STUDIA UNIV. BABEŞ–BOLYAI, INFORMATICA, Volume **LXI**, Number 2, 2016

A COMPUTATIONAL PERSPECTIVE OF THE ORGANIZATIONAL CULTURE EVALUATION

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Abstract. Any business starts with an *idea* and a *vision*. The idea is usually the description of *what to do* and the vision is the description of *how to do it*. A successful business is hardly given by the idea as it is mostly by its implementation, generically given by the vision. This current paper is aiming to give a possible answer of how to track and improve both the idea and the vision using computed versions of economical notions such as *company culture*, *department culture*, *technology culture* and/or the culture of a customly created *area of interest* combined with *AHP methodology* and *time series* which all together can join to provide a valuable feedback as a full set of perspectives (Hofstede's dimensions) to measure the deviations from the initial **vision** and **idea**.

1. Introduction

The *culture of a company* is an extensive notion. Talking about it is wide topic. Establishing it is huge effort. Evaluating the actors inside a company against the companys culture is laborious work. Stimulating the company to respect the culture set (keeping it on the floating line), means to stimulate its employees to respect it [14].

When you ask a manager whats his/her dream about the employees/teams/ departments they will most likely say: "I would like my Employees to be smart enough, fast enough, proficient enough, etc.". But "enough" is not a number on a scale. Still, it is not too bad, since we have already heard a management principle not far from the same expression. That is "just enough" and it belongs to Agile SCRUM management methodology [26].

Received by the editors: June 13, 2016.

2010 *Mathematics Subject Classification.* 62C86, 68M20, 68U35, 90B50.

1998 *CR Categories and Descriptors.* H.4.2 [**Information Systems Applications**]: Types of Systems – *Decision support*; H.5.4 [**Information Interfaces and Presentation**]: Hypertext/Hypermedia – *Architectures*; K.6.4 [**Management of Computing Information Systems**]: System Management – *Quality assurance*.

Key words and phrases. performance indicator, key performance indicator, agility indicator, company culture indicator, department culture indicator, technology culture indicator.

The importance of the organization culture has been a subject to debate for a very long time now, since it has been noticed along time that miss-interpretation of core company values or either ignoring them easily leads to conflicts which erode the company from inside out causing eventually the company to collapse [25]. Small things like gestures can have a big negative impact over the company when it comes to communication between company branches from different regions of the world [17]. For example, a hand sign meaning OK in USA actually means zero (null) in Russia, money in Japan and an insult in Brazil. Avoiding eye-contact is a sign of respect in eastern Asia while it means deceiving intentions in western Europe [23].

This paper is the second in a series of papers dedicated to improving the quality of decisions taken by decision makers involved in an *organization* (*company*, *institution* or *project*) who have an impact on a larger or considerable scale. Further on, we will consider such a person as a **Relevant Decision Maker** (RDM).

The first paper, [27], defines the formal model of the reference system we will use to create the context that can help a RDM to better evaluate his alternatives. Better yet, it is a system that should help the relevant decision makers to calibrate their organization, which means in this case to position their organization with respect to market standards and self expectations [9].

The current paper is aiming to compute the culture of a company using Hofstede's dimensions [15], then to evaluate how much the company's employees/teams/departments respect that culture (that is their own level of agility /willingness to adapt to the company's vision) and how well they have been stimulated to get to respect it as they should (or even better: as they are *expected to*) [2, 10].

In order to do so, we start by comparing values inside a reference system which contains historical context data over a certain period of time, the actual status of the evaluated target inside that context and the stimuli applied to the evaluated target (employee/department/technology/company) [1, 5, 21]. Then, you need to state how specific do you want to be about your company's culture that is a numerical value meant to specify the highest level of importance/weight you want to set (the lowest will always be 0 (zero)). And we will call it importance scale of the company's culture.

