HOLOS
ISSN 1807 - 1600

RESISTANCE IN PROCESSES OF CHANGE IN INFORMATION TECHNOLOGY: A FUZZY AHP APPROACH

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Submetido 17/01/2020 - Aceito 14/03/2021

DOI: 10.15628/holos.2021.10355

ABSTRACT

Current literature on information technology points to a scenario where resistance to change must be considered in all Information Technology (IT) implementation processes. However, there is no consistency in the extant literature about the interplay among the several triggers to resistance to change in IT. This paper aims at surveying the literature and investigating their roles in IT change management. Fuzzy AHP (Analytical Hierarchical Process) is used to provide greater flexibility in understanding the answers. The results point to two main sets of behaviours (intrinsic and extrinsic), which find support from other management fields. This paper contributes to the literature by showing that contrary to what was formerly believed, resistance to change in IT is not as much linked to technical aspects but to personal and team-level causes.

KEYWORDS: Resistance, Change, Information Technology, Fuzzy, Analytical Hierarchical Process.

RESISTÊNCIA EM PROCESSOS DE MUDANÇA EM TECNOLOGIA DA INFORMAÇÃO: UMA ABORDAGEM FUZZY AHP

RESUMO

A literatura atual sobre tecnologia da informação aponta para um cenário onde a resistência à mudança deve ser considerada em todos os processos de implementação de Tecnologia da Informação (TI). No entanto, não há consistência na literatura existente sobre a interação entre os vários motivadores de resistência à mudança em TI. Este artigo tem como objetivo fazer um levantamento da literatura e investigar seus papéis no gerenciamento de mudanças em TI. Fuzzy AHP (Fuzzy Analytical Hierarchical Process) é usada para fornecer maior flexibilidade no entendimento das respostas. Os resultados apontam para dois conjuntos principais de comportamentos (intrínsecos e extrínsecos), que encontram respaldos em outras áreas de gestão. Este artigo contribui com a literatura ao apontar para o fato de que, ao contrário do que se pensava anteriormente, a resistência à mudança em TI pode não estar tanto ligada a aspectos técnicos, quanto principalmente a causas pessoais e de equipe.

Palavras chave: Resistência, Mudança, Tecnologia da Informação, Fuzzy, Processo Analítico Hierárquico.

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1 INTRODUCTION

This work aims at understanding the current literature on Information Technology (IT) change, and to analyse the potential inconsistencies found in the various drivers of resistance in IT-related themes. Extant literature has several isolated studies that identify various dimensions of resistance to change in IT processes (Smollan, 2011), resulting in a significant increase in resistance to change in the status quo (Klaus & Blanto, 2010; Craig, Thatcher & Grover, 2019). Thus, it becomes possible to identify the reasons that lead to resistance, and possibly mitigate negative impacts (Jacobsen & Rodrigues, 2002).

The introduction of change processes can cause instability scenarios and, consequently, lead to a set of defence reactions (Musse, Araújo Neto, Ahlert, Rey, Ignacio & Motta, 2015). As a result, changes tend to be introduced progressively and incrementally, since the adaptation of members to new paradigms is essential to mitigate resistance (Fetzner & Freitas, 2012). As such, there is a tension between the need for changes in processes and the maintenance of habits and routines that tend to prevail in the organization (Burns & Scapens, 2000).

On the one hand, the current literature on resistance is an established theme (Martin, 2017; Thakur & Srivastava, 2018; Neves, Almeida & Velez, 2018). On the other hand, changes in the information technology process are beyond current logic (Salles, Alves, Dolci, & Lunardi, 2016). For this reason, in the case of changes related to new business rules, an exploratory and quantitative measurement study is necessary due to ambiguities and possible formulation of business rules with low performance (Dallavalle, & Cazarini, 2000).

To deal with this inconsistency, the multicriteria decision method Fuzzy Analytic Hierarchy Process was used along with some refinements to provide greater flexibility and precision in the computational responses. A questionnaire (see Appendix A) was developed with the most relevant criteria in the literature and grouping the criteria in a single study in order to classify, categorize and rank them. Diverging from the current literature, the results point to resistance to change in Information Technology (IT) as not as much linked to technical aspects, as potentially to personal and team-level causes. Thus, it was possible to elicit psychological concepts, such as apathy and denial, that tend to induce greater resistance in the processes of changes in information technology, having greater relevance than technical concepts, such as poor selection and misinformation.

2 BIBLIOGRAPHIC REVIEW

Organizational change aims to bring essential changes in business continuity, in order to allow the organization to prosper and position itself to face competition (Siebel, 2019). For the change in an organization to be carried out satisfactorily, it is necessary to have knowledge about the most appropriate moment to carry it out and select the most opportune moment (dos Santos, 2015). It is very important that both the planning and the execution of change are carried out in the best possible way, otherwise they can contribute considerably to the resistance (Breternitz & Galhardi, 2011).

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Every change process tends to be accompanied by resistance. Such resistance processes can be presented openly, implicitly, immediately or in later stages (Robbins & Stylianou, 1999). There is a direct link between the importance of planned change and the resistance that individuals are opposed to (Griffin, 1997). These individuals have different reactions about resistance to an organizational change, which indicates different ways of dealing with the change in the existing process (Piderit, 2000). There is relevant evidence that resistance stems from the psychological context of team members (Oreg, 2003).

