Overview of the

Value Ontology Research & Analysis[1]

Key Words: Value Ontology, Domain Ontology, Value Semantics, Research Approach, Practitioner Design Process, Value Standards, Value Enterprise Standards, Value Ontology Research Team

Introduction

The Value Ontology presented in this publication has taken the Global University Alliance members over a decade to research and develop, with hundreds of 'man years' involved to create the product introduced in this paper. This paper provides an overview of the Value Ontology research and analysis done and elaborates on its development and adaption journey. This research paper therefore has the aim to provide an overview of the research and analysis that has been done around the subject of Value Ontology. It does so by firstly defining what Ontology means in the context of this research after which it elaborates on the research questions and than the chosen research approach. It than describes how the Value Ontology is a part of the Business Ontology and how it is formalizing a Domain Ontology. Followed by a historic overview of the Value Ontology development, findings, adaption and how the Value Ontology is used to develop enterprise and industry standards. The Overview of the Value Ontology Research & Analysis paper than concludes with mentioning the main research team members.

What is Ontology in the context of the research

As ontology formally represents knowledge as a set of concepts within a domain, the value ontology therefore represents the theory and practice knowledge gathered within the value domain, and the relationships between those concepts, it can be used to model the value domain and support various views i.e. models. The Global University Alliance has used the concept of ontology as both a shared value vocabulary and the very definition of its objects and concepts.

Why analysing and researching Value Concepts?

Simply said, the lack of existing Value concepts and value modeling views as well as value standards in the areas of Business Management, Enterprise Modelling,

[1] Based on: http://www.globaluniversityalliance.net/research-areas/

Information & Technology, Enterprise Transformation, Enterprise Engineering and Enterprise Architecture has created the demand for such a research and analysis.

Already our early analysis and research in 2004 within the Global University Alliance, identified that the lack of value concepts and value standards as a reason for difficulties in strategy execution, missing innovation, the ability to develop value capabilities, identification of where the organization creates core differentiating value and where not. On top of that a total misunderstanding and misconception of value. For example, that the customer value proposition is what value is about. Or that all functions, processes or services that are customer facing is the value flow. This is not only what value identification, creation or value realization in organizations about. While value defiantly is connected to both value proposition and value flow, that does not tell an organization anything about their external or internal value drivers. It doesn't capture stakeholder value expectations.

All together resulting in a low understanding of what does and doesn't create and realize value. Also the reason of low value maturity in organizations

The need to develop reusable and replicable value patterns that can be implemented by any organization, both large and small, regardless of its products/services or activities was therefore apparent. Our main goal was to:

- Identify value relevant concepts
- Developing a value ontology with its specific value descriptions, semantic relations and correlations.
- Identify how to organize and structure the viewpoints and objects associated with value engineering, value modelling, and value architecture.
- Established guiding principles for creating, interpreting, analysing and using value objects within a particular domain and/or layers of an enterprise or an organization.
- Specify a set of principles e.g. how and where can the value concepts be related (and where not).
- Recognize and captured a repeatable pattern for value related concepts, structures as well as artefacts
- Develop a value Lifecycle view that incorporates value identification, value planning, value creation, value realization as well as value management and value governance.

The Research Approach

The Global University Alliance (GUA) is an open group of academics with the ambition to provide both business and academia with state-of-the-art insights. Through its ties with the LEADing practice community, which includes large firms and governments, the GUA is able to evaluate and valorize its scientific output. Since 2004, the members of the GUA strive for a continuous improvement of their expertise through the research, comparison, analysis and development of Best and LEADing Practices in Business. Throughout this process, the GUA built its own implicit ontology that revolves around its

expertise of Best and LEADing practices.

This is where the Global University Alliance (GUA) has developed a unique collaborative process between research and industry. After 5 years of already working together, the GUA was founded in 2004 as a non-profit organization and today (September 2015) they are an international consortium consistent of over 450 universities, professors, lecturers and researchers whose aim it is to provide a collaborative platform for academic research, analysis and development. 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 (French: Organisation internationale de standardization)
- **CEN:** The European Committee for Standardization (CEN, French: Comité Européen de Normalisation).
- **IEEE:** 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 defined information security standards.
- **W3C: World Wide Web Consortium-**The W3C 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.

