Your Landscape in Shape
Scape Enterprise Architecture Office and Consulting

Dr. Christian Schmidt

Business Architecture Quantified – Assessing the Complexity of the Business
The Open Group Conference – Edinburgh 2015

Edinburgh, October 20th 2015
How to deal with complexity?
The Janus face of complexity

»Our time-to-market is poor because there are so many dependencies«

»Our costs are so high because of a large number of redundancies«

»Projects often fail due to the enormous level of complexity«

»We need to innovate and leverage new technologies«

»We need to improve the customer experience«

»We need to comply with increasing regulatory requirements«
What is complexity and how can we tell the “good“ from the “bad“?
What is complexity in the context of Enterprise Architecture?

Enterprise Architecture complexity defined

Definition:
The (structural) complexity is a quality of a system (or architecture) referring to the quantity and variety of system elements and the relationships between these.

In the context of enterprise architecture, the system in scope may be the whole enterprise or any subset of it including (horizontal) architecture layers (e.g., business architecture, application architecture, technical architecture) and (vertical) architecture domains (e.g., marketing and sales, financial accounting, human resources).
What is complexity in the context of Enterprise Architecture?
Effective and efficient architectures

Depending on the fulfilment of **environmental requirements** and the **internal complexity** used to achieve this, every system (or architecture) can be classified into one of the following categories:

- **ineffective**
  - environmental requirements not fully met

- **effective but inefficient**
  - environmental requirements fully met
  - internal complexity above minimum

- **effective and efficient**
  - environmental requirements fully met
  - internal complexity at minimum level
What is complexity in the context of Enterprise Architecture? Minimum complexity and architectural waste

It may be assumed that fulfilling the environmental requirements will call for a certain **minimum complexity** that cannot be reduced without causing dysfunctional behaviour.

Any complexity exceeding the minimum level may be considered **architectural waste** (also known as the **complexity surplus**). Successful complexity management is about **minimizing** the complexity surplus.
The complexity continuum
The right amount of complexity in the right place

Depending on the specific requirements, the **optimal level of complexity** may vary across **architecture layers and domains** (with the upper layers defining the minimum complexity for the lower layers).

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**low complexity**

- lower operating costs
- lower maintenance costs
- lower procurement costs
- higher agility / reduced change efforts
- etc.

**high complexity**

- higher customer value
- higher business value
- higher robustness
- reduced vendor dependency
- etc.

Therefore, effective complexity management is not simply about reducing complexity throughout the landscape but rather about creating the **right level of complexity in the right place**.

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BD = Business Domain  
AD = Application Domain  
TD = Technical Domain

[Sc13a] [Sc15]
The role of business complexity
Why architects should care about business complexity

Business complexity needs to be assessed for two reasons: 1. as a **reference to judge the level of IT complexity** and 2. to identify and manage a **complexity surplus in the business architecture** itself.

BD = Business Domain       AD = Application Domain      TD = Technical Domain

**Requirements**

**Business Architecture**

**Application Architecture**

**Technical Architecture**

assess and optimize IT complexity (in relation to business complexity)

assess and optimize business complexity (in relation to other parts of business complexity)
How can complexity 
be assessed 
and measured?
Assessing complexity
The need for quantitative models

Traditional (qualitative) EA models **fall short** in assessing and aggregating complexity on a global scale. They hence need be complemented by **quantitative** views and KPIs.

**Problems**
- models are getting very complex
- handling is very time-consuming
- information is difficult to aggregate

**Quantitative Enterprise Architecture (QEA)**

\[
EM = \sum_{i=1}^{n} f_i \ln \left( \frac{1}{f_i} \right)
\]

**Qualitative View**

**Quantitative View**

**Stakeholder**

**Concern**

**Architecture Data**
How can complexity be measured?
The search for the “one” complexity figure

In the past, many organizations (and researchers) have been looking for a single measure to describe the complexity of their enterprise or IT architecture.

