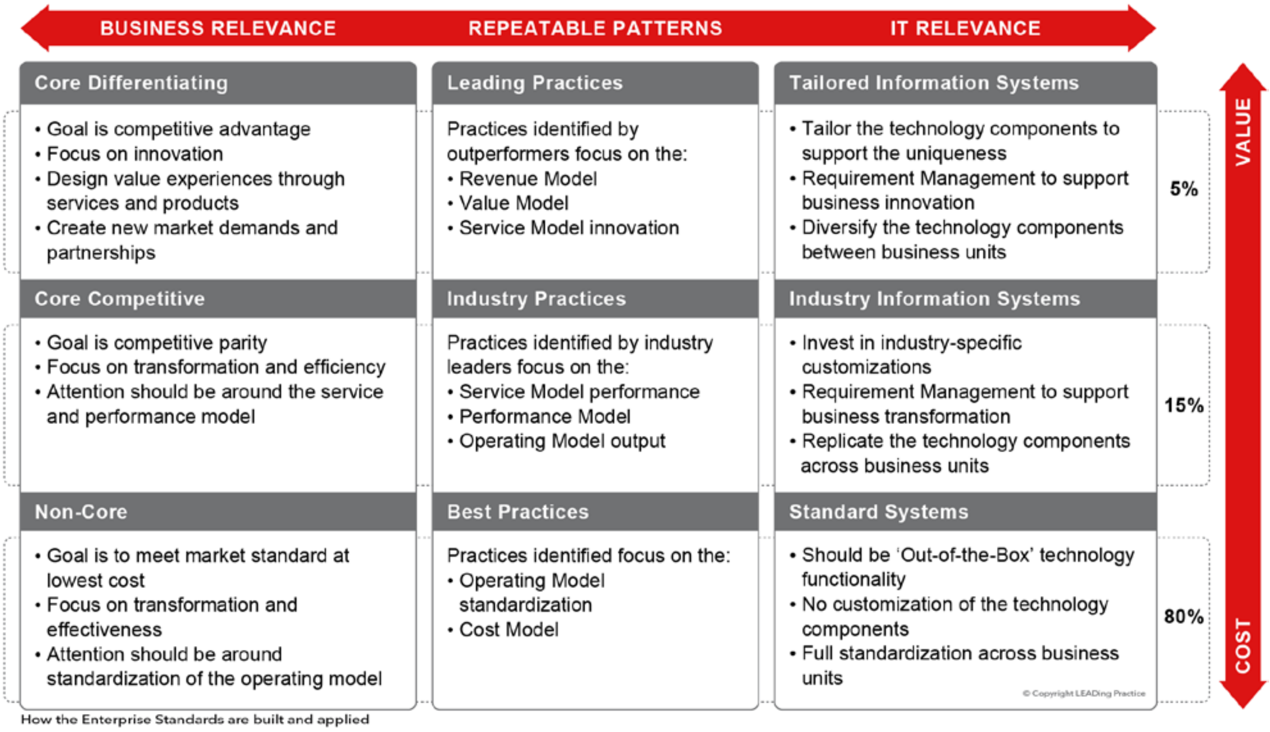

Figure 4: Exemplifying the connections between the researched business context and the patterns identified.

There were multiple repeatable patterns identified, both in the business, information and technology layer. Below are some examples of repeatable patterns identified:

Business Layer:

- Disruptive forces and trends that can influence the core differentiating aspects of the enterprise. The patterns are therefore Leading Practices that help to outperform, outsmart and outcompete the competition. The patterns were identified in 52 different industries.
- Benchmarks on which strategies are being used for the core differentiating, the competitive as well as the non-core aspects. The strategies were distinctive for the core differentiating aspects versus the non-core aspects.
- Most critical organizational capabilities - those that are the basis for both core differentiating and core competitiveness (across 52 different industries).
- Integrated planning (typical functions, processes, KPIs, and the flows involved as well as the continuous improvement loops).
- Most common non-core capabilities and processes across organizations, such as Finance, HR, IT, Procurement, etc. This enables organizations to reuse the content as well as to help them standardize and cut cost.
- Industry-specific processes that helps organizations develop their core competitive performance model as well as help standardize the operating model.
- Critical KPIs (across 52 different industries) that help organizations in their reporting, control and decision making activities.

