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# **Importance and influence of organizational changes on companies and their employees**

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## **Abstract**

The timely and continuing adaptation of companies to the rapid changes in the market is a prerequisite to survival and growth. Simultaneously, the smooth adaptation of employees to changes contributes not only to the improved running of organizations but also to their personal improvement and enhanced satisfaction. The need for change requires the adaptability of organizations and enterprises, the redesigning of the organizational models, continuing reconstruction, learning processes and employees training. In this study we investigate the effects of organizational change, the reactions of employees and the results of change management on productivity. For this purpose a random sample of 355 employees in the private and public sectors and two stage cluster sampling is first used to collect primary data. Logistic Regression is used to explore many useful and supportive elements concerning the function of changes on stress and productivity. We find that change leads to increased stress but when the necessity and utility of change is understood it then leads to increased productivity. The good relations between leadership and employees offer the latter considerable advantages as well as a feeling of security. Once the change is announced, there is a negative effect on productivity and job satisfaction declines. When the change begins to work, we have increased productivity and reduced stress.

**Keywords:** Organizational changes; stress; productivity; logistic regression.

**JEL classification codes:** J01, J08, J81, M12, M50.

## **Introduction**

Modern organizations are continually called upon to adapt to the volatile internal and external business environment, in order to become competitive and to expand in the contemporary market place. Within the framework of the continuous developments in the economic, technological and social factors, it is absolutely necessary for companies to change the way they are organized. We define organizational change, as the actions that have to be taken by management in order to better respond to the broader socio-economic environment, through the turnabout of structures, behaviours and processes, aiming to the development and advancement of an organization.

One of the major reasons that necessitate change in modern enterprises is the evolution of technology. New raw materials, products, methods and operations, require organizations to adapt and implement new technologies, and employees to constantly update their knowledge. Another reason that makes change necessary, is the one streamlined by the new patterns of globalization, mergers, acquisitions and corporate restructuring. The constant change of supply and demand, the creation or abolition of new methods and the development of new services, make the operation of markets an ever-changing and dynamic system and not an aggregate of procedures that are not able to respond to new needs and contribute to the necessary solutions. In the end, we should not forget that social and political factors influence organizations and lead them to change processes.

For the purpose of extracting the basic parameters of change that influence the operations of organizations and employees, we have conducted a study using a random sample of 355 employees from both the public and private sectors. With the help of statistical and econometric models, we have calculated the impact of these changes on productivity and stress. Based on the sample results and the data collection, we calculated the influence of change on productivity and stress by taking into account such factors as the level of education,

creativity, and worker's responsibility. We show that the timely and continuous companies' adaptation to changes is the basic parameter to their development. Innovation and change require organizations adaptability and the need for continuous reconstruction. Additionally they require management to understand the major elements of the system and adopt new principles and prototypes.

Our study is structured as follows. Section 2 reviews the existing relative literature while section 3 discusses the theory behind the application of organizational changes, the reactions of the employees and the importance of the role of a leader within an organization. Section 4 presents the empirical analysis on the subject matter, whereas section 5 displays the influence of change on productivity and stress with the help of econometric modeling. The last section summarizes the most important findings and concludes the paper.

## **2. Literature review**

Organizational change is defined as the adaptation of new ideas or behavior by an organization with many perspectives on strategic change and organization development. The role of the manager or a team of leaders is crucial for the change. Those changes range both from technological to structural change and from psychological transitioning to organization downsizing (Choi, 1995). Organizational changes deal with both operational and transformational change. According to Liberatore et al. (2000) transformational change involves redesign and renewal of the organization often not made by the effort of a management science modeling. Baker and Wruck (1989) and Zhou et al. (2006) argue that organization change occurs in many forms, such as introduction of new technologies (innovations), new products, new process of administrative systems or any procedure new to an organization.