Our target is to help organizations to become more stable while they grow. We believe that having an automated system which could manage periodical measurements on all levels of the organization, top to bottom, and applied on different layers from the generic overview to a very specific target (like onion leafs) could empower the system to offer valuable solutions to avoid future conflicts.

We are aiming four directions of research: company level, department level, technology (expertize) level and the level of custom defined *area of interest*. For each of these levels we will define the indicators we would like to evaluate. Using the technique of online queries and tests we will try to compute values for high-level indicators (*Criteria*). Our online platform [3] will record the results per each evaluation session and compute them graphically for a visual representation, relevant to a RDM. Our focus as an AoI in this paper is on the technical leaders of each production team.

We have chosen Hofstede's dimensions to cover complete specter of company culture for our set of criteria we want to use for this process as follows: Organizational Effectiveness, Customer orientation, Control, Focus, Approachability and Management philosophy.

The structure of the paper is as follows. After this introductory section, the next one introduces main concepts: business culture, organizational culture, and key performance indicator. Third section describes the mathematical model, consisting of several culture indicators considered at different scales of granularity, whose use is exemplified in the fourth section. The last section contains some conclusions and sketches further research directions.

2. Definitions

This section introduces main concepts we operate throughout this paper. We define the ground reference definitions regarding the generic understanding of Business culture and Organizational culture, in order to define the context and the input we are aiming to process within our framework. The definition of Business culture will next help us define the working variables of the our framework by the shape of indicators (KPI) which we will try to track and evaluate [8, 13, 18].

Definition 1 (Business culture [20])**.** *The* ***Business culture*** *is related to behavior, ethics, etiquette and more. A business culture will encompass as Organization's values, visions, working style, beliefs and habits.*

This notion is improved below by the following which will help us better shape up the notions we want to debate in this paper, which is extending the generic notion of *culture* to every level of the Organization so that a RDM can have access and evaluate in detail each subordinated entity, but still have access to the global view of the Organization he/she is involved in.

Definition 2 (Organizational culture [6, 28])**.** *The values and behaviors that contribute to the unique social and psychological environment of an Organization.*

Organizational culture includes an organization's expectations, experiences, philosophy, and values that hold it together, and is expressed in its self-image, inner workings, interactions with the outside world, and future expectations. It is based on shared attitudes, beliefs, customs, and written and unwritten rules that have been developed over time and are considered valid. Also called corporate culture, it's shown in

- *the ways the organization conducts its business, treats its employees, customers, and the wider community,*
- *the extent to which freedom is allowed in decision making, developing new ideas, and personal expression,*
- *how power and information flow through its hierarchy, and*
- *how committed employees are towards collective objectives.*

We need the two definitions because we are aiming not only to evaluate businesses, but also public institutions like a city hall or a university.

Definition 3 (Key Performance Indicators [6])**.** *The* ***Key Performance Indicators*** *(KPI) are key business statistics such as number of new orders, cash collection efficiency, and Return of Investment (ROI), which measure a firm's performance in critical areas.* ***KPIs*** *show the progress (or lack of it) toward realizing the firm's objectives or strategic plans by monitoring activities which (if not properly performed) would likely cause severe losses or outright failure.*

Inside this paper we will define indicators which are key to the metric implementation of culture as we propose it in order to outcome performance [19]. Starting from the above definitions we will try in the following chapters to argument why the indicators we propose or key to measure performance from the organizational culture perspective.

3. Mathematical model

This section gives the definition of variables and indicators used in the evaluation of a company (i.e. specific culture) along with their equations by which we will compute the hard numbers. For each specific culture we will also compute its boundaries (i.e. scale), respectively the maximum potential value (as we consider 0 the absolute minimum).

For the purpose of exemplification, we attach here an example of organizational chart which will serve for future computations to prove the significance of the indicators that will be defined further on. Moreover, we will give examples of how to compute specific culture for the company, for the software department, for the .Net technology and for the leaders of each department (i.e. custom area of interest).

