IT Complexity metrics – How do you measure up?

Thoughts

FORMING THE FUTURE OF FINANCE

IT Complexity metrics – How do you measure up?

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The 'C' Suite agrees – a complexity metric is a worthwhile objective. We have already explained the importance and the power of rigorous IT Complexity metrics[1]. Now we describe how it works in detail.

IT Complexity is so important that 'learning through failing' is no longer satisfactory given that this form of complexity so clearly and harshly impacts the cost, delivery quality and flexibility of the IT landscape.

We now need a robust and functioning model for complexity measurement and mitigation. This paper describes how Commerzbank, in partnership with Capco, is deriving such a model. We also examine how it can be developed over time to provide a cross-industry standard. Specifically, we will be looking at:

- The shape of the model – how does Commerzbank, with Capco's input, model complexity at the moment.
- The key components – a deconstruction of the key components of a rigorous understanding of complexity – the indicators – covering applications, interfaces, data and infrastructure.
- A pathway to live implementation – overview of the key steps required for an organization to start using rigorous, predictive complexity insight as a management lever.

Introduction and background

IT Complexity can and should become a leading indicator for IT performance management

Typically, the CIO scorecard contains the following key performance indicators: costs, flexibility and quality. Sadly, these are 'lagging' indicators whose current values typically result from choices made many years previously. Most experts agree that IT Complexity is a key hidden variable. As such, it is a 'leading' indicator supporting the prediction of costs, flexibility and quality that should (must) be used in today's IT management decisions. IT Complexity is however very difficult to master, since it:

- Creeps up, growing incrementally – but can only be reduced by a substantial management intervention.
- Is not purely local – it occurs locally in many different applications and interfaces, but the impact is only perceptible on the aggregate level.
- Cannot (until now with our model) be measured – a valid measure for IT Complexity does not exist elsewhere, either in academia or in business.

And, as we all know: 'what cannot be measured, cannot be managed'.

Given these issues, Commerzbank and Capco have worked out a practical solution, by creating an IT Complexity model and management decision tool. The tool is based on a number of specific and measurable IT Complexity indicators, organized in a structured IT Complexity analysis framework.

Story so far - origins and progress

Earlier this year, Commerzbank and Capco jointly issued a paper outlining the importance of understanding IT Complexity for technology leaders in the financial services market. The key conclusions reached include the following:

- Leading financial institutions recognize the need to acknowledge, embrace and harness complexity – they understand that today's IT environments cannot be managed with experience - and intuition-based approaches alone. Instead, true

insight into complexity requires objective, quantifiable measurement of its origins and effects.
- Technology leadership within financial services needs to be able to get specific, with reliable knowledge-based statements: ‘Based on the IT Complexity metric in our business case, we have determined that we should replace system X, as overall it will reduce our complexity, thus reducing our costs, in parallel with a reduction in service incidents …’

Commerzbank believe their initial complexity model, while useful, would be much richer when evolved towards a fully developed industry standard. To drive this process, the bank chose to work with Capco. Overcoming the issues through a rigorous metrics-based approach and leaving complexity ‘unplugged’ is one of the foundations of Capco’s ‘forming the future of finance’ platform.

What have we achieved so far? Significant progress towards a fully-functional industry tool

The Commerzbank-Capco partnership has defined a path to broader industry participation. The key steps have been as follows:

- Commerzbank’s own modeling has improved, becoming more generally re-usable within the industry.
- Accessible dashboards for IT Complexity and analytics tools have been built, to ensure that theoretical understanding can be applied to the technology / business management process.
- An open tool for complexity data capture, display and analysis, reflecting the IT Complexity model, is being built - with appropriate confidentiality options to allow for multi-bank user groups.
- Many sessions with potential users have been held, to confirm the need and refine the methods to reflect the realities of the industry.

The Complexity Model in detail

In this section we explore the overall framework of the model, which is based on complexity indicators across functions, interfaces, data and technology (infrastructure).

Our approach focuses on exploring the **Structural Complexity of IT**. We start at the level of individual modules / applications. Then we go all the way to the total system landscape of a financial institution.

