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Human Capital and Competitiveness: Analytical Method to Strategic Management of the Man-Organization interaction

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ABSTRACT

One of the management challenges is to understand the mutual relations between individuals and organizations, which promotes the emergence of methods that allow diagnosing and quantifying the impacts of the human factor in the organization. This challenge has been defining a new area of knowledge known as People Analytics, Human Resources Analytics, among other denominations. Thus, having People Analytics as the main subject of research, this study merges the Triple Bottom Line concept of sustainability, the core competences of the organization and some analytical techniques, with the goal of implementing an own strategic diagnosis method to quantify the impacts of the human factor in a multinational of the electronic sector. Aiming at integrating the technological, human and sociotechnical domains, this method integrates variables related to people, processes and competences. The correlation between these three elements with people management methodologies and analytical techniques facilitates the obtaining of quantitative information about the human factor in organizations, contributing to human management becoming assertive, strategic and oriented to the sustainable development of the business. The implementation was directed to the strategic improvement of competence management in the software development sector, aiming to improve the productivity of its developers. The method showed its potential to promote a qualified diagnosis by quantifying the impacts of the developers' competences on the productivity of the associated processes, enabling the improvement in the functional aspects of the area and subsidizing strategies of success for the company in terms of the assertive management of human capital.

PALAVRAS-CHAVE

People Analytics, Capital Humano, Método Analítico, Desenvolvimento de Competências, Retorno sobre Investimento (ROI).

RESUMO

Um dos desafios de gestão é compreender as relações mútuas entre indivíduos e organizações, o que promove o surgimento de métodos que permitem diagnosticar e quantificar os impactos do fator humano na organização. Este desafio tem definido uma nova área de conhecimento conhecida como People Analytics, Human Resources Analytics, entre outras denominações. Assim, tendo o People Analytics como objeto principal de pesquisa, este estudo funde o conceito de sustentabilidade Triple Bottom Line, as competências centrais da organização e algumas técnicas analíticas, com o objetivo de implementar um método de diagnóstico estratégico próprio para quantificar os impactos do fator humano em uma multinacional do setor eletrônico. Com o objetivo de integrar os domínios tecnológico, humano e sociotécnico, este método integra variáveis relacionadas a pessoas, processos e competências. A correlação entre esses três elementos com metodologias de gestão de pessoas e técnicas analíticas facilita a obtenção de informações quantitativas sobre o fator humano nas organizações, contribuindo para que a gestão humana se torne assertiva, estratégica e orientada para o desenvolvimento sustentável do negócio. A implementação foi direcionada para o aprimoramento estratégico da gestão de competências no setor de desenvolvimento de software, visando melhorar a produtividade de seus desenvolvedores. O método mostrou seu potencial para promover um diagnóstico qualificado, quantificando os impactos das competências dos desenvolvedores sobre a produtividade dos processos associados, possibilitando a melhoria nos aspectos funcionais da área e subsidiando estratégias de sucesso para a empresa em termos da assertiva gestão do capital humano.

1 Introduction

Due to changes in the global organizational scenario and the recognition of intellectual capital as a strategic asset of organizations (Hota & Ghosh, 2013), the opportunities associated with the strategic management of the human factor in the last decades are greater than ever (Huselid, 2015). Consequently, the understanding of the mutual relations between the organization and the individuals for the competent management of human capital constitutes one of the key factors in generating competitive advantages.

Based on the axiom of managerial sciences "what can not be measured it can not be adequately managed" (Breyman & Dolinskiy, 2016), the development of knowledge, tools and analytical methods that allow a quantitative approach for the human capital management constitutes one of the major challenges both academic and business. As resources become increasingly scarce and competition increasingly fierce, the guarantee of benchmark in the marketplace is in disposing of beliefs and empiricism and to increasingly ground on data and metrics for decision-making (Huselid, 2015; Shah *et al.*, 2015).

This scenario propitiates the emergence of methods to diagnose and quantify the impacts of the human factor in the organization, defining a new area of knowledge known as People Analytics, Human Resources Analytics, among others denominations, whose interest has been growing dramatically among scholars and practitioners (Huselid, 2018). As one of the most promising areas in the current corporate world for generation of competitive differential (Bodie *et al.*, 2016), People Analytics constitutes a revolutionary approach with potential to improve the results of business through an assertive human capital management.

However, the current studies on the subject reveal that this area of knowledge has its limits still unexplored. Althought it is recognized the capability of People Analytics to provide better decisions about the human capital, applications of strategic value are still insufficient in the organizations. The diagnosis and quantification of the impacts of human factor, when applied, still represent a tactical or limited value, being focused on supporting the human resources functions and optimizing the operationalization and the solution of specific problems in the area. Consequently, they remain little aligned to the strategic management of human capital in favour of organizational sustainability (Angrave *et al*., 2016; Handa & Garima, 2014; Huselid, 2015; Minbaeva, 2017; Rasmussen & Ulrich, 2015; Schiemann, Seibert, & Blankenship, 2018; Wang & Cotton, 2018).

Paraphrasing Wang and Cotton (2018) and Angrave *et al*. (2016), the current reality reveals a scientific opportunity of advocating more strategic approaches of People Analytics, as well as to influence its use and implementation through studies that grant it a multivariate denotation, integrate its strategic content to the business ideals, offer new approaches and methodologies about it and consider ways to diagnose, quantify and improve the human capital of organizations.

This context has made the claim of this study an initiative with scientific and organizational relevance. Having People Analytics as the main subject of research, this study merged the Triple Bottom Line concept of sustainability (Elkington, 1999), the core competences of the organization (Prahalad & Hamel, 1990) and some analytical techniques, with the goal of implementing an own strategic diagnosis method to quantify the impacts of human factor in a multinational of the electronic sector.