However, every change process tends to always be accompanied by resistance. Such resistance processes can be presented openly, implicitly, immediately or later (Robbins, 1999). There is a direct link between the importance of planned change and the resistance that individuals are opposed to the possible change that can be implemented. These individuals have different reactions about resistance to an organizational change, which indicates different ways of dealing with the change in the existing process (Piderit, 2000). There is relevant evidence that resistance stems from the psychological context of team members (Oreg, 2003).

Resistance can be active or passive and the reasons that tend to result in feelings of rejection are derived from uncertainty (Maurer, 1997; Watson, 1969). It can also be defined as a set of behaviours disclosed by individuals who express some discontent related to any change in information technology (Rivard & Lapointe, 2012; Felisoni, Martins, & Gaspar, 2020). These behaviours can be apathy (Chen & Li, 2019), sabotage (Day, 2000), the denial and maintenance of behaviours prior to implementation (Kim & Kankanhalli, 2009). When resistance is active, the individual tends to make it impossible for the change to cause innovations or changes in organization, including the use of attitudes such as sabotage or conflict (Dey, 2010). In passive resistance, on the other hand, the individual can have a more serene attitude, and can only disregard the suggested proposals for organizational change (Watson, 1969).

Also, according to Maurer (1997), individuals tend to resist changes for fear that something negative might harm them. Following this reasoning, it can be said that for individuals, change occurs like a hurricane, always accompanied by the idea that some members may be harmed. They may also be afraid of losing something valuable, previously conquered and that can be eliminated during the move. Based on the possible attitudes of individuals, one can expect limited contributions or even opposition to change, as individuals are different and lack support. Individuals have different reactions to resistance to organizational change, which indicates inaccurate behaviours (Piderit, 2000). To guarantee survival, both on the part of the organization and regarding the individual, it is necessary to be receptive to change and everything that goes against this thought, is treated as resistance.

Resistance to change, unprepared individuals and with low involvement are causes for the failure in a management system implementation (Garg, 2013). Resistance can also be a perception of the change induced by the implementation of a new information system (Oreg, 2006; Polites & Karahanna, 2012). The importance of resistance to change, as an employee's reaction to information technology-induced change, has been demonstrated to the extent that users tend to resist the use of technology based on their perceptions of change (Bhattacherjee & Hikmet, 2007).

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Motivated by such inconsistencies, a literature review was carried out with a focus on resistance to change in Information Technology (IT). Through a search on the Web of Science® database, a set of 60 articles were surveyed, two of which were possible to initially discard 23 articles (13 of them only cited random terms, 6 mentioned the change management in information technology only as an example, but they were not configured as articles in this field of knowledge, considering the literature and the methodology). In addition, 4 articles did not adequately explore the subject in question, thus leaving a total of 37 articles analysed in relation to the referred topic. Other aspects related to change exist, however, not directly linked to IT, such as resistance in merger processes (Almada & Policarpo, 2016) and the client's resistance to changes (Guilhardi, 2002).

Change, being an orderly procedure, encompasses several phases and has a pre-structured logical sequence. It must be well defined and established according to a concrete methodology based on situations (Beşliu, 2018). Also, according to Beşliu, change has several steps to anticipate the situation and overcome resistance to change is one of these steps. During the new implementation of the business system, employees showed resistance and used other ways to carry out their activities, such as software not authorized by the organization (Davison, & Ou, 2018). The literature regarding the resistance of individuals covers various aspects such as reasons, factors and results (Ali, Zhou, Miller & Ieromonachou, 2016). One of these reasons may be intrinsic behavior and may also be the basis of resistance in IT-related implementations, even though they are not often cited in the literature, such as cynicism (Selander, & Henfridsson, 2012).

Thinking about behavioural aspects, influence tactics can be used to manipulate resistance and behaviours with regard to newly implanted information systems (Ilie, & Turel, 2020). The incorporation or change in information technology is followed by changes in activities related to existing processes and with these affecting individuals (Aseidu & Boateng, 2020). Evidence found in the literature (Laumer & Eckhardt, 2012) shows that the study regarding user resistance has not yet yielded coherent and clear results that show best practices. With this, the studies portrayed in this literature review are presented separately, not relating each criterion with the others found, preventing confrontation, which is one of the contributions of the present study.

In the case of changes in information technology, eight important criteria for the expansion of resistance were identified. In the literature, there are other concepts related to resistance, but only selection, adaptation, defence, instability, denial, mistrust, apathy and disinformation were mentioned and associated with information technology (See Table 1).

3 METHODOLOGY

For the present analysis, the Fuzzy AHP method was selected, which can provide better decisions (Oliveira Neto, Oliveira & Librantz, 2017; Silva, Shibao, Librantz, Santos & Neto, 2020). Fuzzy AHP is part of the multicriteria decision methods family and aims at eliciting weights from criteria that form a global concept (Martins, Santos & Vils, 2017). This method is composed of AHP plus Fuzzy logic. The multi-criteria decision method AHP (Analytical Hierarchical Process), was developed by Thomas L. Saaty, during the 1970s.

