

On the evaluation of companies' managerial maturity**Sobre a avaliação da maturidade gerencial nas empresas**

DOI: 10.34140/bjbv2n3-044

Recebimento dos originais: 20/05//2020

Aceitação para publicação: 20/06/2020

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ABSTRACT

This work discusses a method for quantifying the managerial maturity in a company based on the internal evaluation of the administrative, personal and technical manager's skills, as well as assessing the conceptual maturity existing in the company from the analysis of the perception of resources about the topic. The method involves the weighted classification of items of interest to characterize each specific skill and the use of the Hasch Logistic Model to obtain the maturity level. The investigation demonstrates the importance of guiding training actions aiming to promote the necessary skills according to the motivational moment of the work environment.

Keywords: Managerial Maturity, Work Environment, Item Response Theory.

RESUMO

Este trabalho discute um método para quantificar a maturidade gerencial em uma empresa baseada na avaliação interna dos aspectos de habilidades administrativas, pessoais e técnicas dos gerentes, bem como avaliar a maturidade conceitual existente na empresa a partir da análise da percepção dos seus recursos humanos sobre cada tópico. O método envolve a classificação ponderada de itens de interesse para caracterizar cada habilidade específica e o uso do Hasch Modelo Logístico para obter

o nível de maturidade. A investigação demonstra a importância da correta orientação para ações de treinamento visando promover as habilidades necessárias de acordo com os momentos de estímulo do ambiente de trabalho.

Palavras-chave: Maturidade Gerencial, Ambiente de Trabalho, Teoria de Resposta ao Item.

1 INTRODUCTION

Despite the diffusion of models and “good practices” for the control and alignment of the process areas to be treated within the company's *workforce* space. The influence of managers' skills on the teams' work environment and their impact on productivity can and should be further explored.

Few concepts from past decades have captured the attention of specialist doctors like that of organizational culture. What is culture, and why should managers care about it? The answer to this question may lie in the fact that in the past 40 years there has been almost a complete turnaround in industrial leadership. Large companies were forced to withdraw, and new companies emerged. Why would this have happened? Companies that had significant advantage as pioneers, great technology and financial strength to dominate the industry have failed. Foster [2006], in a study of industries, attributed this failure in part to the inability of these companies to deal with cultural differences between new and consolidated technologies. Tushman and O'Reilly [2013] extended this observation and demonstrated the importance of culture for long-term success, to generate innovative trends. It is the organizational culture that establishes the roots of an organization's ability to be innovative.

Four mechanisms are commonly used by organizations with a strong culture to generate the “commitment” factor [CHATMAN & O'REILLY, 2016]:

- 1) participation systems that promote choice and lead people to feel committed;
- 2) management actions that establish objectives, focus of attention and help people to interpret events in a way that emphasizes their own importance;
- 3) consistent information about the values that others point out about what is important and what is not; and
- 4) comprehensive reward systems that are seen as fair and emphasize individual and collective recognition, approval and contributions.

These four mechanisms are the organizational levers used to develop culture as a system of social control. Each mechanism provides members of the organization with consistent signals as to which attitudes and behaviors are important.

Considering that the skills of managers directly influence the performance of subordinates depending on the work environment more or less stimulating, more or less motivated, it is necessary

to find ways for them to manage or reinforce these skills in order to guide their team towards productivity. Therefore, a map of the questions of interest that underlie the administrative, personal and technical management skills, which positively influence your team for productivity, constitutes a relevant tool for the orientation in training allocation of human resources in the company's management staff.

In an objective way, this work presents a method to evaluate the managerial maturity from the operational and conceptual point of view of the company from the perception of managers and their subordinates.

We consider Operational Maturity, the amount of skill that the management team has according to the evaluation of employees. How well she is able to exercise administrative, technical and personal activities. To achieve this objective, the questionnaire's central question was:

- “How effectively is each conduct performed by your supervisor?”

It was also analyzed how stimulating the work environment is and how satisfied your employees are in this environment:

- "According to the items listed, how much does your company apply each one in order to obtain a stimulating work environment?"
- "How much does each item make you feel satisfied in your work environment? job?"

It was considered for evaluating the Conceptual Maturity, how much each employee understands by administrative, technical and personal skills.

- “How important is each item for him to perceive such skills?”
- "How much does each conduct express the supervisor's ability when performed effectively?"

And how important is each item to maintain a stimulating work environment and for that environment to be satisfactory:

- "How important is each factor to indicate a stimulating work environment?"
- "How much does each item matter so that you are satisfied with your work?"

