IT Leadership in Finnish Organizations and Digital Transformation

The 1st phase of ACIO research project
Final ACIO Report for Tekes

Jari Collin, Marco Halén, Mika Helenius, Kari Hiekkanen, Timo Itälä and Janne J. Korhonen
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ACIO Final Report for TEKES

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1. Introduction

The purpose of this document is to summarize key conclusions of the first phase of ACIO research project. The document is attached to “TEKES-loppuraportti: ACIO -tutkimusprojekti”. The ongoing second phase of the research project will continue till end of June 2015. Thus, final results of the research will be published in the summer 2015.

The motivation of ACIO research was Finnish industries interest in improving strategic competitiveness in business and information systems engineering. During the pre-study in 2010–2011 over 60 leading executive decision makers where interviewed to scope this strategic research agenda.

The name for the ACIO research project –Adaptive and Complex Informatics Organizations –is well deliberated, as it integrates strategic and operations management, information systems, and organizational development and leadership perspectives. The first two words, “Adaptive and Complex”, reflect the fact that today’s business strategy and operations have to react and transform quickly on sudden, unexpected market changes. The word “Informatics” links systems thinking, information systems management, and information systems design theories into the research –studying how to design a system that delivers the right information, to the right person in the right place and time, in the right way. “Organizations” word adds social and organizational transformation and development aspects into the work.

ACIO research project is about studying how Finnish information intensive organizations utilize information technology in developing and managing critical business capabilities. Focus is on understanding and analyzing modern management approaches to make use of information systems for business process and product/service development in digital transformation enabled by software based systems and business models.

The purpose of ACIO research is to:

1. Identify critical IT-enabled capabilities for managing complex service networks in an information intense organization
2. Describe success factors to manage the design, implementation and use of the capabilities in digital service innovations

Scope covers information-intense organizations in business environment characterized by:

- Management of complex service systems with many stakeholders
- Fast-changing business conditions; agile adaptation and transformation
- Significant business potential exists with service and operational innovations
- Need for bundled products and services, i.e. customer solutions
- Complex operations and operating environment
The research is to provide organizations and scholars with up-to-date insight on the latest development of business-IT alignment and IT governance practices. The research is a multi-discipline study integrating theories from information systems (IS), operations management (OM), organizational development (OD), and strategic management.

ACIO is an inductive, new theory building research project aiming at increasing the existing body of knowledge in the field. The study adopts constructive and design research strategies based on multiple case studies. The research team observes phenomena, records and classifies facts in case studies. Using inductive reasoning, the facts are generalized into a “construction/artifact” to be tested in larger scale. The research team uses several data collection methods, like surveys, case studies, interviews, workshops, and “insight” innovation process.

ACIO research program is divided into following four Work Packages:

1. Leading Digital Transformation
2. Beyond IT Alignment
3. Service Innovation
4. Mega Data Center Phenomenon

The following four thematic viewpoints are applied in each Work Package:

**Business and Information Systems Engineering**

Business and information systems engineering (BISE) has established itself as a distinct sub-discipline “between” business sciences and computer science in Europe. BISE is an applied science due to its close contact with reality and its design orientation. BISE draws its foundations from multiple research disciplines and paradigms in order to effectively address a wide range of system challenges. Three of the most important intellectual drivers of future IS research will be dealing with complexity, composition, and control.

**Enterprise Architecture**

Enterprise Architecture (EA) is today's long term strategic capability for digital business models and operations. Digitalized business environment is complex and the systems and applications are now interconnected using same data, information, and technology. In ACIO, we are interested in practice and value of strategic enterprise transformation using a holistic engineering and management approach such as EA.

**The Role of CIO**

The role of Chief Information Officer (CIO) is undergoing a transition when business and information systems have become indispensible as the core of
business models and industrial transformation. In ACIO, we study this transition in multiple large Finnish organizations pursuing innovation, improved in-house capabilities, and merger of business and IT into one.

**Portfolio Management**

Modern enterprise transformation requires both federated and local development projects. In ACIO, we study how companies use project portfolio management in digital transformation to align strategy in multiple business units, balance common business and information systems capabilities, and measure value in business information technology and systems development and transformation projects.

Finnish information-intensive organizations, the stakeholders of the ACIO research, are in a unique position to study and capture the benefits of digitalization. During the research project we have witnessed three common implications of digitalization in these organizations:

1. Products and services are being digitalized.
2. IT is not anymore internal support function, but it is becoming an integral part of business.
3. IT leadership is undergoing a major change at the moment.

These implications are further elaborated in this final report.

**2. Beyond Alignment – The Changing Role of IT**

Digitalization of products and services is a fast-moving, global megatrend that is fundamentally changing existing value chains across industries and public sectors. The manifestations of this ongoing digital transformation are manifold, and there are many terms used in the literature to refer to the phenomenon, e.g. Industrial Internet, Industry 4.0, Internet of Things, Machine-to-Machine, Mobile Apps, and Big Data. Nevertheless, modern wireless Internet-based technologies with real-time data analytics are the common enablers for these digital applications to provide organizations with major business improvements – such as increasing revenue via new online sales opportunities, improving operational efficiency via increased level of automation, and reducing fixed assets via new cloud-based business models. The most significant implication is the rise of new, networked business models that can bring step-wise improvements in customer value across existing industry boundaries.

Telecom, banking & insurance, and media businesses are examples of pioneering industries that are in the middle of such digital transformation in a large scale. During the last decade digitalization has already revolutionized the business models in these sectors. Similar changes are expected to take place in other more
traditional industries, too, when inexpensive, simple ICT-solutions (e.g. sensors and RFID-tags) are going to be embedded in most products. The appearance of the digitalization in everyday business can look very dissimilar in different business and public sectors. The existing ways of working and collaborating in/between organizations will be significantly impacted, when the new technologies are taken into effective use.

