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Abstract

The METRICS framework emerged in 2006 to help manage the social subsystem of customer teams (CuTes) as they engage with external technology and business teams (XTeams) in ERP projects. The framework was first validated in a landmark ERP implementation in Southern Brazil. Our research contributes to the validation and application of METRICS by reporting a study developed in 2011 in a different geographical, cultural and economic region: the Brazilian Northeast. Data collection was based on personal constructs theory and the repertory grid technique – both not included in the first METRICS validation. With 68 out of 88 measures verified empirically, 77.3% of the framework was supported by key ERP informants in the Northeast, what suggests the general validity of the framework across time, regions and empirical methods.

Keywords

Team Performance, ERP Implementation, Regional Differences, Cognitive Psychology, Repertory Grid

1. Introduction

The ERP implementations literature describes the importance of the technical and the social perspectives in IS implementation (Alvarez, 2008; Akgün, Dayan & Di Benedetto, 2007; Momoh, Roy & Shehab, 2010; Osei-Bryson et al., 2008). But even in research that includes both perspectives, the focus is usually put on the external business and technology experts' (XTeam's) performance, thus almost completely ignoring the importance of their counterpart to the implementation success – the customer team (Bellini, Pereira & Becker, 2012). It is the customer team (CuTe) that actually knows the organization that buys the system, that defines its main business requirements (Akgün et al., 2007), that receives technology training (Osei-Bryson et al., 2008) and that can certify if a solution is effective in light of a given problematic situation (Checkland, 1985).

Bellini (2006) developed a framework called METRICS (*model for eliciting team resources and improving competence structures*) to support the processes of planning, controlling, evaluating and recording CuTe performance in customized information systems software (CISS) projects. The framework was developed and validated from 2002 to 2006 in a case

study with analysts, developers and lead users of a landmark ERP implementation in Southern Brazil.

We aim to contribute to the validation and application of METRICS in light of different methodological procedures and empirical environments, thus addressing triangulation between the two researches (the original and ours). The new validation takes as inputs the systems of individual constructs, that is, the cognitive maps or idiographic cartography (Fransella, Bell & Bannister, 2004) of professionals who deal with METRICS issues in their daily work routines, and a cultural and industry setting very distinct from the original. We address the following research question: *What are the differences in perception about CuTe management in CISS projects between IT professionals in Southern and Northeastern Brazil?*

2. Theoretical Background

METRICS is a socially oriented framework formed by 88 measures that are arranged in 27 metrics and seven indicators addressing the cognitive and behavioral traits and the formal and informal relationships of IT workers. The indicators are expected to support the management of customized information systems software (CISS) implementation from a supplier and a customer organization's perspective, with a particular focus on managing in-house professionals who share responsibility and authority in CISS projects. Those professionals meet in customer teams (CuTes) to work with external solution providers – the business and technology experts (XTeams). METRICS contributes to software engineering and organizational theory as it deals with managing CuTes (instead of XTeams, as usual) from the standpoint of the social factors that impact work design and performance (Bellini, 2006; Bellini et al., 2012).

Table 1 shows the name and code of METRICS indicators and metrics, as well as the amount of measures in each metric (for a complete description, please see Bellini, 2006).

Indicator	Metrics	Measures (Qty.)
Adhocratic/organic design (1)	organizational fit (1.1); task interdependence (1.2); goal conflict (1.3); formality & knowledge sharing (1.4); cooperativeness (1.5.); genuine participation & autonomy (1.6)	21
Eligibility (2)	personality (2.1); trustworthiness (2.2); innovativeness & entrepreneurship (2.3); expertise & transactive memory (2.4)	17
Risk-averse attitude & social integration (3)	strategic enrollment (3.1); role cherishing (3.2); system championing (3.3)	14
Self-preservation (4)	goal incongruence (4.1); psychological self-justification (4.2); social self-justification (4.3); sunk cost effect (4.4); completion effect (4.5)	11
Transaction cost management (5)	contractual relationship (5.1); relationship monitoring (5.2); opportunism & information asymmetry (5.3)	11
Interpersonal effectiveness (6)	organizational proxy (6.1); collaborative elaboration (6.2); customer learning (6.3); customer communication & leadership (6.4)	20
Prospect (7)	cooperative interdependence (7.1); partnership propensity (7.2)	09

Table 1: METRICS indicators, metrics and measures

2.1 Brazil and Regional Differences

As the fifth largest country in the world, Brazil's 26 political states and five geographical regions are naturally rich in geographic diversity, ethnicities, religions, political frames of mind, traditions and values (De Holanda, 1995; Motta & Caldas, 1997). The Brazilian culture comes from the mix of races and the influence of immigrants, what accounts for some significant regional differences (De Holanda, 1995). Those differences are an important factor when analyzing countries, regions or communities (Hofstede, 2008). Differences in Brazilian companies and people are found in aspects such as management practices (Pedroso, Massukado-Nakatani & Mussi, 2009), education (Saboia & Kubrusly, 2008), employment and income distribution (Kubrusly, 2011), innovation capacity (Rocha & Dufloth, 2009) and the economy in general (Penna & Linhares, 2009).