Recognized worldwide as a leader in the technology sector and one of the top ten global brands, the company claimed to notice the low productivity among professionals of the software development area. Thus, the proposal of implementation of the method was focuses on the strategic enhancement of competence management in the area, prospecting improvements in the productivity of its developers.

The proposed approach was justified by the fact that People Analytics constitutes an area of knowledge that allows to diagnose and quantify the impacts of the human factor in the organization and enable effective solutions with high added value in human capital management. Therefore, it requires a direction of its potential not only in subsidizing human resources functions, but also in approaching it in a comprehensive way as a supporting tool to the human capital strategic management for organizational sustainability (Angrave *et al.*, 2016).

For confidentiality reasons, organizational data used in the analyses have not been presented in this study. A few demonstrative graphics are

presented, since the intent of the study was to reveal the logical implementation of the proposed method and its results, in order to verify its viability of being explored in a useful way to diagnose and quantify the human factor impacts in organizations.

2 Theoretical Framework

2.1 Organizational Sustainability: The challenge of the 21st century

Due to the 21st century's economic scenario, organizations have been required to develop competences in order to act and survive in competitive environments. The dynamic nature of markets and the increasing availability of information and technology impose to organizations the necessity to innovate continuously, aiming to increase competitiveness and focusing their efforts on organizational sustainability.

Elkington (1999) proposes a wide approach for the sustainability idea through the Triple Bottom Line concept (TBL), which denotes the ideal that a system only becomes sustainable when there is a dynamic balance of social, economic and environmental objectives. Since this approach to sustainability has as its underlying principle the pursuit of continuity of positive business results (Silveira, 2012), the managing challenge for sustainability implies dealing with multiple variables linked to tangible and intangible factors, of human, technological and organizational nature. In this context, the "profit by profit" has become a high-risk strategy, while intellectual capital becomes a strategic organizational asset (Hota & Ghosh, 2013).

The intellectual capital can be understood as the set of intangible resources that organizations have at their disposal, which allows them to produce in an efficient and effective way. It is composed by three components: The structural capital, which involves organizational assets related to the intellectual property category; the relationship capital, that corresponds to the generation of knowledge resulted from relations with other organizations, clients and suppliers; and human capital, its main component that represents the knowledge and skills of employees at the disposal of the organization (Edvinsson & Malone, 1998; Sveiby, 1998).

The emphasis given to human capital is due to its consideration as the basis of all intellectual capital. This consideration derives from its potential of improving the structural capital, internalizing the rewards of relationship capital in order to boost the coming results, and, more importantly, generating new knowledge and applying it through innovations.

Therefore, the capability to mobilize the generation and sharing of the human capital consists in a very important managerial task. Since the early days of studies on the organizational theory, it is known that people and organization participate in a symbiotic relationship, in which one does not exist without another and the behaviour of one modifies the behaviour of the other. Namely, organizations are environment of human transformation and people are their agents of transformation. (Silveira *et al.* 2015).

In this way, efforts for mantain the organizational sustainability over time should consider the importance of strategic alignment of human capital to the ideals of the organization and, at the same time, the need of a proficiency in its management (Momim & Mishra, 2015; Silveira *et al*., 2015).

2.2 Diagnosis and quantification of human factor impacts

Due to the ultracompetitive nature of markets and the increasing availability of information and technologies, the demand for the strategic integration of human capital into organizational actions – as a way to increase competitiveness with quality of life – makes the understanding of mutual relations between individuals and organizations one of the key factors in generating competitive advantages (Silveira, 2012).

Based on the axiom of managerial sciences "what can not be measured it can not be adequately managed" (Breyman & Dolinskiy, 2016), the necessity of using data and analytical techniques to support decision-making has become evident to companies that are looking for a strategic management of the human capital. This need derives from its potential of improving both organizational competitiveness, since that leads to greater confiability of results and better management of investments in human capital, and individual performance and development, due to the consistent approach to people (Bassi, 2011; Bodie *et al*., 2016; Fitz-Enz, 2010; Gustafsson,

2012; Handa & Garima, 2014; Mishra, Lama, & Pal, 2016; Momim & Mishra, 2015; Shah *et al*., 2015).

Given the scientific and technological difficulty of measuring many of the phenomena related to human capital, the development of knowledge, tools and analytical methods that allow a quantitative approach to the management of this asset constitutes one of the major academic and business challenges. This propitiates the emergence of methods that allow diagnosing and quantifying the impacts of the subjective variables set – conceptualized as Human Factor – on the main objective variables of organization, defining a new area of knowledge known as People Analytics, Human Resources Analytics, among other denominations, whose interest has grown dramatically among scholars and practitioners (Huselid, 2018).

Denoting the data science applied to the human factor, People Analytics is adept at a strategic vision of human capital management and it brings answers to the limits imposed on organizational sustainability. Based on correlations between human factors – for example, motivation, knowledge, cooperation, competences, etc. – and the competitive performance of organizations, this area of knowledge allows diagnosing and quantifying the impacts of individuals in the organization in order to improve assertiveness in human capital management.

Thus, as one of the most promising tendencies in the current corporate world (Bodie *et al.*, 2016), with high potential in terms of scientific, economic and social benefits, People Analytics consists in a quantitative approach to the human capital management (Fitz-Enz, 2010; Gustafsson, 2012; Handa & Garima, 2014; Mishra, Lama, & Pal, 2016; Shah *et al*., 2015). By associating knowledge to analytical methods, it ensures quality and strategic design to decisions related to the human side of organizations (Gustafsson, 2012; Mishra, Lama, & Pal, 2016).