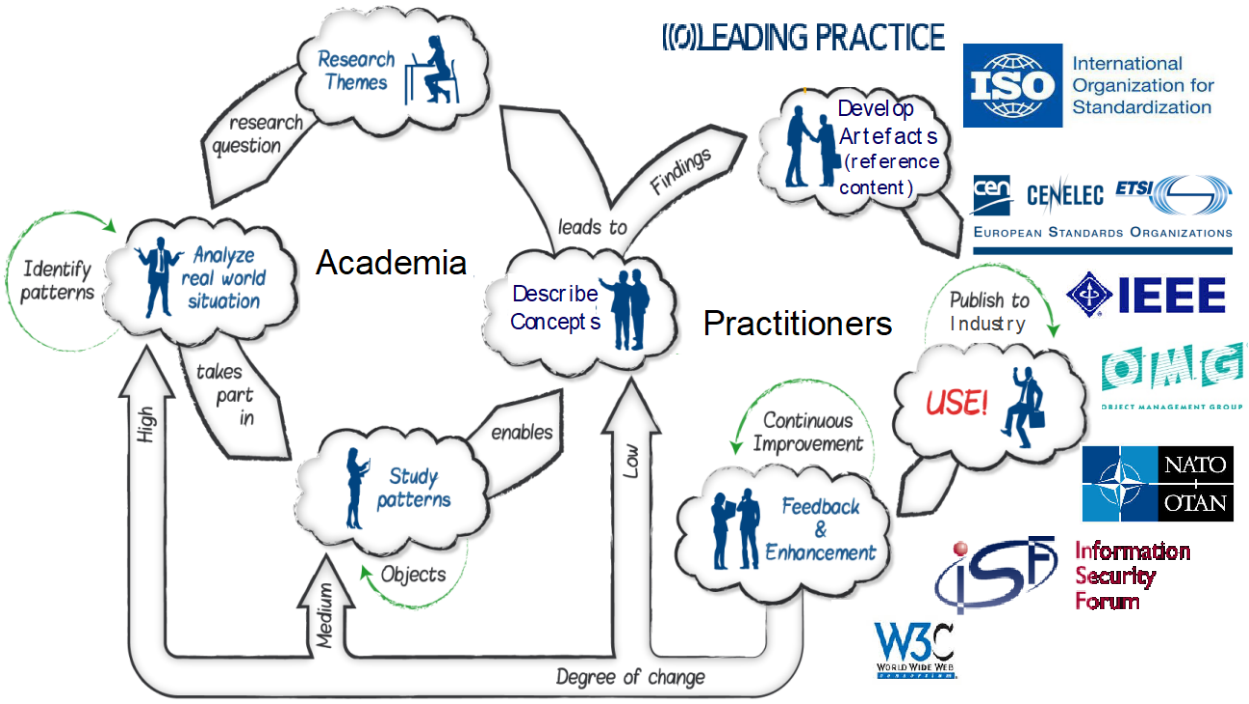

Figure 1: Overview of the Academia – Industry Concept process which is used in the Global University Alliance and the various collaborative industry practitioners involved in partnerships. The Academia – Industry process used in the Global University Alliance and the various collaborative industry practitioners has two types of different cycles. 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).

Research Questions

Information and research is sought on topics related to the understanding and comparison of Value concepts, including, but not limited to:

- The meaning of Value
- The main concepts where Value concepts exist i.e.
  1. Economic Value, a measure of the benefit that may be gained from goods or service.
  2. Marketing and Sales Value, the difference between a customer's evaluation of benefits and costs.
  3. Value investing, an investment paradigm.
  4. Personal Value (incl. cultural aspects)
  5. Value in terms of ethics
  6. Quantity, where value, also known as lightness or tone, a representation of variation in the perception of a color or color space's brightness.
  7. Computer Science Value, an expression that implies no (further) (mathematical) processing; a "normal form".
  8. Qualitative value

9. Value modelling concepts (as related to Enterprise modeling concepts)
10. Value engineering (as related to Enterprise engineering concepts)
11. Value Architecture (as related to Enterprise Architecture)

Therefore the research focuses on Value theories, the study of how the notion of value is used.

- Applied layers and groups where Value concepts exist)
- Main Groups and categories
- Value Ontology Taxonomy
- Value Ontology semantic relations
- Value Ontology classes (applied to MOF)
- Semantic foundations of EAFs
  - What common Ontology aspects do they have?
  - What common meta objects do they have?
- Organization and modularization principles of EAFs
- Extension and customization mechanisms for EAFs
- Comparing EAFs, method and approaches for comparison
- What Enterprise Architecture roles exist
- Concern-oriented considerations:
  - What concerns are well-supported (typical concerns they work with)?
  - What concerns are not currently handled?
- Model and viewpoint considerations:
  - Typical models they work with?
  - What challenges are not being addressed by current models?
  - What are their tasks? How are EAFs situated with respect to other life cycle processes and activities?
  - Which Enterprise Architecture measures (KPIs) exist
  - Tool support: what impediments, opportunities exist?

Already existing research and developments

Already existing research and developments in Performance and Value Management related concepts

	Cross-sector	**Manufacturing**	**Services**
Aggregate Level Studies	Jonscher [1983], Jonscher [1994]	Morrison & Berndt [1991]	Brand & Duke[1982]
(Economy-wide and Industry-level)	Baily [1986b], Baily & Chakrabarti [1988], Baily & Gordon [1988]	Berndt et al. [1992], Berndt & Morrison [1995]	Baily [1986a]
	Roach [1987], Roach [1988], Roach [1989b]	Siegel & Griliches [1992]	Roach [1987], Roach [1991], Roach [2001]

	Brooke [1992]	Siegel [2004]	
	Lau & Tokutsu [1992]	Dahl, Jensen & von Rosing [2010]	
	Oliner & Sichel [1994]		
	Jorgenson & Stiroh [1995]		
	Brynjolfsson [1995]		
	Peppard & Ward [2003]		
	Brynjolfsson [2005]		
	Butler Group [2005]		
	IBM CEO study [2006-2015]		
	von Rosing [2010]		
	LEADing Practice Value Modelling concept (1999-2017		
	OMG Value Delivery Modeling Language [2012-2015]		
Micro-Level Studies	Osterman [1986]	Loveman [1994]	Cron & Sobol [1983]
	Dos Santos [1993]	Weill [1988, 1992]	Pulley & Braunstein [1984]
	Krueger [1993]	Dudley & Lasserre [1989]	Bender [1986]
	Pfeffer & Sutton [2000]		
	Brynjolfsson [2005]		
	Butler Group [2005]		
	LEADing Practice Enterprise Value measures (1999-		

	2017		
	Cook [2007]		
(Firms and Workers)	Brynjolfsson & Hitt [1994]	Barua, Kriebel & Mukhopadhyay [1991]	Bresnahan [1986]
	Hitt & Brynjolfsson [1994]	Brynjolfsson & Hitt [1993] Brynjolfsson & Hitt [1995]	Franke [1987]
	Lichtenberg [1995]	Brynjolfsson [2005]	Strassmann [1985], Strassmann [1990]
	Pfeffer & Sutton [2000]		Harris & Katz [1999]
	Peppard & Ward [2003]		Parsons et al. [2007]
	von Rosing [2009]		Diewert & Smith [2008]
	LEADing Practice Value Framework (2009)		
	von Rosing [2010]		

Table 1: Research and developments in Performance and Value Management

Research analysis and findings

In understanding value concepts, we analysed what the outperformers (leading organizations) have done in this field. The study of why an organization outperforms another organization is not new research topic it has been around for a long time. For the most created by the organizations that aspire to achieve strategic competitiveness and differentiation within their specific industry. The need to plan create and realize value within the '*competitive forces* is a phenomenon all organizations are faced with today. Strategic competitiveness and differentiation has been defined in the literature as an organization's ability to identify major changes in the external environment, to quickly identify the value drivers and commit ones competencies (resources and capabilities) to new courses of action, and to act promptly when it is time to halt or reverse such capability and resource commitments [Shimizu and Hitt, 2004, von Rosing, 2010].
In almost every industry, there are certain value factors that have or are most likely to have a significant impact on competitiveness and/or differentiation and the ability to be able to model these is crucial. All aspects that create value and help compete and differentiate in the market are about the core critical competencies and thereby the ability to model ones capabilities and resources to create offerings/services to the

market. Therefore, any organization that formulates and executes a business model should pay attention to its value offerings and concepts in the competitive environment as it decides on the set of activities and services that it will perform to create and offer value to its customers and as it strategizes to profit from the value.