Information Layer:

- Most common SAP blueprints, both in terms of processes automated in SAP modules, application tasks as well as the SAP system measures. What is relevant is that the level of

tailoring and customizing these ERP systems is mostly way too high (and often done in the wrong places). The tailoring of the information systems should only happen within the core differentiating aspects of the organization. While important, is procurement, HR or finance etc. really the core differentiating components within the organization? While it obviously depends on the industry, products and services, the most likely reason you need to standardize it is to improve the operating model and reduce cost. Consequently, huge customizations do not add value, but most likely enforces your unique way of working, where you are nonetheless not unique (and neither should be). The standardization is important in some areas, but should be done with out of the box functionality (i.e. software vendor best practice).
- Most common Oracle blueprints, both in terms of processes automated in Oracle workflows, modules, application tasks as well as the Oracle system measures.
- Most common way of calculating the information system performance measures. These findings were quite important for analytics, business intelligence, reporting and decision making
- And many others.

Having made these astonishing findings, in 2004, we decided in the GUA to both work with the existing standards bodies, such as ISO, CEN, IEEE, NATO, UN, OMG etc., as well as to create an enterprise standard body (LEADing Practice) that develops the enterprise standards and the patterns. Packaging the patterns identified according to their context and subjects into reusable "Reference Content". Consequently, the Enterprise Standards are the result of international subject matter experts and academic consensus.

The Enterprise Standards has been developed in the following ways:
- Research and analyze the existing patterns in the organization.
- Identify common and repeatable patterns (the basis of the standards).
- Sort the repeatable patterns by:
  - Best practices, enabling standardization and cost cutting.
  - Industry practices, empowering performance for head to head competition.
  - Leading practices, facilitating the innovation of value to develop differentiating capabilities.
- In order to increase the level of reusability and replication, package the identified patterns into Enterprise Standards.
- Build Industry accelerators within the standards, enabling organizations to adopt and reproduce the best practices, industry practices and leading practices.

Today there are 153 different subjects that have been packaged as reusable reference content. What is important is that they are both agnostic and vendor neutral, and are built on repeatable patterns that can be reused/replicated and thereby implemented by any organization, both large and small, and regardless of its products, services or activities. (von Rosing & Laurier, 2015).

All together, they describe the set of procedures an organization can follow within a specified area or subject in order to replicate the ability to identify, create and realize value, performance and standardization, etc.

The 153 different enterprise standards with their repeatable patterns have been categorized into 6 specific areas:
1. Enterprise Management Standards with the official ID# LEAD-ES10EmaS.
2. Enterprise Modelling Standards with the official ID# LEAD-ES20EmoS.
3. Enterprise Engineering Standards with the official ID# LEAD-ES30EES.
4. Enterprise Architecture Standards with the official ID# LEAD-ES40EAS.
5. Enterprise Information & Technology Standards with the official ID# LEAD-ES50EITS.
6. Enterprise Transformation & Innovation Standards with the official ID# LEAD-ES60ETIS.

Academic Research used for Industry Design Development of Enterprise Standards

Today, over 5300+ people in the above 6 areas have developed and worked with the 153 different Industry Standards and the 52 different Industry User Groups.

Industry Design: Enterprise Management Standards

Reference Content Name	Reference Content #
Strategy Management	LEAD-ES10001PG
Hyper Growth	LEAD-ES10002BC
Value Management	LEAD-ES10003PG
Performance Management	LEAD-ES10004PG
Executive Communication & Story Telling	LEAD-ES10005EX
Control Management incl. Evaluation & Audit	LEAD-ES10006GO
Planning Management	LEAD-ES10007BC
Procurement Management	LEAD-ES10008BC
Human Resource Management	LEAD-ES10009BC
Production Management	LEAD-ES10010BC
Product Management	LEAD-ES10011BC
Marketing Management	LEAD-ES10012BC
Selling & Sales Management	LEAD-ES10013BC
Call Center Management	LEAD-ES10014BC
Supply Chain & Logistics Management	LEAD-ES10015BC
Compliance Management	LEAD-ES10016GO
Risk Management	LEAD-ES10017ALL
Governance	LEAD-ES10018GO
Portfolio Management	LEAD-ES10019ALL
Program Management	LEAD-ES10020ALL
Project Management	LEAD-ES10021ALL
Financial Management	LEAD-ES10022BC
Policy	LEAD-ES10023PG