According to a recent study by Fitzgerald et al. (2013), digital transformation will become critical for most organizations in a wide range of industries within the next two years and almost no organization is sheltered from the competitive disruption wrought by the widespread adoption of digital technologies. The study reveals how organizations that effectively manage digital technology can expect better customer experiences and engagement, streamlined operations, and new lines of business or business models. In order to gain any of these business improvements, top management needs have a clear vision and actively lead the transformation in the organization. This is not an easy task for anyone in top management, but especially not for executives who have little understanding on information systems and/or have not been earlier involved in managing IT. Therefore, internal IT functions should be prepared to pro-actively support executives in preparing organizations for a major company-wide transformation that will be boosted by latest digital technologies.

A strong involvement from internal IT is going to be critical in any case, because architectures between internal information systems and commercial digital platforms have to be integrated to some level at least. According to Bharadwaj et al. (2013), it is becoming increasingly more difficult to disentangle digital products and services from their underlying IT infrastructures. The pioneering industries, like banking and telecom sectors, demonstrate how new digital, online service offerings have been built and run on top of legacy information systems resulting in numerous complex system dependencies between commercial online services and internal transactional back-end systems. In practice, this leads to business models where internal information systems cannot be separated from sellable products/services anymore and IT becomes an integral part of (digital) business strategies. In order to successfully manage the digital transformation existing enterprise architectures as well as IT alignment and governance practices have to be revisited accordingly. The role of IT is drastically changing. Table 1 highlights some of the key differences that will transform the traditional business-IT alignment thinking.
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**Table 1: Digitalization is changing the role of IT**

<table>
<thead>
<tr>
<th>EA Domains</th>
<th>Traditional role</th>
<th>Future role</th>
</tr>
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</table>
| Technology            | • Closed platforms  
                      | • Physical                                            | • Open platforms  
                      | • Virtualized                                             |
| Applications and      | • Proprietary  
                      | • Siloed                                              | • Inter-organizational  
                      | • P2P integrations  
                      | • EAI technology  
                      | • Enterprise Systems  
                      | • Automating transactions | • composite  
                      |                           | applications  
                      |                           | • Software as a Service  
                      |                           | • Service-Oriented  
                      |                           | Architecture  
                      |                           | • “Informating”  
                      |                           | interactions                                             |
| Information           | • Structured data  
                      | • Data locked in systems and databases  
                      | • Operational and tactical  
                      | • Business Intelligence  
                      | • Proprietary data structures | • Data, information and  
                      |                           | • knowledge mix  
                      |                           | • Open data  
                      |                           | • Big Data and analytics  
                      |                           | • Industry standards  
                      |                           | • Information  
                      |                           | architecture                                             |
| Business              | • Procedural, linear workflows  
                      | • Centralized control  
                      | • Transactional                                             | • Networked, dynamic  
                      |                           |                           | business processes  
                      |                           | • Distributed business process management                 |

**3. IT leadership in Transformation**

In the last few decades, Information Technology (IT) has had fundamental consequences in business organizations and the society at large. Unprecedented computing power, infinity of virtual space and ubiquitous connectivity have radically reduced the cost of coordination, communications, and information processing as well as enabled entirely new types of technology-mediated interactions. Consequently, computerization has brought about and continues to cause a major restructuring of the economy, industries and societal institutions.

**Digital Age Has a New Logic**

The dominant logic of Industrial Age was linear and product-oriented. Producers packaged content and moved it through a channel, addressed for delivery down a distribution system. Not only was this shipping metaphor applied to the movement of physical goods, but also to marketing, where marketing messages were delivered to consumers through broadcasting media. Customers were conceptualized as the recipients of goods that can be acted on in terms of segmentation, promotion and distribution. Due to increasing division of labor, specialization of organizations and insulating distribution channels, the exchange with customers was often indirect and monetized.
The logic of Digital Age, in contrast, is non-linear and service-oriented. Service provision rather than goods is fundamental to economic change (Vargo and Lusch, 2004, 2008). The perspective shifts from the relatively stable, closed and controllable system of a self-sufficient enterprise to the relatively fluid, open and transformational system of networked co-adaptive entities. These “service systems” co-create value through exchange and application of resources that enhance the development, adaptability and survivability of both the focal service system and the ecosystem at large. This service-dominant (S-D) logic is catalyzed by the liquification (Normann, 2001) of information resources enabled by the emergence, growth, and proliferation of digital communication and computation (Lusch, Vargo and Tanniru, 2010).

In the business world, digitalization has fundamentally changed the nature of relationships between business parties and the way how business is conducted. The role of IT in business is pervasive. Not only does IT improve cost efficiency and reliability, but information and information systems are leveraged to enable new products and services and even to drive entirely new business models. Investments in IT increasingly have transforming effects: productivity improvements through institutional change, business process engineering and managerial innovations come increasingly from information technology that enhances transparency, interaction and speed (O'Callaghan, 2005; Hanna, 2010).

The broad paradigm shift from goods-dominant to service-dominant logic is also reflected in the shift in focus of information technology in business. The brief history of information technology has seen an evolution from centralized, siloed, proprietary and monolithic enterprise information systems to peer-to-peer, service-oriented, standards-based and modular inter-enterprise composite applications. Different aspects of the paradigm shift from production-centric to service-centric IT are summarized in Table 2.

**Table 2: The paradigm shift in information technology**

<table>
<thead>
<tr>
<th>Driver</th>
<th>Production-Centric IT</th>
<th>Service-Centric IT</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Business model</strong></td>
<td>Proactive or reactive push model</td>
<td>Interactive pull model</td>
</tr>
<tr>
<td><strong>Business-IT relationship</strong></td>
<td>Business-IT alignment</td>
<td>Business-IT convergence</td>
</tr>
<tr>
<td><strong>Led by</strong></td>
<td>IT department</td>
<td>Line of Business Managers</td>
</tr>
<tr>
<td><strong>Governance focus</strong></td>
<td>Compliance and control</td>
<td>Enterprise Architecture</td>
</tr>
<tr>
<td><strong>Organizational scope</strong></td>
<td>Enterprise</td>
<td>Inter-enterprise</td>
</tr>
<tr>
<td><strong>Business processes</strong></td>
<td>Complex and hardwired</td>
<td>Modular and reconfigurable</td>
</tr>
</tbody>
</table>
The ongoing digital transformation has a dual impact on IT leadership. On one hand, the demands for leadership, in general, have changed due to digitalization. “Leadership in the digital age” (Wilson, 2004) calls for qualitatively different attitudes, skills, knowledge, and, crucially, capability, than leadership in the pre-digital age. On the other hand, “digital leadership” (ibid.), in the core of the knowledge economy, requires a very specific set of skills and knowledge.

