# Lessons Learned on the use of *i\** by Non-Technical Users

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**Abstract.** Enterprise Architecting activities, particularly the mapping from business strategies to information systems architectures, are time-consuming activities usually conducted by relatively large teams, composed of groups of non-technical stakeholders playing mostly an informative role, led by few experienced technical consultants performing most of the documenting and modelling effort. Lately, several works have been reported that propose and use *i\** to support these modelling activities. In spite of this increasing adoption and experiences in different domains, there exists little work in relation to the practical use of *i\** by non-technical stakeholders and the ability that the notation may provide them to become more proactive in system modelling activities. We present here 10 lessons learned in a study conducted in an Ecuadorian University to gain empirical evidence in relation to the use of *i\** by non-technical stakeholders.

## 1 Introduction

Modern enterprises largely rely on information systems specifically designed to manage the continuously increasing complexity of interactions with their context. Enterprise Architecture (EA) [1] is an increasingly adopted concept which encompasses several levels of architectural design, which requires deep understanding of the enterprise context and strategies. Early phases of the enterprise architecting process are usually oriented to model the enterprise context, which helps understanding the purpose of enterprises on their environment, e.g. what is required from them, thus assisting enterprise decision-makers to design and refine their business strategies and enterprise architects to understand what will be required from the resulting socio-technical system. However, far from easy, the construction of such models is usually a cumbersome task, mainly due to communicational gaps among technical personnel (e.g. internal or external consultants) with limited knowledge of enterprise structure, operations and strategy, and their administrative counterparts imposing pressure and time constraints to the process. Because of this, the role of non-technical stakeholders, instead of being proactive, is mostly constrained to a merely informative role.

In order to deal with these problems, in the last few years we have intensively used the *i\** notation to bridge the gap among technical consultants and non-technical stakeholders [2] and proposed the DHARMA method [3] for discovering business architectures departing from the construction of Context Models (CM) expressed in *i\**. CMs are interactively built with the participation of non-technical stakeholders, who often

sketch drafts of the models without the intervention of technical consultants. Our experiences in these works provided important evidence pointing to *i\** as a valuable framework to be used by non-technical stakeholders, and more proactively help technical consultants achieve their requirements and architecting objectives. To validate this observation, we planned and conducted an empirical validation case, in which we intended to measure the ability of non-technical stakeholders to learn and use the *i\** notation in an industrial setting. We report here the lessons learned in this project.

## 2 Related Work

There exists little work in relation to *i\** usability analysis, particularly in cases involving non-technical stakeholders. We may mention [4] which focuses on *i\** visual syntaxes and semantic transparency. However, that work intends to improve *i\** symbols in relation to several dimensions including semiotic clarity, perceptual discrimination, complexity management and visual expressiveness among other, more than a direct observation on the real usage. Other works [5, 6] focus on guidelines to simplify, conduct and improve the process of drawing *i\** diagrams.

Our intention in this case study is different: to evaluate the capacity of non-technical stakeholders to quickly grasp the main concepts included in the framework, their capacity to assimilate them and produce models of enough quality, when the DHARMA method is adopted.

## 3 Empirical Evaluation with Non-Technical Users

The industrial case study was conducted in a private medium size (10.000 students) Ecuadorian university. We were hired to act as consultants in the reengineering of the systems architecture, in which we used DHARMA as a preliminary step for defining an IT strategic plan and identifying a project portfolio. This portfolio encompassed IT projects of different nature (software acquisition, technology platform modernization and IT processes definition among other). After the needed initial preparation, the first activity conducted, as proposed in the DHARMA method, was the construction of the *i\**-based CM. The CM construction was performed with the contribution of 13 Organizational Areas (OA): Faculties, Graduate School, Professional/Continuing Education, Research Deanship, Financial Direction, Treasury, Human Resources, Students Welfare, Legal Department, Communications Department, Libraries and External Relations Department.

## 4 Lessons Learned

**Lesson 1: Provide balanced training on the graphical framework.**

***Discussion:*** Non-technical stakeholders had no previous training on the graphical framework or the notations to be used. Therefore, they were not aware of their utility and objectives. On the one hand, without basic training they would not have been able

to participate actively in the process. On the other hand, we did not want to train non-technical stakeholders to become experts; this could be a time-consuming and costly process, struggling against their particular interests and objectives, with no clear return on investment and thus, increasing the risk of the process.