In our analysis we asked the organizations the following questions:

1. **Research Question: Does your organization apply value modelling concepts within your organization.**
   Answers: In our analysis between the outperforming organizations and the underperforming organizations, we identified that it is 2.2 times more likely that the outperforming organizations are applying value concepts.
   Conclusion: Value modelling concepts are existing across nearly all successful outperforming organizations.

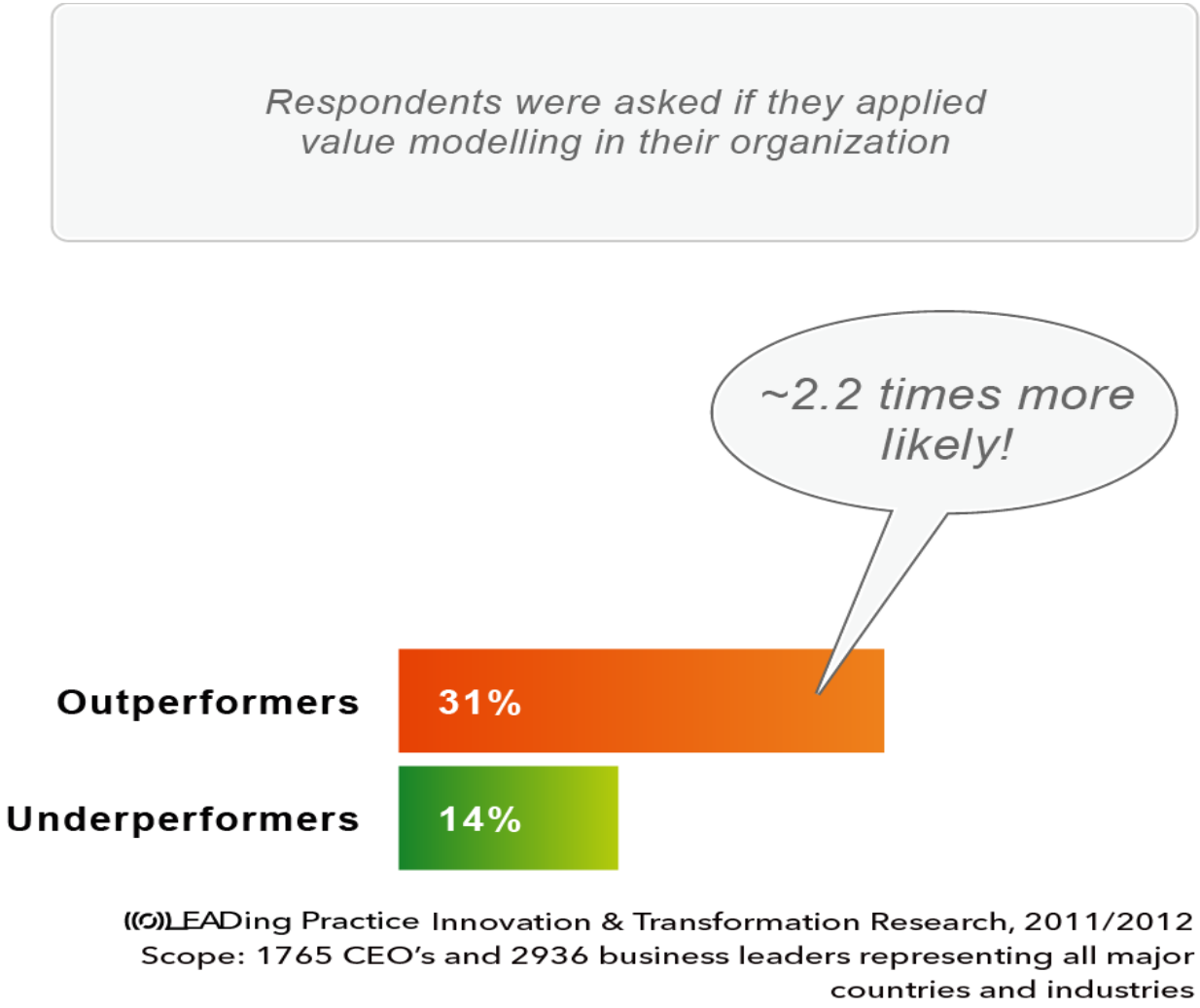

Figure 2: Does your organization apply value modelling concepts within your organization.

2. **Research Question: Where in your organization do you apply value modelling concepts.**
   Answers: Figure 3 illustrated where the organization apply value modelling concepts.
   Conclusion: Finance, strategy, operations and sales/marketing are the most applied areas for value modelling concepts.