Management styles move between meritocracy and personalism. In the first case, the search for efficiency and other business criteria is the rule, while in the other case personal interests have a stake in organizational behavior (Pedroso et al., 2009). It is widely believed that meritocracy is more common in the South, and this may be related to the levels of professionalism achieved by Southern businesses.

As of general literacy of the population and qualified workers, there are significant differences as well, with the Northeast Region positioning at the lower end of the rank (Saboia & Kubrusly, 2008). And regarding the occupancy rates and monthly incomes of the agent population, figures are similar: Kubrusly (2011) uses data from a National Household Sample Survey (PNAD/IBGE, 2007) that shows four South and Southeast states as the biggest employers – each of them accounting for more than 5% of the country's population –, and those states also pay well above the national average.

Innovation capacity is another example of regional differences. Although Southeast states lead in indicators such as the occupancy rate of the population, income generation and technology absorption, they do not have a similar performance when it comes to the breadth of technological innovation (the proportion of innovative companies in relation to the industry), staying behind the Northeast, the North and the South (Rocha & Dufloth, 2009).

Traditions and habits are another interesting dimension that is expected to influence one's frame of mind and behavior. Ethnic diversity and how colonization and land occupation took place greatly influenced the Brazilian way of life, giving birth to phenomena such as the duo *apadrinhamento* and *clientelismo* (benefits granted to someone or a group by a powerful individual known as the "godfather"), *coronelismo* (an informal but effective political practice resulting from the creation of the republican system along with the decay of farm owners, in which power is concentrated in oligarchies), informality in interpersonal behavior, and the primacy of habits and customs over rules (the "Iberian personalism"). Those attributes of the Brazilian culture are more evident in regions like the Northeast (De Holanda, 1995; DaMatta, 1979).

This brief background enables us to anticipate differences in perception about CuTe management priorities in CISS projects by Brazilian professionals according to the region where they live. In particular, our research assumes that significant differences may exist between the South and the Northeast, as they very often occupy opposite positions in most country indicators.

2.2 Personal Constructs and Repertory Grid

Alternative constructivism, or George Kelly's (1955) vision that gave rise to *personal constructs theory*, advocates that each individual develops his/her frames of mind and constructs from a particular perspective about reality. Even if there is only one single reality, nothing prevents it from being perceived differently by each individual; in other words, there are alternative constructs for the same phenomenon. Some constructions serve better than others, that is, one's constructs about the same aspect of reality can be better than another's, thus justifying the replacement of the latter by the former.

Repertory grid is a technique developed by Kelly (1955) that allows the researcher to get a view of the world from the "lenses" of the constructs of another individual by means of in-depth interviews (Hardison & Neimeyer, 2007). A grid has four components: a topic, elements, constructs and ratings about the last two components, with measurements being based on a respondent's own judgment.

The *topic* defines the conversation's scope – the subject on which the respondent will manifest his/her perceptions –, and an *element* is an example, an instance, a sample or an occurrence of a particular topic (Jankowicz, 2004). Elements are systematically compared to one another in order to reveal an individual's *constructs* from his/her manifest preferences. A construct is the basic unit of analysis in a grid. People interpret the world through constructs, and *to interpret* means to make sense of what is of interest in terms of a very personal perspective. A construct conveys a contrast (Kelly, 1955), but not necessarily an opposition (Jankowicz, 2004). For instance, we do not know what "a nice guy" means up to the moment we are aware of known alternatives, such as the contrasting phrase "rude guy".

Finally, the *rating* (Jankowicz, 2004) is the established connection between each construct and each element. This is what allows the accurate identification of the adoption of elements and constructs by an individual. The rating of each construct in each element in a grid provides a mental map of how an individual thinks about, gives meaning to and interpret the topic of interest (Fransella et al., 2004).