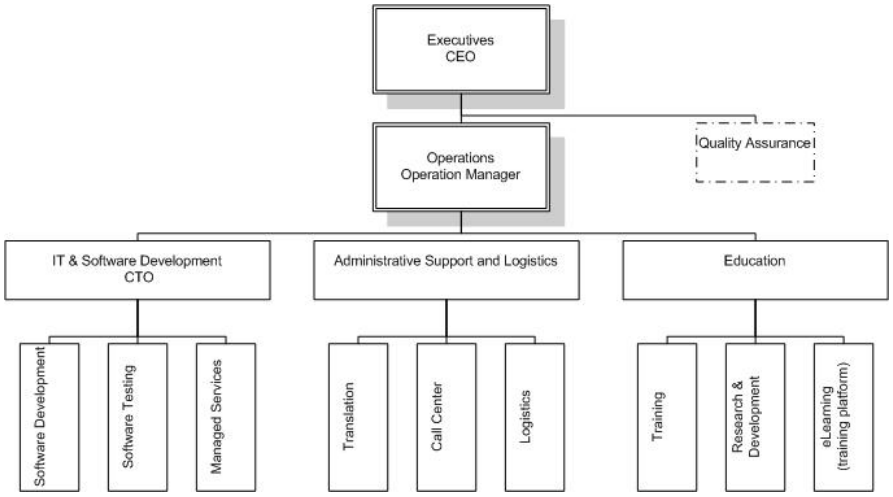

FIGURE 1. Company Organizational chart

3.1. **Area of Interest.** Department and Technology are two ways of grouping the evaluation criteria, allowing a better understanding of the evolution of the initial vision. Of course, each has its own specific non-linear subset of aspects, first of all because they each mean something very specific in its context, BUT sometimes these two can simply not provide enough information to have the best perspective of the evolution of someone's idea and vision implementation, so we prefer to leave an opened door to cover that.

In what follows, we define additional concepts to support various perspectives by which to measure the cultural dimensions of an organization in order to enforce the power of the output analysis as we suggest in our case study.

Definition 4 (Area of Interest)**.** *The* ***Area of Interest*** *(AoI) represents the subjective way of grouping criteria used to evaluate a certain target, either it is a company, department or team. It is a meta-indicator to help business developers better evaluate their vision. (e.g. department leaders, technology experts, etc.)*

It is not always about what we analyze, as in criteria set, but also how we analyze it, as in how realistic is the importance we demand for each criterion. We believe that having an in-depth perspective of the way organizational culture is reflecting from top to bottom could help any *RDM* better define the importance they set for each criterion which will help them better shape their organizational culture.

3.2. **Scales of Importance / Relevance / Weights.**

Definition 5 (Importance Scale)**.** *The* ***Importance Scale*** *(IS) is a closed interval of numeric values representing weights in consecutive order from the lowest to the highest value in the set, where the lowest value is always* 0*. The smallest group of values should not contain less than three consecutive values. The largest group of values can be adapted to each individual specific need.*

When setting up a scale we actually specify the level of accuracy of our metric. The higher this level, the better chances for accuracy. For our experiment we have set a range of 0 *to* 100*, just as suggested by Hofstede, so that we can use his work as a reference to validate ours.*

Scenario 1. *If the decision is to indicate a unique value in the defined scale range, the number of allocated values can match the number of evaluated criterion or other indicator that participates into a specific computation.*

Scenario 2. *If the decision is to have a better granularity and easy means of computation, the number of allocated values should be a round number and a multiplication of the value* 10 *(e.g. 10, 20, . . . , 100, etc.).*

Depending on the scale of an organization we chose to evaluate, we can choose either scenario to follow. We believe that a scale should reflect in size the complexity of the organization.

Definition 6 (Maximum Importance Scale)**.** *The* ***Maximum of an Importance Scale*** *(MIS) is a numerical value representing the extreme right value of the interval of potential values to be taken into consideration when evaluating weights on any Importance Scale.*

The maximum value of the importance scale will be an argument in the equation for further computation of system boundaries.