Outsourcing	LEAD-ES10024ALL
Contract Management	LEAD-ES10025BC
Culture	LEAD-ES10026ALL
Deliver on Promise	LEAD-ES10027ALL
Enterprise DNA	LEAD-ES10028ALL

Industry Design: Enterprise Modelling Standards

Reference Content Name	Reference Content #
Meta-modelling	LEAD-ES20001ALL
Capability Modelling	LEAD-ES20002PG
Stakeholder Management	LEAD-ES20003EX
Business Model	LEAD-ES20004BC
Business Process	LEAD-ES20005BP
Process Flow	LEAD-ES20006PF
Revenue Model	LEAD-ES20007BC
Value Model	LEAD-ES20008BCPG
Service Model	LEAD-ES20009BCBS
Service Flow	LEAD-ES20010BCSF
Performance Model	LEAD-ES20011BCPG
Operating Model	LEAD-ES20012BC
Cost Model	LEAD-ES20013BCPG
Role Modelling	LEAD-ES20014BC
Competency Modelling	LEAD-ES20015BC
Measurement	LEAD-ES20016PG
Workflow	LEAD-ES20017ALL
Channel	LEAD-ES20018ALL
Case Management	LEAD-ES20019ALL
Event Model	LEAD-ES20020ALL
Technology Consolidation	LEAD-ES20021ALL
Digital Twin of the Organization	LEAD-ES20022ALL
Extended Sequence Flow	LEAD-ES20023ALL
Value Chain	LEAD-ES20024PGBC

Industry Design: Enterprise Engineering Standards

Reference Content Name	Reference Content #
Decomposition & Composition	LEAD-ES30001ALL
Lifecycle Management	LEAD-ES30002ALL

Testing	LEAD-ES30003SPADPI
Requirement Management	LEAD-ES30004ES
Quality Management	LEAD-ES30005EM
Enterprise Sustainability	LEAD-ES30006ALL
Agile	LEAD-ES30007ES
Categorization & Classification	LEAD-ES30008ES
Enterprise Tiering	LEAD-ES30009ALL
Enterprise Ontology	LEAD-ES30010ALL
Enterprise Taxonomy	LEAD-ES30011ALL
Enterprise Semantics	LEAD-ES30012AS
Periodic Table of Enterprise Elements	LEAD-ES30013ALL
Meta Objects	LEAD-ES30014ALL
Enterprise Meta Model	LEAD-ES30015ALL
Artefacts & Templates	LEAD-ES30016ALL
LEAD Way of Structuring	LEAD-ES30017WS
Information & Systems Engineering	LEAD-ES30018BCSAD
Data Monetization	LEAD-ES30019DI
Multiexperience	LEAD-ES30020ALL
User Democratization	LEAD-ES30021ALL
Human Augmentation	LEAD-ES30022ALL
Blueprinting	LEAD-ES30023ALL
Implementation	LEAD-ES30024ALL
Enterprise Navigator	LEAD-ES30025ALL
Packaged Business Capabilities	LEAD-ES30026ALL
SMART City & Digital City	LEAD-ES30027BCBPSADPI
Productization	LEAD-ES30028ALL

Industry Design: Enterprise Architecture Standards

Reference Content Name	Reference Content #
Layered Enterprise Architecture	LEAD-ES40001ALL
Business Architecture	LEAD-ES40002PGBCPSI
Value Architecture	LEAD-ES40003PG
Process Architecture	LEAD-ES40004BP
Service-Oriented Architecture	LEAD-ES40005BS
Application Architecture	LEAD-ES40006SAID
Information Architecture	LEAD-ES40007BCSAD
Data Architecture	LEAD-ES40008SAI
Platform Architecture	LEAD-ES40009PL
Infrastructure Architecture	LEAD-ES40010IN

EA Governance	LEAD-ES40011GO
Security Architecture	LEAD-ES40012CS
Cloud Architecture	LEAD-ES40013CC
Agile Enterprise Architecture	LEAD-ES40014ALL
Technology Architecture	LEAD-ES40015PLIN
Composite Architecture	LEAD-ES40016ALL