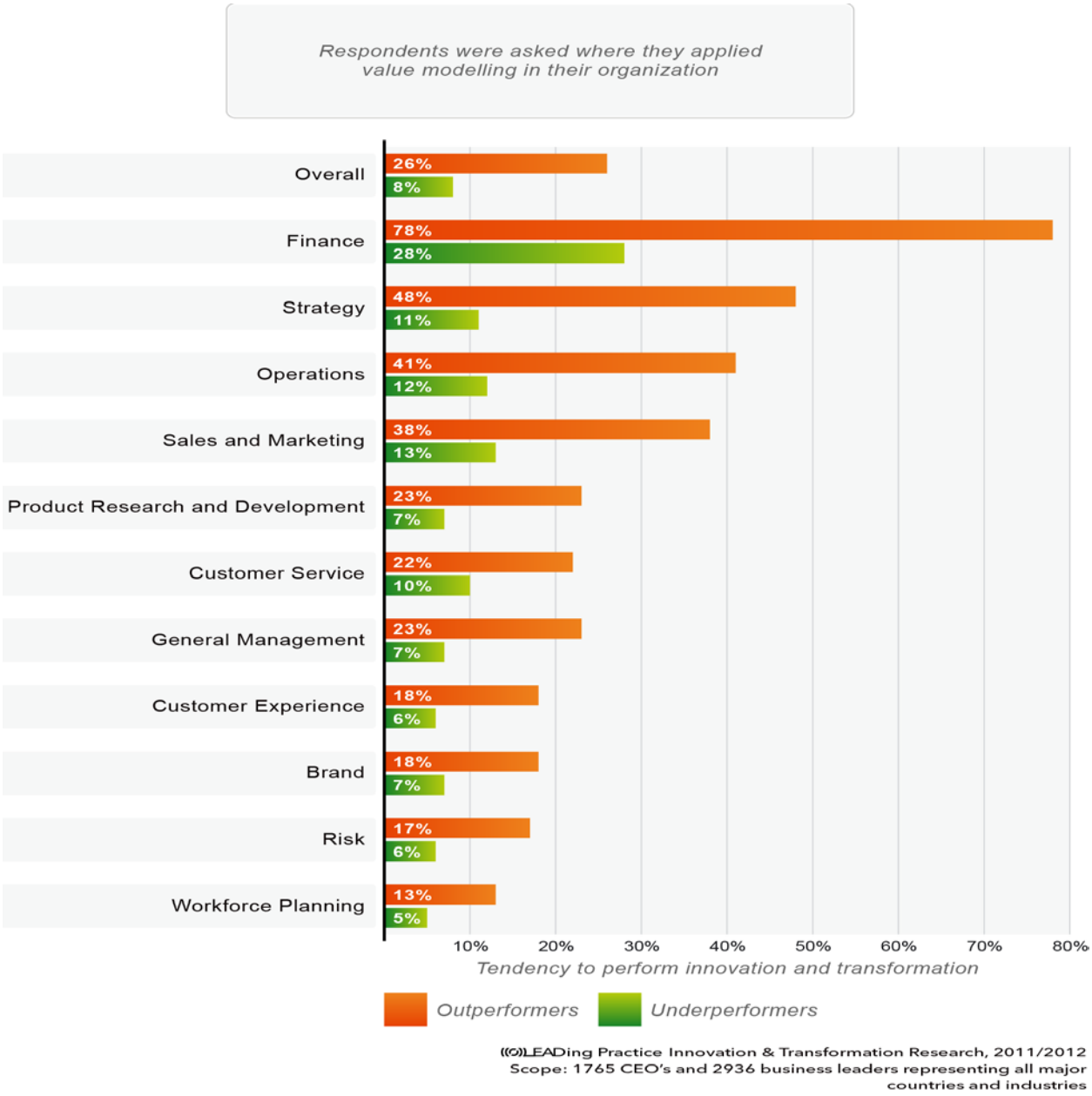

Figure 3 Where the organization apply value modelling concepts.

3. Research Question: Why do you apply value modelling concepts?

Answers: Figure 4 illustrated which areas in terms of business model, revenue model and service model are most impacted by applying value modelling concepts.

Conclusion: Underperformers apply value modelling concepts mostly because they want to innovate and transform their business model and the revenue model and least their service model. Whereas the outperformers apply value modelling concepts not only because they want to innovate and transform their business model, but also their service model concepts. Followed by their revenue model. The outperformers realize that modelling their service model, will impact their revenue model more that changing the revenue model in itself.