It is considered that, by associating knowledge related to the human factor to the possibility of quantifying its impacts on the organization as a whole, People Analytics represents an area of knowledge that reaches the current state of art in the organizational management field. For organizations searching for better managing the returns on human capital investments, People Analytics appears as a new domain, abolishing hunches and intuition and cherishing decision-making based on data and evidences (Shah *et al.*, 2015). Containing elements of business intelligence, this approach of human capital quantification goes from a systematic process of reporting human resources metrics to a process of combinating analytical techniques for the establishment of predictive models to support decisions (Bassi, 2011; Mishra, Lama, & Pal, 2016; Momim & Mishra, 2015) and people development.

Thus, since People Analytics increases the credibility and effectiveness of human resources policies and practices, it constitutes an approach that enhances the strategic role of the human resources area, the human capital management and, at the same time, the organizational results (Lins *et al.*, 2015). Namely, People Analytics consists in a source of competitive advantages to organizations that have it as a main management competence (Bassi, 2011; Bersin *et al.*, 2016; Breyman & Dolinskiy, 2016; Fitz-Enz, 2010).

Therefore, there is a consolidation of a human capital management approach encompassed for an ideal of sustainable development, which is able to provide companies competitiveness with quality of life. Namely, an approach of management and people development at the same time profitable and illuminated, cherishing gains to the organization, people and society (Bassi, 2011).

2.3 Strategic diagnosis method: Rationale and formulation

Although People Analytics is moving towards a new corporate mainstream and denotes the state of art in people management, there are still few international groups with relevant academic studies (Gustafsson, 2012; Lins *et al.*, 2015). The main references in this area of knowledge are the American universities Harvard and Wharton and the British one King's College London.

Furthermore, even though the capability of People Analytics to provide better decisions about the human capital is known, its prevailing approach still represents a tactical or limited value. When applied, it remains focused on diagnosing and quantifying the impacts of the human factor in order to support the human resources functions and the solution of specific problems in the area. Preponderantly focused on the optimization of these processes, People Analytics remains little aligned to a strategic management of the human

capital in favour of organizational sustainability (Angrave *et al.*, 2016; Handa & Garima, 2014; Huselid, 2015; Minbaeva, 2017; Rasmussen & Ulrich, 2015; Schiemann, Seibert, & Blankenship, 2018; Wang & Cotton, 2018).

Commonly, the use of People Analytics is limited to conventional metrics that answer questions of historical nature, with low predictive potential of future events. In solving human capital problems, organizations persist in a reactive circle that is limited to operational report, underutilizing the potential of People Analytics as a strategic and proactive tool for decision-making (Angrave *et al.*, 2016; Handa & Garima, 2014).

It is certain that the prevailing approach already favours competitive gains in human resource actions. However, there is a risk of People Analytics becoming another management praxis of unknown real value to organizations (Rasmussen & Ulrich, 2015).

Thus, People Analytics should not be restricted to the human resources functions. Its potential use must be inherent to a quantitative approach to manage the questions related to the human capital with objectivity and method – as well as it is done with other resources of the organization – and also to promote its integration and strategic alignment in the business as a whole.

Basing on the opinion of Momim e Mishra (2015) in which every strategy related to the human resources should be aligned with business strategy, People Analytics needs to transcend the functional boundaries of human resources. Its sustainable approach requires developing a strategic understanding about the contribution of human capital for the organization (Angrave *et al.*, 2016).

Therefore, it is required a People Analytics approach that prioritizes the alignment of analytical techniques to people management methodologies as well as their application to a logical structuring of data analysis (Fitz-Enz, 2010), in order to understand the correlations between human capital, productivity and organizational competitiveness. This approach makes feasible effective and high-added value solutions in human capital management, which not only referring to the human resources management but also enabling organizational sustainability.

For this reason, a strategic insertion of People Analytics must reference it as a fusion of quantitative and qualitative information and data to support people management (Handa & Garima, 2014). Unlike the traditional vision that considers its application only requires statistical skills, since predictive models dispense any qualitative analysis, the benefits of quantifying the human factor impacts are linked to multidisciplinary analyses of the gained results and decisions taken.

For this reason, qualitative analyses are also required for the diagnosis of human factor impacts, not only for arranging data into information, but also for generating knowledge from them and for designing decisions according to all influence factors. Namely, analytical methods and techniques must subsidize decisions and guide them to results, and not simply dictate an absolute course of action in a way that qualitative analytical competences be banned (Bidwell, 2016; Spears & Bolton, 2015).

In summary, by addressing the ideology of quantification of the human factor kepting it oriented to results, the greater is the time spent. However, it is a way to position the human capital management alongside the sustainable challenge of organizations, managing the elements of this asset throughout the value chain (Rasmussen & Ulrich, 2015).

2.3.1 The essential of simplicity: Processes, Competences & People

Once exposed that the comprehension and measurement of human factor impacts in the organization and in its competitive performance are fundamental issues for a sustainable management of this valuable resource, an approach of human capital management that aligns such necessity to the sustainability notion in its wider scope (Elkington, 1999) is considered crucial. After all, human capital is per se a strategic resource to overcome unsustainable organizational models (Silveira, 2012).