Consecutively, to reach the successful transformational change, the organization first should have a substantial amount of time, and second; mistakes in any phase of the change

could have a devastating impact delaying momentum and negating all the gains. In their paper Liberatore et al. (2000) categorized the changes as knowledge creation and dissemination and altered coordination and communication patterns. Additionally, they show that effects of modeling on organizational structure are generally limited to the creation of new organizational roles and routines. The operational changes, caused by modeling, also have much in common with those obtained through other forms of process innovation. Also, they pointed out that people (and furthermore the organizations) often fear and resist in changes.

In order to overcome that resistance the literature has proposed suggestions including education and commitment, participation and involvement, facilitation and support, negotiation and agreement, manipulation and co-optation and explicit and implicit coercion. Moreover, technical and administrative changes affect firms' performance through distinct paths (Zhou et al., 2006). Technical changes have a positive and more direct influence on the performance of an organization, while administrative changes enhance the performance of the firm indirectly through technical changes. Organizations' culture also plays an important role in the adaptation of administrations change. According to the authors, an organization can moderate the effect of changes through three dimensions (motivation, opportunity and capability of change).

Choi (1995) tried to bridge the gap between the field of continuous improvement in manufactures and Organization change in the field of strategic change and development. In the Organization Change (OC) literature, authors sort changes as major and minor. Choi (1995) state the conditions that triggers the change, the nature and the characteristics as if the performance implications of the change. Additionally, organizational performance is also influenced by learning and market orientation (Oxtoby et al., 2002). Apart from the conditions, the necessity of the organizational changes has been figured out by Sun and Gertsen (1995). In their paper they discussed not only the necessity but also the dimensions

and the influential factors of organizational changes. They determine that Organization changes benefits sizes of the company such as manufacture technology quality, productivity and labor saving.

On the contrary, these benefits are the result of a combined innovation and organizational changes and not an individual process. Studying three cases, they set the main dimensions of the organization changes.<sup>1</sup> Afterwards they suggest that mostly the organizational changes were in the direction from individual-based to group-based work organization. Moreover, they come to the conclusion that group-based work organization reacts better to the changes, but also expose the view that any change is not gentle for the organizations since there are many factors influence the changes.<sup>2</sup>

It is not easy to convince a group to change. Conformism is not such a general phenomenon as we are lead to believe by Festinger (1954): one of the more spontaneous procedures that we see in group communication is the pressure applied for the creation of group conformism. There are cases where people seek out change and innovation. We should also mention that many times the composition of a group is not defined by the needs of the people but by the targets of the group.

A comprehensive framework was developed by Mintzberg and Westley (1992) to eliminate the misunderstanding of theory in changing behavior in organizational changes and assist the understanding of those behaviors in a more systematic way. Their basic idea was that changes in organizations could be depicted as a system of moving cycles (concentric, circumferential, tangential and spiraling). By dichotomizing the changes in levels (conceptual and concrete) they argue that at the most concrete levels, an organization can change peoples

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<sup>1</sup> According to Sun and Gertsen (1995) the main dimensions of organizational change are education and skill, incentive system, building teams/groups, operation authority, communication, job rotation and department integration.

jobs even though their operations (machines, architecture and facilities) and the operational management and with the implications of the changes conceived as deductive or inductive.

Bertschek and Kaiser (2004) provide a more comprehensive analysis of workplace organization change focusing on the effects on labor productivity. Workplace reorganization is suitable if the productivity gain from the change exceeds the cost of the workplace change assuming two different types of organizational change forms (enhancement of group work and flattening of hierarchies). The first and foremost advantage of this enhancement is the reduction of communication costs between the employees and the hierarchies. As we discussed before, a technological change also plays an important role in the organizational change.

In order to pass smoothly to any change in an organization, Piva et al. (2006) figure out the skill bias of the workers. Skill biased organizational change hypothesis is defined as the demand for skilled labor force (and the decrease for unskilled) during the acceleration in the rate of technological change. Additionally, it is a specific form of complementary innovation rather than alternative to technological change. Furthermore, employees' emotions follow out four stages during the process of organizational change<sup>3</sup> (Liu and Perrewe, 2005). At the time of uncertainty, information about the process of adaptation is very important helping out the reduction of employees' anxiety and intensifying their efficiency.