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This method consists of supporting decision making and allows identifying and selecting the decision that best suits the objective intended to arrive. It provides a broad and coherent scenario for formulating a problem in decision making, as well as demonstrating and dimensioning its elements and comparing these elements with the general objectives, evaluating correlated alternatives.

Table 1: Criteria and descriptors.

Criterion	Descriptor	References
Poor selection	Some poorly selected changes can be detrimental to the organization	Lamba & Singh, 2018
Maladaptation	Attempt to adapt to proposed changes	Miller, Ota, Sumaila, Cisneros & Cheung, 2018
Defence	The perception that change will happen, along with trying to avoid it	Rendon & Snider, 2019
Instability	Would like to keep the organization moving towards without it	Prib & Gromova, 2019
Denial	No need for change	Goksoy, 2017
Mistrust	People tend to distrust the new	Galli, 2019
Apathy	Lack of attitude of team members	Thite & Bhatta, 2019
Disinformation	Members may have the misconception that change can cost them a job	Stone, Aravopoulou, Evans, Aldhaen & Parnell, 2019

However, it would not be possible to obtain the best results with the use of AHP alone. The use of AHP was considered together with fuzzy or fuzzy logic, better known as Fuzzy logic. The method was introduced to scientific circles in 1965 by Lofti Asker Zadeh and consists of a form of logic with multiple values. Unlike Boolean logic, where values can only be 0 and 1, or true and false, Fuzzy allows values to be any real number, from 0 to 1.

A consistent criticism of the basic use of AHP is that the original method it is not sensitive to the inaccuracy in the definition of discrete weights (Chan, Kumar, Tiwari, Lau & Choy, 2008). One option to deal with these limitations is to integrate diffuse logic with traditional AHP (Nazari-Shirkouhi, Miri-Nargesi, & Ansarinejad, 2017), making it possible to transform linguistic variables into fuzzy triangular numbers (Ayhan, 2013) – figure 1 shows the steps proposed for this research.

For a more assertive result, the procedure of Ayhan (2013) was used, with a small change. Weighting rules have been inserted to compensate for the difference between weights in the responses at different levels. Although the original method is an improvement compared to pure AHP, the method proposed by Ayhan (2013) is still not sensitive to the quality of the respondent - that is, respondents of different technical levels are treated with the same weights.

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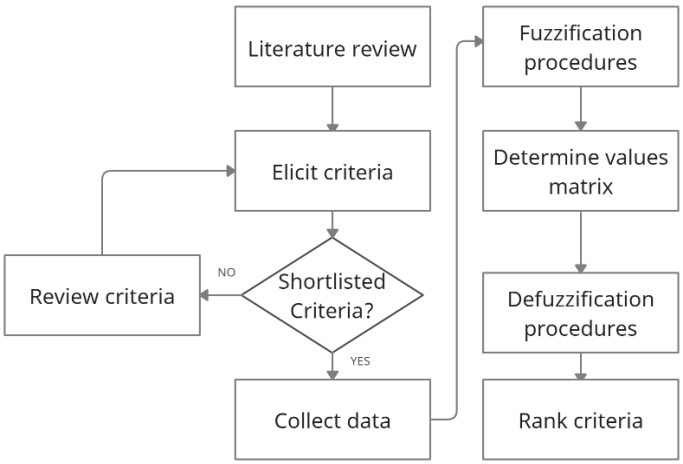

Figure 1: Proposed steps.

This limitation is of little importance when there is a very large population of respondents. On the other hand, when there is limited access to respondents or the respondents themselves are limited in number, to avoid a decrease in responses, we employ a weighting system in which less desirable responses are used, however, with a penalty, as in Felisoni and Martins (2019).

Table 2: Saaty scale numbers, verbal descriptions and triangular fuzzy numbers.

Saaty Scale*	Equivalent verbal description	Triangular fuzzy numbers computed
1	Equally important	(1, 1, 2)
3	Weakly important	(2, 3, 4)
5	Fairly important	(4, 5, 6)
7	Strongly important	(6, 7, 8)
9	Absolutely important	(8, 9, 9)

* Numbers 2, 4, 6, and 8 are used when individuals have intermittent perceptions, their triangular fuzzy numbers' ranges are n-1 and n+1, just as the Saaty numbers above, except for the extreme points (there is no number under 1 or over 9).

As an example, when a decision-maker states that Criteria A is fairly more important that Criteria B (A fairly > B), it is realized internally as triangular fuzzy numbers (4, 5, 6). Comparatively, if it were the opposite (A fairly < B), these would be operationalized as (1/6, 1/5, 1/4) on the contribution matrix. This pairwise choice is represented by $\tilde{d}_{ij}^{k}$ in the equation 1. As a weight adjustment procedure, first strategic personnel's average is computed and then all other (tactical, operational) responses in $\tilde{d}_{ij}^{k}$ are multiplied by a p weight, where for each tactical personnel's $\tilde{d}_{ij}^{k}$, 0.33 is added if under or 0.33 is taken if over the strategic personnel's average. The same happens for operational personnel, but with a different weight (0.66 penalty/award). We have collected both weighted and non-weighted data in the model for comparison.