Definition 7 (Company culture Importance Scale)**.** *The* ***Company culture Importance Scale*** *(IS_{CC}) represents an Importance Scale previously and individually set in order to measure the Company's culture. MIS_{CC} is the highest potential value for the range of chosen IS_{CC} values.*

A certain target to be evaluated, either it is a *company*, *department*, *team* or *individual human resource*, is being evaluated against several criteria. The proposal was to quote each criterion with an importance/weight mark that is a numerical value between 0 (zero) and the value represented by the company's importance scale. We will call it **Criteria Importance Scale** (IS_{Cr}) and it is dependent on the selected Criteria: $IS_{Cr} = f(C)$.

Definition 8 (Company Importance Scale)**.** *The* ***Company Importance Scale*** *(IS_C) represents an Importance Scale previously and individually set in*

order to make generic Company measurements. It usually represents the base foundation and reference of weights allocation per each evaluated Company. MIS_C is the highest potential value for the range of chosen IS_C values.

The IS_C is the implementation of a specific organization we chose to evaluate.

Definition 9 (Criteria Importance Scale)**.** *The **Criteria Importance Scale** (IS_{Cr}) represents an Importance Scale previously and individually set in order to make generic Criteria measurements. MIS_{Cr} is the highest potential value for the range of chosen IS_{Cr} values.*

Each Criterion is specific to a certain aspect of the evaluation process, ranging from extremely technical to extremely soft skills, grouped in Areas of Interest (AoI). The proposal is to quote by Importance each such AoI, called Area of Interest Importance Scale (IS_{AoI}) and it is dependent on the selected AoI: $IS_{AoI} = f(AoI) = f(sum(Cr))$. Another recommendation is to identify as granular as you can any AoI in order to cover any perspective of the market with regards to your Business.

3.3. **Culture indicators.** In this section will be described the **culture Indicators** as they can become suitable enough in terms of retrieving the adequate aspect perception and context for a RDM. For each of the following sections we will define and describe the constant reference ($C_{(X)}$) and the evaluated variables ($AC_{(X)}$) which will make subject of a graphical representation as can be seen in the *Case study* section.

For each evaluation session, we need to rely on the number of participants. Depending on the size of the organization, each session will be structured around a form of aggregation for the participants, like teams or departments. Further, we will consider the Department as the smaller such form.

For each culture indicator we provide several equations for computing them, depending on the complexity of the target organizational structure for which it is computed. The context is explained in the form of different scenarios. Some of them are independent and others are interconnected as we will specify below.

3.3.1. *Department culture Indicator.* Starting from the way things can physically be evaluated, we will consider a Department as consisting of two groups of assets: technical and human, each with its own set of Criteria and furthermore we will consider two different scenarios to compute both complementary cases, as follows:

Definition 10 (Department culture Indicator)**.** *The* ***Department culture Indicator*** *(C_D) can be computed as follows from two different perspectives considering the internal organizational means from inside a company:*

Scenario 3. *C_D is a computed value, being the result of summing the Expected Value (ExV) multiplied by its weight (I_{Cr}) across all evaluation criteria set to reflect the initial vision of implementing an idea into a Business regarding that specific Department and multiplied the the Department's weight I_D.*

$$C_D = \left[\sum_{Cr \in D} (I_{Cr} \times ExV_{Cr}) \right] \times I_D \tag{1}$$

Scenario 4. *C_D is a computed value and the result of applying the arithmetic average over all individuals considering their ExV as per each professional level multiplied by their corresponding I_{Cr} across all evaluation criteria set to reflect the expectation of each professional human resource (HR) involved in that Department and multiplied the the Department's weight I_D.*

$$C_D = \left[\sum_{Cr \in D} \left(I_{Cr} \times \frac{\sum\limits_{HR \in D} (ExV_{Cr}(HR))}{N_{HR}} \right) \right] \times I_D \tag{2}$$

Definition 11 (Department Actual culture)**.** *The* ***Department Actual culture Indicator*** *(AC_D) is the actual value of computing the culture of the department as a result of each individual Evaluation Session* [27].