3. Methodology

Exploratory procedures supported by in-depth interviews initially addressed the cognitive maps of IT professionals working in the Northeast. The professionals were selected on the basis of historical professional achievements (Palvia, Mao, Salam & Soliman, 2003) and worked in companies that implement CISS products. They were asked to consider as a topic a CISS implementation project developed for a customer also located in the Northeast. Thus, the research's cultural component was limited to the geographical location defined by each tuple of the form *(IT professional's homebase, XTeam's headquarters, CuTe's headquarters)*. Technology clusters located in the states of Bahia, Pernambuco and Paraíba were contacted in order to identify CISS companies that have been contracted by Northeastern ERP customer companies. Those states were selected due to the ranking of IT professionals with formal employment in the Brazilian software and services sector (Softex, 2009).

For the sample size, we looked for quality instead of a predefined amount of respondents, so that theoretical saturation was the target (Strauss & Corbin, 2008). Saturation in fact emerged during the 13th interview out of 16.

3.1 Data Analysis

Given that the research design includes data collection and analysis about several grids and corresponding audio recordings, content analysis was effected. Content analysis is a technique for the analisys of communications in an objective, systematic and quantitative way, or a set of techniques that intend to infer, from the researcher's perspective, about the content of messages and the knowledge therein, taking into account the context in which the messages are transmitted and received (Bardin, 1977).

The audio record of each interview was put into text. Each interview lasted on average 67 minutes, and the transcripts averaged 8.38 pages and 5,235 words each. The recording unit of analysis was made up of the sentences for each construct that expresses a respondent's values and intentions. The written text was divided into sentences that were codified into a table (TSen). A unique, sequential identifier (ID) was assigned to each TSen sentence, resulting in 4,829 sentences for all constructs. A table of classes (TNat) was also developed in order to classify each TSen sentence according to its class – the interviewee's perception on people as elements, and the interviewee's general concepts on the topic, examples, repetitions, emphasis, etc., that served to explain his/her understanding about the elicited construct. The sentences were classified according to TNat by the first author of this manuscript and by an external researcher invited to collaborate. TNat sentences were then validated through inter-rater analysis by means of *joint probability of agreement*, that is, the number of times the same nature was attributed by each researcher to each sentence, divided by the total number of sentences (Gwet, 2010). Total differences amounted 11.4% of the classifications from both raters, what is considered an acceptably valid inter-rater agreement (Uebersax, 1987).

The analysis of the sentences according to their nature allowed the construction of ladders (Reynolds & Gutman, 1988) that show the evocation process for each construct. Ladders were then adopted as a source for the categorization of constructs *vis-à-vis* METRICS measures, since TSen analysis enabled the extraction of relevant concepts and insights put together in the form of a ladder that led the interviewee from a generic idea to a more elaborate construct.

4. Results

There was convergence of personal constructs in 68 of the 88 original measures (77.3%), what means that there are important similarities and some differences in the perception of IT professionals in Southern and Northeastern Brazil about CuTe management priorities in CISS projects. Also, the most and least cited measures may be relevant for a prospective redesign of the METRICS framework if it is expected to account for the levels of interest in each measure. For instance, one may want to classify and deploy measures as they are considered critical measures, context-specific measures, and so on.

It is worth of note that measures mainly about the selection of CuTe individuals on the basis of their personal traits are of relevance, but there is no clear convergence of such measures to METRICS (Table 2).

Figure 1 shows that the respondents' answers converged to constructs mentioned before the 13th repertory grid application. This is coherent to previous cases reported in the literature (Napier et al., 2009).

Repertory Grid	ID	Construct
RG1	1	Proactivity praising.
	2	Allocation of an individual to a CuTe, particularly with regard to his/her ability to dedicate time and effort to the project. [RG3 and RG8 also mention this.]
	3	Deadlines that are met by CuTe individuals. [RG9 also mentions this.]
RG2	4	Trust development among CuTe individuals.
RG3	5	Motivation ability that leaders must have in regard to their team members.
	6	Transfer of knowledge developed in the project to the company's peers.
	7	Personal engagement towards knowledge development by means of formal education.
RG4	8	Synchronized integration of activities in the project.
RG5	9	Political influence suffered by people in decision positions. [RG9 also mentions this.]
	10	Awareness about the consequences on others from the activities that are performed.
	11	Realistic goal definition in terms of chronological, quantitative and qualitative criteria.
RG6	12	Enthusiasm about possible productivity improvements in one's work routines.
	13	Role and responsibility definitions by the customer company's manager.
RG7	14	Behavioral aspects directly observable that may impact CuTe performance, such as the commitment to the work agenda.
	15	Unpredicted additional costs due to the need to convince CuTe individuals about the benefits stemming from the CISS project, and rework from misspecifications and non-compliant tasks.
	16	Ability to exert positive influence on CuTe individuals about the project.
RG8	17	Ability to assimilate knowledge.
RG9	18	Previous knowledge by CuTe individuals about the contractual terms that will govern the XTeam-CuTe relationship throughout the CISS project.
RG10	19	Ability to establish communication channels between the XTeam and people in the customer company other than CuTe people.
RG16	20	Family ties between CuTe individuals and the owner of the customer company.