The case of U.S. railway reform has been presented by Barr et al. (1992), where organizational changes requires from the managers to adopt mental models, following changes happened in the environment of the organization. They proposed that delays in the adaptation of mental models in a rapid changed environment, often are associated with a decline and they

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<sup>2</sup> Factors influencing organizational change are: technology, original organization, external organization and management style.

proposed in the literature a number of explanations for those delays. Between-form and within-form analysis made by Forte et al. (2000), helped them to reach the conclusion that a fit between environmental calamities and organizational form is related to the performance of the organization. Many organizations face great pressure from the environment to transform themselves. Organizations have to change in order to be adaptive in the environmental changes and resist in completion (Liu and Perrewe, 2005).

Yvrande-Billon and Menard (2005), analyzed how institutional constrains may influence investment and prevent policymakers decisions after an organizational change. Studying the case of British rail reformation, they pointed out that if policymakers do not pay attention on the transactions after a change in a public organization, then problems would arise between market forces and policymakers. These problems jeopardize and impose constraints on efficient decisions (also in D' Aunno et al., 2000). Investments play the key role in their essay after the adaptation of a change in the organization.

Specifically, in competitive environments, investments (as a lobby) try to push policymakers to adopt changes for their profit. Adopting an approach of organization opposite to the type of assets the parties to the transaction had to cope with, policymakers have two options. To follow the investors will or set strategies that make changes adopted easily but lose the investments. The close connection between investment and productivity was also developed by Brynjolfsson and Hitt (2000). According to the authors, the higher the value of information technology, the higher the investments the organization attracts. These investments help the firm to increase the output and simultaneously create new products or improve the exiting firms' products.

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<sup>3</sup> First stage: emotions high in arousal, hedonic tones and anticipation. Second stage: mixed emotions lead to positive or negative emotions. Third stage: emotional experience affects employees' behavior. Fourth stage: including of discrete evaluated emotions.



Applications and research has been done, also, in the real estate industry. Aswath and Kose (1997) examined all real estate firms who have changed their organizational form between 1966 and 1989 and categorized them as with looser or with tighter structure, studying changing in performance, asset, sales, investment and other financial measures. Their finding were that, firms in financial trouble are likely to change their organizational form from tighter to looser, taking advantage of the flexibility of the new form of the organization increasing their financial measures.

### **3. Implementation of organizational changes, workers reactions and the role of leadership**

In order for change to be successful it must follow a specific path. According to Lewin (1951) successful change is a mechanistic three-phase process. First is the phase of unfreezing, that is, to move people out of the frozen state and get them to move. In this phase forces of change dominate over the current status-quo which is trying to maintain the system under its current status. Next is the phase of transition in which change is implemented throughout all levels of the organization. The final stage is that of refreezing which puts down the roots again and establishes a new place of stability.

Kotter (1995) worked the other way around, focusing the success of change to the avoidance of errors, such as:

- Incomplete feeling of the emergency of the situation (competition cannot wait, the markets keep on going, technology proceeds at a fast pace)
- Inexistence of a strong leading team, which will lead changes and will encourage the organization's members toward change, as well as the lack of vision and politics for its materialization
- Latent transmission of the vision to the team members
- Narrow roles, which leave no space for thought and action

- Not accomplishing short-term goals, in order for the members to be encouraged and see the weaknesses and capabilities of change
- Changes that do not go hand-in-hand with the organization's philosophy. In no case an organization must change its basic values when changes are taking place in the market but change market in order to remain loyal to its values.

Drucker (2000), on the other hand, gave great significance to the crucial role of leadership at various levels of an organization for the change to be successful. He considers that the leader must drive the organization into a policy of systematic renovation, a policy which by itself creates change. In this way he forms an attitude that makes change appear as an opportunity and to show every 6-12 months the accomplished changes in various levels, the non-expected successes or failures of the organization or its competitors, the problems that arise in procedures (i.e., production, sales, procurement procedures, etc.), new developments of the sector or the market, demographical changes and new understanding.