Four dimensions of complexity indicators

Within our IT Complexity model, there are four dimensions:

- **Function**, relates to functionality or the business & process logic supported by the IT asset.
- **Interfaces**, relates to interoperability between the IT assets.
- **Data**, relates to logical and physical data objects.
- **Technology**, relates to the underlying technology infrastructure (hardware, middleware, systemware).

Each indicator is defined on the basis of a hypothesis advanced by Commerzbank and Capco IT specialists; which in turn is founded on their experience and on leading IT principles used in the industry. Subsequent dialogue (based on conversations with experienced IT leaders) has confirmed that these principles are to be found all across our world.

The relevance of each indicator has been validated through statistical analysis of Commerzbank data. This analysis has mathematically confirmed the relationship between the IT Complexity indicators and IT KPIs, such as costs and incidents.

Overview of complexity indicators

Indicator name	Indicator abbreviation
Function	
Functional Coverage	FC
Functional Occurrence	FO
Location of Usage	FLU
Number of User	FU
Number of User Departments	FUD
Functional Implementation Scope	FIS
Functional Implementation Overhead (= FIS/FC)	FIO
Functional Standard Conformity	FSC
Functional Domain Diversity	FDD
Interfaces	
Information Flow intensity	IIF
Interface Intensity	II
Interface Implementation Overhead (= II/IIF)	IIO
Interface Implementation Type diversity	IIT
Interface External information Flow Ratios (external logical dependency)	IEFR
Interface External Ratio (external implementation dependency)	IER
Data	
Number of Information Objects	DIO
Number of Database Objects	DBO
Data Implementation Overhead (= DBO/DIO)	DIO
Technology	
Number of Infrastructure Requirements	TIR
Technology Infrastructure Products	TIP
Number of Infrastructure Services	TIS

The indicators can be implemented in various ways, accommodating specific data availability issues in different organizations.

Note that it is not the absolute value of the indicator that is most significant. What is actually more revealing is the insight gained by combining and comparing indicators. When working with the complexity indicators, the following points should be kept in mind:

- Not all indicators are necessary all the time – a pragmatic approach should prevail.
- Different indicators are relevant for different and distinct questions / management decisions.
- Relativity is an issue – i.e. the indicator's relation to other IT assets within the financial institution, or within its business domain (e.g. in a threshold analysis, using average values and standard deviations).
- Bench marking is an issue - consider the relation to the (normalized) IT Complexity indicator within the same business domain in similar institutions.
- The technology / business relationship is an issue – the ratio between the IT implementation-driven indicators and the related business-driven indicators (plotting the IT design overhead and indicating the level of reducibility of IT Complexity).

For analysis and reporting purposes, the IT assets may be clustered in a functional domain model. Alternatively, you can use any form of IT asset bundling, carried out either logically or physically, that is relevant in decision making around IT Complexity (in an IT transformation or project portfolio management process).

Functions

Many complexity indicators are functionality related (almost half of them, in fact). This is in line with our expectation that IT Complexity correlates with the level and diversity of functionality; confirmed by the Commerzbank data analysis.

Our model utilizes five business-driven quantitative indicators; indicating the level of functionality that is driven by business requirements and business model choices:

1. **FC** **Functional Coverage**, i.e. the number of use cases, business process activities or function points of an application.
2. **FO** **Functional Occurrence**, or its importance within the overall IT landscape of the enterprise. (The functional occurrence is measured by the number of functional blocks in an overall business domain, or enterprise architecture component.)
3. **FLU** **Location of Usage**, covering the higher functionality usually required of an application used in more than one location.
4. **FU** **Number of Users**, representing the additional design complexity related to the more stringent, non-functional requirements in the areas of security, user-friendliness, performance, and availability.
5. **FUD** **Number of User Departments**, relates to the additional complexity due to greater and more disparate business requirements (the result is more complex governance when multiple business departments specify the requirements).

The functional implementation scope, **FIS**, is expressed in the number of functional components that are needed to support the required business functionality and its related software engineering needs.

The ratio between this indicator and the functional coverage implies the functional implementation overhead **FIO**, instigated through the application design, and indicates the level of *reducibility* of IT Complexity. This is an important indicator for IT management in reviewing the architecture of an application/s during IT change.