### Linear Thinking Falls Short in the Face of Change

The paradigm change pertaining to digitalization requires a marked change in how leaders think. In linear and logical thinking that has traditionally prevailed, change is something external that can be “managed” or something imposed from the outside that needs to be adapted to. The tendency is to seek stability of the system through internal adjustments that match the changing environment. These adjustments may be developmental (Anderson and Ackerman Anderson, 2001) – wherein the current operations are improved – or transitional (ibid.) – wherein the current operational work systems are replaced.

However, logical thinking falls short in the face of transformational change (Anderson and Ackerman Anderson, 2001) that calls for fundamentally rethinking the very identity, purpose or business model of the organization, which is reflected in change of individual and collective mindsets, beliefs and values. According to Laske (2008), formal logical thinking is confined to closed systems that cannot size up non-physical moving targets. Open, living systems always include contradictions and things “other” than what the system in its present form openly manifests. Transformation of such a system is a developmental movement across time that explodes any closed system in its entirety (Laske, 2008). While linear, logical thinking may be requisite at less complex work such as project management, incremental process improvements, or reengineering efforts for optimized performance, it falls short in complex transformational undertakings such as business model transformation or business mergers that require more advanced cognitive capabilities (Laske, 2008; De Visch, 2010).
In dialectic thinking, unceasing change is seen as an intrinsic part of reality that can be directed to developmental ends. It cannot be predicted with logical thinking relying on lagging (past-oriented) indicators and it cannot be managed in a traditional sense. Rather, change is endogenously and proactively created. A full-system organizational transformation is “led from the future as it emerges” (Scharmer, 2009). It starts from the stance that it has already succeeded as opposed to the disparity between “as-is” and “to-be”. By shifting the context – redrawing the boundaries – what is inside the boundary of inquiry becomes what we know that we don’t know (Davis, 1982). This focuses attention to create the content, a new reality that derives from this “ground of being”. Rather than being pulled along by the strategy, organization can be used to push the strategy toward its realization.

Complex transformational change calls for a fundamental shift in a leader’s perception of the world, a willingness to embark on a personal journey of reflection and exploration of existing mental models, and openness to personal growth and change (Vurdelja, 2011). Few leaders possess this capacity. Only about 10% of leaders are functioning at the post-heroic (Bradford and Cohen, 1998; Joiner and Josephs, 2007), or, post-conventional (Torbert, 2004), levels of development that fully embrace transformational thinking (cf. Laske, 2008).

Three Types of CIOs
As leadership, in general, and IT leadership, in particular, is amidst a sweeping paradigm change, the role of Chief Information Officer (CIO) is undergoing a respective transformation. The value of IT increasingly stems from the ability of managers to invent new processes and organizational structures that leverage computational capability. While specific skills, knowledge and experience continue to be important, the discretionary component of work – the mental processing (Jaques, 1998) – becomes important in leading IT-driven enterprise transformation.

In the core of work capability is the notion of discretion: “the exercise of judgment in making choices in carrying out a task” (Jaques, 1998). Decision-making entails giving energy and direction to non-verbal mental processing whose outcomes are integrated with knowledge and used in conscious problem-solving. Human work can never be exclusively knowledge-based, for when all non-verbal judgment is taken out of a decision, it becomes a calculation, not a decision (ibid.).

In the following, three types of Chief Information Officers (CIOs) are outlined: Implementer, Business Enabler, and Strategist. Each successive type of CIO requires progressively more discretion in decision-making and, i.e. higher level of capability. The characteristics of the role and requirements for the capability of each type of CIO are summarized in Table 3.
Table 3: Three types of CIOs

<table>
<thead>
<tr>
<th>Role Characteristics</th>
<th>Capability Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Strategist</strong></td>
<td></td>
</tr>
<tr>
<td>Corporate role</td>
<td>Shapes new contexts</td>
</tr>
<tr>
<td>Strategic intent</td>
<td>Uses power of vision</td>
</tr>
<tr>
<td>5–10 years time</td>
<td>and participation</td>
</tr>
<tr>
<td>horizon</td>
<td>Multiple frames of</td>
</tr>
<tr>
<td>Ensures long-term</td>
<td>reference</td>
</tr>
<tr>
<td>resilience and</td>
<td></td>
</tr>
<tr>
<td>viability</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Business Enabler</strong></td>
<td></td>
</tr>
<tr>
<td>Demand-side</td>
<td>Capacity for</td>
</tr>
<tr>
<td>Tactical portfolio</td>
<td>envisioning future</td>
</tr>
<tr>
<td>2–5 years time</td>
<td>possibilities</td>
</tr>
<tr>
<td>horizon</td>
<td>Holds opposing</td>
</tr>
<tr>
<td>Ensures business</td>
<td>ideas in mind</td>
</tr>
<tr>
<td>responsiveness</td>
<td>Applies conceptual</td>
</tr>
<tr>
<td></td>
<td>frameworks</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Implementer</strong></td>
<td></td>
</tr>
<tr>
<td>Supply-side</td>
<td>Focus on functional</td>
</tr>
<tr>
<td>Operational</td>
<td>and technical tasks</td>
</tr>
<tr>
<td>excellence</td>
<td>Either-or mind-set</td>
</tr>
<tr>
<td>1–2 years time</td>
<td>Analytical problem-</td>
</tr>
<tr>
<td>horizon</td>
<td>solving</td>
</tr>
<tr>
<td>Ensures efficient</td>
<td></td>
</tr>
<tr>
<td>and reliable IT</td>
<td></td>
</tr>
<tr>
<td>system</td>
<td></td>
</tr>
</tbody>
</table>

**Implementers** are on the supply side: delivering to the goals and requirements of business and being measured on the results expected from IT. They are responsible for implementing and maintaining an organization’s IT solutions and technology infrastructure, which they aim to make happen in the most cost-effective and efficient manner. They are also the sensors of the organization, reporting operational issues and problems upwards. The requisite time span of discretion in the role of Implementer would be less than two years.

