Modelli per la misura del software. Parte III.

Using MMLC in practice: Quoting from experiences.

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Application Domain

The MMLC, as proposed in the previous slides, has been applied as MM production tool within a technology transfer pilot project, aiming at investigating the BPR–ability, Business Processes Reengineering-ability, of a class of administrative organizations, namely the *Public Administration*, (PA).

Development Context and People Involved

The project was devised at the University of Roma Tor Vergata, Italy, in the second part of ‘90s, when each PA organization usually was still including an internal data-processing unit.

The project involved personnel of the target organizations in the whole software process, and was specified by *Use cases*. However, higher level managers did not participated.

Goal

Those target organizations constitute a set of loosely coupled administrative organizations (e.g. Ministries) and (are assumed to) share a common goal:

- To *improve* the business processes by including computer-based process-technologies, *without* modifying, at least in the short term, the personnel and processes structure in-place.

Alternative Solution Hypotheses

In order to achieve the given goal, we took into account both a:

- Radical BPR approach, and an
- Evolutionary BPR approach.

(formulation of the goal-oriented SHs).

Quoting from Experience
Solution Hypotheses

The former SHs was excluded because of the explicitly stated constraints of respecting the structure of the processes and the corresponding roles.

Hence, the business system was investigated according to an *evolutionary BPR approach*, and, ultimately, a *workflow automation approach* was applied.

Workflow Automation

In the very end of ‘90s, Workflow Automation (WA) was an expanding new technology, with a multitude of advertised supporting tools, but lacking of methods, techniques, reusable knowledge and products.

What WA development technology for those goals?

The choice of the WA development technology most adequate to the organization's goals became therefore the issue to address.
In other words, once identified the set of available technologies, the problem was to *select the most suitable one*.

What WA development technology for those goals?

For such a purpose, we decided to produce a goal-, and application-domain, -based Measurement Model (MM), i.e.: a technology MM able to express the *attitude of a given WA-development technology* to support the organizational goals.

Reducing the number of technologies to cope with

The idea was to construct an MM so that once

- Built the Awareness technology set by browsing the technology domain,

to apply that MM to:

- Filter the Candidate technologies (i.e. situating technologies), and then
- Select the Treatments (i.e., technologies worth to be empirically evaluated in a systematic way).

High-level goal of the target organization

Goal Structure	Goal Facet
Object of Study:	Business processes
Purpose:	Improve
Quality Focus:	Performance (reliability, responsiveness, process transparency, and data privacy) and control
Viewpoint:	External customers (collaborating organizations, coordinated agencies, and citizens) and Internal customers (managers, employees)
Context:	Organization (without modifying the structure of the processes in place, or the hierarchical structure of the involved roles)

Subordinate Project Goals

The main goal led to various subordinate goals and/or constraints. Some were strictly related to the project, such as:

- Introduce a WA environment suitable to be managed directly by the organization
- Reduce the training time
- Evaluate convenience of having internal development and maintenance.

Subordinate Long Term Improvement Goals

Others subordinate goals were more concerned with the long-term organization improvement, such as:

- Create a expertise on WA technology to be spread across similar organizations.

Strategic Mgt. Decision

In particular, (we assumed that) at a strategic management level, the decision was made of automating *only* a specific sector of one of the target organizations, e.g., *a division* of a Ministry, before drawing up the final plan.

What MM is needed?

The MM had therefore to combine the ability of capturing and formalizing the experience the organization was building up, with the suitability of operating as a selection tool.

Usability, reliability, and flexibility (ease of updating) were therefore among the *crucial requirements* that set off the Creation Phase of the needed MM.

MM Definition. MM Components

As the MMLC prescribes (MM Definition), the next steps concerned the definition of the MM components, i.e.:

- *Attribute properties* (e.g., the *Attitude has to be positive*),
- Technology model suitable to capture the *capabilities of the WA development system relevant for evaluating its attitude in supporting the organizational goals*, and
- function mapping.