2 MOTIVATION IN TECHNOLOGY PROFESSIONALS

Motivation is a critical ingredient for high performance of individuals and teams. Highly motivated professionals and project teams usually go much further(MORAES, 2019).

In fact, when managers acquire experience, they soon realize that, to get new ideas and new advances, it is necessary to have individuals with a grade A motivation and a grade b capacity than

the other way around [Pinchot, 1985]. Pinchot states that R&D managers typically list the motivation of engineers and technicians as one of the most difficult and complex aspects of their leadership roles. A general model of the motivation process, according to Steers *et al* [2004], can be characterized by three common denominators. Motivation is first of all (1) what gives energy to a particular behavior, (2) what directs or controls these behaviors as if they were channels, and (3) how these behaviors are altered and sustained. These three components represent an important aspect of human motivation. The first component is focused on the needs, directions or expectations of the individuals, while the second component emphasizes the goals and visions of the individuals and teams in which the stimulating behaviors are directed. The last component of any motivation model is feedback.

All cognitive theories of motivation, such as Maslow's Theory, Herzberg's Two-Factor Theory, and McClelland's Needs Theory, agree that when employees are challenged in their jobs, it is hardly necessary to force or manipulate them to work. more and better [CHIAT & PANATIK, 2019]. When there is a “compromise” between the individual and the job, the person typically obtains a high level of internal motivation, feeling good about himself and his achievements. Good performance becomes rewarding. Likewise, poor performance creates feelings of discouragement, in which it forces the person to work harder to avoid unpleasant results and earn the rewards that good performance provides. The result is a cycle of positive motivation continuity supported by the reward of work. The critical phase for organizations is to structure and design projects that are rewarding and satisfying.

3 MANAGEMENT SKILLS IN TECHNOLOGY COMPANIES

This section presents the characterization of managerial skills in three types: administrative, technical and personal. This study was developed by [Cordero *et. al*, 2004] and presents the relationship between these types of skills and productivity in technology companies from a more or less motivating work environment.

Considering the environments of Research and Development (R&D) laboratories characterized by [Cordero *et. al*, 2004], there are two critical issues to be addressed: maximizing the performance of professionals and maximizing job satisfaction for these professionals.

The study carried out shows how R&D managers can contribute to this maximization of performance and satisfaction of technical professionals.

Managers are assumed to have three different types of skills: technical, personal and administrative. And that these managers are able to use their skills to promote a stimulating work environment.

Some hypotheses regarding the use of the three types of managerial skills were raised:

Hypothesis A. Technical Skills

Technical skills involve knowledge of a discipline and the familiarity and competence in using techniques and tools of the discipline are added to these.

Competence is understood as the formal recognition of a capacity for action.

- H1 (T): A positive relationship is expected between the technical skills of managers and the stimulating work environment of their team.
- H2 (T): The more the team is provided with a stimulating work environment, the less positive the relationship will be between the technical skills of the supervisors and the performance and satisfaction of their team.

Hypothesis B. Personal Skills

Personal skills involve effective relationships with others and influence, in addition to the ability to provide emotional support.

- H1 (P): A positive relationship is expected between the personal skills of managers and the stimulating work environment of their team.
- H2 (P): The more the team is provided with a stimulating work environment, the less positive the relationship between the manager's personal skills and the performance and satisfaction of his team.

Hypothesis C. Administrative Skills

Administrative skills involve taking action and being clear about the organizational objectives that need to be achieved, what resources are needed and how these resources can be structured.

- H1 (A): A positive relationship is expected between managers' administrative skills and their team's stimulating work environment.
- H2 (A): The more the team is provided with a stimulating work environment, the more positive the relationship between the supervisors' administrative skills and the performance and satisfaction of their team.

The results showed that supervisors use their technical skills, but in particular personal and administrative skills to help their team have a more stimulating work environment.

As for technical skills, the results show that supervisors must be careful when trying to replace the lack of adequate technical stimulus in the work environment with their skills, at the risk of diminishing the potential for innovation and usefulness of their subordinates.

It was also noted, regarding personal skills, that supervisors use them in order to compensate for the lack of adequate personal stimulation in the work environment.

With regard to administrative skills, managers can aggravate the lack of administrative encouragement in the workplace if they use these skills to try to “impose” a task structure on members of the team they already have.

Finally, the results show that managers need to use their technical, personal and administrative skills to help overcome their team's weaknesses and highlight their strengths, providing a more stimulating work environment.