Such weighted pairwise triangular fuzzy numbers $\tilde{d}_{ij}^{k}$ express the k^{th} decision-maker's preference of the i^{th} criterion over the j^{th} criterion and are included in the contribution matrix ($\tilde{A}^{k}$).

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The tilde emphasis sign marks the triangular number expression thereof. For instance, $\tilde{d}_{12}^{1}$ represents the first decision-maker's preference for the relationship between the first and second criteria, whose parameters are l, m and u – for example (2, 3, 4).

$$\tilde{A}^k = \begin{bmatrix} \tilde{d}_{11}^k & \tilde{d}_{12}^k & \dots & \tilde{d}_{1n}^k \\ \tilde{d}_{21}^k & \dots & \dots & \tilde{d}_{2n}^k \\ \dots & \dots & \dots & \dots \\ \tilde{d}_{n1}^k & \tilde{d}_{n2}^k & \dots & \tilde{d}_{nn}^k \end{bmatrix} \quad (1)$$

Whenever the decision-making process includes more than one decision-maker, the stated preferences are aggregated in an averaged triangular number set ($\tilde{d}_{ij}$), as the following:

$$\tilde{d}_{ij} = \frac{\sum_{k=1}^{k} \tilde{d}_{ij}^k}{k} \quad (2)$$

After the weight adjustment procedure and averaged preferences, the aggregated $\tilde{A}$ matrix is as follows:

$$\tilde{A} = \begin{bmatrix} \tilde{d}_{11} & \dots & \tilde{d}_{in} \\ \tilde{d}_{21} & \dots & \tilde{d}_{2n} \\ \dots & \dots & \dots \\ \tilde{d}_{n1} & \dots & \tilde{d}_{nn} \end{bmatrix} \quad (3)$$

According to Eq. 4, $\tilde{r}_i$ represents the geometric mean of the fuzzy comparison (triangular) values, for each criterion:

$$\widetilde{r_i} = \left(\prod_{j=1}^{n} \tilde{d}_{ij}\right)^{1/n}, \quad i = 1, 2, \dots, n \quad (4)$$

Then, one must find the vector summation for each $\widetilde{r_i}$. Next, it is necessary to compute the (-1) power of summation vector as well as substituting the triangular fuzzy number and set them in an increasing order. To find the fuzzy weight of criterion i ($\widetilde{w_i}$), one must multiply every $\tilde{r}_i$ by this reversed vector.

$$\widetilde{w_i} = \widetilde{r_i} \otimes (\widetilde{r_1} \oplus \widetilde{r_2} \oplus \dots \oplus \widetilde{r_n})^{-1} = (lw_i, mw_i, uw_i) \quad (5)$$

The next step is de-fuzzifying the triangular numbers. This de-fuzzified number is M_i. We follow Chang and Chou's (2008) centre of area method:

$$M_i = \frac{lw_i + mw_i + uw_i}{3} \quad (6)$$

Finally, since M_i is not a fuzzy number, it is normalized according to the following equation:

$$N_i = \frac{M_i}{\sum_{i=1}^{n} M_i} \quad (7)$$

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Such procedures are applied to all criteria in a given decision, as well as the alternatives, whenever those exist. Since our analysis is of theoretical nature, no true alternatives exist (although the weights found in this paper may be applied to real IT outsourcing contracts in future studies).

Before the questionnaire was sent, pre-tests were carried out to identify ambiguity, errors or issues that could lead to misunderstanding. After the testing phase and with the segregation of the groups completed, e-mails containing the questionnaire were sent, together with instructions for filling it out. Regarding ethics, all precautions were taken, so that the respondents had access to the results and had the guarantee of confidentiality in the research. Initially, contact was made by phone or through an electronic messaging application and the invitation to participate in the research was carried out. With the invitation accepted and with the necessary permission, the employees were divided into three groups, according to the level of experience informed by them. During the three-week data collection period, respondents had easy access to researchers, if they had any questions during the process of choosing the criteria.

For data collection, a questionnaire was developed focusing on the Saaty scale where the columns portray the level of importance to each attribute compared to another, associating each column with a verbal scale that intends to simplify the perception during the attribution of values (Saaty, 2008).

The sample was collected from employees of several consultancies specialized in the implementation of information systems, located in São Paulo (Brazil). These employees were selected due to the huge number of deployments carried out, in different customers and with different segments and, therefore, covering a diverse range of situations and experiences. Therefore, it is easy to understand the diverse environments found as well as the conflicts generated by the change in information technology. In this study, care was taken to analyse respondents from the three levels of technical experience (junior, full and senior analyst), in order to acquire the different perceptions arising from the criteria.

4 RESULTS

The data obtained is presented as follows – sampling characteristics, weighted responses and unweighted responses. Regarding the number of respondents, works already reported in the literature report that there is no minimum number of experts to participate in the decision-making process (Dey 2010; Yadav & Sharma 2015).