As a consequence, we will use two different mathematical equations to compute the AC_D, one based on the entire Criteria set, just as explained already earlier:

$$AC_D = \left[\sum_{Cr \in D} (I_{Cr} \times AV_{Cr}) \right] \times I_D \tag{3}$$

and the other one based on computing the evaluation of all individual Employees assigned to the Department:

$$AC_D = \left[\sum_{Cr \in D} \left(I_{Cr} \times \frac{\sum\limits_{HR \in D} (AV_{Cr}(HR))}{N_{HR}} \right) \right] \times I_D \tag{4}$$

3.3.2. *Company culture Indicator.* We will use this indicator to compute the culture of the entire Company out of the desired Criteria and Expectation Values which a relevant decision maker can set over them. Just as we have mentioned earlier, evaluating a Company is a laborious task with complex mechanics [7], so we will present two scenarios that can be used to compute the culture Indicator, one coming directly from the Criteria set and its related Expectations (Expected Values) and the other one from individual Departments culture Indicators, respectively gathered using a summing mathematical formula. If a company is of small size, without any departments OR has applied a flat organizational structure, we only need to apply the first scenario (flat structure) in order to evaluate its culture. Otherwise, we need to use either the second scenario (deep structure), or both for better reference.

Definition 12 (Company culture Indicator C_C)**.** *Depending on the Size and the Maturity Level* [16, 24] *of the Company, respectively, we can define this indicator either as follows:*

Scenario 5 (flat structure)**.** *C_C is a computed value and the result of summing the Expected Value (ExV) multiplied by its weight (I_{Cr}) across all evaluation Criteria set to reflect the initial vision of implementing an idea into a Business.*

$$C_C = \sum_{Cr \in C} (I_{Cr} \times ExV_{Cr}) \tag{5}$$

Scenario 6 (deep structure)**.** *C_C is a computed value and the result of summing ExV multiplied by its corresponding I_{Cr} across all Departments and multiplied by its weight (I_D) set to reflect the initial vision of implementing an idea into a Business.*

$$C_C = \sum_{D \in C} C_D \tag{6}$$

For each existing department that has been created, there was a reason behind its creation - which means that we can in fact use that reasoning in order to apply Weights to each Department, so that we can clearly evaluate the impact and Relevance of each Department inside the Company.

Definition 13 (Company Actual culture)**.** *The* ***Company Actual culture Indicator*** *(AC_C) is the actual value of computing the culture of the Company as a result of each individual Evaluation Session* [27].

As a consequence, we will use two different mathematical equations to compute the Company Actual culture AC_C, one based on the entire Criteria set, just as explained already earlier:

$$AC_C = \sum_{Cr \in C} (I_{Cr} \times AV_{Cr}) \tag{7}$$

and the other one based on computing individual Departments indicators:

$$AC_C = \sum_{D \in C} AC_D \tag{8}$$

as per each scenario explained in the root definition.

3.3.3. *Reference scales.* All of the indicators defined earlier need an adapted system of references where we can set the computed data. This way, they can be evaluated by company owners or project leaders so that they can base their future decisions upon. We will note the highest potential value of each reference scale by MRV (as in *Maximum Reference Value*) and we'll define it individually for each of the previously defined notions.
Also, we will consider the variable MEV as the highest potential value we chose to set for any of the evaluation values, either it is a Standard Value, Expected Value or Actual Value (which inside the database structure it has been called $MaxEvaluationLevel$ [27]).

We will consider the system of coordinates as shown in the Figure 2 to assemble all of the computed indicators and evaluate them against the Expected culture of the Organization.