The focus of Implementer CIO is on operational excellence: making sure that the IT systems, processes and solutions create value in the present and can be developed to meet the likely needs of the near future. This calls for some degree of conceptualization: connecting things to develop a systematic response, taking into account factors such as risk, cost, and time to completion. Implementers know how to get things done and are great at devising systems, policies, guidelines, instructions and procedures that ensure smooth, reliable and stable operations. They are good in analytical problem-solving, yet typically limited by an either-or mindset.
Business Enablers oversee the organization's IT strategy and, working together with business on the demand side, develop policies and goals for the IT department. They also manage the portfolio of IT investments and make investment and divestment proposals pertaining to strategic information systems, technology platforms and standards, etc., even though higher approval may still be needed before the investment can proceed. The time horizon of Business Enabler would go two to five years out to the future.

The focus of Business Enabler CIO is on ensuring business responsiveness: developing a functioning set of systems that addresses comprehensive business needs now and in the future. The objective of his/her activities is often to introduce innovative new systems or solutions, or to decommission the obsolete ones. This demands integrative, cross-disciplinary thinking. Business Enablers must also be capable of assessing, prioritizing and revising goals as well as reorienting towards new goals. In comparison to Implementers, they have higher capacity for envisioning future possibilities and are better able to hold opposing ideas in mind. Their thinking is more systemic and often employs conceptual frameworks and other thinking tools.

Strategists craft the organization's strategic intent pertaining to IT, co-create IT-driven business models with senior business executives and envision and enforce strategic IT capabilities. This breed of CIOs is very rare, often transcending the mere IT function, and likely to be found only in large information-intensive corporate organizations. Strategist's time horizon would go beyond five years.

The focus of Strategist CIO is on shaping the organization's information technology and information systems landscape to ensure long-term business continuity within the organization's environment. This requires dialectic and transformational thinking: long-term visionary insight into the developments in technology innovation, the industry structure and the society at large, as well as into the co-causal interrelationships and higher-order consequences of these developments. Strategists are the creators of the future: with the ability to take on multiple frames of reference, they harness the power of people and shape new contexts that enable the vision to come into being.

Shift Happens

The last few decades have seen a shift of the CIO role from the supply-side to the demand-side. With growing appreciation of the increasingly important role of IT in value creation, the CIO role is often that of Business Enabler. IT function is given the exalted status that it deserves, but its role is still that of an enabling function. In the words of a corporate CIO, such “IT is a bit like a taxi driver: you drive the shortest and best route to the destination, avoiding foreseeable traffic jams, but in the end of the day the one who says where to drive [the business] is sitting on the back seat.”
With the onset of digital business models, however, application of information technology has become a core strategic capability for a growing number of leading business organizations. “Analytic competitors” (Davenport, 2006, 2012) and pure digital companies have information and information technology in their very DNA. As IT has a fundamentally strategic role in these organizations, Strategist CIOs emerge. They may not be called CIOs, as the title of the role often reflects this more encompassing scope. Aiken and Gorman (2013) call for the role of Chief Data Officer (CDO), solely dedicated to leveraging organizational data assets de-linked from business information system development. Chief Digital Officer (also, CDO) is another emerging epithet.

Regardless of the title, the role type of Strategist CIO represents the new forefront of the IT leadership of digital businesses. While the knowledge, skills and attitudes required in this role transcend those of more traditional CIOs, it is ultimately the required work capability – the ability to exercise discretion in decision-making – that is markedly more scarce. As only about 10 per cent of all leaders have “what IT takes” in the 21st century, not only will the leading organizations want to provide people with training in relevant skills but they will also want to identify their true IT leadership potential and build their talent pool respectively. Only when the CIO has the “mental horsepower” to conceive true transformational change can the full power of digital technology be unleashed.

4. Management and Enterprise Architecture

Enterprise architecture (hereafter referred to as EA) is today’s long term strategic capability for digital business models and operations. Digitalized business environment is complex and the systems and applications are now interconnected using same data, information, and technology. In ACIO, we are interested in practice and value of strategic enterprise transformation using a holistic engineering and management approach such as EA.

The rapid change of the current information intensive business environment and the increasing importance of information technology within enterprises create pressure to manage change and make correct decisions that take into account both business and information technology needs.

Enterprise Architecture, a holistic management practice covering both business and information technology, is gaining popularity as an approach for organizations to adapt to changes faster than ever before and manage the complexity of business processes as well as increasing number of information systems.

Successful implementation of EA can produce benefits across the whole organization. However, EA is most often associated with information technology
consolidation and information technology landscape management as well as business and information technology alignment.

Benefits of Enterprise Architecture
EA can offer several potential benefits across the whole organization. The benefits of EA from a selection of professional and academic studies (CIO Council 2001; Ross et al. 2006; Infosys 2007; Kappelman et al. 2008; The Open Group 2009; Tamm et al. 2011) can be summarized into five categories:

1. reduced IT costs
2. improved efficiency, utilization and integration of IT systems
3. improved strategic alignment between business and IT
4. improved change and risk management
5. improved communication and collaboration within the enterprise

The benefits of Enterprise Architecture are mostly indirect and have proven to be difficult to verify empirically. If the linkage between benefits and Enterprise Architecture as management practice is not established, the full potential of Enterprise Architecture cannot be realized.