It usually varies from 3 to 20 experts and this number depends on the experience and their level of knowledge in the process. In our case, the experts have more than 15 years of experience in IT outsourcing. We have obtained full responses from 21 respondents (years working in the IT sector: mean = 19.71). Raw numbers were weighted according to level (strategic, tactical and operational).

The global weights are also provided (to compare with non-weighted original method). Results are as follows for the eight criteria:

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Table 3: Geometric means of fuzzy comparison values.

mistrust	*lw*	*mw*	*uw*	disinformation	*lw*	*mw*	*uw*
	0.00	0.03	0.04		0.01	0.06	0.13
instability	*lw*	*mw*	*uw*	poor selection	*lw*	*mw*	*uw*
	0.01	0.18	0.31		0.09	1.18	1.29
defence	*lw*	*mw*	*uw*	apathy	*lw*	*mw*	*uw*
	0.02	0.16	0.22		0.07	0.94	1.17
maladaptation	*lw*	*mw*	*uw*	denial	*lw*	*mw*	*uw*
	0.07	0.88	0.93		0.12	1.44	2.13

The relative fuzzy weights of each criterion are as follows:

Table 4: Quality criteria: relative fuzzy weights of each criterion.

	lw	*mw*	*uw*	M_i	N_i
Mistrust	0.00	0.01	0.07	0.03	0.005
Disinformation	0.00	0.02	0.15	0.06	0.013
Instability	0.00	0.05	0.45	0.17	0.037
Poor selection	0.02	0.21	3.03	1.09	0.238
Defence	0.00	0.04	0.42	0.15	0.034
Apathy	0.02	0.19	2.41	0.87	0.191
Maladaptation	0.02	0.14	2.40	0.85	0.186
Denial	0.02	0.35	3.69	1.35	0.296

Thus, we have the following orders for all responses (weighted):

Table 5: Compared responses.

Order	Weight	Descriptor
1st	0.645	Denial
2nd	0.170	Apathy
3rd	0.116	Poor selection
4th	0.033	Maladaptation
5th	0.014	Defence
6th	0.013	Instability
7th	0.009	Disinformation
8th	0.001	Mistrust

Finally, one must understand the implications of the results obtained. First, the criteria in the final table were all elicited from the extant literature on IT. This points to a maturity in the area and a

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convergence of studies, yet no study before has studied said criteria in an aggregated fashion. On the other hand, the values obtained for each criterion may be different according to the organization, hierarchical level of respondents, cognitive difficulties in dealing with numbers in questionnaires, as well as the effect of stress induced by crises (including the current Covid-19 one), along with several other possible aspects. Studies show that crises affect perception across all kinds of industries, including in the high echelon and middle management (Adriaenssens, De Gucht & Maes, 2012; Leiser, Benita & Bougeois-Gironde, 2016; Martins, Lucato, Vils & Serra, 2020)

As such, these numbers should be treated with caution, and further studies are needed to confirm the overall weights of such criteria. Further studies may also employ large datasets from heterogeneous companies and use such data as control variables in order to provide fine-tuned theoretical implications.

5 DISCUSSIONS

According to the literature, criteria responsible for resistance were presented in different studies, that is, in isolation, making it impossible to compare and qualify these criteria. As part of the contribution of this research, the criteria found in the literature were grouped in a single study, with the intention of promoting the categorization and prioritization of concepts in view of the increased resistance in processes of change in information technology. Another part of the contribution is the observation of the differences and similarities that these criteria have among themselves. In this way, it is possible to specify and prioritize the criteria and distribute them in intrinsic and extrinsic aspects. The first aspect concerns issues related to the individuals' internal behaviours. The extrinsic aspects are related to organizational and technical aspects. The correlation between these two aspects is very similar to the relationship found in the theories alluding to internal and external motivations, needing to have the same attention to manage such motivations, balancing the two.

Two distinct dimensions were identified, where the criteria may belong to two classes and which are relevant to the increase of resistance in processes of changes in information technology. In the review, other concepts are related to resistance; however, only selection, adaptation, defence, instability, denial, distrust, apathy and disinformation were mentioned as relevant to information technology. Still referring to the criteria found, it is possible to make an association, using intrinsic and extrinsic motivation. Intrinsic motivation is the stimulus that the individual, or team, uses to accomplish something simply by doing it alone. Extrinsic motivation is stimulated, for example, due to a reward or stipulated deadline. Regarding resistance, denial can be a type of intrinsic motivation, since the individual denies only the need for change, for no apparent reason. Defence by the individual can be seen as a form of extrinsic motivation, as it aims to defend his work. The association of intrinsic and extrinsic motivations to information technology is the subject of several studies, but does not mention resistance. The terms are used to encourage use and not as incentives to impede the progress of a specific activity.

For a better understanding, the criteria were grouped into two distinct subsets, according to their characteristics and in this way, it is possible to reach the expected conclusion. The subsets were

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classified as psychological and other criteria, and technical. The criteria adaptation, denial, defence, mistrust and apathy were included in the subset of psychological criteria. Selection, instability and misinformation, inserted in the technical subset. Regardless of the years of experience of each respondent, the individual's expertise is considered. The imminent change may be new to everyone, but it tends to be better analysed when the individual has a higher degree of abstraction and greater knowledge about the processes that will be directly affected.