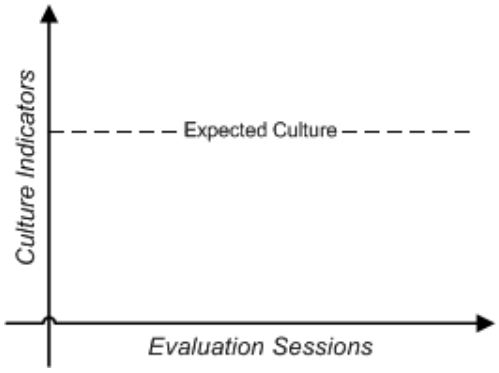

FIGURE 2. Generic Reference Scale

So, in order to define the reference values for either the Criteria, Department or Technology, we will define the following equations which are supposed

to define the extreme positive dimension of the Indicators axis:

The Maximum Reference Value for an Evaluation Criteria (MRV_{Cr}) will be the product of the value representing the Maximum Evaluation Value previously set for the entire Company or Organization (MEV) by the value representing the Maximum Importance Level previously set for evaluating Criteria (MIV_{Cr}).

$$MRV_{Cr} = MEV \times MIV_{Cr} \tag{9}$$

The Maximum Reference Value for a Company (MRV_C) will be the product of the value representing the Maximum Evaluation Value previously set for the entire Company or Organization (MEV), the value representing the Maximum Importance Level previously set for evaluating Criteria (MIV_{Cr}) and the Total Number of Criteria chosen to evaluate the Company or Organization (N_{Cr}).

$$MRV_C = MRV_{Cr} \times N_{Cr} \tag{10}$$

The Maximum Reference Value for a Department (MRV_D) will be the product of the value representing the Maximum Evaluation Value previously set for the entire Company or Organization (MEV), the value representing the Maximum Importance Level previously set for evaluating Criteria (MIV_{Cr}), the Total Number of Criteria chosen to evaluate the Department (N_{Cr}) and the Maximum Importance Level set for Departments (MIV_D).

$$MRV_D = MRV_{Cr} \times N_{Cr_D} \times MIV_D \tag{11}$$

4. Case study

For better exemplification, we will use the Organizational chart shown in Figure 1 to build the Reference System upon and compute the culture Indicator values of the company (C_C) to be used in further graphical representations, visually useful for a RDM. Using our online platform, we have defined a small local company (GCI), configured all five of its employees and traced it during three trimesters.

The minimum number of indicators to use is already fairly big, so tracking inside a considerably wide reference system will be a burden unless implementing visual means to help hasten a manager's reaction. For this case we have used six criteria, the corresponding six dimensions proposed by Hofstede.

The full exercise to create the Company culture overview implies calculating the Actual culture (AV) over each Evaluation Session and compare it with the Expected culture (ExV), which in our case has been computed to 174500.

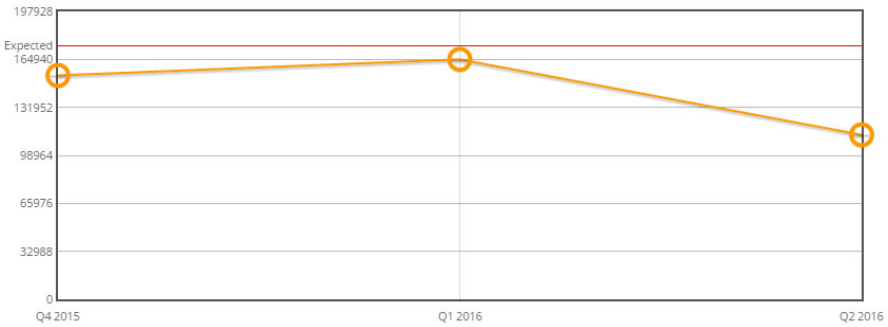

FIGURE 3. Computed evolution of Company culture

The graphical representation should offer to a *RDM* a visual understanding of the consequences of his previous decisions while trying to stimulate the employees to respect the implementation of the initial vision. In order to create the entire visual graphic, we need to compute the **Maximum Reference Value** of the vertical Axis which represents the culture values. As per each evaluation Session, we have computed the following *AC* values: for *Q4 2015* it is 153900, for *Q1 2016* it is 164940 and for *Q2 2016* it came out 113100. If we want to take a look at the Department culture overview, we need to respect the similar flow, but applied at the level of Departments and compute the Maximum Reference Value accordingly (MRV_D).