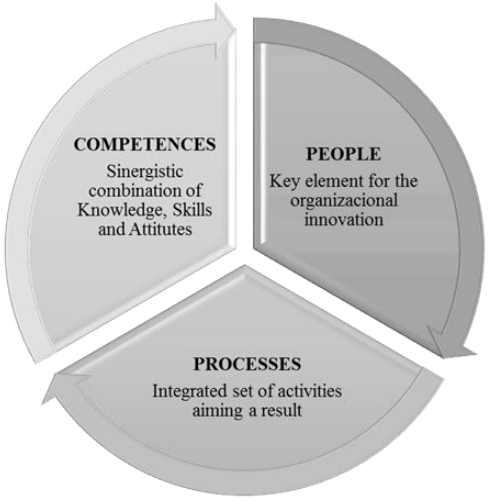
Since human capital represents the knowledge and competences at the disposal of the organization (Silveira, 2012), a human capital management as basis for organizational sustainability requires an approach that also incorporates the core competences theory, proposed by Prahald and Hamel (1990). After all, being crucial for the formulation of strategies, the key organizational competences are the basis of the generation of competitive advantages.

Therefore, a sustainable management of this valuable resource requires approaching it

according to the strategic alignment between the Triple Bottom Line concept of sustainability, the core competences of the organization and analytical techniques.

In this way, this study is based on the principle that an assertive management of human factor requires an integrated knowledge about the factors related to the human capital and the assessment of its impacts. Therefore, it links its purpose to an own strategic diagnosis method for a sustainable human capital management based on three key organizational elements, namely, processes, competences and people (Figure 1).

Figure 1. Strategic Diagnosis Method



Source: Elaborated by the authors.

The reason for a method based on these three elements is due to logical cadence of this combination. It is known that the fundamental purpose of organizations is to guarantee their success over time. Therefore, in order to generate sustainable competitive advantages, the organization must act in a way that its product or service adds enough value to satisfy the customers and, at the same time, brings it positive returns on investments

For this reason, knowing that a product or service is a result of a series of processes, many authors, especially those who present the systemic approach of organizations (Gonçalves, 2000; Maranhão & Macieira, 2004; Maximiano, 2000; Schoderbek, Schoderbek, & Kefalas, 1980; Senge, 2013; Silveira, 2006; Tachizawa & Scaico, 2006), they consolidate a vision of processes as being the fundamental components of an organization. Such vision is based on three perspectives:

a) Any system can be seen as a circular relation between purpose, environment and functions that correspond to the processes;

b) Based on the process perspective as a transformation that adds value, it is evident that only through its network of processes that an organization can transform a set of Inputs – materials, information or clients – in Outputs – final or intermediary results – that fulfill the organizational purposes;

c) The process perspective presents a similar complexity to organizations, as it is compounded of multidimensional factors associated to physical dimensions (equipments, infrastructure, materials, so on), organizational (procedures, information flow, decision-making, so on) and human dimensions – knowledge, competences, cooperation, so on.

Therefore, the organization is consolidated per se as a network of processes. It is compounded of integrated sets of activities that are sequenced in a coordinated manner – not always linear – in order to produce specific results to satisfy the clients (Gonçalves, 2000). Thus, the method proposed considers that the guarantee of success over time includes a good management of the **processes**.

In this aspect, the logical combination between the processes and others elements of the method is due to the pretension of emphasizing that the effectiveness of a process, as well as the satisfaction of their related necessities (Silveira, 2006), depend on the capability of that who runs it. Therefore, since they boost the processes and, consequently, the organizational essence, the competitiveness is also linked to the management of the **competences** – a synergistic combination of Knowledge, Skills and Attitudes expressed by professional performance in a particular organizational context (Perrenoud, 1999; Silveira, Maia, & Fioravanti, 2012).

Hence, the cycle of the proposed methodology advocates that the guarantee of organizational sustainability lies in the strategic management of **people**, a key element for the organizational innovation that is constituted as the bearer of necessary competences to execute the organizational processes.

Therefore, the sustainability of an organization depends on its strategic action on what is under its governability. The organizational success is consequence of a jointed work of elements and variables that, being guided by

strategy, allow a coherent set of **people, competences and processes**. Hence, the human dimension consists in a focus to be explored.

The logical cadence of this combination reveals the inherency of this method's foundation to the People Analytics approach. Since the competences are considered as the basis of the organization's strategic performance, being up to them to define the productivity and the level of competitiveness, changes, innovation and the reduction of costs (Shah *et al*., 2015), the positive relation between a strategic approach of human capital management and the organizational performance depends on the data collected, information generated, available knowledge and individual competences to be aligned with the organization's core compentences.

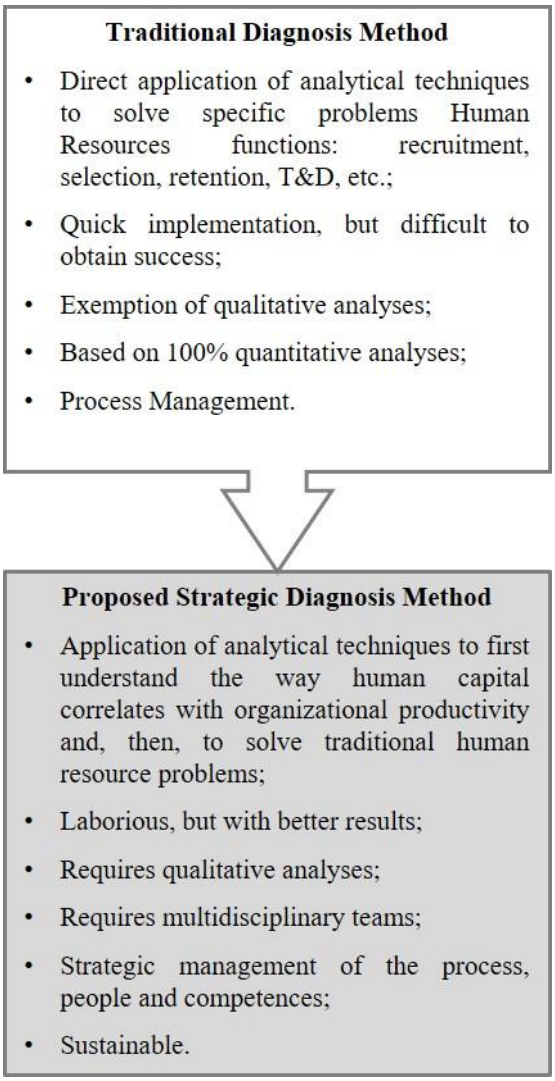
Thus, the method is based on the alignment of data, information, knowledge and competences. It consolidates an approach of technological, human and sociotechnical domain, involving the gathering of internal and market data, the organization of these data into information, the reflection and generating of knowledge and the management of knowledge and competences of interest.