Supposedly, most individuals tend to deny any possibility of change. This is due to the high level of stress, decreased productivity and difficulties in adapting (Salerno & Brock, 2008). Therefore, psychological criteria tend to increase resistance in IT-related processes, more than technical criteria. The results obtained demonstrate the responses of analysts with three levels of experience. These responses, both weighted and unweighted, demonstrate that denial and apathy have a higher percentage of responses and that instability and misinformation are not so important for resistance in information technology. Managing such instabilities may help organizations better cope with their intricacies (Felisoni et al., 2020) as well as ensure better use of teams in IT companies (Librantz, Costa, Spinola, Oliveira Neto & Zerbinatti, 2020).

With this information, one can try to identify and, to a certain extent, mitigate resistance in processes of change in information technology. In a way, denial tends to be accompanied by fear or a sense of loss. This loss may be associated with a routine, habit or even loss of a job. Apathy can be related to denial, being responsible for the lack of commitment during the process.

By identifying the source of these criteria, it is possible to develop an action plan, so that individuals feel more confident and secure to participate more effectively, thus avoiding traces of denial and apathy that could be harmful to the change project. The other criteria, mentioned in this study, also contribute in some way to resistance. Only eight criteria were selected for this study. There was no method of any kind for this definition. There was no cut whatsoever. Only the criteria found and related to the research question of this study were selected.

6 CONCLUSIONS

This paper aimed at understanding criteria for resistance to change in IT teams in an aggregated form, since extant literature points to isolated studies focusing in single criteria. In this sense, the analysis concluded that eight main criteria can be considered (selection, adaptation, defence, instability, denial, mistrust, apathy and disinformation) for a IT standpoint. The second part of the study aimed at providing evidence that these criteria are convergent in IT teams. The results point to a scenario in which the criteria cited in the literature emerge, albeit in different weights. Whereas the results serve as a example and bring forward questions for future studies (such as the division proposed – technical versus team/personnel aspects), future research may be needed to provide validation of said criteria and categories.

Still, this paper contributes to the current literature by analysing criteria for resistance to change in IT, analysing them in a conjoint study and to propose further investigation about the division

between technical and personnel dimensions – as well as positioning said criteria with both IT (especially the technical aspects) with the established management literature (with a focus on team/personnel management).

The present research has as limitations the number of respondents because it was only possible to collect data in a single company. Respondents, due to the company's vision, delivered responses with similar ideas and this can lead to a not so expressive result. In addition, research was limited in terms of geographic and relationship location. Questionnaires were sent to other companies, but as the relationship with the employees of these companies was missing, they did not comment, nor did they respond to the survey.

As a topic for future research, it is possible to study how to reduce or avoid resistance to change processes. Resilience can help both the concepts that showed the highest resistance rates and the others. After identifying the source of the resistance, it is necessary to recognize potential ways to keep individuals and/or teams resilient and able to overcome the process of change. In addition, further studies may investigate gradations in resistance – for instance from passive (ignoring instructions, bypassing settled systems, etc) or active perspectives (intentionally ruining processes, hiding information, etc.) and from an IT auditing perspective. Especially in a context of crises (and having the current Covid-19 as an example), this is especially important, as these mechanisms affect team learning and task sharing, as well as becoming potential burdens on workload, stress and negative emotions.

7 REFERENCES

Adriaenssens, J., De Gucht, V., & Maes, S. (2012). The impact of traumatic events on emergency room nurses: Findings from a questionnaire survey. *International journal of nursing studies*, *49*(11), 1411-1422.

Ali, M., Zhou, L., Miller, L., & Ieromonachou, P. (2016). User resistance in IT: A literature review. *International Journal of Information Management*, *36*(1), 35-43.

Almada, L., & Policarpo, R. V. S. (2016). A relação entre o estilo de liderança e a resistência à mudança dos indivíduos em um processo de fusão. *REGE-Revista de Gestão*, *23*(1), 10-19.

Aseidu, S. T., & Boateng, R. (2020). Exploring the Scope of User Resistance: A Bibliometric Review of 41 Years of Research. In *Handbook of Research on Managing Information Systems in Developing Economies* (pp. 548-572). IGI Global.

Ayhan, M. B. (2013). A fuzzy AHP approach for supplier selection problem: A case study in a Gear motor company. *arXiv preprint arXiv:1311.2886*.

Beşliu, D. C. (2018). Institutional management of change resistance of the employees against organizational transformations. Scientific Research & Education in the Air Force-AFASES, 351-358.

Bhattacherjee, A., & Hikmet, N. (2007). Physicians' resistance toward healthcare information technology: a theoretical model and empirical test. *European Journal of Information Systems*, *16*(6), 725-737.

Breternitz, V. J., & Galhardi, a. C. (2011). Contribuições ao processo de seleção de sistemas erp (enterprise resource planning) para pequenas e médias empresas. *Revista Eletrônica de Tecnologia e Cultura*, *3*(2), 8.