Following the introduction of EA in the 1980s, the concept has been accepted and widely studied by academics and practitioners (Simon et al. 2013). However, even though the EA practices and benefits are widely known, the concept has not yet been extensively adopted by organizations (Ross et al. 2006).

Enterprise Architecture Evolving
EA is an approach for providing insight and an overview for an organization. Moreover, it is a holistic management practice covering both business and information technology to manage complexity and aid strategic decision-making (Op’t Land et al. 2009). Originally, EA was developed as a tool for information systems management (Kappelman et al. 2008), but during the past decade the concept has evolved more towards an instrument for business IT alignment (Simon et al. 2013) or even a leadership practice (Ross et al. 2006).

EA has included business goals and strategy as elements of the framework since it was first introduced by Zachman (1987). However, at that time the framework was adopted more as a tool for describing an enterprise from the perspective of information systems architecture.

Later on, EA has been more and more attached to strategic planning and business transformation (Ross et al. 2006; Kappelman et al. 2008; Simon et al. 2014). However, a survey of the state of EA programs shows that a great number of IT professionals still saw that business-oriented EA is implemented on a much smaller scale than it would be required (Leganza 2010). In addition, a variety of studies show that EA is most often associated with IT consolidation, business IT alignment and IT landscape management, which shows the lack of focus on the business architecture layer of EA (Winter et al. 2010; Simon et al.
Existing literature includes very few examples of how EA can be linked with strategy and strategic decision-making (Simon et al. 2014). This lack of focus on business side of architecture seems to indicate a gap between EA implementation and strategic business leadership. One of the few models truly linking EA with strategy is The Foundation for Execution approach presented by Ross et al. (2006).

**Enterprise Architecture as Strategy**

According to Ross et al. (2006) an enterprise needs to build a solid understanding about three concepts, to have an effective Foundation for Execution: (1) the operating model; (2) enterprise architecture; and (3) the IT engagement model. Figure 1 illustrates how the Foundation for Execution is created and exploited through the three related concepts.

**Figure 1**: Creating and exploiting the Foundation for Execution (Ross et al. 2006, p. 10)

Ross et al. (2006) define four types of operating models, which represent the integration and standardization requirements of the business processes of the organization. Standardization creates processes that are similar through the organization regardless where the process is executed. Integration links and shares data across business processes creating a single face towards the customer. The operating model concept is easy to understand approach to enable better decision-making.
Ross et al. (2006) define Enterprise Architecture as: “the organizing logic for business processes and IT infrastructure reflecting the integration and standardization requirements of the company’s operating model.”

Van der Raadt et al. (2010) point out the need for stakeholder cooperation and active business participation in EA governance. Therefore, the business management should participate actively and be responsible for the domain of Business architecture. The Figure 4 shows the EA domains and suggested responsibilities.

IT engagement model is the governance mechanism, which ensures that the business and IT projects launched to implement the foundation for execution will achieve both local and company-wide objectives. (Ross et al. 2006)
The key with successful EA is to communicate the organizational vision in a clear way in order to create the required business processes and IT structures. Ross et al. (2006) suggest that the discussion and communication between senior business management and IT management should be facilitated through core diagrams. In general, the core diagrams include four elements:

1. the core business processes
2. the shared data driving the core processes
3. the key linking and automating technologies and
4. the key customer.

The elements are specific to the company's operating model and reflect the realization of the organizational vision. (Ross et al. 2006)

**Enterprise Architecture Breaking Free from IT**

Lapalme (2011) identifies three schools of thought on EA, each with its distinct belief system, scope, limitations and set of assumptions. These schools in the order of increasing embrace and sophistication are: Enterprise IT Architecting, Enterprise Integrating, and Enterprise Ecological Adaptation.

In the Enterprise IT Architecting view, EA is seen as “the glue between business and IT”. Focusing on enterprise IT assets, it aims at business-IT alignment, operational efficiency, and IT cost reduction. It is based on the tenet that IT planning is a rational, deterministic, and economic process. The role of the Enterprise Architect is seen as the master planner/designer of the architecture.

Enterprise Integrating school (Lapalme 2011) views EA as “the link between strategy and execution.” EA addresses all facets of the enterprise in order to coherently execute the strategy. The environment is seen both as a generator of forces that the enterprise is subject to and as something that can be managed.
The Enterprise Architect is a facilitator, whose challenge is to enhance understanding and collaboration throughout the business.

In the Enterprise Ecological Adaptation school (Lapalme 2011), EA is seen as “the means for organizational innovation and sustainability.” The enterprise and its environment are seen as co-evolving: the enterprise and its relationship to the environment can be systemically designed so that the organization is “conducive to ecological learning, environmental influencing, and coherent strategy execution.” The Enterprise Architect faces the challenge of fostering sense-making in the organization and facilitating transformation as needed.

**ACIO and Enterprise Architecture**

In ACIO research program, several aspects of EA have been researched. Blomqvist (2013) examined how enterprise architecture (EA) can be connected with strategic planning and development processes in a large organization. The primary objective of this study is to explaining the linkage between EA and strategic planning. The second objective of the study is to increase the knowledge of business-oriented EA in the case organization.

The main findings include that EA is needed to bring insight in order to manage the increasing complexity of organizations. Furthermore, the benefits of EA ranges from reduced IT costs to improved strategic alignment between the business and IT. The analysis points out that the future role of EA is promising in the case organization, even though the current role of business-oriented EA is relatively weak. This is evident since EA is shown to bring value to the development planning process of the organization, which corresponds to the strategy implementation phase. Furthermore, the empirical evidence shows that the Finnish terminology is confusing and that there is no proper term for EA in Finnish that supports the shared understanding of the concept.