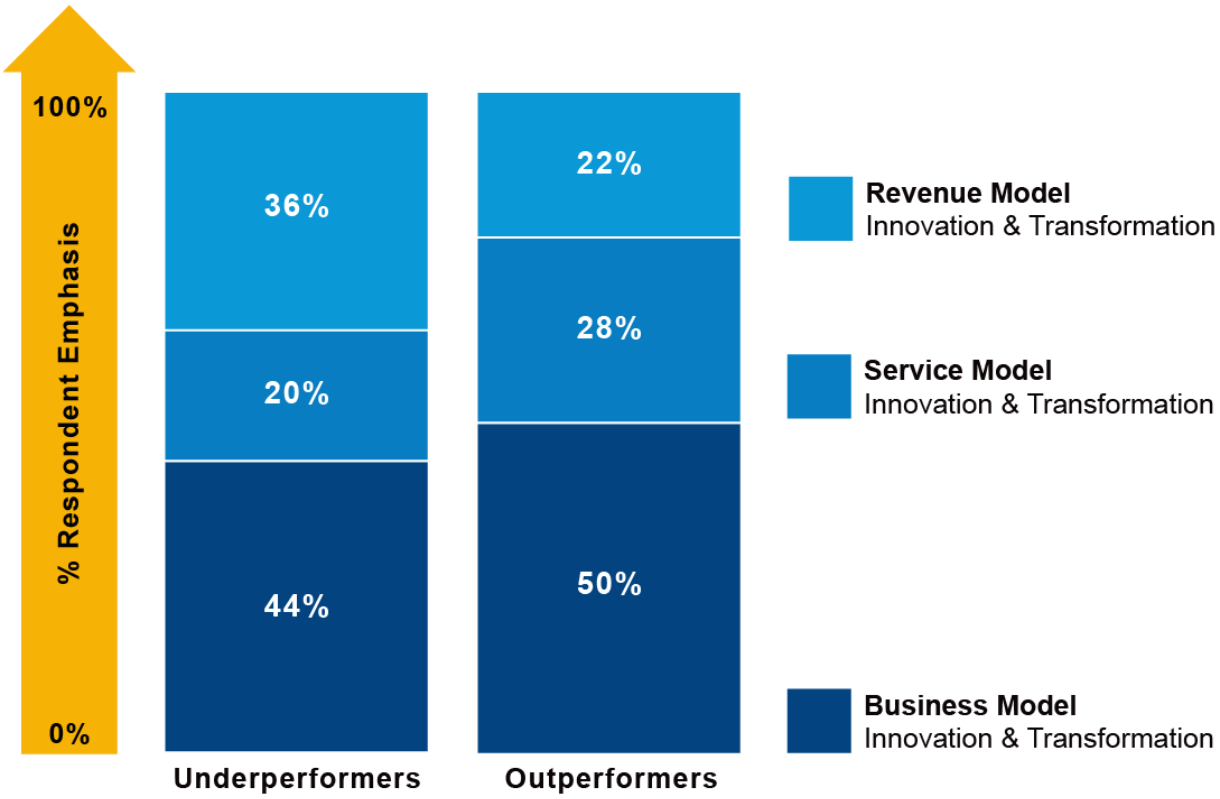

Figure 4 illustrates why organizations apply value modelling concepts.

3. Research Question: How do you apply value modelling concepts.

Answers: Figure 5 illustrates with which topics the outperforming and underperforming organizations apply value modelling concepts.
Conclusion: The underperformers and outperformers apply the same value modelling concepts, namely identify and model the both the value elements (objects/entities) and specify the value offering. Link all the value elements and value offerings to your capabilities (organizational as well as technical). Detail, improve and model your value proposition and at last but not least, specify your value measures that are linked to the strategic objectives and goals. Noteworthy is that the outperformers apply the concepts much more than the underperformers. The value gap between the outperforming and underperforming organizations can clearly be seen.

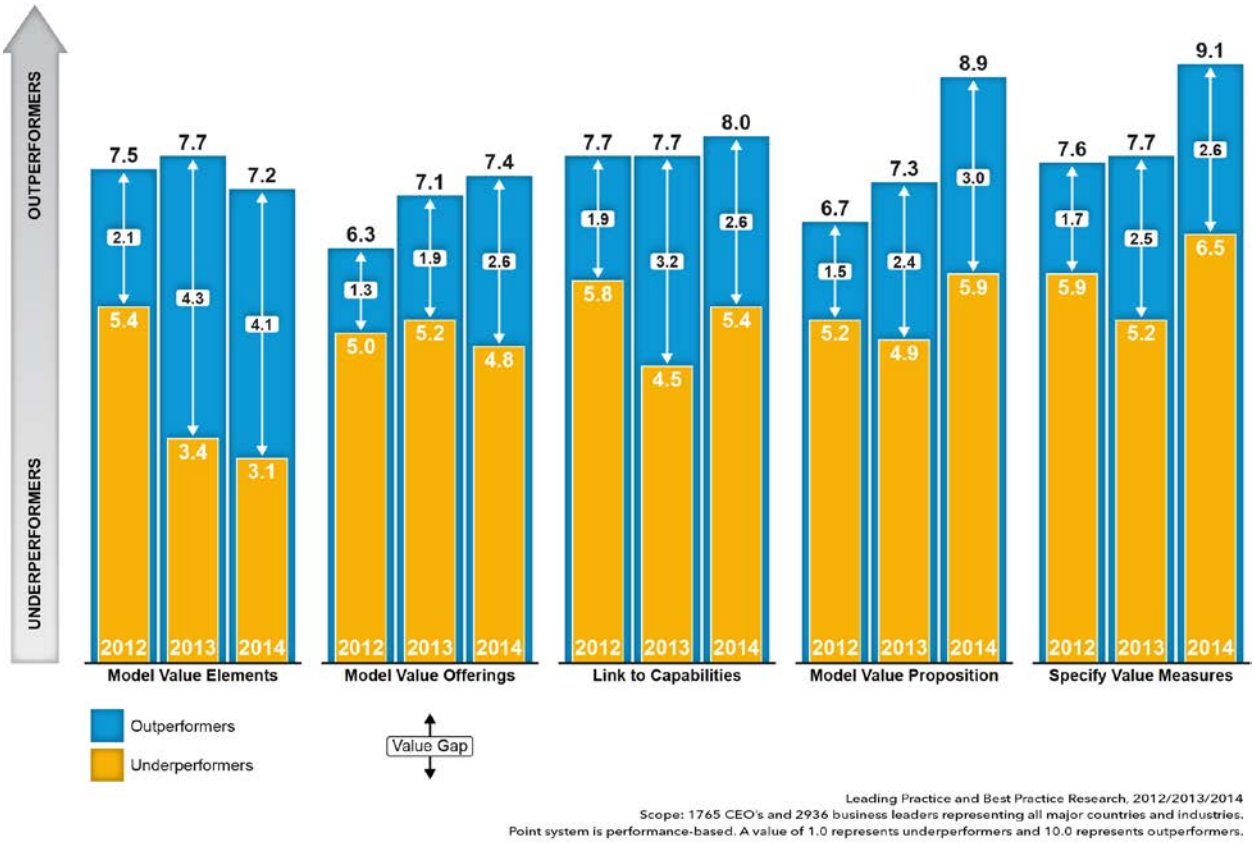

Figure 5: How do you apply value modelling concepts.

On a specific note, we would like to point out, that one thing that the outperforming organizations applied is the linkage of their value elements as well as their pain points. Enabling them to capture both their value flows as well as their weakness clusters (like bottlenecks but based on weak points/pain points). See example in figure 6