This rationale is aligned to the consideration of processes, people and competences as the main organizational components and, therefore, as crucial basis for a strategic business diagnosis. The synergistic correlation between such components with methodologies of people management and analytical techniques enables obtaining quantitative information about the human factor in organizations and contributes to human management becoming strategic and oriented to the sustainable development of the business.

Constituted by a comprehensive vision that includes components of the organization as a whole, such method allows approaching the human capital management in a more assertive way, allowing the understanding and measurement of its relations to organizational performance and productivity.

The strategic value of the proposed method is linked to its potential of diagnosing organizational elements that subsidize not only the human resources area and the improvement of its respective functions, but also the empowerment of its role to similar levels to other organizacional areas. The method's comprehensiveness allows overstepping boundaries of the human resources area. Propitiating a qualified diagnosis of aspects related to the human factor, the method enables deeper investigations, instigates new reflections and delimits assertive solutions, in order to minimize flaws in the assessment of value.

Figure 2. Proposed strategic diagnosis method versus traditional methods



Source: Elaborated by the authors.

In summary, Figure 2 presents the way that the proposed strategic diagnosis method differs from traditional methods. By dealing with the human capital in a measurable way, it consists in a quantitative management approach that allows bringing innovative elements to human capital management, influencing the organizational sustainability in a positive way.

Wherefore, since its main proposal is to implement the aforementioned method in a business practice, the following topic describes the study' methodological details.

3 Methodology

Basing on Gil (2002), the study was exploratory. Such classification is due to the study has approached People Analytics as an area of knowledge which there are still few relevant academic studies about and its intention of exploring the human factor diagnosis and quantification as an approach whose potentialities exceed its current focus on human capital management.

Therefore, looking to position it as a potential ideal to provide organizations competitiveness with quality of life, the study bibliographically mapped People Analytics as area of knowledge. Its proposal was to approach the subject according to the alignment between the Triple Bottom Line notion of sustainability (Elkington, 1999), the core competences of the organization (Prahalas & Hamel, 1990) and analytical techniques, in order to guide the implementation of its own strategic diagnosis method – reasoned and described in the previous session – in a multinational of the eletronic sector. The company is recognized worldwide as a leader in the technology sector and one of the top ten global brands.

The study was focused on the software development area of the organization, which is composed of a team of sixteen developers. Although in a subjective way, the organization claimed to notice a low productivity among these professionals. Hence, the proposal was to implement the aforementioned method in order to improve the competence management in the area.

Therefore, the purpose of this study involved the quest for quantifying the impact of the developers' competences on productivity in order to prospect improvements in their performance.

For confidentiality reasons, organizational data used in the analyses have not been presented in this study. A few demonstrative graphics are presented, since the intent of the study was to reveal the logical implementation of the proposed method and its results, in order to verify its viability of being explored in a useful way to diagnose and quantify the human factor impacts in organizations.

3.1 Mapping the software development area

The studied organization already claimed to have a strategic management of human capital. The required competences in the developer position had already been mapped, totalling a set of twenty-one competences.

Based on the CHA Model of competence management – a model aligned with the vision of specialists on competences development (Perrenoud, 1999) which is based on the notion of competences as synergetic combinations of Knowledge, Skills and Attitudes expressed by professional performance in a particular organizational context (Silveira, Maia, & Fioravanti, 2012) – it was identified that the developer position required ten kinds of Knowledge and eleven Skills and Attitudes, as shown in Table 1.

Table 1. Current mapping of the competences of the Software Developer job position

Knowledge	Skills and Attitudes
Technical Knowledge 1	English
Technical Knowledge 2	Alignment/Standardization
Technical Knowledge 3	Strategic Orientation
Technical Knowledge 4	Problem Solving
Technical Knowledge 5	Interpersonal Relationship
Technical Knowledge 6	Cooperation/Teamwork
Technical Knowledge 7	Communication
Technical Knowledge 8	Leadership
Technical Knowledge 9	People Management
Technical Knowledge 10	Customer focus
	Response Time

Source: Elaborated by the authors.

Likewise, the Key Performance Indicators (KPI) of each developer had already been mapped by the organization's system and they were measured based on time. In other words, Time was the key performance indicator and it consisted in a fundamental element of the organization's Management Information System.

The area grouped developers as Junior, Full-fledged and Senior. The grouping criterion was based on the period of experience.

3.2 Application of the method

The method formulated in this article is based on the application of own algorithms which use Analysis of Variance (ANOVA) and Cluster Analysis techniques to correlate data referred to people, competences and processes, crucial elements for the business diagnosis.

As usual in the corporative world, the information provided by the organization were not stored into one place. The mapping of the competences constituted the human resources area database, while details about processes performance were stored in software development area database.

Thereby, since disintegrated information sources difficult the data analysis (Visier, 2014), the first action was to integrate both bases in a way that subsequent analyses could be facilitated. Afterward, the study looked to understand the relations between the collected data, aiming to diagnose the impacts of each competence on the productivity.