*Our approach:* We surveyed participants and identified an average of 8 hours as maximum time to be spent on training. We designed a 4-session seminar, each session 2 hours long. In the first sessions we socialized the project and its objectives and taught participants about strategic planning in technology and hybrid systems architecture [3]. In Session 3, participants were introduced to *i** basic concepts for modeling SD diagrams and the DHARMA method: actors, dependencies, dependency directions and dependency types (goal, soft-goal, task and resource) were discussed and several examples were provided; open discussion among participants was and encouraged at all times. In the last session, examples of application of the DHARMA method for construction of *i** SD models where provided.

### Lesson 2: Provide a roadmap to perform the work

*Discussion:* Even after training, modelling activities and their objectives can be fuzzy to non-technical participants. In addition, because of lack of experience, they will not have notion of time spans or deliverables to be produced as result of each activity.

*Our approach:* We provided participants with a detailed schedule containing the work breakdown structure (WBS), including main modelling activities, their task decomposition, time assigned for their fulfilment and deliverables to be produced. Task decomposition was fine-grained, so models were completed in several steps. For instance, for the first activity, we identified the tasks listed in Table 1. Each task was assigned 2 to 8 hours, but the full activity was scheduled to be completed in a week.

***Table 1.** Excerpt of WBS proposed for first modelling activity for one of the OA.*

| Task | Description | Duration | Starts | Ends | Work Product |
|---|---|---|---|---|---|
| 2.2 | Construct first CM of the OA | 1w | 04-jun-13 | 08-jun-13 | 1st. Version of CMs from OA view |
| 2.2.1 | Environmental actors identification | 4h | 04-jun-13 | 05-jun-13 | List of environmental actors |
| 2.2.2 | Goals identification | 8h | 05-jun-13 | 07-jun-13 | CMs including only goals |
| 2.2.3 | Resources identification | 2h | 06-jun-13 | 07-jun-13 | Enriched CMs including resources related to goals |
| 2.2.4 | Soft-goals and tasks identification | 4h | 06-jun-13 | 07-jun-13 | Enriched CMs including soft-goals and tasks |
| 2.2.5 | Review and consolidation | 4h | 07-jun-13 | 08-jun-13 | 1st. Version of CMs from OA view |

### Lesson 3: Provide guidelines to improve quality

*Discussion:* Since participants were non-technical, they tend to do their best effort and justify poor quality of results based on that fact. Techniques shall be provided to participant to improve quality of their work products.

*Our approach:* For most well-known graphical frameworks there exist several best practices documented, as well as tacit knowledge emerging from consultants' own experience, which can be transferred to non-technical participants. Starting from the first day of seminar, we introduced participants to recommended best practices and encouraged to use them at all times. We issued recommendations referent to: methodology (e.g., consider only one actor in the environment of the OA at a time; do not consider dependencies among environmental actors –not relevant for the modeling of the organization; use pattern from [6]); conduction (e.g., draw models by hand was

allowed; use tables instead of graphical models was allowed); notational (e.g., the guidelines listed in [7] were also provided).

**Lesson 4: Help users to manage size**

*Discussion:* A common setback shared by most graphical modelling notations is the difficulty to manage drawing when models scale up. Advice shall be provided to non-technical participants to avoid over-scaling their models, and facilitate their handling.

*Our approach:* Fragmenting models in smaller packs or transforming them to tabular representations are good strategies to manage size. Guidelines such as the provided in Lesson 3, proved to be particularly good for this purpose. Although some of them may impede users from viewing the whole picture, fact is that whole models may have a similar effect because of size and number of elements to be considered at a time. It is also a fact that these guidelines help participants to focus their attention in one problem at a time improving quality of work product.

**Lesson 5: Avoid the use of specialized tools.**

*Discussion:* Mastering the use of specialized modelling software can be a time consuming and rewardless activity, particularly in cases where users may never use the tools again. In addition this can unnecessarily increase project time span and costs.

*Our approach:* We lead non-technical participants to create their own models without providing training or biasing them towards the use of any particular tool. Of course this approach produces several hand-drawn CMs, all with different notations, but intentional elements are easy to recognize and time spent by participants on drawing activities is significantly reduced. This leads participants to focus in more relevant issues such as, the identification of dependencies or their intentionality.

**Lesson 6: Do not over-constrain user's imagination.**

*Discussion:* Overtraining non-technical users or excessive guidelines may constraint their thoughts, leading them to skip aspects that can be very relevant for the process.