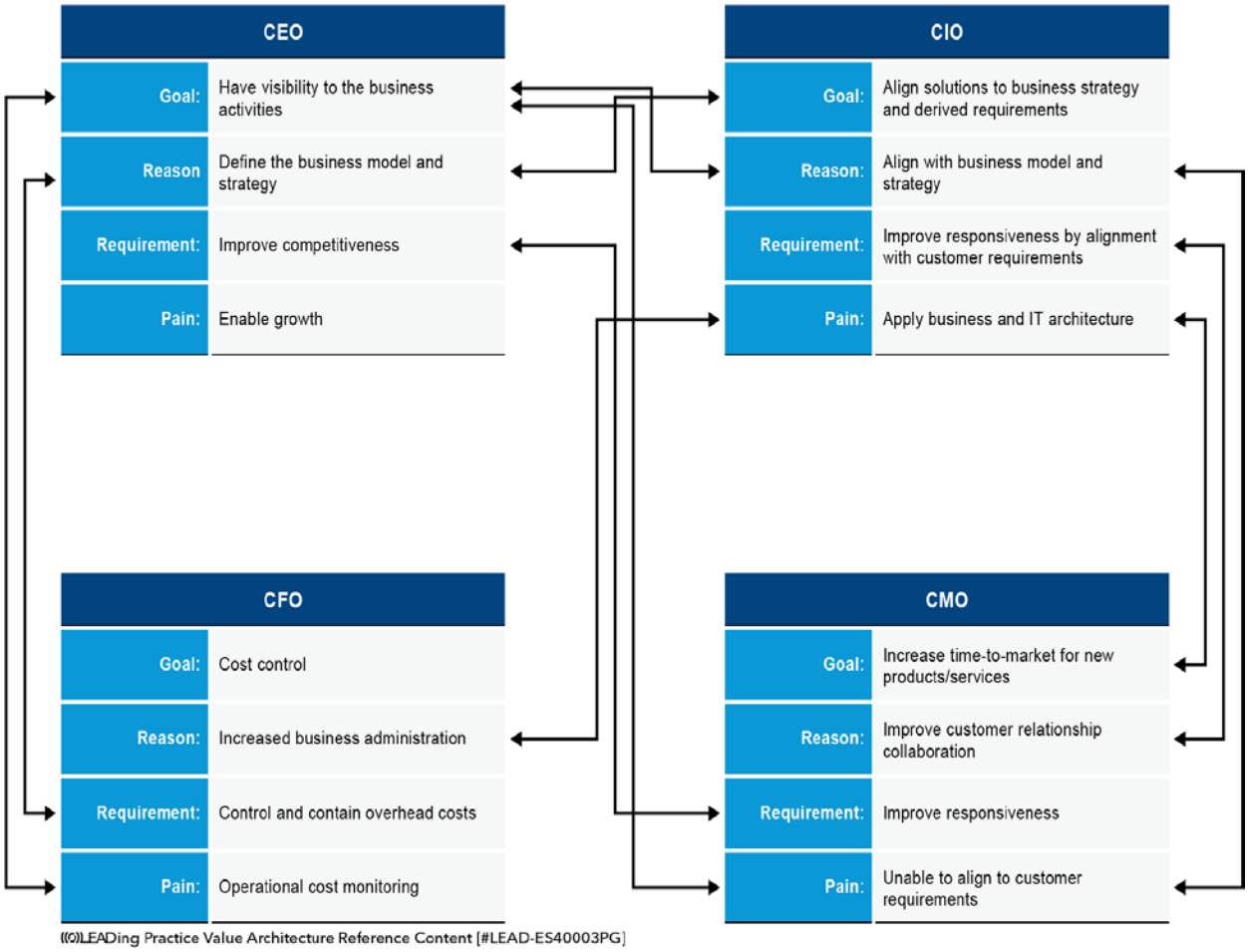

Figure 6: Example of the linkage between value flows as well as their weakness clusters (pain points).

4. Research Question: Do you use data and information analytics in connection to your value decision making flow

Answers: Figure 7 illustrates how outperforming and underperforming organizations use data and information analytics in connection to your value decision making flow.

Conclusion:

First finding: The underperformers and outperformers apply data and information analytics in connection to your value decision making flow.

Second finding: The underperformers and outperformers apply the same concepts in processing the data, namely capture data, aggregate data, analyse data, disseminate data.

Third finding: The underperformers and outperformers in using the data, apply the same concepts of guiding future strategy and guide day to day operations.

Fourth finding: The outperformers apply the processing of data and using of date around their value concepts for decision making much more.

