

<p>Customer Orientation</p> <p>Lean Six Sigma</p> <p>Agile Processes</p> <p>Project Estimations</p> <p>Transfer Functions</p>	<p><b>swissICT</b> SwiSMA</p> <p>Thomas M. Fehlmann, Zürich Euro Project Office AG E: <a href="mailto:info@e-p-o.com">info@e-p-o.com</a> H: <a href="http://www.e-p-o.com">www.e-p-o.com</a></p> <p><b>ISBSG</b> Delivering IT Confidence</p>	<p><b>IoT Product Development</b></p>  <p><b>euro project office</b> Master your project.</p>
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## IoT Orchestrierung

Marcel Bernet wird über IoT Orchestrierung und Physical Mashup im Web of Things referieren - also die Erstellung neuer Produkte durch Rekombination bestehender Geräte und Dienste.

Als ein Beispiel gezeigt wird das «Kitchen Helper Project», ein IoT Orchester, welches das Überkochen von Herdplatten verhindert. Das Beispiel wird an die Teilnehmer vollständig abgegeben mitsamt allen notwendigen Schnittstellen und Software-Metriken.

### Datum & Zeit

04.03.2016 15:00 - 04.03.2016 17:00

### Kategorien

SwiSMA

### Ort

TECHNOPARK Zürich  
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8005 Zürich

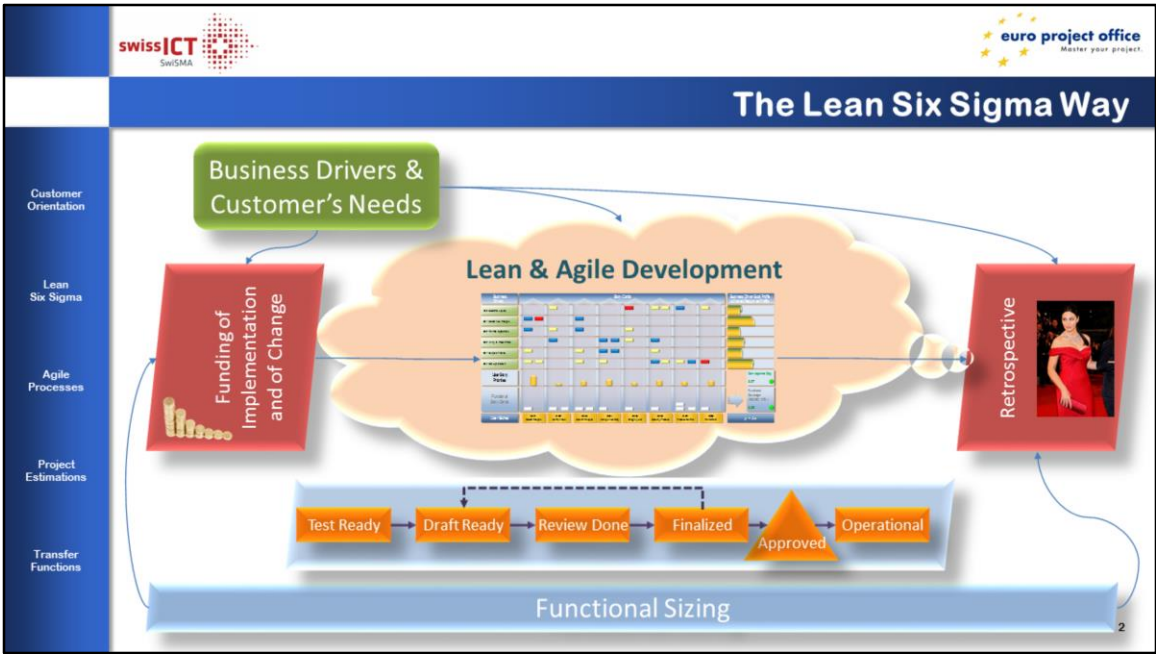
**weitere Informationen**

**Organisation**

Fachgruppe SwiSMA

**Direktlink zur Veranstaltung**

[http://www.swissict.ch/expertenwissen/fachanlaesse/?VER\\_ID=176](http://www.swissict.ch/expertenwissen/fachanlaesse/?VER_ID=176)



A Lean Six Sigma software project uses many of the concepts known from Agile, including the Definition of Done (*Six Steps to Completion*) and the Retrospective.

Other elements are freely selectable: not even sprints are needed to ensure reducing variation, although waterfall approaches suffer from the well-known fact that complete and unambiguous specifications are very, very hard to get. Maybe in some strictly regulated high-risk environment, such things exist.

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The Vision

Customer Orientation

Lean Six Sigma

Agile Processes

Project Estimations



Transfer Functions



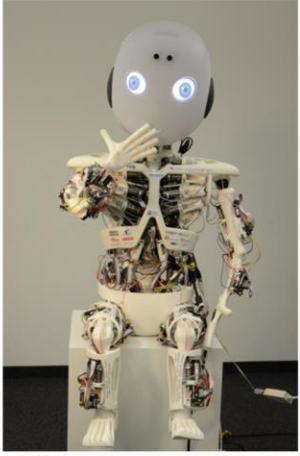
Seen that before?

## Transfer Functions

Downloaded from <http://www.jstor.org/stable/2346111>

## The Vision – the Kitchen Helper

<div style="background-color: white; color: #0056b3; padding: 2px; font-size: 0.8em;">Customer Orientation</div> <div style="background-color: white; color: #0056b3; padding: 2px; font-size: 0.8em;">Lean Six Sigma</div> <div style="background-color: white; color: #0056b3; padding: 2px; font-size: 0.8em;">Agile Processes</div> <div style="background-color: white; color: #0056b3; padding: 2px; font-size: 0.8em;">Project Estimations</div> <div style="background-color: white; color: #0056b3; padding: 2px; font-size: 0.8em;">Transfer Functions</div>	<ul style="list-style-type: none"> <li>● He knows what I intend cooking           <ul style="list-style-type: none"> <li>➔ By reading recipes</li> </ul> </li> <li>● Watches temperatures if I'm off           <ul style="list-style-type: none"> <li>➔ reading e-Mails, during phone calls...</li> </ul> </li> <li>● Prepares my shopping list           <ul style="list-style-type: none"> <li>➔ Knows what I need and what's missing</li> </ul> </li> <li>● Does shopping in e-Shops           <ul style="list-style-type: none"> <li>➔ Shopping bags are at my door when returning from work</li> </ul> </li> <li>● Tells the oven and the boiling plates what they have to expect tonight</li> </ul>	 <p style="font-size: 0.8em; margin-top: 5px;">Bild Roboy © ZHAW School of Engineering, Rolf Pfeifer</p>
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- He knows what I intend cooking
  - ➔ He reads recipes
- Watches temperatures if I'm off
  - ➔ reading e-Mails, during phone calls...
- Prepares my shopping list
  - ➔ Knows what I need
- Does shopping in e-Shops
  - ➔ Shopping bags are at my door when returning from work
- Tells the oven and the boiling plates what they have to expect tonight
  - ➔ Download cooking plans is what you might expect – never more!