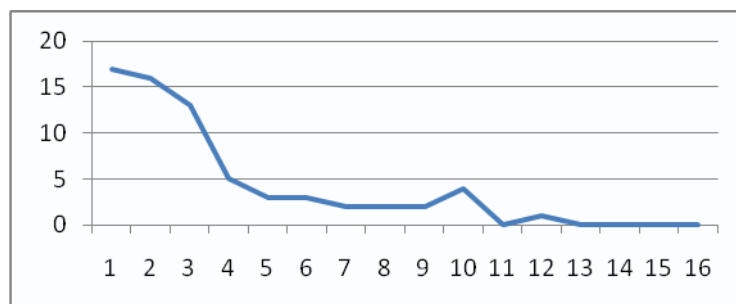**Table 2: Relevant constructs not included in METRICS**

Figure 1: Theoretical saturation

5 Discussion

Although not in their original formulation, most METRICS measures were verified in the cognitive maps of IT professionals working is CISS projects in Northeastern Brazil. With 68 measures found empirically, 77.3% of the original METRICS framework was supported by professional practice in ERP implementations in the states of Bahia, Pernambuco and Paraíba. Even if the original framework is too complex due to the very different cognitive, behavioral and structural factors involved, it is significant that all its key concepts were

mentioned to some degree in the interviews. We thus believe that METRICS is integral to the latent work requirements of Northeastern IT professionals.

However, there were differences in perception between professionals working in the South and the Northeast. For the IT professionals working in the Northeast that were interviewed, indicators such as self-preservation (#4) and transaction costs (#5) are less relevant than others, and five metrics were even not mentioned: genuine participation and autonomy (#1.6), social self-justification (#4.3), sunk cost effect (#4.4), completion effect (#4.5), and relationship monitoring (#5.2).

According to Bellini (2006, p. 92), metric *genuine participation and autonomy* describes "how authoritative each individual is in his/her role, that is, how control and operational information is expected to flow within the project." The level of genuine participation and autonomy is inferred from the measurement of (a) whether situations included in the individual's domain knowledge are immediately reported to him/her even if not included in his/her domain authority, and (b) how much of the implemented system reflects the individual's contributions to the project. The lack of comments from the interviewees on this metric possibly suggests that such roles are implicit and obvious in the Northeast. This is relatively straightforward if we accept that *coronelista*-like organizational hierarchies exist in the region: roughly speaking, the higher the hierarquical level, the more authoritarian (less open to interventions from subordinates) and influential one is.

According to Bellini (2006, p. 99), metric *social self-justification* describes "how the individual feels about the public image he/she has to espouse and protect in what comes to linking individual responsibility and project success." The level of social self-justification is inferred from the measurement of (a) whether the individual believes that his/her public image will be damaged if he/she abandons the project, and (b) whether the individual believes that people inside and outside the company see him/her as the mind behind the project. The lack of comments from the interviewees on this metric possibly suggests that a CuTe individual's concern with his/her public image is irrelevant for the fulfillment of CISS projects, what may have a link to a relatively common disregard with ethically questionable behaviors. But it may also be the case that it is implict that the project and the professional are intimately linked, what is perfectly predicted by known personalism.

According to Bellini (2006, p. 100), metric *sunk cost effect* describes "one's affection to the resources already invested in the project and that cannot be rolled back, that is, resources highly specific to the transactions already performed." The level of sunk cost effect is inferred from the measurement of (a) whether the individual mentions his/her own efforts invested in the project as a reason to remain in it, and (b) whether the individual reports that time, money and other organizational resources invested in the project are critical reasons to remain in it. The lack of comments from the interviewees on this metric possibly suggests that individuals working in the Northeast do not feel uneasy with personal and organizational investments that may be lost if a project fails, what may be related to the aforementioned distance between the shop floor and top decision making; in other words, it may be that shop floor workers do not feel psychologically bonded to or responsible for the organizational resources and performance.