Next to functionality level, we also know that functional diversity drives IT Complexity. We have embodied this in two indicators:

1. **Functional Standard Conformity** **FSC** of an application is measured on its deviation from enterprise-wide established IT standards and principles.
2. **Functional Domain Diversity** **FDD** is measured by the number of applications that are required to support that domain.

Interfaces

Very early in developing the model, we noticed a statistically significant correlation of interface complexity with cost - in line with our intuition and experience.

Interface complexity is driven by business needs on the one hand and by IT design and implementation choices on the other. Understanding each of these aspects independently provides compelling insights. But when examination of the influences of business need and IT choice is combined, we have found that their impact on complexity (and therefore cost and service quality) is brutal.

This relationship between business requirements and technical implementation is very interesting. Our

research has identified three indicators that capture the relationship. And our modeling has confirmed our intuition, that these are indeed useful:

1. **Interface Information Flows IIF** counts the logical incoming and outgoing information flows of a business process / area (we use the expression 'application domain') weighted by the required data latency.
2. **Interface Intensity II** counts all incoming and outgoing interfaces of an application, weighted by the implementation type (e.g. file transfer, webservice, direct database access, application specific API…) and the level of data transformation quantified by the different data structures supported in the interface.
3. **Interface Implementation Type IIT**, is our mechanism to capture technical diversity. The idea is that the greater the diversity of implementation types (File, View, message brokers, ...) employed in an application, the more complex the application will be.

The external information flow dependency, or **Interface External Information Flow Ratio IEFR** measures the relative dependency of an application domain. It is evaluated on its internal structure, based on the ratio between the number of external and internal data flows. The greater this ratio, the greater is the dependency of the domain on its environment – i.e. it is not independent!

Interface External Ratio IEIR is the number of interfaces divided by the number of internal interfaces. A possible further indicator could be the 'loop factor' - counting the loops within an application domain.

Data

We have chosen two indicators – again one business-driven and one IT implementation-driven. These are statistically proven not only to be relevant for the measurement of complexity in data. They also contribute to an overall understanding. The indicators are:

1. **Data Information Objects DIO** - This indicator looks at the business component, measuring the number of information objects and their relationships within a defined business area (functional domain). To do this, we capture the raw data / numbers on:
   a. Information objects (person, product, service agreement) in a domain
   b. Entities, attributes, relationships between entities
   When combined, the information creates a clear view of the business- related data complexity.
2. **Database Objects DBO** - This indicator addresses the technical aspects of data, by looking at the number of database objects in an application domain (same definition as for data measure above), based on a physical count of Databases, Tablespaces, Tables, Views, Constrains and Indices. Added to other views (e.g. number of applications in the domain) this indicator allows useful insights (such as profiling how data intensive these applications are).

We believe the two indicators described above are the **mandatory** data indicators. We recognize of course that there could be more but, for benchmarking purposes, these are sufficient. Even working with them in isolation, they are useful. But it is much more important and productive to take the following steps:

- Link the technical to the business-related data indicator, thus gaining an indication of the IT implementation overhead and potential reducibility of design complexity
- Aggregate the 'data complexity' with the application, interface and infrastructure complexity – this is the source of real, holistic insight

Technology

Another - and crucial - dimension of IT Complexity is clearly 'Technology'. This overall description relates to the underlying technology itself (hardware, middleware, systemware …) as well as any drivers of complexity derived from operating requirements (operating model, business criticality, prescribed time for recovery …).

When analyzing technology complexity, we are aiming to understand the impact on complexity from the 'employed' infrastructure for an application or an application bundle. One can also look at infrastructure bundles, e.g. in an operations center.

We propose the following technology indicators:

- **Technology Infrastructure Products TIP** measures the number of different infrastructure products / components – including, among others, databases, operating system and applications server.
- **Technology Infrastructure Services TIS** counts the number of different infrastructure services.
- **Technology Infrastructure Requirements TIR** measures the number of different infrastructure service level requirements to be supported. To this end, we assign numerical values to business criticality and other non-functional infrastructure service requirements.

Complexity model applied for reporting and management decisions

The basic information used in IT Complexity reporting and decision making comprises:

- IT Complexity indicators as described above.
- The impact of the indicators on flexibility, costs and quality.
- Benchmark data to link the above measures to comparable organizations.