- Natural nutrition contains no RFID
  - ➔ Your kitchen appliances cannot know what it is when cooking
- Most grocery shops give you paper receipts only
  - ➔ Some friendly shops may send you a PDF delivery list that you can OCR
- Most cooking recipes are online
  - ➔ Few provide you with an API or XML export
  - ➔ And REST conform JSON export is yet to come
- Your kitchen appliance's Internet is for remote planning & control rather than support cooking
  - ➔ You seldom find sensors that allow for feedback control loops
- It must be a collaborative approach between
  - ➔ Nutrition shops
  - ➔ Cooking sites (Betty Bossi in CH; Chefkoch in D; ...)
  - ➔ Kitchen appliance software providers

Disclaimer: the brands listed or mentioned here have nothing to do with the (fake) project shown in this talk. They are just used to stir your imagination.







## The Information is Here

Customer Orientation  
  
 Lean Six Sigma  
  
 Agile Processes  
  
 Project Estimations  
  
 Transfer Functions

- Big Data is available
  - ➔ Just grasp it!
  - ➔ Using your Smartphone





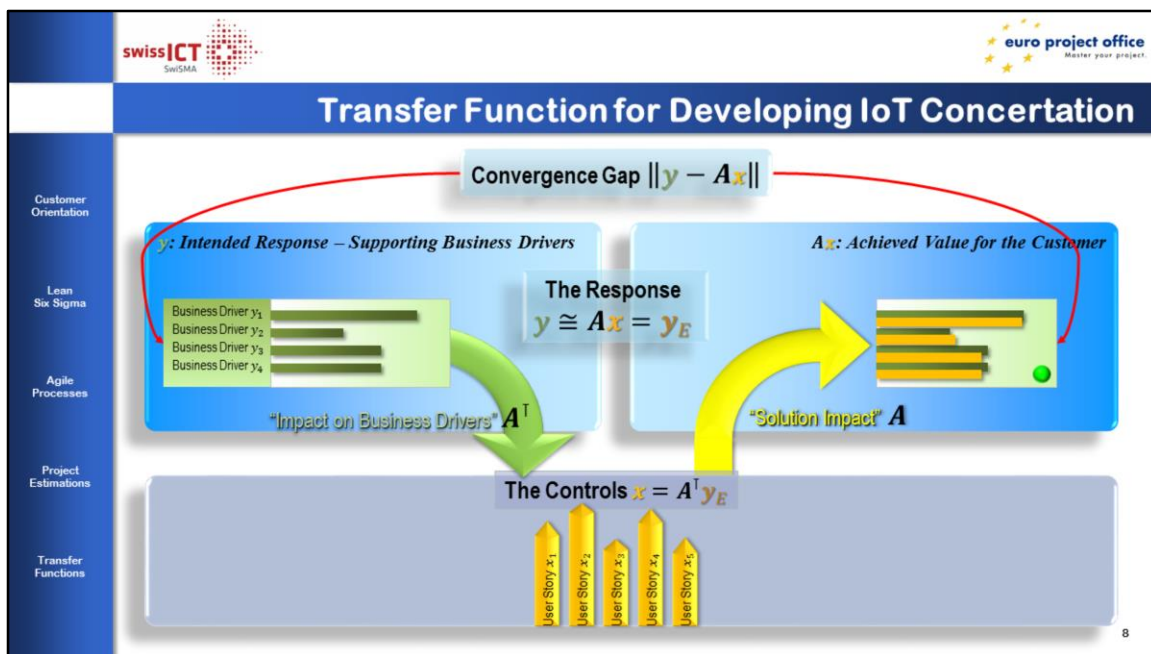
- ARM mbed connect physical and virtual world
  - ➔ With Sensors for collecting information
  - ➔ With Actuators for impacting physical world
- Cloud Services provide an IoT hub

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You have your Smartphone always available to capture the data you need – cooking recipes, shopping lists, etc.

Arduino-compatible processor boards are cheap and easily programmable devices that connect to the Internet and link it to physical events, using sensors and actuators.