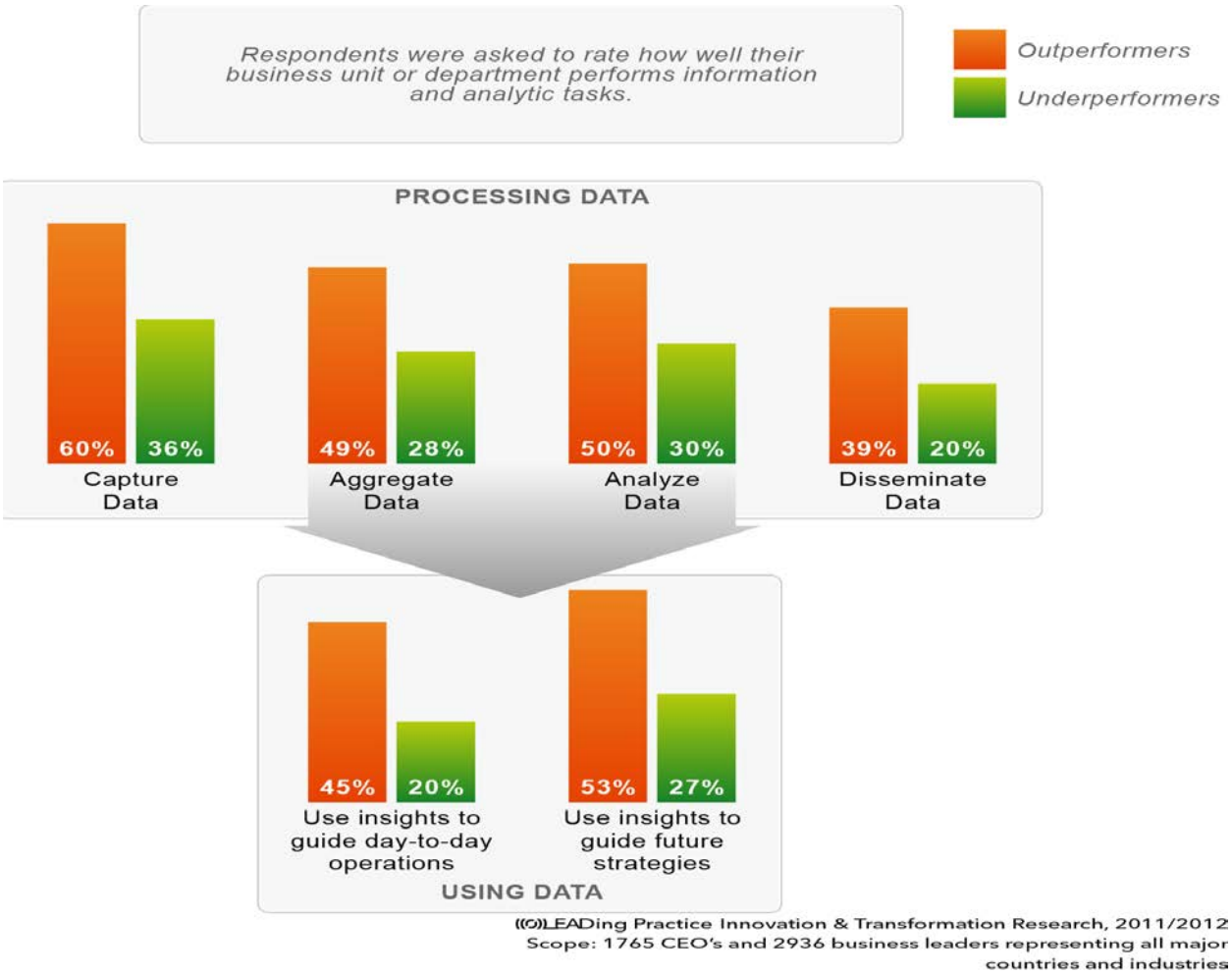

Figure 7. How the outperforming and underperforming organizations use data and information analytics in connection to their value decisions.

5. Research Question: How do you use value and performance intelligence in connection of your enterprise.

Answers: Figure 8 illustrates how value and performance intelligence is being used in connection of organizations.

Conclusion:

First finding: Value and performance intelligence is being used in organizations.

Second finding: The value intelligence components are namely mission, vision, corporate values, strategy (using in combination of for example strategy maps and strategy matrices). The balance scorecard is also being used as a Value intelligence component, but it is also as a performance tool. It is noteworthy that the balance scorecard is for the most not used as the academic model of balance scorecard, but with tailored areas/subjects etc.

Third finding: The performance intelligence components are namely, cascading performance measures, process performance measures as well as enterprise applications are today also used as performance tools.

Fourth finding: The value intelligence components relate to the business model, while the performance intelligence components more relate to the process relevant subjects.

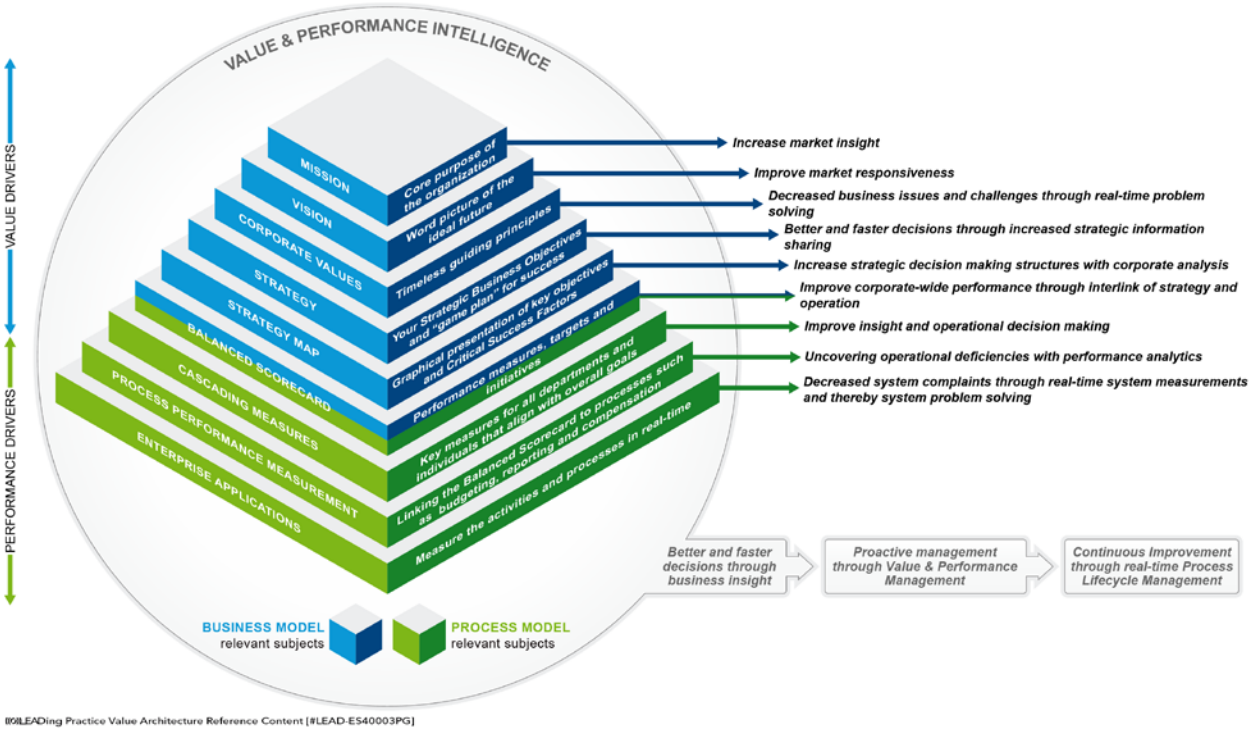

Figure 8: How do you use value and performance intelligence in connection of your enterprise.

6. Research Question: What is the connection between value modelling, value engineering and value architecture concepts

Answers: Figure 9 illustrates the specific elements as well as the connection between value modelling, value engineering and value architecture concepts.
Conclusion: The relationship between value modelling, value engineering and value architecture concepts are between the value relevant objects (i.e. entities/elements). To ensure full integration of different value method and approaches within an organization, one needs to identify the value objects/entities and semantics that apply across:

- engineering principles- how and where the value objects/entities can or need to be decomposed and composed together
- modelling principles-which value design concepts can or should be applied
- architecture principles - which architecture rules apply and which artefacts and templates e.g. maps, matrices and models could or should be used.