For this purpose, according to its own statements, the implementation of the method allowed to consider that, in order to measure the impact of the mapped competences on the process, the key factor was to obtain data referring to the developers, intermediary agents of this relation.

Therefore, the study sought to investigate the differences between developers in terms of competence level to the extent of influencing the required time for execution of their activity. Through 360º performance evaluation methodologies – evaluation by superior, peers, subordinates and own developer – the level of each developer for each mapped competence was evaluated, being assigned Level 1 (low), Level 2 (medium) or Level 3 (high).

In summary, approaching the developer's Competence Level and Productivity as variables of interest and investigating the relation between them in an analytical way, strategic improvements in the competence management of the area were suggested, prospecting enhancements in developer's performance. By the synergy between the method's components, people management methodologies and analytical techniques, the study considered its analyses in subsidy to strategic management of human capital and to the improvements in the procedural functions of human resources area, in terms of recruitment and selection, training and retaining talents.

4 Analyses

Through its adequacy to the fundamentals of the aforementioned strategic diagnosis method, the proposed implementation was potential to solve problems pointed as important by the organization and to reach the established objectives.

Based on integrated analysis of the three elements that compound the implemented method, when correlating the competence level of each developer and their performance in the process, it was possible to quantify the impact of each kind of knowledge, skill or attitude on the developer's productivity. This action allowed to better understand which competences added value to the position and generated significant changes in the results, as well as how to manage them in an assertive, strategic and oriented to the business's sustainable management way.

The measurability of the method has shown potential to make explicit aspects that had not been considered by the organization. As mentioned above, the mapping of the competences followed subjective standards and their relevance for improvements in productivity was unknown.

Therefore, by allowing approaching the human factor in an analytical way, the implementation of the method subsidized strategies of success for the organization in terms of human capital management. Even though the study has been focused on an area whose processes involved high complexity, its foundation on the synergistic relations between three aforementioned organizational elements, human management methodologies and analytical techniques, has favoured strategic enhancements in the competence management of the area, prospecting improvements in the developers' productivity.

Furthermore, the assertiveness conferred by the method on human capital management has propitiated improvements in the functional aspects of the human resources area, allowing the strategic establishment of new foundations for recruitment and selection, training and retaining developers. By correlating competence level and productivity – both variables of interest – this study allowed determining which competences should be considered in the recruitment and selection,

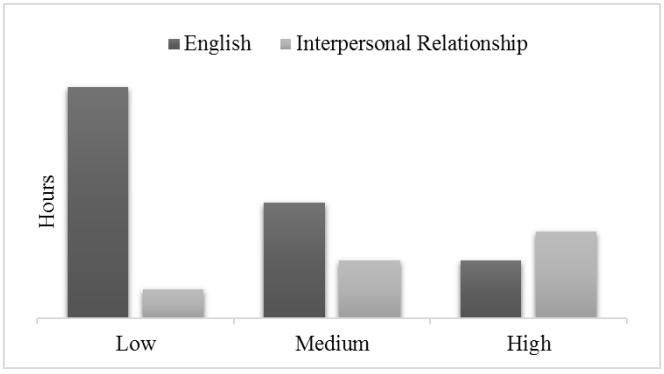
training and retention processes, as detailed in topics 4.1, 4.2 and 4.3.

4.1 Recruitment and selection of software developers

The established parameters for the recruitment and selection of software developers followed the subjective mapping of competences considered important for these professionals (Table 1). However, through application of statistical techniques, in order to understand the relations between competence level and the productivity of processes, it was found that some mapped competences generated significant improvements in productivity as far as their level increases, while others declined. Therefore, there were identified competences that impacted the performance in a directly proportional manner and competences that impacted performance in an inversely proportional manner.

The Figure 3 illustrates this occurrence, considering the levels of English and Interpersonal Relationship and the amount of required hours to execute a given activity. According to the Figure, high levels of English improved the performance, while high levels of Interpersonal Relationship decreased the developer's performance.

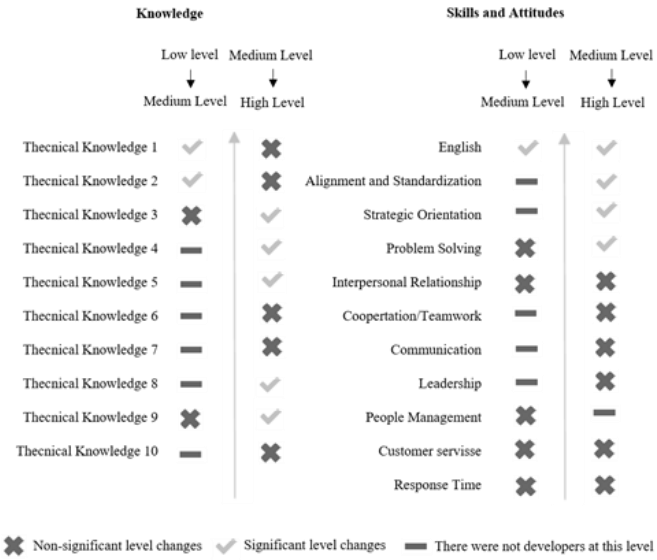
Figure 3. Levels of English / Interpersonal Relationship versus Productivity



Source: Elaborated by the authors.

Hence, based on the way that each competence level influenced productivity, it was possible to extract from the mapped competences those that really should be considered in a recruiting and selection process and those that could be disregarded (Figure 4). It is important to know that the impact of some levels of competence on productivity could not be measured, since there were not developers with the respective level.

Figure 4. Impact of competence level on productivity



Source: Elaborated by the authors.