In the standard tool that we have built to measure complexity, this base data is:

- Normalized – to enable comparison of different indicators.
- Aggregated – to provide overview insight on specific business domains, such as payments or corporate risk management.
- Calibrated – to allow for comparison between different business domains and benchmarking with other financial institutions.

In addition to this information, the level of data completeness and quality (and historic trending) is disclosed in the standard reporting (see figure 1 on page 8 for an example).

The information illustrated on page 8 provides a dashboard. But we find that the true value of IT Complexity management lies in its use in proactive support of IT portfolio management, architecture and transformation decisions. To explore and realize this value, we run simulations and scenario analysis to model the change in complexity for different options. In this way, we can finally take IT Complexity – the 'hidden variable' - into account to make better decisions.

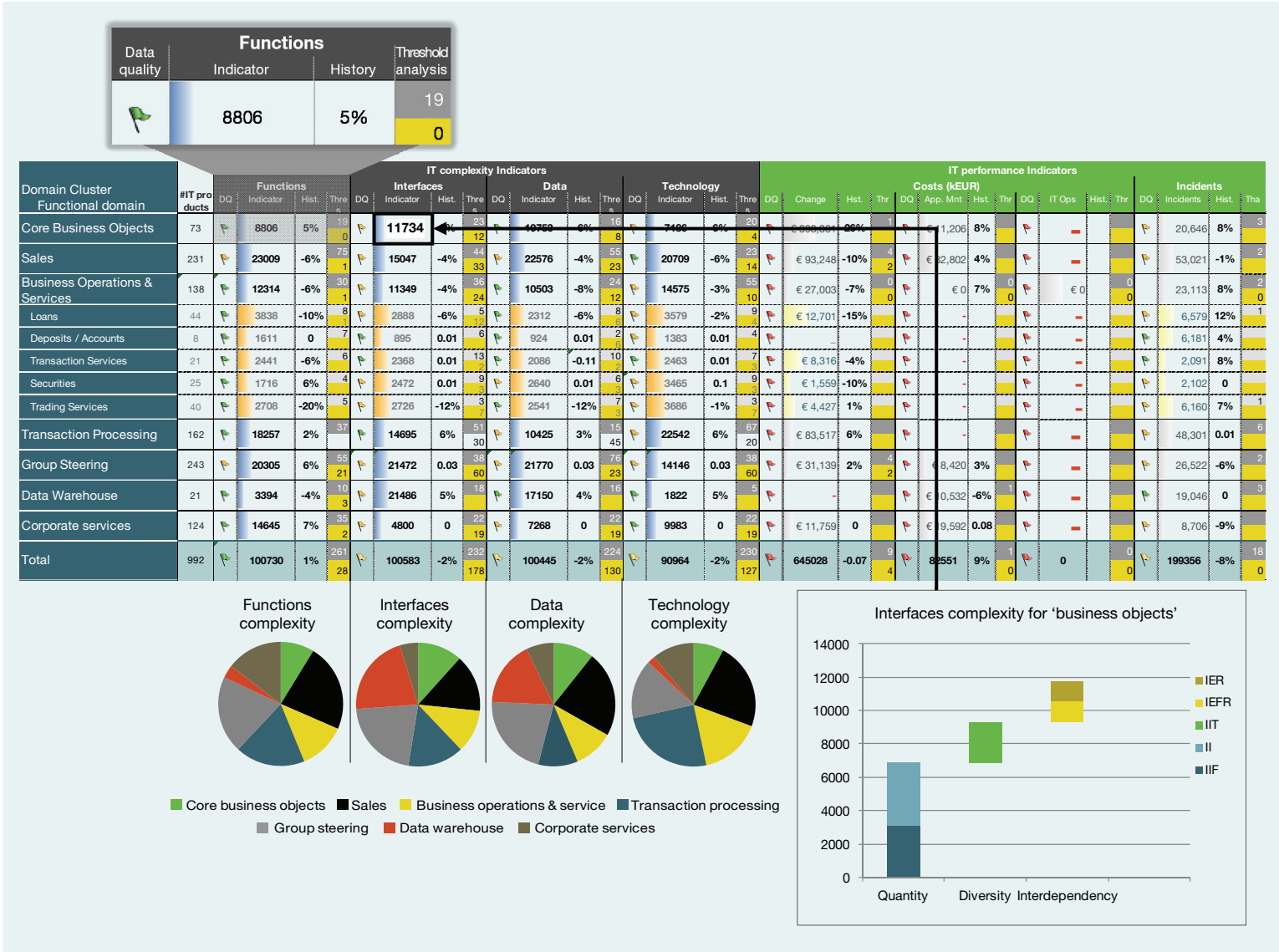

Figure 1. Commerzbank IT Complexity landscape

The model works, now how can you make it work for you?