Industry Design: Enterprise Information & Technology Standards

Reference Content Name	Reference Content #
IT Strategy	LEAD-ES50001PG
Business Model of IT	LEAD-ES50002BC
IT Process Map	LEAD-ES50003BP
IT Center of Competency	LEAD-ES50004BC
Cloud Computing	LEAD-ES50005CC
Cyber Security	LEAD-ES50006CS
Knowledge Management	LEAD-ES50007PGIDBC
Artificial Intelligence	LEAD-ES50008PGIDBC
Robotic Process Automation	LEAD-ES50009PGIDBC
Analytics	LEAD-ES50010PGIDBC
Reporting	LEAD-ES50011PGIDBC
Application	LEAD-ES50012SAIDBCBP
Application Modernization & Optimization	LEAD-ES50013SAIDBCBP
Enterprise Resource Planning (ERP)	LEAD-ES50014SADIBC
Software Testing	LEAD-ES50015SADI
Information Management	LEAD-ES50016BCIDSA
Data	LEAD-ES50017DISABC
Rule Modelling	LEAD-ES50018PGBCSADI
Service-Oriented Computing	LEAD-ES50019ES
Platform	LEAD-ES50020PLES
Infrastructure	LEAD-ES50021IL
Social Media	LEAD-ES50022ALL
Distributed Cloud	LEAD-ES50023ALL
Hyperautomation	LEAD-ES50024ALL
Machine Learning	LEAD-ES50025ALL
Robotic Automation	LEAD-ES50026ALL
Smart Automation	LEAD-ES50027ALL
Industry 4.0 Technology	LEAD-ES50028ALL
Blockchain	LEAD-ES50029ALL
Workplace	LEAD-ES50030ALL

Digital Twin of the Organization	LEAD-ES50031ALL

Industry Design: Enterprise Transformation & Innovation Standards

Reference Content Name	Reference Content #
Alignment & Unity	LEAD-ES60001ALL
Change Management	LEAD-ES60002ALL
Maturity Assessment	LEAD-ES60003ALL
Continuous Improvement	LEAD-ES60004ALL
Organizational Development	LEAD-ES60005ALL
Optimization	LEAD-ES60006ALL
Effectiveness	LEAD-ES60007ALL
Efficiency	LEAD-ES60008ALL
Re-engineering	LEAD-ES60009ALL
Root Cause Analysis	LEAD-ES60010ALL
Transformation Benchmarking	LEAD-ES60011ALL
Innovation	LEAD-ES60012ALL
Alignment of Portfolio, Program & Project Management	LEAD-ES60013ALL
Innovation & Transformation Blueprinting & Implementation Method	LEAD-ES60014ALL
Transformation	LEAD-ES60015ALL
Digital Innovation & Transformation	LEAD-ES60016ALL
Industry 4.0 Innovation & Transformation	LEAD-ES60017ALL
Health Check	LEAD-ES60018ALL
Quickscan	LEAD-ES60019ALL
Organizational Assessment	LEAD-ES60020ALL
Product Innovation	LEAD-ES60021ALL
Innovation & Disruption (develop your Core Differentiating & Core Competitive aspects)	LEAD-ES60022ALL

The Enterprise Standards published by LEADing Practice is the last stage of a long process that commonly starts with the proposal of new work within their work groups. Here are some abbreviations used for development and amendment of the standard (with its status):

Description	Formal Abbreviation
Enterprise Standard Proposal	LEAD-ESP
Enterprise Standard Draft	LEAD-ESD
Enterprise Standard	LEAD-ES
Enterprise Standard Amendment	LEAD-ESA
Specification & Report	LEAD-SR
Publicly Available Specification	LEAD-PAS
Available Trends Assessment	LEAD-ATA

The Industry Design User Groups

The Industry User Groups are industry organizations and people who have similar industry interests, goals, and/or concerns. We have 10 Industry Standards & User Groups with 52 sub-industry standards and their corresponding working groups.

1. Financial Services (#LEAD-IS1)
2. Industrial (#LEAD-IS2)
3. Consumer Goods (#LEAD-IS3)
4. Energy (#LEAD-IS4)
5. Public Services (#LEAD-IS5)
6. Healthcare (#LEAD-IS6)
7. Utilities (#LEAD-IS7)
8. Transportation (#LEAD-IS8)
9. Communication (#LEAD-IS9)
10. High Tech (#LEAD-IS10)

As our Industry User Groups have members distributed throughout the world, they communicate with various technologies from web sessions, chat capabilities, message boards, mailing lists and Skype meetings. While the user groups are devoted to one Industry or sub industry, the subjects researched and analyzed within the industry are used as input in the multiple industry standards.