A different way of viewing the motives that are given to employees was presented by Stiglitz (1984). The efficiency wage model explains why different firms pay similar workers different wages. This applies primarily to cases in which employment positions demand high level of responsibility and creativity, and the quality of the work cannot be clearly defined and measured. As a result, employers lean on to the conscientiousness of the employees with regard to how well they are performing their work.

Akerlof and Yellen (1986) argue that better work quality can be achieved either by enhancing the employees cost of being fired or giving greater incentives. In the first case, the employers pay workers in excess of the market-clearing wage, further aiming to increase the fear of job loss. In the second case, when the employer gives greater rewards, it evokes the feeling of reciprocity amongst the employees, causing them to feel that productivity cannot be measured in such a way as to be acceptable by both the employer and the employee.

More contemporary views try to pinpoint the issue of productivity, based on the subjective elements that create the relation between labour time and intensity of work. Akerlof (1982) argues that worker effort depends on the relevant reference groups. The reference group forms a notion of the fair wage and fair work day. Beyond to these typical obligations, the effort is similar to the procedure of gift exchanging during Christmas. It is an interactive relationship in which if someone does not conform and reciprocate, the other party will react accordingly.

Organizational changes are always accompanied by various reactions leading workers to change their knowledge, capabilities, working time, labour relationships, environment and procedures. The individuals react to change either out of fear or because they see that they cannot meet the new demands, or feel uncertain regarding their new place in the organization, or the loss of their position, or they do not feel confident of their position and they should renew and improve knowledge and skills in order to regain the position they previously possessed. In order for the individuals to meet changes, they must change their knowledge, attitudes and behaviour.

Changes in knowledge are easier to be made. Educational seminars are aiming at changing knowledge. In every organization employees have some level of knowledge. The more this knowledge becomes available to everyone, the better for the company. The sharing company is one where knowledge is shared by all employees; it is available to everyone, and ready to be used to achieve the goals set forth by management. In the traditional company, group knowledge dominates and guides organizational functions. Things must be done the way employees were used to, and there is a general refusal to change as well as an avoidance of experimentation.

At stage A where group knowledge dominates and then there is a stage B where individual knowledge plays a leading role to stage C, where knowledge is shared by

everybody, there is an abundance of knowledge available, that can be used by employees in order to achieve results. In stage C (knowledge sharing), there is two-way communication of information and an exchange of knowledge amongst employees, without any fear. In this environment, change is more easily adopted in the organization; it becomes more easily accepted, and problems that might arise, meet minimum resistance and are solved quicker.

Attitudes are different from knowledge, in that they involve emotions in a positive or a negative way. Adding the parameters of psychological or emotional elements makes it more difficult to change knowledge. In the process of forming an attitude, the person tends to value a situation in his own way. If he has a crystallized opinion about a matter, then he will try either to adjust it to his own facts and figures, or reject it. In other words, he will not change his perception of doing things.

Changes in personal behaviour seem to be much more difficult and require more time than the aforementioned. An important element to consider is habit. Employees that perform a specific task for a long period of time are used to doing it in a certain way. Other elements to consider are insecurity and nostalgia. When employees for example are confronted with something new they tend to feel insecure. A person who is assigned a new task, fears that he will not be able to finish it successfully. He remembers his previous state during which he was in control of things; whereas now a lot of questions arise concerning the proper execution of the work.

Changes in the team and organizational performance can be included changes in knowledge, in the attitudes and in the behaviour and it is impossible to influence the structure of the teams or of the organisation. There are, however, certain factors that can lead to diminished reaction and resistance. Specifically:

1. Avoidance of excessive and unnecessary changes. It must be determined first, if a proposed change is really necessary. Any change in policy and procedures that can be

translated as a threat to the satisfaction of the employees needs must be examined carefully, and all possible effects of change must be detected and pinpointed. As a result, it is preferable for someone not to introduce unnecessary and immaterial changes because the reactions that they are going to cause will cost more than the continuance of the existing methods.