If you want to take part in this exciting development what do you need to do and how long does it take?

Based on experience to date, and knowledge of the likely data available in most financial services technology shops, we envisage that three key streams of activity will be required:

- Data availability – to model complexity firstly requires data on complexity, as we have explained. The initial step is to assess what data you have, align it with the models and think through the data capture and transfer process. Completeness is not necessary, and one does not need every indicator, nor all IT assets covered. Follow a pragmatic approach by starting, for example, with one business domain.
- Technical load – once the data has been sourced and made available, we would recommend a first technical load into the analytical tools which can be used as a pilot and enables data refinement based on the results. This is followed by a 'first' formal data load, which would enable you to mobilize and use it as a management tool.
- Sharing – if you are comfortable and your organization allows it, we will work with you to ensure that a sanitized version of your data is included in the benchmarking data set. You can participate in the user community process, which will allow you to learn along with others, benchmark against them and also to progress the model.

It is a three to six month journey, worst case, to get to the point of realizing benefit from complexity understanding. Early indications are that this activity will absorb approximately 1.5 full-time equivalent (FTE) of time through the analysis, load and trial period – depending on data availability. It will subsequently require 0.5 FTE to maintain the data and manage the processes to achieve greatest benefit.

Initially, we considered this was a high investment level. But we have since observed that the preparation process has significant ancillary benefits, including:

- Improved data understanding - you will start to understand your IT assets better
- Improved data quality - you will improve the quality of information on your IT assets
- Putting in foundations for managing complexity – this is all part of embedding a sustainable culture of ongoing, rigorous and predictive complexity management

Conclusion

We trust this paper has:

- Confirmed the importance of understanding complexity
- Added to your existing awareness of the drivers of complexity
- Proved that IT Complexity can be measured – and therefore mastered
- Persuaded you that now is the time to act

Action starts with attending a workshop or initiating the process within your organization. If you want to participate in the exercise, please do not hesitate to contact us.

Footnote

1. IT Complexity – model, measure and master

Dr. Peter Leukert is the Chief Information Officer of Commerzbank AG. He is in charge of information technology across all business units of Commerzbank and oversees approximately 4,000 employees. Peter was co-lead of the integration of Dresdner Bank into Commerzbank, which was successfully completed in May 2011. Before joining Commerzbank, he was a partner at McKinsey & Company, serving financial institutions and the public sector on IT and operations topics. Peter studied mathematics and physics at the University of Bielefeld and obtained a doctorate in financial mathematics at the Humboldt University of Berlin.
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About Commerzbank

Commerzbank is a leading bank for private and corporate customers in Germany. With the segments Private Customers, Mittelstandsbank, Corporates & Markets, Central & Eastern Europe as well as Asset Based Finance, the Bank offers its customers an attractive product portfolio, and is a strong partner for the export-oriented SME sector in Germany and worldwide. With a future total of some 1,200 branches, Commerzbank has one of the densest networks of branches among German private banks. It has above 60 sites in 50 countries and serves more than 14 million private clients as well as one million business and corporate clients worldwide. In 2010 it posted gross revenues of EUR 12.7 billion with some 59,100 employees.

About Capco

Capco, a global business and technology consultancy dedicated solely to the financial services industry. We work in this sector only. We recognize and understand the opportunities and the challenges our clients face. We apply focus, insight and determination to consulting, technology and transformation. We overcome complexity. We remove obstacles. We help our clients realize their potential for increasing success. The value we create, the insights we contribute and the skills of our people mean we are more than consultants. We are a true participant in the industry. Together with our clients we are forming the future of finance. We serve our clients from offices in leading financial centers across North America, Europe, Africa and Asia.

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