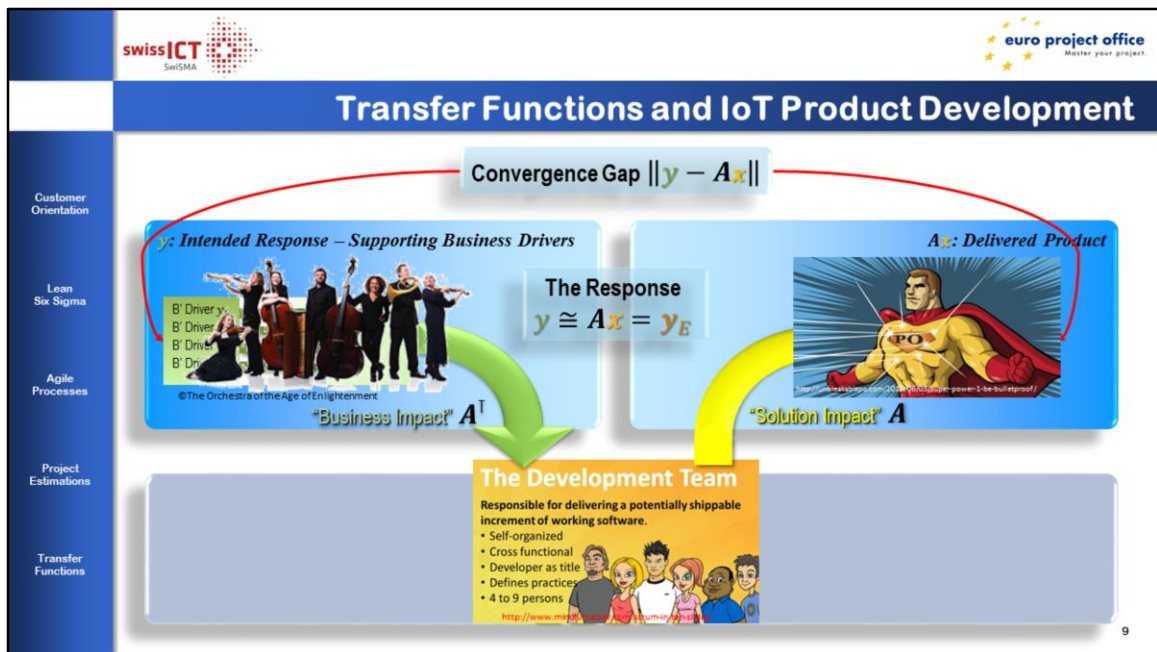
Often, an IoT hub – can be a Raspberry PI, a Mobile Phone or a Cloud Service – collects data and distributes updates in order to be able using low-power connectivity on the sensors.



Now, applying this for new product development is straightforward. The intended response become e.g. Business Drivers, following Denney, that define the goals of a product: the “What”. The controls are whatever makes the product work as intended by defining the “How”.

In Agile, the term *User Story* is used for both the “What” and the “How”; in UML the term *Use Case* always denotes the “How”.

For clarity, we consequently use “User Story” to refer to how customers want to use the software, and we use the term *Functional User Requirement* (FUR) to denote the “What”, in functional terms, and *Business Driver* to denote the “What” that refers to quality aspect driving business with customers. Some authors, especially in software, use the term *Non-functional Requirements* (NFR) instead of Business Drivers.



- The **Sponsor** is responsible to explain the Intended Response
- The **Product Owner** is responsible for the Achieved Response
- The **Scrum Master** is responsible for Lean & Agile Development

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What else are Transfer Functions Good for?

Customer Orientation

Lean Six Sigma

Agile Processes

Project Estimations

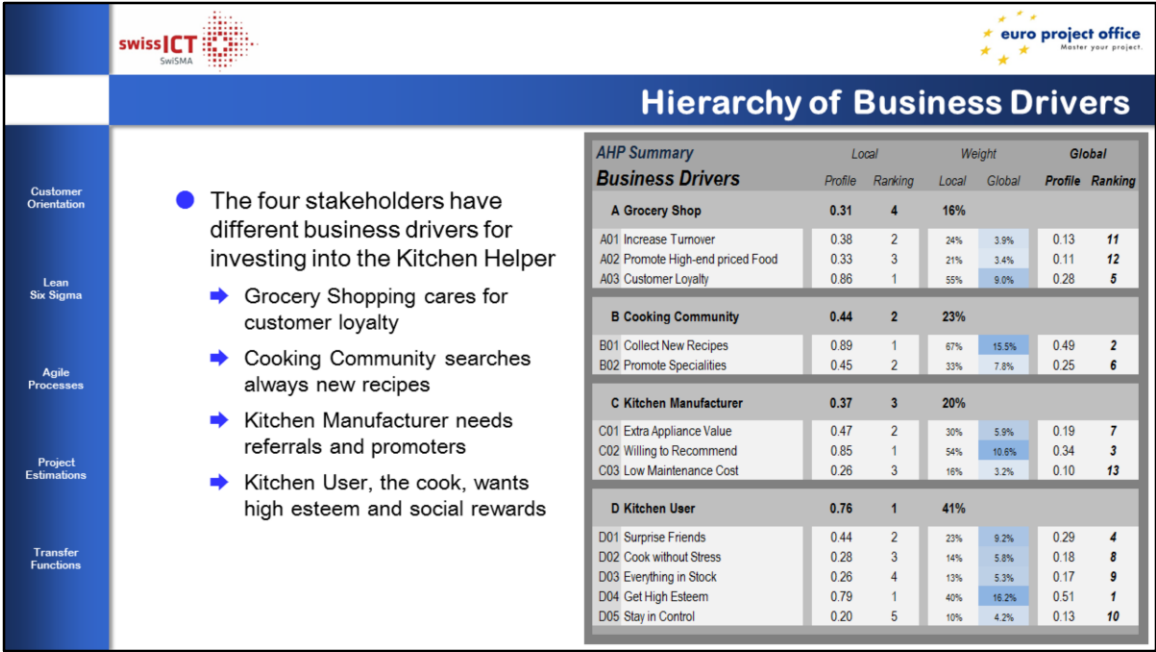
Transfer Functions

- Forces you to find out what your *Business Drivers* are
  - Customer Delighters
- Help you select the *User Stories* that support Business Drivers best
- Might be used on the technical level to guess missing information
  - What might be boiling in this pot?