Halén et al. (2014) attempt to identify what are the prerequisites for shifting from IT driven Enterprise Architecture to business driven Enterprise Architecture, and what leadership challenges have to be mitigated before the full potential of Enterprise Architecture can be achieved. Study shows that even though the benefits of Enterprise Architecture are well understood, the lack of progress on the business-oriented Enterprise Architecture can potentially result in failure to demonstrate real business value. However, four prospective roles of Enterprise Architecture were identified:

1. Creating and maintaining descriptions of business models along with operating models
2. Working as a tool to outline the target state of the business
3. Supporting business decision-making in the development planning
4. Setting targets and tracking the implementation of projects

Study demonstrated the importance of applying EA as an integral part of business development and corporate governance, not as a separate practice.
Moreover, a dedicated business sponsor is required to drive the process, and business architect resources should reside within business organization.

It is clear, that more research attention should be given to identifying the means to attract business decision-makers to use EA as management practice. There could even be demand for a new, simplified framework or construct, taking into account the aspects of business decision-makers' socially constructed reality. It is highly unlikely that without progress on the field of common understanding the Enterprise Ecological Adaptation school of Lapalme (2011) could be reached.

Successful enterprises should possess flexibility as an inherent capability and be able to adapt to changes faster than ever before. By applying EA, organizations can manage change and make correct decisions that take into account both business and information technology needs.

Korhonen and Molnar (2014) argue that “Enterprise Architecture is increasingly seen as transcending enterprise-wide IT architecture. In its exalted conceptualization, EA provides the link between strategy and execution and is driven by strategic considerations such as business transformation and business agility. However, academic research on the topic is still relatively incipient. In particular, there is a gap in the literature as to what is EA’s scope in terms of the organizational structure. When EA is defined as strategic capability: it pertains to the strategic application of competencies to organize and utilize the organization-specific resources towards desired ends. Its “area of value ownership” is at the organizing level, linking between strategy and execution, and guiding the evolution of the operational core. Anything “lower” is mere design, while anything “higher” goes beyond a single organization’s scope. This platform of competencies is essentially socio-technical and calls for enterprise engineering perspective with qualitatively different kind of disciplinary premises than information systems perspective, in which EA has its roots. Furthermore, EA as capability is required to properly govern business-driven, value-oriented enterprise transformation.”

5. Digital Transformation – New Platforms and Services

Change in IT Value Creation

Use of IT in companies and other organizations started some 30–40 years ago from automation of manual tasks. Finance, inventory, order processing, invoicing, payroll were among the first functions and the supporting applications were developed or purchased by these functions. Next phase was to use IT, like ERP and CRM applications to support company-wide business processes across the organizational boundaries with focus in improving cost-efficiency and streamlining operations. Third domain of IT use has focused in enabling business growth and improving competitive position in the organizations marketplace. Examples like home banking, loyalty card schemes and e-commerce are some
examples of domains where the focus of IT is to improve the value created to the customer.

During economical downturns companies often try to focus in cost savings and even try to find more opportunities where IT could be used to cut costs in the organization. However, it must be pointed out that cost-cutting mode cannot continue forever because of the law of diminishing marginal utility. In practice this means that for every new euro invested in IT in order to save costs the gain is less.

For that reason the companies are strongly shifting the focus of IT from cost savings into revenue generation, into development of new products and services which also involve new innovative business models.

**Bits Will Eat Atoms**

In 1995 Nicholas Negroponte, the director of MIT Media Lab published his book “Being Digital” (Negroponte 1995). He was discussing the difference between bits and atoms. His bold prediction was “Bits will eat Atoms, whenever and wherever possible. Now, almost twenty years after the book was published, this has become true in many areas and the trend continues with increasing speed thanks to the Internet, mobile and digital business platforms.

One topic of research in ACIO project has been digital transformation. It can be divided in areas like digital shopping (e.g. e-commerce, mobile payment), digital services (e.g. e-booking), digital products (e.g. CDs and DVDs) and digital delivery (e.g. Spotify and Netflix).

The term digital and electronic are often used to mean the same phenomena, the situation where bits are eating atoms. Sometimes word “digital” is connected to the product or service itself and word electronic connected to the method of communication. This article uses both words quite freely and interchangeably.

**Shopping**

Shopping has gone digital. Take for example Amazon.com which started 1995 as an on-line bookstore. Compared to the largest brick-and-mortar bookstores and mail order catalogs which might offer 200,000 titles, and online bookstore could carry several times more, since they had an almost unlimited virtual warehouse: those of the actual product makers/suppliers. We just browse the titles, choose what to buy, pay it online and receive the book carried to our home or nearest postal office. And today e-commerce is everywhere even spreading to traditional markets like grocery stores. We can buy books, shoes, clothes, electronics, tools, medications just to name a few of items available for online shopping.

**Mobile Payment**

Payment has gone digital. Most shops have installed on-line point-of-sale terminals and accept debit or credit cards. With mobile communications these terminals can be used in taxis, restaurants and other places where customers are
visiting. Mobile payment services using smartphones instead of cards are also increasingly developed offering customers even more options for paying mobile.

Customer service
Customer service has gone digital. We pay our bills using online services of our banks. Within public sector we can change our home address online instead of visiting the local register office. Our tax office collects information from our employers and other sources in electronic form. It even sends us a proposal for taxation, which we can then modify online if needed.

Digital Products
Products have gone digital. Audio went digital in large scale when the Compact Disc (CD) was introduced in 1982. It quickly gained popularity and soon passed sales of analog music like vinyl records or music cassettes. Similarly, Digital Video Disc (DVD), which was introduced in 1995 soon passed sales of analog VHS cassettes.

Similar development has taken place in consumer photography. First digital consumer cameras were introduced in early 1990s and now by far most cameras sold are digital cameras. Since 2003, digital cameras have outsold film cameras. Transformation to digital has made an enormous change in the whole industry including cameras, films, processing laboratories, distribution of images etc.

Regarding books, we can look again at Amazon.com. They launched their Kindle e-book reader, which enables users to read digital media. The launch of an e-book reader was just enabling the customers to access digital content. Amazon.com also supports other Kindle readers on Windows, Apple OS X and iOS, Android, Windows Phone and other platforms. Amazon Kindle e-book downloads outsold paperbacks in the last three months of 2010, according to BBC news.