According to Figure 4, the level of English, for example, is an important consideration when recruiting a candidate to the developer position. Changes on the level of this skill generate significant impacts on productivity, in which the higher level of developer, more efficient will be his productivity. On the other side, the level of Interpersonal Relationship, for example, unlike it seems, is not seen as potential for developers' productivity.

Figure 4 also presents cases where a competence only becomes relevant to productivity when its level is higher or lower. For example, Technical Knowledge 9 is relevant for developer's productivity solely in cases that he has it in a higher level, while Technical Knowledge 2 only shows potential when he has in a lower level.

Therefore, the fact of appealing to analytical techniques allowed a more assertive mapping of competences that were more important to the position and that, for this reason, they should be considered in the recruitment and selection processes of the area. Justified by Figure 4, the new mapping of knowledge, skills and attitudes for the developer position is shown on the Table 2.

Table 2. Proposed mapping of the competences of the Software Development job position

Knowledge	Skills and Attitudes
Technical Knowledge 1	English
Technical Knowledge 2	Alignment/Standardization

Technical Knowledge 3	Strategic Orientation
Technical Knowledge 4	Problem Solving
Technical Knowledge 5	
Technical Knowledge 8	
Technical Knowledge 9	

Source: Elaborated by the authors.

4.2 Retaining talent

As previously mentioned, the software development area grouped developers as Junior, Full-fledged or Senior. The grouping criterion was based on the period of experience in the organization. However, it was observed that there were developers in the current grouping who, although theoretically considered Junior, they produced just as a Senior, and vice-versa.

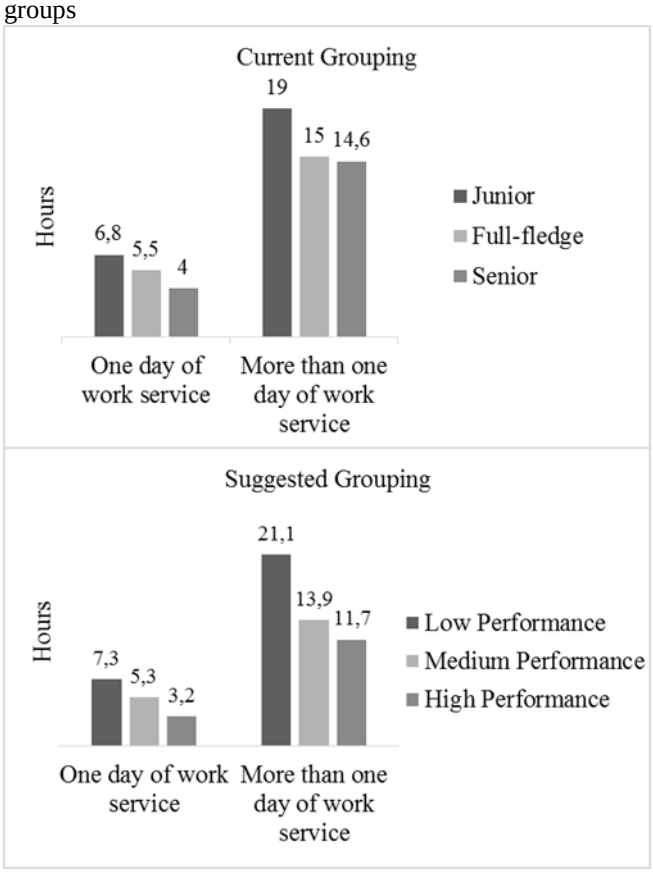
Consequently, due to the absence of quantitative criteria to support assertive decisions, the organization could search for strategies to retain developers by the simple fact that they were Senior, whereas a Junior retaining could be more strategic, considering his better performance.

This finding corroborates the opinion of Huselid (2015) regarding to the current gap of information in many organizations, which makes the most representative talents the least measured and managed.

Hence, through Cluster techniques, a new way of grouping the developers was designed, not according to the fact that they are Junior, Full-fledged or Senior, but according to the performance obtained in the process, in order to maximize the performance differences between groups. In this way, developers were regrouped into three new groups organized in the following way: Low Performance (3 Junior / 1 Senior); Medium Performance (2 Full-fledged / 5 Senior); and High Performance (1 Junior / 2 Full-fledged / 2 Senior).

Figure 5 illustrates how the performance difference between groups was maximized with the new grouping suggestion, both in considering the performance of the groups on simple tasks, which required up to one day of work service, as well as on complex activities that required more than one day of work service.

Figure 5. Maximizing the performance difference between groups



Source: Elaborated by the authors.

According to the Figure, in the current grouping, the performance difference between Junior and Senior developers is approximately three hours on simple activities and four hours on complex activities. Otherwise, in the suggested grouping, the performance difference betweeen low and high-performance groups on simple and complex activities has become approximately four and nine hours, respectively.

Therefore, by maximizing the performance difference between groups, the suggested grouping subsidized conclusions about which developers should be retained and which could be developed. Regardless of being Junior, belonging to the high-performance group meant that developer should be retained. In the same way, regardless of being Senior, belonging to the low-performance group meant that developer could be developed.

Therefore, from sixteen developers, such analysis allowed to identify five for whom the retention should be strategic, since they belonged to the High-performance group (1 Junior / 2 Full-fledged / 2 Senior), and four developers who, belonging to the Low-performance group, should be developed (3 Junior / 1 Senior).

4.3 Training and development

Once the suggested grouping allowed identifying which developers should be retained and which could be developed, observing the differences on the competence levels of the low, medium and high-performance groups, it was possible to identify which competences were constituted as differential factors of the groups' performance and that, therefore, consisted in potential competences to be trained and developed.