Miss Italia  
photo by  
Jonny Delighter

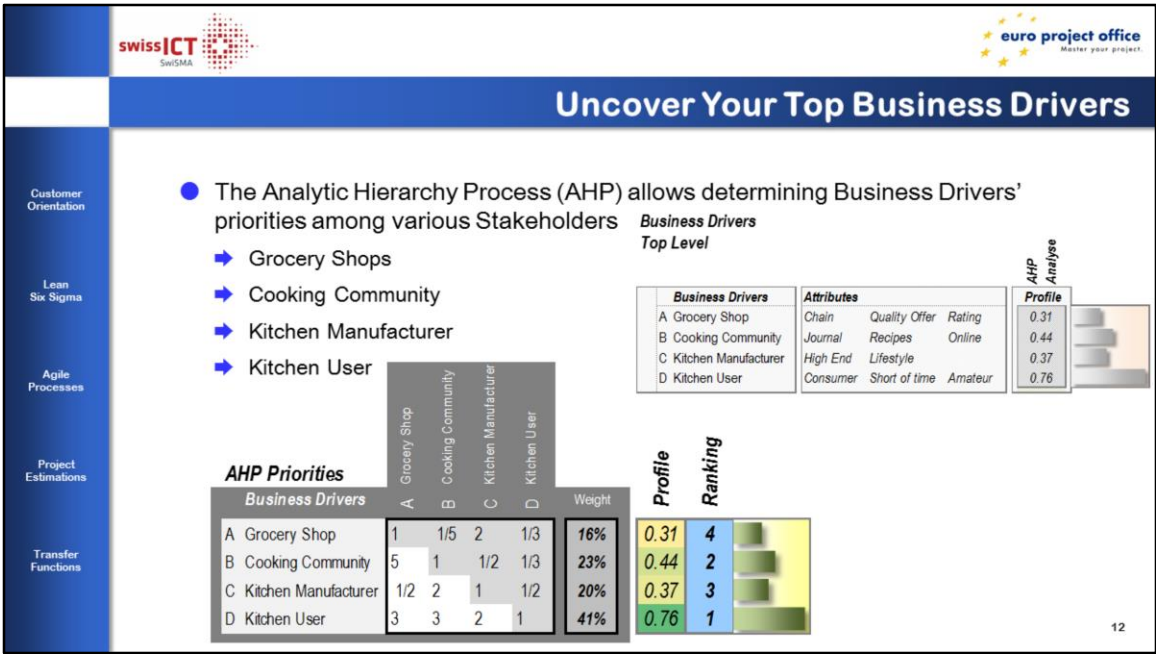
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- Transfer Functions come into play on two different levels
- Find the User Stories that match Business Drivers;
  - Can be used to guess missing information, e.g., what boils on which plate?



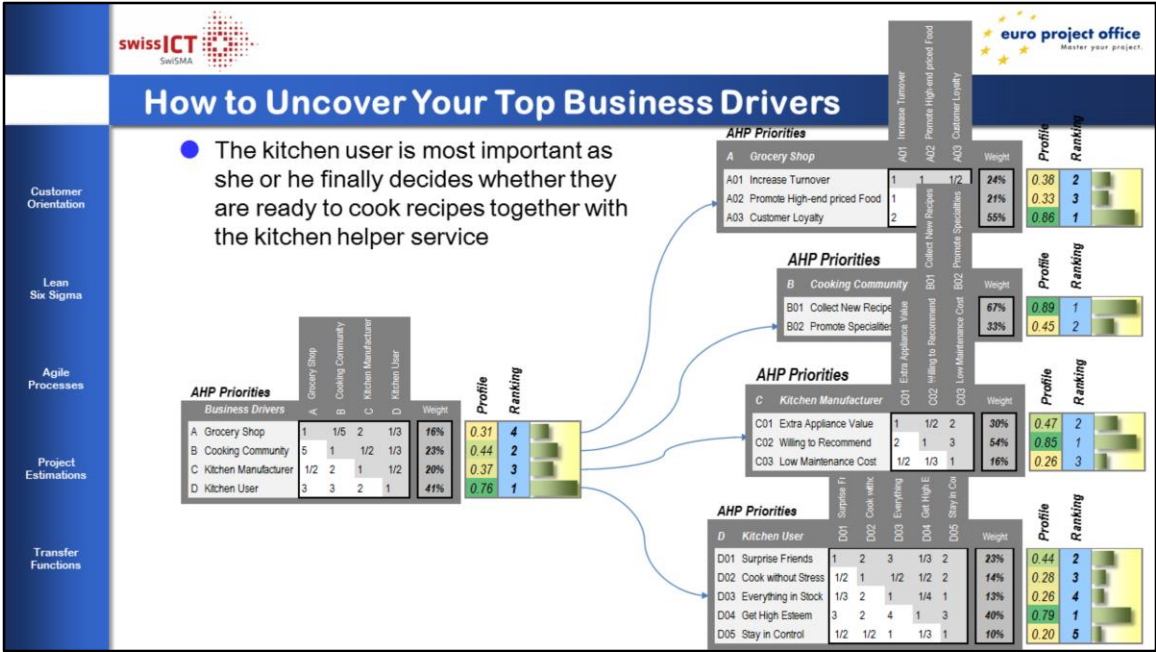
There are four different stakeholders involved:

- Grocery Stores
- The Cooking Community
- Kitchen Manufacturers, and
- Kitchen Users



We have four stakeholders in the project; three among them as sponsors and the fourth, the kitchen user, decides whether the product will be a success.

They might have to pay for it; most probably not in full as the three other stakeholders see the kitchen user as their most valuable consumer, and want to sell either food or new kitchen appliances.



- The AHP process splits the prioritization into two steps:
- Determine the importance of which stakeholder to the success of the project
  - Find the most important Business Driver for each of the four stakeholders



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The Kitchen Helper Application – Top Business Drivers

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● The six highest priority Business Drivers for a successful Kitchen Helper

➔ Seen from the perspective of kitchen users

➔ They decide whether the project will be successful

➔ ... and they change their minds fast!

● Ordered by priority:

Top Business Drivers

Business Drivers

Top Business Drivers	Attributes		Profile	
D04 Get High Esteem	Earn praise	Make friends envious	0.51	0.56
B01 Collect New Recipes	Be special	Make it essential	0.48	0.54
C02 Willing to Recommend	A special kitchen		0.34	0.37
D01 Surprise Friends	Feel cool	Kitchen helper helps!	0.29	0.32
A03 Customer Loyalty	Customer come back	Find special food	0.28	0.31
B02 Promote Specialities	Recipes promote high-yield food		0.25	0.27

Not too surprisingly, the needs of the kitchen user to get high esteem and always have access to new recipes is dominant.

This insight allows to select the IoT that pertain to this needs, and avoid spending time and money on others, less important. For instance, having the kitchen helper do the food supply autonomously is no business driver, absolutely!



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The Kitchen Helper Application – Top Business Drivers

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Transfer Functions

● The six highest priority Business Drivers for a successful Kitchen Helper

➔ Seen from the perspective of kitchen users

➔ They decide whether the project will be successful

➔ ... and they change their minds fast!