Burns, J., & Scapens, R. W. (2000). Conceptualizing management accounting change: an institutional framework. *Management accounting research*, *11*(1), 3-25.

Chan, F. T., Kumar, N., Tiwari, M. K., Lau, H. C., & Choy, K. (2008). Global supplier selection: a fuzzy-AHP approach. *International Journal of production research*, *46*(14), 3825-3857.

Chen, H., & Li, W. (2019). Understanding commitment and apathy in is security extra-role behavior from a person-organization fit perspective. *Behaviour & Information Technology*, *38*(5), 454-468.

Craig, K., Thatcher, J. B., & Grover, V. (2019). The IT Identity Threat: A Conceptual Definition and Operational Measure. *Journal of Management Information Systems*, *36*(1), 259-288.

Dallavalle, S. I., & Cazarini, E. W. (2000). Regras do Negócio, um fator chave de sucesso no processo de desenvolvimento de Sistemas de Informação. *São Carlos: USP-EESC-Escola de Engenharia de São Carlos-Área: Engenharia de Produção*.

Davison, R. M., & Ou, C. X. (2018). Subverting organizational IS policy with feral systems: a case in China. *Industrial Management & Data Systems*, 118(3), 570-588.

Dey, P. K. (2010). Managing project risk using combined analytic hierarchy process and risk map. *Applied Soft Computing*, *10*(4), 990-1000.

Felisoni, P., Martins, F. S. (2019). A fuzzy-AHP analysis of IT outsourcing monitoring in public organizations. XIV *SemeAd. Annals*. Sao Paulo.

Felisoni, P. R., Martins, F. S., & Gaspar, M. A. (2020). Evaluation of the main performance criteria of IT outsourcing for contract management in public companies: a bibliometric review. *Research, Society and Development*, *9*(11), e81491110390-e81491110390.

Fetzner, M. A. D. M., & Freitas, H. M. R. D. (2012). Repensando questões sobre mudança, afeto e resistência na implementação de SI. *REAd. Revista Eletrônica de Administração (Porto Alegre)*, *18*(1), 1-26.

Galli, B. J. (2019). An engineering manager's guide for commonly used change management approaches—from one practitioner's experience. *IEEE Engineering Management Review*, *47*(3), 118-126.

Garg, P., & Garg, A. (2013). An empirical study on critical failure factors for enterprise resource planning implementation in Indian retail sector. *Business Process Management Journal*, *19*(3), 496-514

Goksoy, A. (2017). The role of psychological empowerment and organizational citizenship behaviors on employee resistance to change. *European Journal of Interdisciplinary Studies*, *3*(2), 85-93.

Griffin, A. (1997). The effect of project and process characteristics on product development cycle time. *Journal of marketing research*, *34*(1), 24-35.

Guilhardi, H. J. (2002). A resistência do cliente a mudanças. *Guilhardi et al. Sobre Comportamento e Cognição*, *9*, 133-156.

Ilie, V., & Turel, O. (2020). Manipulating user resistance to large-scale information systems through influence tactics. Information & Management, 57(3), 103178.

Jacobsen, A. L., & Rodrigues, M. M. B. (2002). Abordagens para lidar com a resistência humana frente a processos de mudança organizacional. Ciências da Administração, 4(7), 39-49.

Kim, H. W., & Kankanhalli, A. (2009). Investigating user resistance to information systems implementation: A status quo bias perspective. *MIS quarterly*, 567-582.

Klaus, T., & Blanton, J. E. (2010). User resistance determinants and the psychological contract in enterprise system implementations. *European Journal of Information Systems*, *19*(6), 625-636.

Lamba, K., & Singh, S. P. (2018). Modeling big data enablers for operations and supply chain management. *The International Journal of Logistics Management*, *29*(2), 629-658

Laumer S. & Eckhardt A. (2012) Why Do People Reject Technologies: A Review of User Resistance Theories. In: Dwivedi Y., Wade M., Schneberger S. (eds) *Information Systems Theory*. Integrated Series in Information Systems, vol 28. Springer, New York, NY.

Leiser, D., Benita, R., & Bourgeois-Gironde, S. (2016). Differing conceptions of the causes of the economic crisis: Effects of culture, economic training, and personal impact. *Journal of Economic Psychology*, *53*, 154-163.

Librantz, A. F. H., Costa, I., Spinola, M. D. M., de Oliveira Neto, G. C., & Zerbinatti, L. (2020). Risk assessment in software supply chains using the Bayesian method. *International Journal of Production Research*, 1-18.

Maurer, R. (1996). Transforming resistance. *Training & Development*, *50*(12), 20-24.

Miller, D. D., Ota, Y., Sumaila, U. R., Cisneros-Montemayor, A. M., & Cheung, W. W. (2018). Adaptation strategies to climate change in marine systems. *Global Change Biology*, *24*(1), e1-e14.

Martin, W. J. (2017). *The global information society*. Routledge.

Martins, F. S., Santos, E. B. A., & Vils, L. (2017). Organizational creativity in innovation – a multicriteria decision analysis. *Independent Journal of Management & Production*, *8*(4), 1223-1245.