However, it can happen that a specific industry design user group is devoted to a narrow range of industry design ideas and concepts or has strict confidentiality or security requirements. In this case the industry user group is closed and does not collaborate with the other Industry User Groups.

All user group work is documented and the industry standards they produce are based on an open standard development process are tracked under the following Industry Standard reference content numbers:

Financial Services User Group & Industry Standard Committee

Industry Group Name:	Reference Content #
Central Bank	LEAD-IS10001
Commercial Bank (Banking)	LEAD-IS10002
Insurance	LEAD-IS10003
Financial Markets	LEAD-IS10004
Real Estate	LEAD-IS10005

Industrial User Group & Industry Standard Committee

Industry Group Name:	Reference Content #
Aerospace & Defense	LEAD-IS20001
Automotive	LEAD-IS20002

Chemicals	LEAD-IS20003
Forestry & Paper	LEAD-IS20004
Metal & Mining	LEAD-IS20005
Construction & Materials	LEAD-IS20006
Electronics & Electrical Equipment	LEAD-IS20007
Manufacturing & Industrial Engineering	LEAD-IS20008

Consumer Goods User Group & Industry Standard Committee

Industry Group Name:	**Reference Content #**
Food	LEAD-IS30001
Beverage	LEAD-IS30002
Tobacco	LEAD-IS30003
Fashion & Apparel Goods	LEAD-IS30004
Retail	LEAD-IS30005
Travel & Hotel	LEAD-IS30006

Energy User Group & Industry Standard Committee

Industry Group Name:	**Reference Content #**
Oil & Gas	LEAD-IS40001
Alternative Energy	LEAD-IS40002

Public Services User Group & Industry Standard Committee

Industry Group Name:	**Reference Content #**
Defense (Public)	LEAD-IS50001
Finance & Treasury	LEAD-IS50002
Customs & Border Services	LEAD-IS50003
Foreign Affairs & Trade	LEAD-IS50004
Health	LEAD-IS50005
Agriculture & Food	LEAD-IS50006
Labor & Social Services	LEAD-IS50007
Energy & Natural Resources	LEAD-IS50008
Education	LEAD-IS50009
Environment	LEAD-IS50010
Tourism	LEAD-IS50011
Transport & Infrastructure	LEAD-IS50012
Justice	LEAD-IS50013

Culture	LEAD-IS50014
Local Government	LEAD-IS50015

Healthcare User Group & Industry Standard Committee

Industry Group Name:	**Reference Content #**
Healthcare Services & Equipment	LEAD-IS60001
Pharmaceuticals	LEAD-IS60002
Life Science & Biotechnology	LEAD-IS60003

Utilities User Group & Industry Standard Committee

Industry Group Name:	**Reference Content #**
Electricity Utilities	LEAD-IS70001
Gas, Water & Multiutilities	LEAD-IS70002
Power Producers	LEAD-IS70003

Transportation User Group & Industry Standard Committee

Industry Group Name:	**Reference Content #**
Airline	LEAD-IS80001
Railways	LEAD-IS80002
Shipping	LEAD-IS80003
Postal	LEAD-IS80004
Logistical Service Providers	LEAD-IS80005

Communication User Group & Industry Standard Committee

Industry Group Name:	**Reference Content #**
Media & Entertainment	LEAD-IS90001
Telecommunication	LEAD-IS90003
Publishing	LEAD-IS90002

High Tech User Group & Industry Standard Committee

Industry Group Name:	**Reference Content #**
Software & Services	LEAD-IS100001

Also the Industry Standards published by LEADing Practice are the last stage of a long process that commonly starts with the proposal of new ideas and thereby work within the mentioned Industry Committee. Here are some abbreviations used for development and amendment of the industry standard (with its status):

Description	Formal Abbreviation
Enterprise Standard Proposal	LEAD-ESP
Enterprise Standard Draft	LEAD-ESD
Enterprise Standard	LEAD-ES
Enterprise Standard Amendment	LEAD-ESA
Specification & Report	LEAD-SR
Publicly Available Specification	LEAD-PAS
Available Trends Assessment	LEAD-ATA

Using the Industry Design Standards

We realize that organizations apply various method and approaches; therefore, we have ensured that all our Industry Standards published have a structured Way of Thinking, Working, Modelling, Implementation and Governance. To ensure full integration to other methods and approaches within an organization, the Industry Standards have an ontology and semantic concept built in that allows for the Industry Standards meta objects to be reused.