● Ordered by topics:

Top Business Drivers

Business Drivers

	Top Business Drivers	Attributes		Profile	
A Grocery Shop	A03 Customer Loyalty	Customer come back	Find special food	0.28	0.31
B Cooking Community	B01 Collect New Recipes	Be special	Make it essential	0.49	0.54
	B02 Promote Specialties	Recipes promote high-yield food		0.25	0.27
C Kitchen Manufacturer	C02 Willing to Recommend	A special kitchen		0.34	0.37
D Kitchen User	D01 Surprise Friends	Feel cool	Kitchen helper helps!	0.29	0.32
	D04 Get High Esteem	Earn praise	Make friends envious	0.51	0.56

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We can rearrange the business drivers according the four stakeholders that we used for the AHP.

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User Stories – High-level Scope

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Transfer Functions

● Eight User Stories describe how the kitchen user wants to perform the tasks

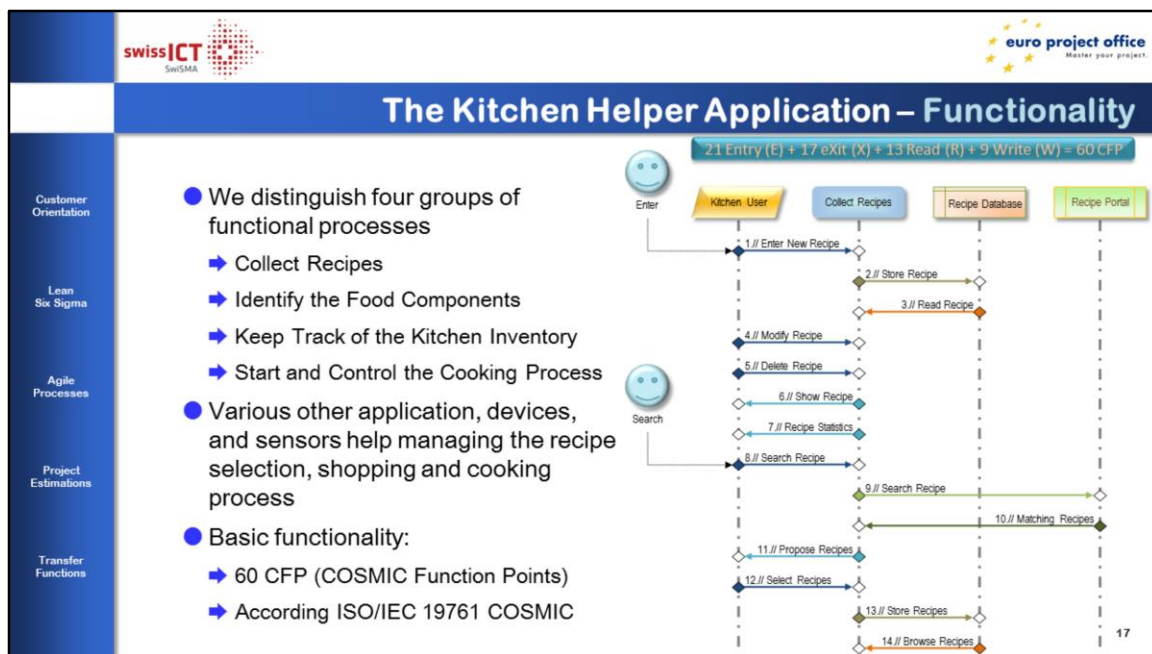
➔ Other user stories left apart, for simplicity

● The priority originates from how important these stories are for satisfying stakeholder's needs

User Stories	As a ... [functional user]	I want to ... [get something done]	such that ... [quality characteristic]	so that ... [value or benefit]	Priority
1) Q001 Collect Recipes	Kitchen User	collect recipes	I can select one that interests me	my family and guests are impressed	0.65
2) Q002 Identify Food	Kitchen User	identify food components	my shopping list is accurate	the recipes use correct components	0.14
3) Q003 Search Recipes	Kitchen User	find new recipes	I can select one that interests me	my family and guests are impressed	0.30
4) Q004 Manage Inventory	Kitchen User	know what's in my kitchen	I can get rid of obsolescent food	before it decays	0.39
5) Q005 Shopping List	Kitchen User	get a shopping list	I buy everything that's needed	I can cook my recipe	0.19
6) Q006 Cooking Process	Kitchen User	start cooking	my appliances know what I'm doing	they can help me doing it right	0.35
7) Q007 Process Control	Kitchen User	execute the cooking process	heat and treatment is correct	boiling pans don't overflow	0.26
8) Q008 Remember	Kitchen User	remember what I cooked last time	for my family or guests	they won't get weary of my recipes	0.30

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This is a somewhat simplified version of our Kitchen Helper project. For instance, there are no security or privacy aspects recorded in these eight user stories. It might be possible to use Smartphone SIM-Application security for all of it; however, this is not within the scope of this talk.



The first thing we do is designing the intended solution using an UML Sequence Diagram. This has the advantage that such diagrams easily split into functional tasks by focusing on a few data movements only, and thus is more suitable than UML or any other modeling technique to define the product scope. As an additional benefit, we get the functional size of the project, expressed in COSMIC function points (ISO/IEC 19761).

Project Scope means then the split of the product scope into small bundles of data movements. We call them *Story Cards*.

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The Kitchen Helper Application – Objects of Interest


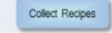



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Transfer Functions

	Description	Type
 Kitchen User	Wants to cook some recipe	Device User
 Collect Recipes	A process that collects cooking recipes of interest	Functional Process
 Recipe Database	List of recipes collected from various sources	Persistent Data
 Boiling Plates	IoT Hub collecting and distributing info to "things"	Cloud Service or IoT Hub
 Identify Food	Another process that is able to identify various food	Functional Process

- About 16 objects of interests connected by more than 60 data movements describe the full functionality needed for the eight user stories
  - ➔ Limited to the kitchen users' area of interest
- Sequence diagrams describe functionality on a level granular enough for defining integration test cases
  - ➔ Next level above unit tests; ideal for crowd testing