The even more interesting perspective offered by the ARS implementation is the ability to chase all evaluation sessions per all evaluated dimensions and compare them against their importance (I_{Cr}) as we have set per each dimension. For instance, as you can see, the team has lost a great deal of Focus while trying to improve Customer orientation and Control. So the mission of the *RDM* for the upcoming trimester is to balance measures in order to recalibrate the company. The new challenge of the Company is to gain Focus without losing its Customer orientation.

5. Conclusions and further work

Computing culture Indicators means a full-time job of continuous integration and adaptation of all variables in order to educate both the Vision and all Actors who participate in the process of implementing the Vision [11, 12].

Implementing an Idea and its Vision into a Business is a valuable work, but a tricky thing. Different areas of Business react to different stimuli, use different key Criteria sets and need careful analysis of all culture Indicators evaluation.

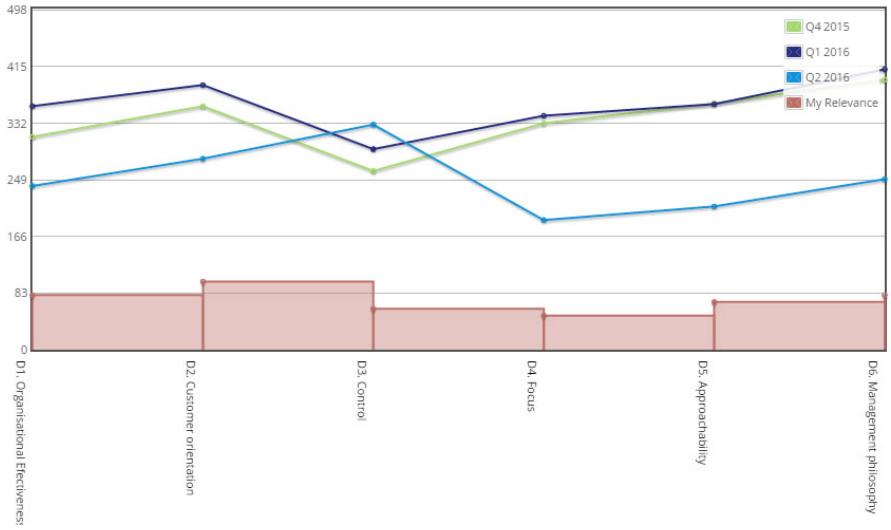

FIGURE 4. Computed evolution of dimensions

Part of a Business's success stories is all about optimizing processes down to the tiniest detail. In this case, optimization of processes means the continuous adaptation and improvement of Criteria Sets, Scales of Importance and optimization of all equations computation.

We have focused our trial experimentation [3] on a very small company and therefore another goal for us would be to implement this system on a high scale company with a complex organizational structure and also a complex employees structure as a level of expertise.

Considering this, one of the future work experiences we would like to dedicate time to is to define the mechanics and mathematical equations to compute and discover the best suitable Set of Criteria and Scale of Importance for any specific Organization so that it could improve the means by which Actual culture can meet the Expected culture [4].

Stable markets are relatively easy to integrate Businesses into. But trying to implement a Business into an emerging market who's regularly facing exponential degrees of change, applying indicators becomes a challenge and adapting variables becomes a highly consistent work [22].

So, the future work we would like to dedicate time to is building a Decision Model to help improve the implementation of a complex idea from the Software Industry into a dynamic/emerging market and tracking it from a Change Management methodology perspective.

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