This includes applying the various standards:

- Management Principles – to define the strategy, objectives, performance indicators as well as to administer, govern and control the various enterprise initiatives.
- Engineering Principles – how and where it can or needs to be decomposed and composed together.
- Modelling Principles – which design concepts can or should be applied.
- Architecture Principles – which architecture rules apply and which artifacts and templates (e.g. maps, matrices and models) could or should be applied.
- Information & Technology principles - that enables the automation and optimization of the organization.
- Transformation & Innovation principles - where and how can things be optimized, modernized or thought through in a new way.

Creating the ability to "Unify" different enterprise standards together as well as combine them with the industry standards (or vise versa) concepts in combining the relevant aspect. Developing a whole new concept of agile integration and standardization.

Why we develop Industry Standards

Simply said, the lack of existing Industry Standards in the areas of Business Management, Enterprise Modelling, Information & Technology, Enterprise Transformation, Enterprise Engineering and Enterprise Architecture has created the demand for such a community.

Our analysis and research within the Global University Alliance, a group of 450+ universities, academics and researchers has identified that the lack of repeatable standards has high costs, lack of innovation and business process inefficiencies. The need to develop reusable and replicable patterns that can be implemented by any organization, both large and small, regardless of its products/services or activities was therefore apparent.

How we develop the Industry Standards

The Industry Standards are the result of international industry experts and academic consensus. The standards are both agnostic and vendor neutral and are built on repeatable patterns that can be reused/replicated and thereby implemented by any organization, both large and small, regardless of its products/services or activities. All together describing the set of procedures an organization needs to follow in order to replicate the ability to identify, create and realize value in the specified area/subject. The Industry Standards have been developed in the following ways:

- Research and analyze Industry Best Practices & Leading Practices.
- Identifying common and repeatable patterns (the basis of our standards).
- Develop the Industry Standards that increase the level of re-usability and replication.
- Build Industry accelerators within the standards, enabling to adopt and reproduce the Best & Leading Practices.

How can I join?

We have +450 Universities, academics and researchers involved with the LEADing Practice research and development. To get involved on an educational level or research via the Global University Alliance, please contact the Chairman of the Global University Alliance Board, Prof. Mark von Rosing at mvr@globaluniversityalliance.net.

Chair Board

Our Chair Board consists of exceptional visionary individuals and researchers from both academia and industry that have left a mark on this generation. They have been instrumental in our success. In their work on the Board, members do not represent any personal or professional interests.

The board is dedicated to advance research and the development of concepts. Board-directors exercise a major impact on the academic concepts and industry standards and strategic direction of the Global University Alliance. The board is instrumental to plan, organize, and execute the annual conference and events.

The Chair Board consist of the following members:

Name	Organization	Position
Prof. Mark von Rosing	Global University Alliance	Chairman, Head of Enterprise Modelling and Patternicity Research
Dr. Simon Polovina	Global University Alliance	Co-Chairman, Head of Enterprise Architecture and Enterprise Semantics Research
Prof. Dr. Wim Laurier	Global University Alliance	Co-Chairman, Head of Enterprise Ontology Research

The tasks of the Global University Alliance Board are the following:

- Insure collaboration across universities, professors and researchers
- Manage regional GUA work
- Work on joint publications
- Funding requests/proposals
- Support events and conferences
- Seek and enable research
- Advance the development of concepts and standards
- Enhance the body of knowledge
- Ensure tight cooperation and collaboration with Industry Partners

The Academic Advisory Board of Directors

The Academic Advisory Board of Directors consist of the following members:

Name	Organization	Position
Prof. Dr. Hans-Jürgen Scheruhn	Global University Alliance	Advisory Board Member, Head of Enterprise Navigation system Research
Prof. Maxim Arzumanyan	Global University Alliance	Advisory Board Member
Prof. August-Wilhelm Scheer	Global University Alliance	Advisory Board Member
Jamie Caine	Global University Alliance	Advisory Board Member
Dr. Elizabeth Uruchurtu	Global University Alliance	Advisory Board Member