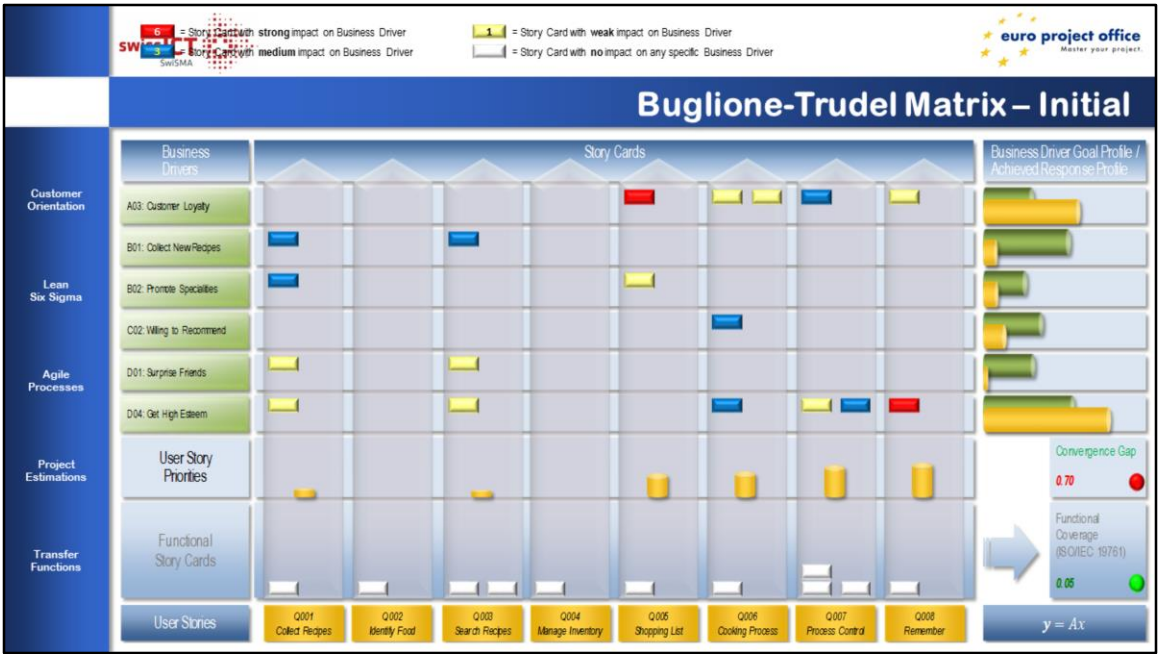
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The “Objects of Interest” represent the

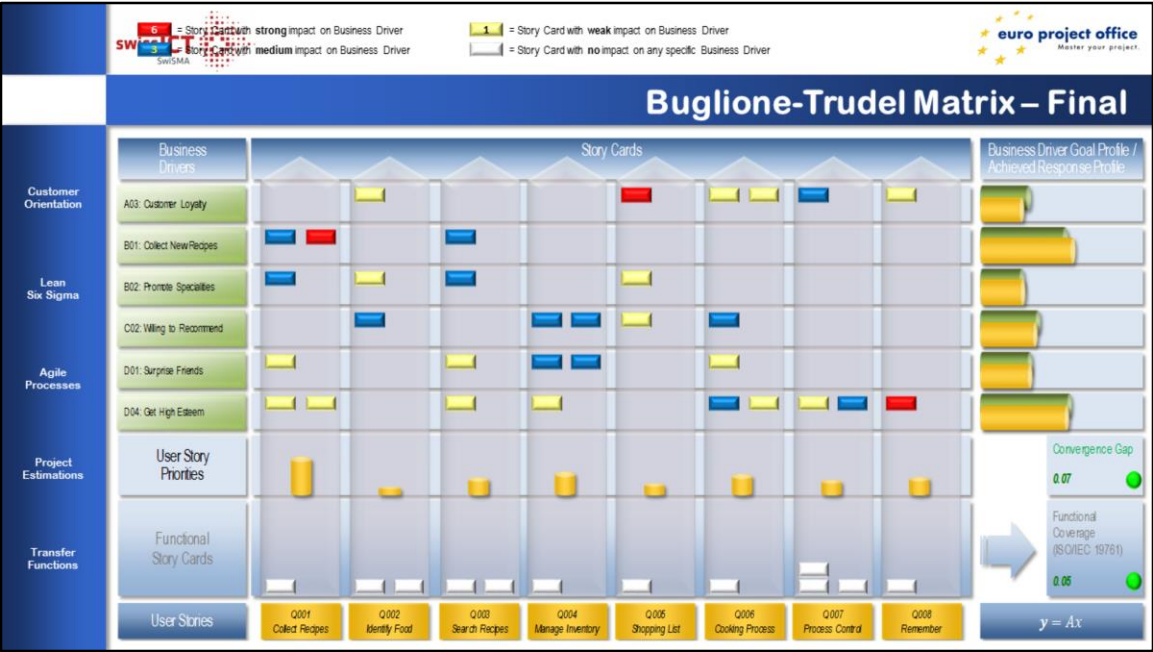
- Functional Processes needed to execute the App; here two of them.
- Device Users using the App; here the interactive device, the holder of the smartphone, and its GPS device.
- Persistent Data resides on the smartphone.
- Other Applications behave as any other device users; however, they might reside on some other system or service.

Note that Androids and iOS phones need an external GIS Application, Google Maps, to interpret GPS coordinates delivered by the phone. The Ticket Shop application is always external. The phone’s system clock synchronizes with local train times and thus is also considered an (external) application.

All other applications are assumed to be operational and already tested; not part of the game.