Three factors stood out. The first factor was called administrative skills because the indicators characterizing this factor suggest leadership, processes and organizational skills. The second factor

was called technical skills because the indicators suggest scientific and engineering skills. The third factor was called personal skills because the indicators that characterize this factor suggest motivational and human relations skills. Finding three factors confirmed that technical professionals in R&D labs can widely identify three separate types of skills in their supervisors: administrative, technical and personal skills. Therefore, three factors were computed to provide the supervisors' skill measures made by their subordinates, as shown in the table below:

Indications that describe the supervisors	Administrative	Technical	Personal
Elaborates a good vision of opportunities / innovations for the group and the company	.90	-.05	-.02
Acts as a facilitator for major changes that occur in the group and / or in the company	.87	-.03	-.02
Communicates the strategic priorities of your division / group / department	.85	-.07	-.02
Communicates the goals of team development programs	.78	-.03	.07
Get resources needed by the team	.77	.06	-.07
Finds relevant issues for the team to work on	.77	.21	-.15
He is a spokesman for his team for the rest of the company	.76	.06	.00
Defends team projects	.71	.05	.09
Promotes a sense of commitment to group programs / projects	.69	.05	.17
Identify and co-opt / absorb creative individuals for the team	.68	.09	.05
Manage the relationships between your team and other teams	.57	-.02	.25
Encourages and establishes good relations between members of your team and those of other units	.56	.03	.23
Creates the productive climate needed to conduct tasks	.51	.04	.37
Creates an informal productive organization among team members	.48	.02	.35
Conducts necessary plans and schedules	.46	.15	.17
He is a mentor to his technical team	.37	.32	.25
Presents good ideas on how to perform tasks in your specific area of expertise	.01	.91	-.01
Provides knowledge of information relevant to members' work	.03	.90	-.03
Has a good understanding of the techniques and methods applied in his work	-.03	.85	.06
Promotes encouragement for tasks performed by the team	-.08	.12	.90
Promotes recognition for a job well done	.00	.05	.84
Promotes enthusiasm for work lucidly (with common sense)	.26	.14	.53
Make each team member understand their role	.29	.00	.52
Has sensitivity and discernment of individual differences	.24	-.02	.52
Leads people to work well together	.34	.05	.49
Promotes critical evaluations seeking the good and the feasible / achievable	.30	.26	.33

4 ITEM RESPONSE THEORY

Item Response Theory (IRT) is a collection of statistical models of prediction, estimates or inferences about the skills (or competencies) measured in a test. Through statistical models it is possible to predict such skills by means of correspondences between the score obtained by a student in a test situation and the items provided to him [Hambleton & Swaminathan, 2013].

The TRI proposes models that represent the relationship between the probability of a right answer to an item and the ability of the individual evaluated, considering also the difficulty of the item duly calibrated by the correct answers of a given universe.

Traditionally, in the evaluation and selection of individuals, results obtained in evaluations are used, expressed only by the simple weighted totalization of their scores. This means that, for example, the higher the individual's grade in an exam, the better his classification. The characteristic of this procedure is that the analyzes and interpretations are always associated with the total score and not with a particular item (question).

IRT is a powerful instrument, which has been progressively applied in quantitative processes in the area of educational assessment. The IRT proposes models of latent variables to represent the relationship between the probability of an individual presenting a specific response to an item and its latent traits or skills in the assessed knowledge area, which cannot be directly observed, in this case, managerial skills.

4.1 THE LOGISTIC MODEL

The logistic model of a parameter, also called Rasch model, relates the Probability of correctness of an item $P(\theta)$, its Difficulty Index b and the Skill θ of the individual in the subject in question (DE LUCAS BRANDÃO, 2020).

The equation for the Rasch Model is given by:

$$P_i(\theta) = \frac{1}{1 + \exp^{-1.(\theta - b_i)}} \quad (1)$$

Where, considering that maturity is assessed based on the degree of presence of certain anagement practices corresponding to one of the administrative, personal or technical skills, we have to:

- $P_i(\theta)$ is the probability of the maturity-level organization θ satisfactorily applying the i -th practice;
- b_i is the parameter that represents the difficulty of satisfactory implementation of the i -th practice, measured on the same scale as maturity;
- θ represents the degree of managerial maturity of the organization.

In this study, the Rasch model will be applied to determine:

- The level of operational and conceptual managerial maturity in a company by adopting practices consistent with the requirements of interest corresponding to each of the administrative, personal or technical skills.

4.2 DIFFICULTY INDEX

In the educational area, the difficulty index b is associated with the difficulty of an individual to answer a question correctly. In the context of skills assessment, it is associated with the degree of difficulty of a set of supervisors (directors, managers and heads) of the company in performing a certain practice or interest issue:

- as b grows, the degree of difficulty of good performance of practices, and vice versa.