Martins, F. S., Lucato, W. C., Vils, L., & Serra, F. A. R. (2020). The effects of market and entrepreneurial orientation on the ambidexterity of multinational companies' subsidiaries. *European Business Review*, *32*(1), 4-25.

Musse, J. I., Araujo Neto, A. C. D., Ahlert, H., Rey, L. F., Ignacio, M. C., & Motta, T. S. (2015). Impactos estruturais da implantação da governança de TI em uma universidade pública. In *Conferencia de Directores de Tecnología de Información (5.: 2015: Viña del Mar). Actas. Viña del Mar: Red Clara, 2015*.

Nazari-Shirkouhi, S., Miri-Nargesi, S., & Ansarinejad, A. (2017). A fuzzy decision making methodology based on fuzzy AHP and fuzzy TOPSIS with a case study for information systems outsourcing decisions. *Journal of Intelligent & Fuzzy Systems*, *32*(6), 3921-3943.

Neves, P., Almeida, P., & Velez, M. J. (2018). Reducing intentions to resist future change: Combined effects of commitment-based HR practices and ethical leadership. *Human Resource Management*, *57*(1), 249-261.

Oliveira Neto, G. C. D., Oliveira, J. C. D., & Librantz, A. F. H. (2017). Selection of logistic service providers for the transportation of refrigerated goods. *Production Planning & Control*, *28*(10), 813-828.

Oreg, S. (2003). Resistance to change: Developing an individual differences measure. *Journal of applied psychology*, *88*(4), 680.

Piderit, S. K. (2000). Rethinking resistance and recognizing ambivalence: A multidimensional view of attitudes toward an organizational change. *Academy of management review*, *25*(4), 783-794.

Polites, G. L., & Karahanna, E. (2012). Shackled to the status quo: The inhibiting effects of incumbent system habit, switching costs, and inertia on new system acceptance. *MIS quarterly*, 21-42.

Prib, H. A., & Gromova, Z. V. (2019). Connection between resistance to organizational change and psychological resistance of an individual. *Journal of Intellectual Disability-Diagnosis and Treatment*, *7*(3), 170-178.

Rendon, R. G., & Snider, K. F. (2019). *Management of defense acquisition projects*. American Institute of Aeronautics and Astronautics, Inc..

Rivard, S., & Lapointe, L. (2012). Information technology implementers' responses to user resistance: Nature and effects. *MIS quarterly*, 897-920.

Robbins, S. S., & Stylianou, A. C. (1999). Post-merger systems integration: the impact on IS capabilities. *Information & management*, *36*(4), 205-212.

Saaty, T. L. (2008). Decision making with the analytic hierarchy process. *International journal of services sciences*, *1*(1), 83-98.

Salerno, A., & Brock, L. (2008). *The change cycle: How people can survive and thrive in organizational change*. Berrett-Koehler Publishers.

Salles, A. C., Alves, A. P. F., Dolci, D. B., & Lunardi, G. L. (2016). Green information technology: a study of its adoption in organizations / Tecnologia da informação verde: um estudo sobre sua adoção nas organizações. *RAC - Revista de Administração Contemporânea*, *20*(1), 41-64.

Selander, L., & Henfridsson, O. (2012). Cynicism as user resistance in IT implementation. *Information Systems Journal*, *22*(4), 289-312.

Siebel, T. M. (2019). *Digital transformation: survive and thrive in an era of mass extinction*. RosettaBooks.

Silva, F. C., Shibao, F. Y., Librantz, A. F. H., Santos, M. R., & Neto, G. C. O. (2020) Perspectiva de aplicação do método Analytic Hierarchy Process no cenário brasileiro de pesquisa. *Revista Organizações em Contexto*, *16*(32), 95-124.

Smollan, R. K. (2011). The multi-dimensional nature of resistance to change. *Journal of Management and Organization*, *17*(6), 828.

Stone, M., Aravopoulou, E., Evans, G., Aldhaen, E., & Parnell, B. D. (2019). From information mismanagement to misinformation–the dark side of information management. *The Bottom Line*, *32*(1), pp. 47-70.

Thakur, R. R., & Srivastava, S. (2018). From resistance to readiness: the role of mediating variables. *Journal of Organizational Change Management*.

Thite, M., & Bhatta, N. M. K. (2019). Soft Systems Thinking Approach to e-HRM Project Management. *e-HRM: Digital Approaches, Directions and Applications*, 42-56.

Watson, G. (1969). Resistance to change. In WG Bennis, KF Benne and R. Chin (Eds), The planning of change.

Yadav, V., & Sharma, M. K. (2015). Multi-criteria decision making for supplier selection using fuzzy AHP approach. *Benchmarking: An International Journal*, *22*(6), pp. 1158-1174.

COMO CITAR ESTE ARTIGO:

Junior, da S. W., Martins, F. S., Librantz, A. F. H. (2021 Resistance in processes of change in information technology: a Fuzzy AHP approach. *Holos.* 37 (3), 1-17.

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HOLOS
ISSN 1807 - 1600

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Editor(a) Responsável: Fábio Paiva

Pareceristas *Ad Hoc*: VIVIANE DAL MOLIN DE SOUZA E THIAGO FRANÇA NAVES