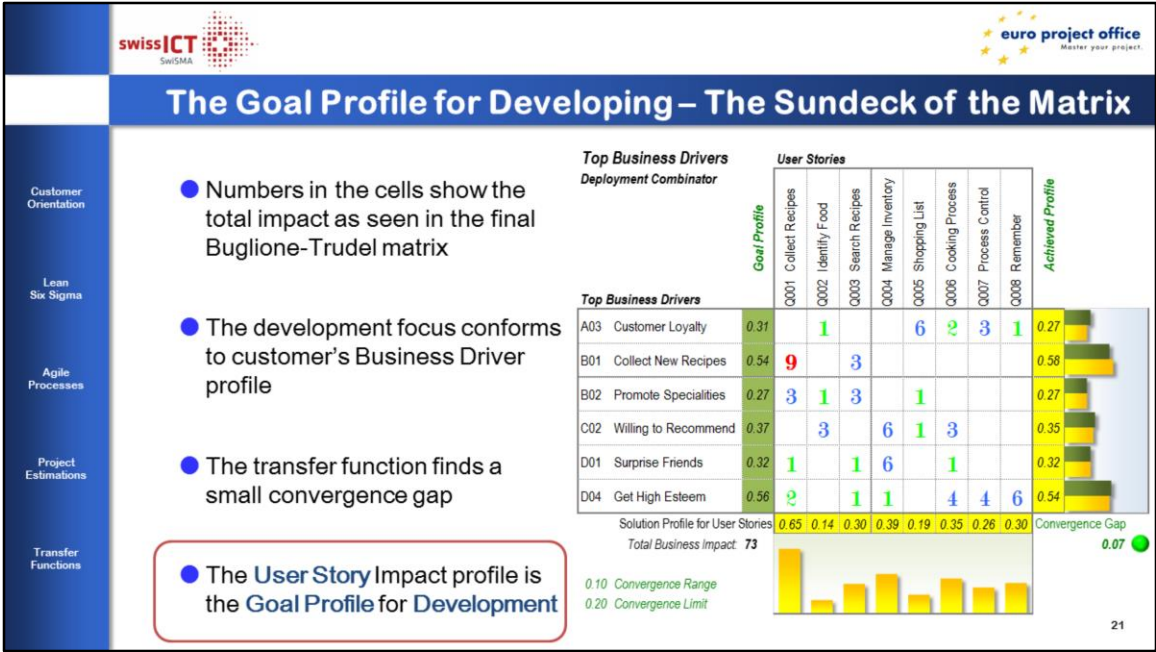


Not quite. The *Buglione-Trudel* matrix shows each story card with regard of its impact on the Business Drivers; calculating the transfer function shows a mismatch between the goal profile and the achieved response profile.



Yes, two of them already do the job:

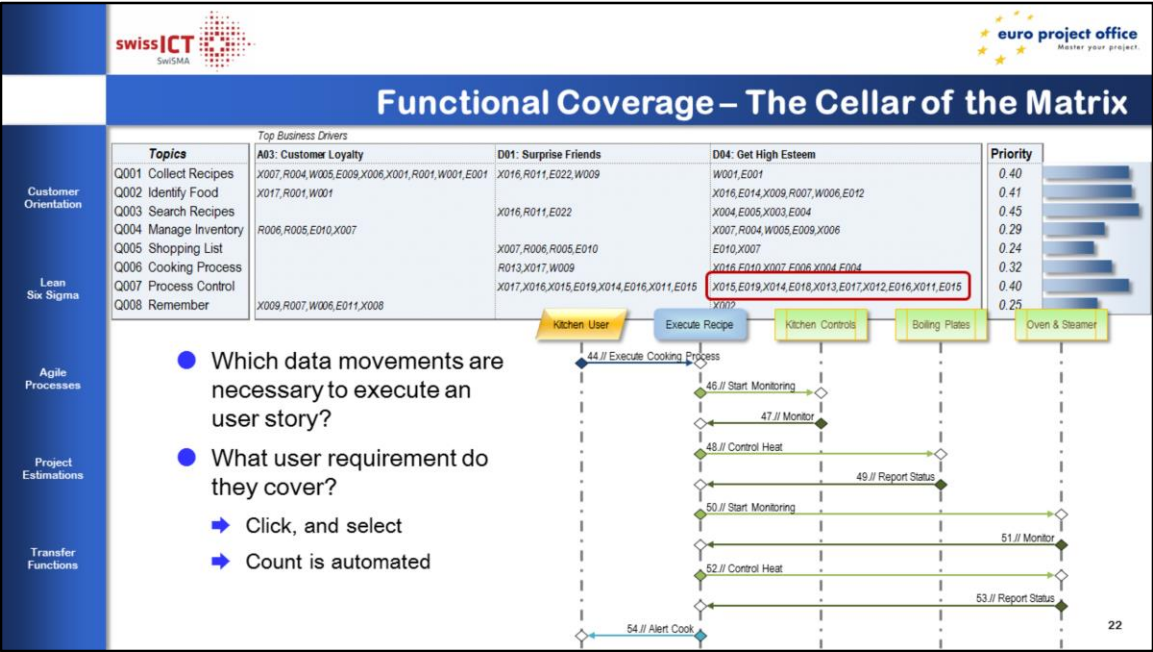
- Add promotions to the product to drive the creation and distributions of new recipes over suitable channels
- Support the ability to perform of kitchen users. This might induce additional functionality later (e.g., rating ability by adding a kitchen game); however, it's already within project scope, and thus cost.



The Excel graphics shows the calculation of the transfer function mapping user stories to business impact.

The impact is represents the non-functional requirements of the users and stakeholders.





● Which data movements are necessary to execute an user story?

● What user requirement do they cover?