To estimate parameter b , we used the loading factors described in Tables 1, 2 and 3. However, to work in the same maturity range, we normalized the values, which range from 0 to 100% to vary from -3 to 3, therefore, the new values for the level of difficulty of the practices was defined as:

$$b_i = (6 \times b'_i - 3) \quad (2)$$

Where:

- b_i is an index of difficulty in implementing the i -th practice;
- b'_i is the loading factor (0 to 100%)

The loading factors to indicate the skills of supervisors, mean how important a particular practice or item of interest is for the characterization of each of the three types of skills studied: administrative, technical and personal.

For example, the item “elaborates a good view of opportunities / innovations for the group and for the company” has a loading factor of 0.90 for the administrative skill.

Thus, developing a good vision of opportunities / innovations for the group and for the company is very important (90%) to identify a supervisor with administrative skills and does nothing to identify technical and personal skills. The item “presents good ideas on how to carry out tasks in your specific area of activity” is very important to identify technical and non-administrative skills, not to mention personal.

“Promotes enthusiasm for work in a lucid manner (with common sense)” is a question that has a somewhat balanced weight for the perception of the three skills. It is 26% characteristic of supervisors with administrative skills, 14% for technical skills and 53% for personal skills.

Both the loading factors to indicate a work environment and those to indicate the satisfaction of professionals, have only one aspect, unlike the three skills of supervisors.

4.3 ORGANIZATIONAL SKILL

The parameter θ represents the organizational skill in the proper application of each practice or item of specific interest. Theoretically, this parameter can assume values of - and +. In order to maintain the same scale as the level of difficulty b , the range of -3 to 3 was again assumed, which is quite reasonable in the literature.

After tabulating the data, we calculated the average of the responses obtained for each item. Normalizing to the required range, the maturity parameter was defined as:

$$\theta_i = \frac{3\theta'_i - 6}{2} \quad (3)$$

Where:

- θ_i is an organizational skill for applying the i -th practice;
- θ'_i is the average of the responses obtained in the survey (0 to 7)

In our work, organizational maturity means how much the analyzed company has of each item. For example, according to their subordinates, supervisors have 86% of the item "creates the productive climate necessary for the conduct of tasks".

4.4 EVALUATION OF MANAGERIAL MATURITY

Then applying IRT using the Rasch Model, we reach the probability that supervisors have, given their ability θ_i to reach the item in question that has b_i , of importance.

For example, if the technique to be applied is "to conduct necessary plans and schedules". Considering that this item is 34% important for the composition of the manager's administrative skills (achieved through the load factors) and he was classified by the employees as being 48% skilled, he has an 89.51% chance of being successful in this item.

To obtain the company's score we will start from the definition of Hope, which is a random variable that gives us the average of all the values we would expect, that is, it is the average value that would result if we observed a random variable many times, also called Value Expected.

In our case, we must calculate the hope of reaching a b_i -level requirement, where $P(\theta_i)$ is the probability of reaching the item by a maturity level manager θ_i :

$$E(x) = b_i \cdot P(\theta_i) \quad (4)$$

This means, for example, that in the item “defends the team's projects”, starting from the manager's maturity level of 58% to reach this item that has an importance of 71% for that skill, a range of 52.56% is expected.

As we wish to obtain the Expected Value of reaching n items / items, we must divide the sum of the expected values of all items by the sum of the importance of all items. The company's grade is calculated by:

$$\pi = \frac{\sum_{i=1}^n E_j(x)}{\sum_{i=1}^n P(\theta_i)} = \frac{\sum_{i=1}^n b_i \cdot P(\theta_i)}{\sum_{i=1}^n P(\theta_i)} \quad (5)$$

5 CONCLUSION

We conclude that it is possible to assess the operational and conceptual managerial maturity of human resources in a company based on the internal assessment of managers' skills and the Item Response Theory. Based on this, plans and strategies to increase this maturity can be put into practice based on the focus on specific practices and requirements of interest, for example, with specific training or reallocation of personnel.

In order for a company to be mature enough to apply management techniques, it is essential that team members keep in mind in a conceptual way, the importance that each item fulfills in the whole of the company.

This work concluded that the Item Response Theory presents itself as a useful tool for quantitative assessment of the conceptual and cultural maturity of a company based on the analysis of the perception of human resources regarding the behaviors and skills of managers, realizing which points must be clarified to the team to obtain a strong culture.

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