This finding allowed claiming that the differential factor of the low-performance group to the medium-performance group was constituted of two skills and attitudes, highlighting the necessity of developing them. Meanwhile, three technical knowledge and one skill and attitude delimited the differential of the medium and high-performance group, highlighting the possibility of being developed.

Therefore, the strategic nature of the proposed diagnosis method is due to its potential to serve not only as a resource for human resources functions or to solve specific problems related to the human factor, but also to promote a qualified diagnosis for the quantification of impacts and the assertive management of this valuable resource.

5 Conclusions

This study had as the main subject of research the quantification of the impacts of the human factor in the organization, emerging knowledge area known as People Analytics, among other denominations, one of the most promising areas of knowledge in the current corporate world for the generation of competitive differential (Bodie *et al.*, 2016).

While People Analytics is moving toward being a new corporate mainstream, as an approach with the potential to leverage business results through assertive human capital management, its limits of action remain unexplored. The diagnosis and quantification of the impacts of human factor in the organization remain focused on supporting human resources functions and optimizing the solution of specific problems of the area. Consequently, they remain little aligned to the strategic management of human capital in favour of the organizational sustainability (Angrave *et al.*, 2016; Handa & Garima, 2014; Huselid, 2015; Rasmussen & Ulrich, 2015).

This study explores the aforementioned limits when presenting the means to implement a strategic management of human capital through the insertion of methodologies of the area of People Analytics in the conduction of the organizations. It was tried to show how the quantification of the variables associated to the human factor in support of the business strategy, and not only limited to the functions of human resources, allows solutions with high added value in human capital management, that are promoters of organizational sustainability (Angrave *et al.*, 2016; Huselid, 2015).

The implementation of methodologies in the area of People Analytics in support of the organizational strategy requires the alignment of efficient analytical techniques with practices in people management, enabling an assertive human capital management, that allows to understand and quantify the relations of the workforce with the performance and organizational productivity.

The study presented, with People Analytics as the central research theme, aligned the concepts of the Triple Bottom Line of sustainability (Elkington, 1999) and essential competences of the organization (Prahalad & Hamel, 1990) with analytical techniques, aiming to present the application of its own strategic diagnosis method to quantify the impacts of the human factor in an electronics multinational.

Based on the alignment of data, information, knowledge and skills, the implemented method enables an integrative approach in the technological, human and sociotechnical domains; for that, both internal and market data are collected. The organization of these data in relevant information allows the generation of new knowledge, resulting in the management of this knowledge and the competences of interest in support of the organizational strategy.

Considering that the sustainability of an organization depends on its strategic action on what is under its governability, such method integrates variables related to people, processes and competences, considered as the main components of the organization and, therefore, the crucial elements for the business diagnosis.

Through it, the study advocated that the synergic correlation of people, processes and competences with people management methodologies and analytical techniques facilitates to obtain quantitative information about the

estrategic human factors in organizations and contributes to people management becoming objective, strategic and oriented to the business' sustainable management.

It is certain that, by comparing the diagnosis method addressed here to the traditional methods, since it keeps focused on the results and consists in a comprehensive vision that includes the components of the organization as a whole, the bigger is the work and time spent for its application on daily reality of the organizations. However, it consists in a way of positioning the human capital management along the current demands of the century.

The implementation of the mentioned method was focused on the reality of an organization that, although recognized worldwide as a leader in the technology sector and as one of the top ten global brands, it claimed to perceive a low productivity among the professionals of the software development area. Hence, through demonstrative graphics, the logic of the method and its applicability on the diagnosis and quantification of the impacts of the human factor for the strategic improvement of competence management in the area was revealed, prospecting improvements in the developer's productivity.

The method showed potential to solve the problem claimed by the organization and to reach the proposed goals. Through integrated analysis of three organizational key elements, people management methodologies and analytical techniques, the implementation of the method enabled strategic improvements in the competence management and in the procedural aspects of the area, establishing assertive foundations to three processes of the HR area: selection, training and retention of professionals.

In summary, it is possible to consider that, allowing the approach of the human factor in an analytical and quantifiable way, the implementation of the method subsidized strategies of success to the organization in terms of human capital management.

6 Implications and Further Research

The results of the presented study can subsidize new studies that guarantee the scientific and organizational relevance of the purpose that has been started here.

Regarding the possibilities guaranteed by the studied organization, since they were specific and equivalent to the implementation of the proposed method for the strategic improvement of the competence management in the studied area, the results achieved justify the continuity of the research for new method directions. This will allow to diagnose other problems related to human factor and delineate strategic actions that join improvements on the productivity of the area, as well as the competitive performance of the organization.

A very interesting new possibility of research consists on the implementation of the method defended and implemented here in the diagnosis of one of the greatest problems related to human capital, that is the presenteeism. Characterized as an "invisible absence" at work, the presenteeism becomes a chronic behaviour that, by attenuating productivity, threatens organizational sustainability in all its aspects (Garrido *et al*., 2017).

The justification for this direction lies in the fact that, after acknowledging the range of presenteeism, an assertive management of this behavior requires approaches that provide ways to diagnose its manifestation (Lowe, 2002) and to measure its impacts on the individual and the competitive performance of the companies (Ospina *et al.*, 2015, Tang, 2014). However, although the efforts have been put into searching and how to measure it since 1992 (Pereira, 2014), the management of this behaviour is still tinged by the approaches of People Analytics, which were exposed in the topic 2.3.

For this reason, since the identification, understanding and measurement of this behavior and its effects on productivity still represents one of the greatest management challenges (John, 2010; Lowe, 2002), the implementation of the defended method in studies aiming the diagnosis and quantification of its impacts on the individual and the competitive performance of organizations also consists of a path of potential relevance.

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