Digital Distribution
In addition to digital commerce and digital products, digital distribution creates a third dimension in digital transformation. Since the widespread use of Internet and World Wide Web within the last 20-25 years ubiquitous high-speed access is available almost everywhere at a minimal cost. That has also a deep impact in how digital products and services are delivered to the customers.

When we used to buy and download to our own device digital content like movies or e-books from the web-store, today’s high-speed connections are making this model obsolete. Today we subscribe to Spotify or Netflix and stream music or movies when we want.

Digital distribution is changing many industries. Like television in Finland. Digital terrestrial television in Finland started in 2001 and run in parallel with analog distribution until 2007 until this was closed down. Today, in parallel with
digital terrestrial broadcasting, YLE is distributing most of its content on the Internet.

**Products On-Demand**
Digital distribution is also changing rapidly how we deliver physical products. 3D printing is in developmental phase and has potential to change manufacturing into on-demand production. The ordering, manufacturing and distribution of digital products would radically change our traditional concepts of mass production into one-on-one and on-demand production.

**New Business Models**
Digital transformation is profoundly changing the ways in which value is created and how value is captured. New companies with new, innovative business models are born. Existing companies need to rethink their business models when transforming to digital era. How to define and explain business models to enable common understanding, discussion, evaluation and agreement of implementation has also been a topic within ACIO project.

**Two-Sided Markets**
In literature of business models, an emerging model is the business platform, sometimes also called two-sided or multi-sided business model pattern. When single-sided business models have one or several customer segments which are distinct from each other, the platformed business model has two or several customer segments which interact with each other using the platform. Well known example of a platform is commercial tv company, which offers both content and commercials to viewers. Their business model is to sell time slots to advertisers and provide them and content to viewers for free. In this specific two-sided market model the other customer segment, advertisers, subsidize the other segment, the viewers.

Models of digital business platforms are, for example, Google and Facebook. They do not deal with physical products; their business is totally digital. They both have an advertisement-funded business model, where money from the advertisers is used to subsidize the users of those platforms.

**Ecosystems**
Another word often connected with platforms is “Ecosystems”. In his book “The Age of the Platform: How Amazon, Apple, Facebook, and Google Have Redefined Business” (Simon, 2011), Phil Simon names these companies “The gang of Four”. They are superior in use of technology and have created strong ecosystems of companies and partners to innovate new products and services. And their business model is Platform.

**Network Effects**
One factor which makes the platformed business model so strong is called network effect. Instead of linear growth based on how good a company is to attract new customers, the platform can experience a non-linear, sometimes
exponential growth by enabling its customers to attract each other. In system
dynamics parlance, this behavior is called a reinforcing feedback loop.

A well-known example of network effect is credit card companies like American
Express, Visa, Master Card etc. Their customer segments are sellers and buyers.
And the network effect is cross-side effect: The more sellers accept a specific
credit card, the more it attracts new buyers to use that credit card. And the more
buyers are using that credit card, the more it attracts new sellers to accept
payments with that card.

An example of same-side network effect is bookseller Amazon. The readers of
the books can write reviews, which are then used by potential buyers, when they
are making their buying decisions. The more readers write reviews, the more it
attracts new buyers to purchase the book and also to write their reviews. And
then this creates the cross-side network effect: The more buyers buy from
Amazon, the more it attracts new sellers to offer their products through Amazon.
And again, the more sellers join Amazon, the more it attracts new buyers to buy
from that platform.

**Digital Business Platforms**

Digital business platforms are changing the ways on products and services are
created and offered and threatening established companies. AirBnB is a platform
which connects those ordinary people who are willing to provide room for
travellers and travellers who are in need of an inexpensive accommodation. Über
is a platform which connects ordinary people who are willing to provide taxi
drive and customers who are in need of getting from one place to another.

Both digital business platforms create also trust to both sides, the service buyers
can write reviews of their experience and also the service providers can write
reviews of their customers.

**Impact in Finland**

Digital transformation based on the Internet, mobility and digital business
platforms has no respect to borders of countries. In Finland, we use digital
business platforms like Google, Facebook, Apple, Amazon and others in our
everyday lives. They create enormous value to us, but, at the same, time they
capture enormous amounts of money that goes outside Finland.

This is poses us hard questions: Is Finland, with 5.4 million people, too small a
marketplace for network effects to emerge on domestic platforms? Should
Finnish companies develop platforms or should they join existing platforms?
Which would be their customer segments and how value would be created and
captured?

Digital transformation is tightly related to digital business platforms and new
business models. That could be one interesting avenue for further research.
6. Mega Data Centers – Key Infrastructure for Digitalization

Digital Transformation is partly fueled by the convergence of mobile computing, consumerization of IT, cloud computing, big data, and advanced data mining technologies. It has been noted, that we are currently living in at least three periods that build upon digital data: the information era, the social era, and the Big Data era.

The explosive growth of data coming from business transactions, mobile devices, sensors, social and traditional media, streaming video, cloud computing, et cetera. The data is generated in the interaction between people, machines, applications and combinations of these. The proliferation of connected devices both for personal and industrial use, coupled with the content required to satisfy the (seemingly insatiable) end user needs, has led to an increased demand which only appears to be heading one way: the demand for computing is an unending upward spiral in the near future.

This ongoing digitalization is driving explosive growth in supporting infrastructure, i.e. data centers and related services. Data processing and storage has evolved from the traditional, enterprise-owned server farms into industry-scale data processing facilities storing and processing data for thousands of different organizations and millions of individuals. Across the globe, billions of dollars are spent on data center infrastructure in order to meet the growing demands of businesses and their customers. Competition on the data center infrastructure has become the new "arms race" for organizations trying to differentiate themselves in this crowded, technology driven world.