MM Definition. MM Components

In particular, in order to identify and classify the relevant technology capabilities, the concept of technology management was refined and tailored to the specific class of organizations, and the application domain (i.e., the business system within which the WA system had to be applied) was carefully analyzed, from the goal's perspective.

Some examples follow.

Example of Influential Capabilities

- Organization management: dealing with organization charts, roles etc.
- Process management: representing the process state, cost, deadline and delays, the periodic activities, the exceptions, etc.
- Product management: handling aspects such as document-versioning, -filing, -queuing, etc.
- Technology management: coping with models, languages, results, learning-time, etc. of a technology.

% Detecting Influential Capabilities

Others examples of influential capabilities are:

- Process transparency
- Data privacy
- Personnel and team management (e.g., process-ownership, workload, etc.)
- Learnability
- Trainability
- Usability (user interfaces, on-line help, etc.).

Developing a Technology Model

In order *to produce a structured technology model*, once recognized, the influential capabilities were organized into a

Goal-oriented and Capability-based Technology-Tree (TT).

Technology Tree (TT)

In a TT nodes represent technology capabilities, and edges represent decomposition relationships. In particular:

- The **`root`** represents the *main capability* (i.e. the attribute attitude).
- **`Edges`** are ordered couples of nodes that represent *decomposition relationships* between capabilities.
- A **`non-leaf node`** represents a *compound capability*, which is decomposed into more capabilities (i.e. it is root of a (sub) technology tree).
- A **`leaf node`** represents an *elementary capability*, i.e. a capability that the organization is no further interested to breakdown, or that can not be decomposed within the current iteration of the modeling process.

Developing a Technology Tree

- A TT can be developed by a *stepwise refinement process*, including improvement cycles, and provides us with the sought flexibility.
- Once the main attribute has been decomposed, i.e. after the first breakdown step, each new node can be further refined.
- A TT can be stored for future improvement and reuse.

Refinement Level of a TT

When to exit refining?

The refinement level to reach depends on the specific interest of the organization, the available knowledge, and the ability or choices of the MM engineers. Hence, the derived model will result as more refined and improved as more knowledge is gained about the goals and other needs of the organization, the application domain, and eventually the investigated technology.

Weights in a TT

In a TT, each node can be weighted, **`Weight (node)`**, to represent the relative importance the organization assigns to capabilities for what the goal is concerned, so having a weighted TT.

A weighted TT will allow an organization to formalize and quantify the relevance of the technology capabilities and their relationships in achieving the set goal.

Scores in a TT

Eventually, nodes of a TT can be scored, **`Score (node)`**, to represent at what extend a *desired*, *expected*, or *actual* technology includes the associated capability.

So, at the end of the process, it will result into a weighted and scored TT.

Scales in a Technology Tree

Different kind scales can be adopted for weights and scores, depending on the reference standards, desired precision, and available knowledge.
In particular, the scales we used included the following real Ratio scales:

- Weights, in the range [0.0 – 1.0];
- Scores, in the range [0.0 – maxfloat].

A Measurement Model for the **Attitude** (of a Technology to support given organizational goals in the form of TT), **A(TT)**

$$A\ (TT) = \Sigma_{(J=1..L)}\ Weight\ (J) * Score\ (J)$$

Testing the MM

After an initial formal validation, the described MM was experimentally tested (*Acceptance*).

In particular, an experiment, based on the development of multiple synthetic processes [18], was performed to verify that the order established among the technologies by the MM was empirically valid.

Testing the MM

Then, the technology that eventually obtained both the best measurement and experimental ratios was used to develop a *pilot project*.
Again, experimental results provided empirical support to the MM.

Testing the MM

Finally, it is worth noting that the suggested Technology-Tree can be exploited to analyze, investigate, and measure more specific technology main attributes (e.g. benefits, costs, features, performance, etc.), and eventually the value of a technology (e.g. in terms of benefit to cost ratio).

Testing the MM

A TT can, in fact, be easily modified to add new capabilities, remove pre-existent ones, or express new needs, for example, to mirror new goals or new application contexts.

In addition, more mapping functions can be defined over the same TT, or parts of it, to obtain different MMs.