*Our approach:* We value free thinking of non-technical participants so we try to provide just conceptual training and basic guidelines. In some cases this may lead to significant contributions, both for the process and the methods used to support it. For instance, when we asked participants to identify environmental actors, we meant actors in the external context of the organization. However, when creating the CMs from the perspective of their own OA, non-technical participants also identified other OA as actors on their context and dependencies among them, which represent internal process activities. As a result, systems functionality will support needs for both external and internal actors'.

**Lesson 7: Do not expect excellence in the use of framework elements.**

*Discussion:* As mentioned in Lesson 1, non-technical participants' lack of experience and training required to master graphical notations. Therefore is it quite normal for their CMs, to contain several flaws.

*Our approach:* As mentioned earlier, we led non-technical participants to draw freely. Resulting models have to be reviewed by consultants anyway, and eventually be transferred to specialized tools. Even if the number of mistakes is high, experience

shows that corrections required, are very simple to achieve. Usually requires changing dependencies directions, their type or the verbal tense in some descriptions. For the tabular form we use Excel sheets and dropdown lists which largely simplify this process.

**Lesson 8: Review continuously and provide feedback.**

*Discussion:* Regardless of basic training, roadmaps and guidelines, non-technical participants will require continuous but decreasing feedback in relation to their intermediate and final work products.

***Our approach:*** During the process we scheduled review meetings in various milestones. In particular, we scheduled two hour review meetings with each OA, after the tasks of the first modelling activities (see Table 1) where concluded. An additional week was given to participants in order to refine their models, considering the provided feedback.

**Lesson 9: Plan for validation activities.**

*Discussion:* Analyzing i* graphical models is not an easy task. On the one hand models are not enforced by any prescriptive method; they are greatly built based on modelers' point on view and perception. On the other hand, as they scale up, the number of graphical elements can become very large making the process very hard to manage. In cases like the one described in this paper the problem is even worst: 13 models were built by the different OAs simultaneously, which included common elements which had to be identified and mapped.

***Our approach:*** To facilitate the process, we started by identifying the elements of the notation and their attributes to be validated. In addition to actors, we considered dependencies the central element for the validation process, and their type, direction and description the attributes to be validated. To simplify the analysis process, we conducted the following activities for each of the resulting OA's CM:

- CMs were transcribed from original handmade drawings delivered by non-technical stakeholders to their tabular representation by the consultants.
- Identified environmental actors were categorized as actors in the context of the organization (ECA) and actors that represent OAs, when they appear as part of the CM of other OA (ICA), and assigned an identification code.
- Additional columns were used to state the correct type, direction and description, of each of the dependencies included by non-technical stakeholders in their CMs, after a careful analysis.
- Finally, consultants added rows to include important dependencies missed by non-technical stakeholders in their CMs.

After the review process was completed, workshops with each of the OAs were conducted in order to validate that the interpretation of consultants.

**Lesson 10: Be aware of consolidation activities**

*Discussion:* Many empirical studies will require several i* models to be constructed and later consolidated into a final model, encompassing all of the elements included in individual ones. Far from easy, this activity could become one of the most difficult tasks to achieve in the empirical validation process.

*Our approach:* As mentioned earlier, in our case 13 CMs were constructed. In order to easy consolidation we first converted them to their tabular form, and merged them in an Excel sheet. Rows were sorted by actor, dependency type, direction and dependency description, using Excel's built-in sorting capacities. This eased the identification and eventually elimination of duplicated dependencies identified by more than one OA (including dependencies which were the same but had dissimilar description, type or direction). The final CM model after completing this process included 69 ECA grouped in 6 categories (identified according to the CRM pattern we presented in [8]), 53 ICA grouped in 5 categories and 1124 dependencies, 569 connecting the organization with some ECA and 555 connecting the organization with some ICA.

## 5    Concluding Remarks

Conducting empirical studies involving graphical notations is not an easy task. Many problems emerge from the nature of the notations themselves and also from their use by participants, particularly in cases where they do not have training in the required graphical notations. These aspects make this kind of study specially challenging.

In this paper we have identified some problems emerging from this type of studies and presented lessons that were learned in an empirical case study conducted in an industrial process in which we acted as consultants. Other lessons, e.g. related to the practical semantics of *i** constructs [9] or about granularity of goals and tasks, have not been reported by lack of space. The case study was finally successful, and although this does not necessarily mean a cause-effect relationship, there was an agreement that the actions described in this paper were fundamental for its positive conclusion.

## 6    References

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