Consequently, the data center has changed considerably as the evolution of information technology has enabled it to become the critical nerve center of today's enterprise. These modern, industry-level data centers form the backbone on information processing for the digital transformation. These modern data centers have grown into mega-size facilities spanning tens of thousands of square meters and consuming tens, even hundreds of megawatts of power and costing hundreds of millions in capital expenditure. The focus of these mega-size facilities is on energy-efficiency and the provision of cost effective, reliable and secure services for all types of clients and their needs.

The availability of inexpensive storage and flexible pay-per-use processing capabilities enabled by this industrialization of data processing and data centers is also one important factor paving the way for the Big Data revolution. Big data has emerged to one of the top trends affecting business and technology today. Big data is an agglomeration of different technologies resulting in data processing capabilities that have been unreachable before.

Big Data is generally characterized by three factors: volume, velocity and variety. Big Data technology has touch points in different businesses across industries,
but finds its place likewise in government organizations and the healthcare sector. Big Data, together with the use of tools such as analytics and decision support systems will impact organizations and the managerial decision-making. If the proponents of the Big Data are to be believed, big data will have a significant impact on our society in the near future, changing the way people live their everyday lives, their work and the way their homes are connected.

Finland is in a desperate need for a new industry to drive national growth; data center industry has been suggested as one key opportunity for the nation. Investment into mega-scale data center amounts to hundreds of millions of euros, so the government level interest into this phenomenon is understandable. It should be noted though, that – unfortunately – the data centers are not necessarily a great business after the construction phase. Data centers do not actually produce anything in themselves and the effect on employment is minimal compared to many other industries with similar levels of investments into facilities. A typical data center – even a mega-scale data center – might provide employment only to several dozens of blue-collar workers such as janitors, guards, and electricians. In that sense, data centers should not be considered as a high-tech industry.

As part of ACIO research dealing with service innovation and digital transformation, Antti Savolainen analyzed in his Master’s thesis (2013) data centers and the related investment criteria. Thanks to advanced power infrastructure, cheap electricity, stable operating environment and cool climate, Finland is believed to provide strong data center investment opportunities. The case setting in this thesis is an industrial city in Finland, which is looking for data center investments to accelerate business activity in the area. In the literature review, the modern data center is defined and the potential market for data center construction is analyzed. The empirical part the study employs a qualitative research methodology. A total of 26 people were interviewed to form a holistic view of the data center investment decision. These people represented a wide range of stakeholders (energy, networks, regional development, government and data center industry executives and analysts).

Based on the interview data, a prioritization model for data center investment criteria was constructed, in which the factors are broken to primary and secondary factors driving data center investments. Primary factors are energy (availability, price, redundancy of grid, generation mix), network (availability of fiber and latency and routing to largest internet exchanges), incentives and physical aspects of the site. Secondary factors are knowledge, safety & security and customer base.

The results of the study suggest that Finland has basic prerequisites in order to function as a data center hub, such as a stable operating environment and a redundant electricity grid. However, the findings also revealed that the data center industry in Finland is relatively immature and there is a lack of
capabilities in building mega-scale data centers, there is a lack of education in the
data center domain, and in general Finnish network connectivity to the rest of
the world is limited in comparison with our neighboring countries. Finnish
efforts concentrate on attracting foreign data center companies into Finland, as
foreign direct investments and the development of locally owned data-center
infrastructure and related capabilities is lacking.

Savolainen (2013) started his thesis started with a quote: “Finland is an island”.
In many ways, this is true when it comes to data centers and the digital economy
development in general. The remoteness of Finland also shows on a mental level
–"Finland always comes 5–10 years behind everyone else" was a quote by many
interviewees.

7. Competences in Business and Information Systems Engineering

Helenius (2013) argues that “new Business and Information Systems
Engineering (BISE) field aims at integrating many fields to serve society by
combining both qualitative and quantitative epistemology in highly complex and
information intensive business and industries contexts. Society and industry
need better educated and skilled engineers with better teaching, and proven
practice evidence –and one of the answers is holistic engineering (Grasso and
Burkins 2010). Balanced availability of engineering and science talent and skill is
a prerequisite for vibrant high-tech sector and rapidly growing start-ups (Shane
2003).”

In order to support the competence development in this area, BISE Pro training
program was initiated. It is a professional development program that provides IT
leaders, managers and other senior experts in production-oriented or service-
oriented organizations with a platform for raising their IT management
competencies to a new level. The program combines IT technology, business
strategy and change management into a functional entity for organizations.

Education program contains following training modules:
  1. IT Strategy Foundations
  2. Business Strategy and IT Strategy Coordination
  3. Governance Models
  4. Portfolio Management
  5. Enterprise Architecture
  6. Procurement and Legal Issues
  7. Human aspects of IT organization
  8. IT Service Management
  9. Organizing IT function
  10. Final Seminar

“The new complex digital and information services systems and industries are
calling for new transdisciplinary approaches on how to achieve technical, social,
and cultural knowledge and skills to serve future needs of the industry and society. The leading digital industry is in demand of engineer's with knowledge and capabilities to collaborate and move between highly complex digital business and technical systems domains. The new reality is under constant transformation, highly intangible and nonlinear interconnected system. Transformative digital business innovations, rapidly evolving business models, architectures enabled business model scalability and ultra large-scale of systems are the new characteristics of this software-dominant-logic. This paper aims at covering contemporary challenges of the interdisciplinary in business, service, software and systems engineering by analyzing different research ontologies and curriculum models. The paper analyses recent Computer Science (CS) and Information Systems (IS) curriculum developments and reflects through different ontologies and recent research. Paper uses Service Design and Engineering (SDE) as a didactic and curriculum model for future Information Systems Engineering (ISE) and Business and Information Systems Engineering (BISE). The new curriculums serve the needs of global information start-ups, businesses, governments, and societies. This paper aims at describing the ontological foundations and conflicts, the axiology of the new curriculum model and proposes an integrated multi-ontology as the foundation for BISE new curriculum.”
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