➔ Click, and select

➔ Count is automated

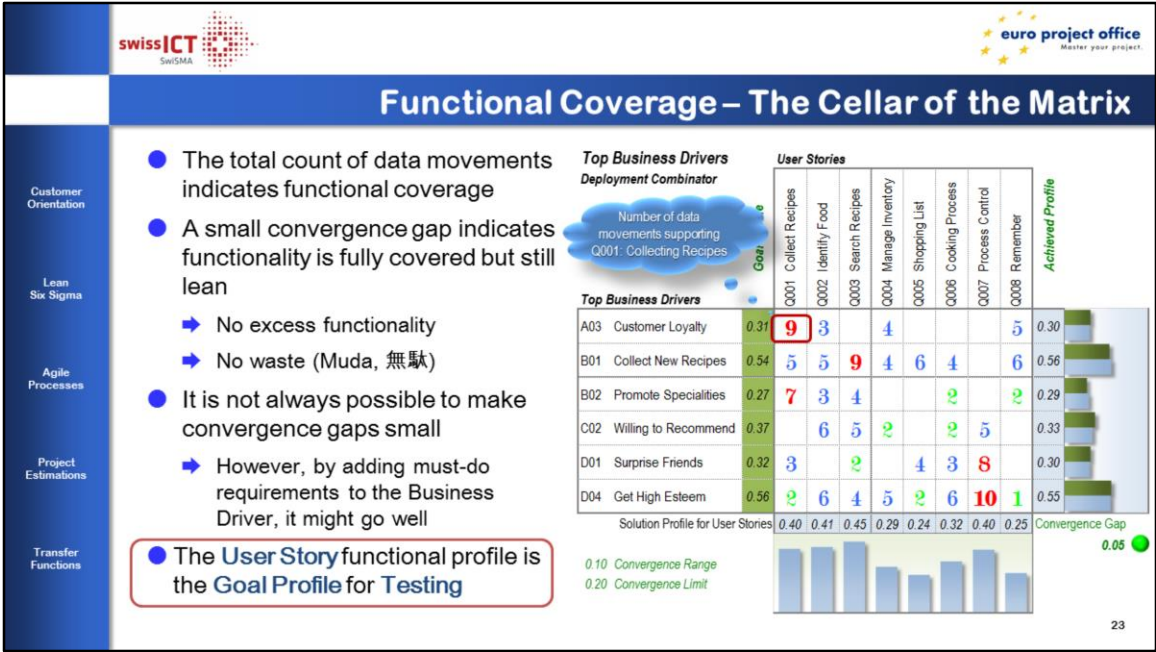
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Functional coverage is countable thanks to taking data movements as basic units for functionality. No code is needed.


As any measurement, it's measuring exactly one aspect, in this case data movements. It is clear that there are many other aspects of software that deserve being measured if possible. It's like you say: "the road to Bern is 122 km long" but you don't specify neither anything about road capacity, traffic jams, or else.

Another question might be whether functionality must meet Business Drivers. You might decide to meet other needs as well, such as what developers deem essential and desirable; however, when doing an App for customers of public transportation service, it might be worth asking for functional coverage of their needs, and not add functionality that they don't value. This concept stands at the origin of agile software development and is largely accountable for its big success.






The transfer function mapping data movements to business drivers assess the functional completeness of the implementation. Functionality might be needed for other reasons than business impact, and usually the functional profile is different from the impact profile.




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Findings from this Case Study

Customer Orientation  
  
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 Transfer Functions

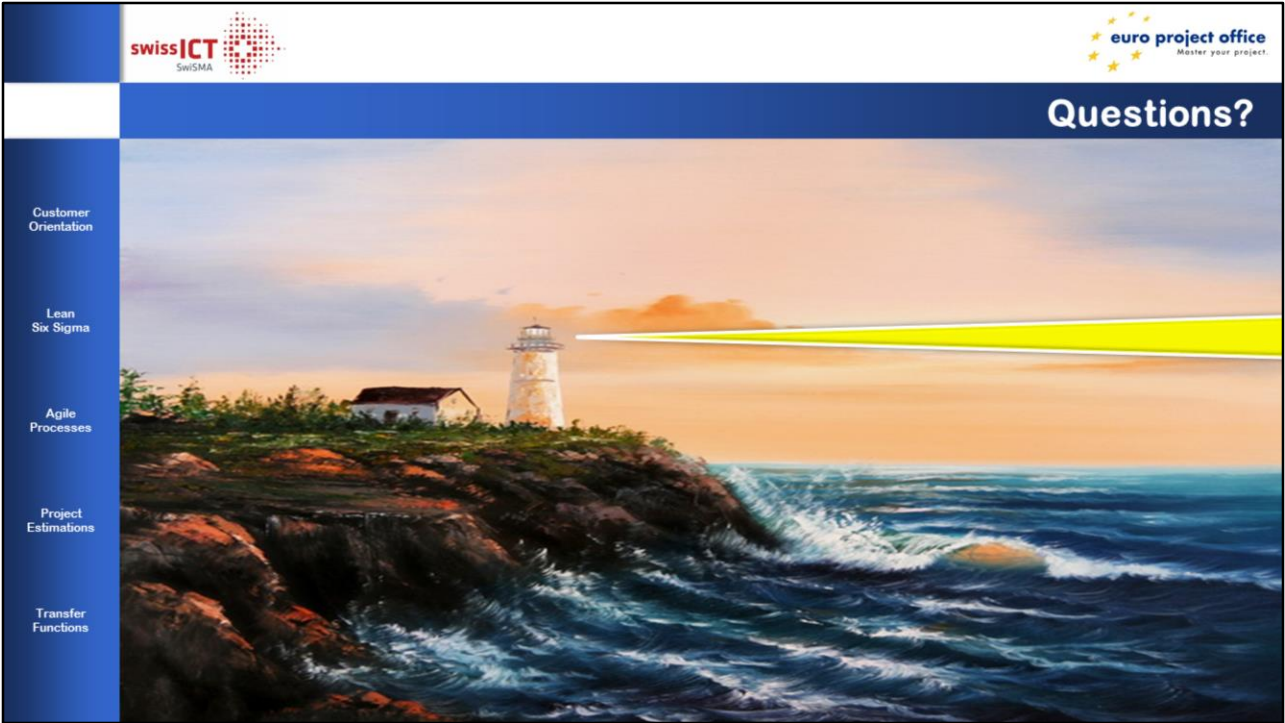


- **Lean** means managing the scope of the project to meet stakeholder's expectations
  - And never more than that!
  - Not producing any 無駄 – muda, waste!
- **Agile** Scope Management is bottom-up
  - In Agile, *User Stories* define the project scope
  - In Lean, focus on Business Drivers limit scope creep
  - Lean & Agile works from the start as well as for all changes
- **Lean & Agile** product development orientates itself towards the end customer
  - Stakeholder's needs are important as well
  - It all depends whether you can profile the product development targets

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The small example we've shown here is for demo purposes only – it's not complete or proven to be feasible and only comprises some 60 FP (ISO/IEC 19761) – possibly not a realistic figure for an IoT application.



The author has published quite a bit on the subject together with Eberhard Kranich in Duisburg – e.g., in QFD symposia, at SW metrics conferences like MetriKon or IWSM / Mensura; also at Lean Six Sigma Conference Glasgow, Strathclyde and in Zurich.

Currently, there is a book in the works: "Managing Complexity"