Our complexity is 42

Today, it is widely acknowledged, that complexity is a multi-dimensional concept that needs to be measured and assessed along its various dimensions.
Measuring complexity
A generic complexity model

Generally, the (structural) complexity of a system can be described along four aspects: the number (or quantity) and heterogeneity (or variety, also concentration) of system elements and relations [SWK13].

This approach is generic in the sense that it can be applied to any type of system and architecture including technical architecture, application architecture and business architecture.
Measuring complexity
Framework of standard complexity measures

For each aspect, a number of **standard measures** have been identified. In principle, these can be applied to any existing architecture model and layer (independent of the respective metamodel).

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Elements</th>
<th>Relations / Paths</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Number</strong> ((N_E))</td>
<td><strong>Number</strong> ((N_R))</td>
</tr>
<tr>
<td></td>
<td><strong>Relative Number</strong> (N_{E_1}/N_{E_2})</td>
<td><strong>Relative Number</strong> (N_{R}/N_{E})</td>
</tr>
<tr>
<td></td>
<td><strong>Entropy</strong> (EM_{E:A})</td>
<td><strong>Entropy</strong> (EM_{R:E:A}^{*})</td>
</tr>
<tr>
<td>Heterogeneity / Variety / Concentration</td>
<td><strong>Rel. Entropy</strong> (EM_{E_1:A_1}/EM_{E_2:A_2})</td>
<td><strong>Modularity</strong> (M_{R:E})</td>
</tr>
</tbody>
</table>

\(EM^{*} = \) numbers-equivalent entropy measure

[Sc15]
What measures could be used to assess business complexity?
What is Business Architecture all about?
Integrated Business Architecture framework

**Business Motivation**
- Driver
- Mission
- Vision
- Goal
- Objective
- Strategy
- Directive
- Values
- Constraint

**Business Model**
- Cost Model
- Supplier Segments
- Supplier Channels
- Value Proposition
- Products / Services
- Design Themes
- Value Chain Configuration
- Value Chain Coordination
- Value Chain Cooperation
- Customer Segments
- Core Assets
- Customer Relationship
- Operating Model

**Business Execution**
- Incentives
- Processes
- Information
- Organization
- People
- Resources
- Culture
- Control

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[SI15]
How to measure business complexity
Measure candidates for business execution complexity

- **Business Motivation**
  - Number of External Drivers
  - Number of Goals
  - Goal Relations

- **Business Model**
  - Number of Customer Segments
  - Distribution Relations
  - Product Variety

- **Business Execution**
  - Number of Capabilities
  - Capability Dependencies
  - Process Concentration
  - Capability Redundancy
  - Organizational Modularity

...
### Capability Redundancy

**KPI Fact Sheet**

<table>
<thead>
<tr>
<th>ID</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>BA-05</td>
<td>Capability redundancy</td>
</tr>
</tbody>
</table>

**Description**

The average number of business capability realizations per number of (logical) business capabilities.

**Rationale / Interpretation**

The KPI measures the redundancy of a business entity with respect to capability implementation and is an indicator for the business execution complexity surplus.

**Example**

A pharmaceutical group, whose procurement capability is implemented multiple times across different countries and deploying different variations of the same process type has a higher business execution complexity than a competitor with a global shared service organization providing this centrally.

**Primary Stakeholders**

- Board Member
- Executive Manager
- Business Strategist

**Adressed Concerns**

- Ensure the efficiency and focus of the organization by minimizing redundancies at the level of business capabilities

**Required Metamodel Elements**

```
Capability
  realizes
  Cap. Realization
```

**Type**

```
<table>
<thead>
<tr>
<th>E</th>
<th>R</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q</td>
<td>V</td>
</tr>
</tbody>
</table>
```

**Layer**

```

```

**Calculation**

\[
\frac{N_{\text{Capability Realization}}}{N_{\text{Capability}}}
\]

**Range**

[0; \infty]

**Optimum:** 1

**Breakdown**

- by Entity
- by Capability
- by Capability Group
Capability redundancy
Example: procurement capability

\[
\frac{N_{\text{Capability Realization}}}{N_{\text{Capability}}} = 3
\]

\[
\frac{N_{\text{Capability Realization}}}{N_{\text{Capability}}} = 1
\]
How to measure business complexity
Measure candidates for the business model