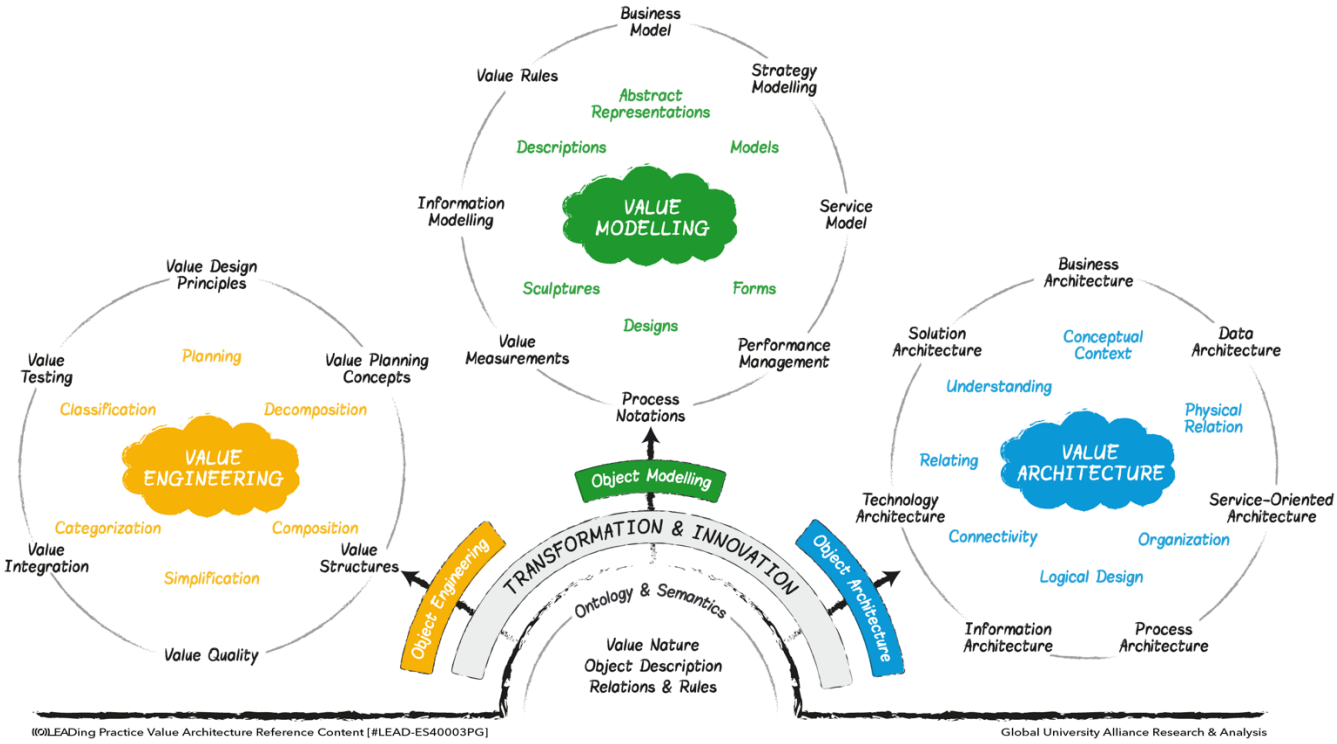

Figure 9. The specific elements as well as the connection between value modelling, value engineering and value architecture concepts

Research Team

The value research & analysis contacts are:

Research Leader: Professor Mark von Rosing

Head of Research, Global University Alliance

The research team involved in this work are among others the following academics, researchers and analysts:

- Value Ontology (meta objects), Prof. Wim Laurier
- Value Semantics (relations and rules), Prof. Simon Polovina
- Comparing Value concepts, method and approaches, Prof. Mark von Rosing
- Typical Value models applied, Prof. Hans Scheruhn
- Most common Value strategies applied, Jamie Caine
- Most common Value KPIs, Ulrik Foldager
- Most common Value Roles, Maria Hove
- Most common Value Viewpoints, Maxim Arzumanyan
- Most common Value Stakeholder & Concerns, George Etzel
- Most common Value automation with smart technology applied, Elizabeth Uruchurtu

Collaboration Partners[2]

Enterprise Standard Body:

George Etzel, LEADing Practice, CEO

Enterprise Architecture Framework:

John A. Zachman, Inventor and Father of Enterprise Architecture, Zachman International

International Organization for Standardization

Johan H Bendz, ISO, SC 7, WG 42 Convener

[2] involved when and where needed

IEEE Coordinator:

Rich Hilliard, Institute of Electrical and Electronics Engineers, Editor of IEEE Std 1471:2000, Project editor, ISO/IEC/IEEE 42010

Software Standard Body

Henk DeMan, OMG VDML Chairman

NATO Coordinators:

Johan Goossens, NATO Allied Command Transformation

Branch Head, Technology & Human Factors

UNESCO Coordinator:

Dr. Selin N. Şenocak

UNESCO Chair Holder

Cultural Diplomacy, Governance and Education

Director, Occidental Studies Applied Research Center

Political Sciences and International Relations Faculty Member

CSIR Coordinator:

Rentia Barnard

Research Institute CSIR, Enterprise Architect Research Group Leader

Information Security Standard Body

Steve Durbin, CEO of Information Security Forum

Some of these findings have been published in the following Publications

- von Rosing, M., Chase, G., Omar, R., Taylor, J., Rosenberg, A., (2011) Applying Real-World BPM in an SAP Environment, SAP Press, 698 pages, ISBN 978-1-59229-877-8
- von Rosing, M., Hove, M., Subbarao, R., Preston, T., Getting Business Transformation Right - Combining BPM and EA, (2012) Commerce and Enterprise Computing (CEC), IEEE 13th Conference
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