According to Bellini (2006, p. 100), metric *completion effect* describes "the effect of advancing over the project plan on the individual worker." The level of completion effect is inferred from the measurement of (a) whether the individual expresses that he/she has gone

too far in the project to simply abandon it, and (b) whether the individual expresses that he/she was too near to the end of the project to simply abandon it. The lack of comments from the interviewees on this metric possibly suggests that it is irrelevant in the Northeast given that such decisions are not typically under the individual's discretion. Another reason may be that the levels of commitment (Table 2) serve as a bridge for goal definition and goal achievement.

According to Bellini (2006, p. 101), metric *relationship monitoring* describes "how bounded rationality mediates the tracking of the joint work between the partners." The level of *relationship monitoring* is inferred from the measurement of (a) whether the individual has a clear vision about how developed the relationship with the XTeam is, (b) whether the individual sees that it is easy and pleasant to work with the XTeam, (c) whether the individual sees that XTeam's members also see that it is easy and pleasant to work with him/her, and (d) whether the individual sees that working with the XTeam flows smoothly. The lack of comments from the interviewees on this metric possibly suggests that, in the Northeast, such concerns about CuTe individuals are implicit and obvious. To the extent that informality prevails in relationships along with some degree of *apadrinhamento* and *clientelismo*, formalisms included in relationship monitoring seem to be out of purpose.

On the other hand, professionals working in the Northeast also discussed measures *not* included in METRICS, that is, measures that were not discussed by their Southern peers. The additional measures address issues primarily concerned with personal traits (such as proactivity, trustworthiness, punctuality/promptness, and readiness for professional qualification) and management style (such as leadership, communication, political influence, and goal setting), what may imply that appropriate CuTe hiring and empowering may help mitigate current challenges in personnel management and improve general management.

Thus, as of the general differences perceived between the two Brazilian regions in CuTe management, we note that in the South there prevails a business logic and managerial practices more directly grounded on formal processes, standards, and technical reasoning, while in the Northeast there is likely a mix between formality and informality in which the work routines are subject to priorities and conveniences defined at a tacit, cultural level. Such differences may account for significantly different professional effectiveness that is due to regionally developed frames of mind directly related to how work should be accomplished and how people should integrate to the work system. This would also suggest that METRICS may have to be adapted to each region at some level according to local preferences and organizational maturity, while it is also true that most of the original rationale is arguably valid across the two regions.

6. Conclusions

From a socio-technical perspective on the implementation of ERP systems, the METRICS framework emerged in 2006 as a tool to help manage the social subsystem of CuTes as they engage with XTeams in CISS projects (Bellini, 2006). The framework was first validated in a landmark ERP implementation project in Southern Brazil. Our research adds to the METRICS validation and application tradition by reporting a study developed in a very different geographical, cultural and economic region: the Brazilian Northeast. Data collection was based on personal constructs theory and the repertory grid technique – both not included in the original research.

Validation was asserted on the basis of a significant proportion (77.3%) of common factors perceived by IT professional from the two Brazilian regions, as well as from the fact that different empirical methods and timeframes resulted in reasonably similar outcomes. Results also suggest a need to calibrate the METRICS framework in order to make it perfectly adapted to CuTe management accross time and contexts.

Empirical findings suggest three main concerns of IT professionals about the challenges in CISS project management: (a) the technology, its introduction and acceptance in organizations, (b) operations and decision-making processes, including the incorporation of best practices, innovation and change, and (c) the organizational structures concerning the positive and negative factors related to team and company performance as a function of team building, leadership, hierarchies, and management style.

Respondents also made it clear that it is the individual who interpret and interact with processes, technologies and structures – as predicted by the classical socio-technical perspective. Interpretations and interactions, however, do not preempt individual traits such as personality, abilities, skills and culture that are framed within a system of personal constructs. It follows that concerns reported by the IT professionals about the challenges in CISS project management end up with the elaboration of constructs such as engagement/enrollment, proactivity, commitment, responsibility and productivity, to name a few.

As a managerial implication, the application of conceptual frameworks and instruments to support CuTe management are expected to mitigate difficulties in project management (Helo et al., 2008), to support the adherence to managers' expectations (Osei-Bryson et al., 2008) and to optimize the work efforts (Metagroup, 2003). In our case, this is expected to be effective in both CuTe and XTeam routines, what may eventually lead to improved efficiency in CISS implementations.

An additional managerial implication may be the development of *service-reception agreements* in addition to service-level agreements (SLA). Service-reception agreements would formalize CuTe participation in CISS projects as a standard contractual issue, serving especially to set limits for an XTeam's authority and responsibility in projects in contrast to a CuTe's corresponding authority and responsibility.

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