<table>
<thead>
<tr>
<th>Business Motivation</th>
<th>Business Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of External Drivers</td>
<td>Number of Customer Segments</td>
</tr>
<tr>
<td>Number of Goals</td>
<td>Distribution Relations</td>
</tr>
<tr>
<td>Goal Relations</td>
<td>Product Variety</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Business Execution</td>
<td></td>
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<td>Capability Redundancy</td>
<td>Process Concentration</td>
</tr>
<tr>
<td>Organizational Modularity</td>
<td></td>
</tr>
</tbody>
</table>
Product variety
KPI fact sheet

<table>
<thead>
<tr>
<th>ID</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>BA-12</td>
<td>Product variety</td>
</tr>
</tbody>
</table>

**Description**
The variety of the product portfolio with respect to product types.

**Rationale / Interpretation**
The KPI measures the heterogeneity of the product offering and is an indicator for the supply side complexity of the business model.

**Example**
The business model of an organization with a highly heterogeneous set of products and services, for example, including mobile devices, displays, printers, and household appliances may be considered more complex than that of a company with a very focused offering.

**Primary Stakeholders**
- Executive Manager
- LoB Manager
- Business Strategist

**Adressed Concerns**
- ensure the focus of the business model with respect to product segments

**Required Metamodel Elements**
- Product
- + Category

**Calculation**

\[ EM_{Product;Category} \]

**Range**
[1; ∞]

**Breakdown**
- by Entity
Product variety
Example: product portfolio in consumer electronics

Product variety lets us calculate the product portfolio in consumer electronics.

\[ N_{Product} = 19 \]
\[ EM^*_{Product;Category} = 2.57 \]

\[ N_{Product} = 424 \]
\[ EM^*_{Product;Category} = 4.03 \]
How to measure business complexity
Measure candidates for the business motivation

- **Business Motivation**
  - Number of External Drivers
  - Number of Goals
  - Goal Dependencies

- **Business Model**
  - Number of Customer Segments
  - Distribution Relations
  - Product Variety

- **Business Execution**
  - Number of Capabilities
  - Capability Dependencies
  - Capability Redundancy
  - Process Concentration
  - Organizational Modularity
Number of goal dependencies
KPI fact sheet

<table>
<thead>
<tr>
<th>ID</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>BA-36</td>
<td>Number of goal dependencies</td>
</tr>
</tbody>
</table>

**Description**
The total number of dependencies between business goals.

**Rationale / Interpretation**
The KPI measures the interdependencies between business goals and is an indicator for the inherent complexity of the goal system of the enterprise.

**Example**
An insurance company operating under the Solvency II regime will have to follow a larger number of mutually dependant business goals than it would have to without the Solvency legislation.

**Primary Stakeholders**
- Board Member
- Executive Manager
- Business Strategist

**Adressed Concerns**
- ensure that the different goals to be followed and their interdependencies are clear and adequately addressed by the underlying business model and business execution

**Required Metamodell Elements**

**Calculation**

\[ N_{(Goal \rightarrow Goal)} \]

**Range**

\([0; \infty]\)

**Breakdown**
- by Entity
Business motivation complexity
Example: regulation of the insurance industry

\[ N_{\text{External Driver}} = 2 \]
\[ N_{\text{Goal}} = 4 \]
\[ N_{(\text{External Driver} \rightarrow \text{Goal})} = 2 \]
\[ N_{(\text{Goal} \rightarrow \text{Goal})} = 4 \]
How can complexity measures be put to practice?
Application scenarios
Possible applications for complexity measures

1. **Decision support / simulation** for (major) architecture decisions (e.g., mergers and acquisitions, business transformation planning, target application landscape planning)

2. **Comparative analyses within an organization** (e.g., to explain differences in costs and flexibility between domains or business lines, time series analyses)

3. **Cross-organizational architecture benchmarkings** (complementing existing cost benchmarkings, etc.)

4. **Systematic planning of target values** as part of a continuous architecture management (e.g., differentiated by architecture layers and domains)
Implementing a quantitative EA / complexity reporting
Process model and tools (overview)

- Stakeholder interviews
- Catalogue of KPIs
  - Identify and prioritize stakeholder concerns
  - Derive set of required KPIs and views
  - Extend metamodel and maintenance processes
  - Implement KPI calculation and views
  - Establish regular reporting

- Catalogue of concerns
- EA repository / tool
- KPI Calculation Toolsets

- Stakeholder interviews
  - Identify and prioritize stakeholder concerns
  - Derive set of required KPIs and views
  - Extend metamodel and maintenance processes
  - Implement KPI calculation and views
  - Establish regular reporting

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## Application example

### Enterprise IT architecture reporting

<table>
<thead>
<tr>
<th>Domain</th>
<th>Applications</th>
<th>Interfaces</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number</td>
<td>Risk Class</td>
</tr>
<tr>
<td>Master Data</td>
<td>8</td>
<td>14%</td>
</tr>
<tr>
<td>Underwriting</td>
<td>22</td>
<td>60%</td>
</tr>
<tr>
<td>Client Systems</td>
<td>11</td>
<td>44%</td>
</tr>
<tr>
<td>Exposure Mgmt.</td>
<td>33</td>
<td>5%</td>
</tr>
<tr>
<td>Accounting</td>
<td>24</td>
<td>15%</td>
</tr>
<tr>
<td>Consolidation</td>
<td>8</td>
<td>10%</td>
</tr>
<tr>
<td>Business Intell.</td>
<td>14</td>
<td>5%</td>
</tr>
<tr>
<td>Controling</td>
<td>18</td>
<td>25%</td>
</tr>
<tr>
<td>Investment</td>
<td>6</td>
<td>5%</td>
</tr>
<tr>
<td>Other</td>
<td>43</td>
<td>33%</td>
</tr>
</tbody>
</table>
Application example
EA complexity dashboard (domain view)
## Conclusion

### Summary and outlook

<table>
<thead>
<tr>
<th>What has been achieved</th>
<th>What still needs to be done</th>
</tr>
</thead>
<tbody>
<tr>
<td>✓ conceptual foundation established</td>
<td>✖ gather more experience on the use of the defined measures and determine their practical relevance</td>
</tr>
<tr>
<td>✓ unified measurement model and set of standard measures provided</td>
<td>✖ develop methods for measure integration (cross-layer) and aggregation</td>
</tr>
<tr>
<td>✓ measures defined (KPI catalog) and (partly) validated for the domain of IT architecture</td>
<td>✖ define standards to support intra- and inter-organizational benchmarkings</td>
</tr>
<tr>
<td>✓ initial measures defined (KPI catalog) for the domain of business architecture</td>
<td></td>
</tr>
<tr>
<td>✓ process model developed and reporting views created</td>
<td></td>
</tr>
</tbody>
</table>
Recommended reading
Business Architecture Management

**Business Motivation / Model**

- **An Architectural Approach to Strategizing: Structure and Orientation for Developing the Business Motivation** (Daniel Simon)
- **From Business Motivation to Business Model and Beyond: A Customer Value-Driven Approach** (Jörg Heiss)

**Modeling and Measuring**

- **Effectively Modeling Your Architecture** (Gerben Wierda)
- **Business Architecture Quantified: How to Measure Business Complexity** (Christian Schmidt)
- **Building Agile Enterprises** (Marc M. Lankhorst / Bas van Gils)

**Business Execution**

- **Using Capability Models for Strategic Alignment** (Wolfgang Keller)
- **Can Culture Be Designed?** (David W. Gray)
- **Business Architecture for Change Program Design and Planning** (Adrian P. Apthorp)

**Implementation**

- **Business Architecture for Niche-Market Enterprises** (Tom S. Graves)

(And others)
References


References


Thank you for your attention

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