2. Gradual introduction of change. A proposal to change things immediately causes fear of the unknown and in this way many good ideas for change fail, if we try to implement them immediately. However, if the ideas for change are introduced gradually and enough time is given to employees to adapt their mentality and relieve their fears and objections, then success will be achieved much easier.
3. Preparation for change. Right after a change has been announced, maximum amount of information should be given to the employees in order to alleviate any possible fears and objections. The better the preparation for change, the more effective the alleviation of fears.

In any case, resistance is always smaller if the nature, goals and benefits of change are clearly defined. The larger the extent of effective communication the more employees are willing to accept and advocate change. For this reason, enough explanations must be given (what, why, how) reasons and goals of change must be clarified, and employees must be informed how they will benefit from this change. It is very likely for employees to accept change if they understand and see the long term benefits of it (i.e. the change will make their work easier, quicker, safer or creative). Then there is a greater probability to accept change by raising less resistance.

Greiner (1967) observed that many times successful change is accomplished by bringing in an external body (institute) that has prestige and skills. It is observed that the changes are higher that resistance will be less and success is greater. Leavitt (1965) also believed that

external bodies have higher chances of implementing successful changes as they usually approach the task in a more objective and scientific manner and consequently their analysis and methods are better and more realistic.

Applying change can either be done in a participative or in a forced manner. A participative change is achieved when a person or a team is given knowledge. It will be very positive for the team to accept the facts and develop a positive attitude and consent towards the direction of the desired change. On this level, strategy can either be direct employee or team participation in order to choose or shape goals, or new methods to achieve goals. This constitutes team participation towards problems solution. The next stage is to alter the employees consent to real behaviour (i.e. it is one thing to be interested in a problem and another to become part of its solution). The directive of European Union ECC 94/95 - Industrial Democracy concerning participative change, mentions the necessity of workers participation to the introduction of changes and the formation of decisions. This is an expression of fair process and it is possible to maximize the degree of change acceptance.

The oppressive method of change begins by imposing change throughout the organization, something that tends to influence the system of interaction to an individual level. The differences between the two methods are spotted in the fact that that the participative change can be more appropriate for mature teams since those are moved by achievements and have a degree of knowledge and experience which is useful for the development of new strategic goals. On the other hand, when dealing with immature individuals imposing change upon them can be more productive because those individuals are dependent and unwilling to assume new responsibilities, unless they are forced to do so. These individuals prefer guidance and structure when they confront decisions that frighten them.

Change must not be imposed upon people. With participative change, the major advantage is that as soon as it becomes acceptable, it can last for a long time since the individuals have

given their consent to change. Its disadvantage stems from the fact that it tends to be rather slow and evolutionary, the exact opposite of oppressive change. The advantage of oppressive change is speed because the leader, by using the power of his position, can immediately enforce change. Its disadvantage is that it tends to be volatile. It can be maintained only while the leader remains in a position of strength.

At this point, we should emphasize the importance of the leader's role towards change and his/her influence on its development. The leader should try in such a way so as to correlate the need for change as close to the needs of the employees as possible. If the employees realize that change will primarily benefit the company, and not them, then it is more likely to pose greater resistance. Before the leader can help towards the fulfilment of this goal, he/she must understand why the new program is projected and what exactly is asked from him/her and his/her team.

The adaptation of continuous dialogue and communication is necessary not in a downward direction (from the supervisor to the subordinates) but a two-way dialogue explaining change. A conversation must take place with the supervisor and amongst them, where the team members participate by expressing and discussing their ideas, positions, opinions and their recommendations in relation to change. This feedback from the employees is the only way for the manager to determine whether the information which was given to them was understood and acceptable. In addition an opportunity is given to the employees to express their fears and worries in order to confront them accordingly.

This is why the manager must not forget that apart from change, it is possible that employees can perceive it as a threat, and this is why they react accordingly. Full scale information regarding change can be twisted as easily as incomplete information. By discussing ideas and sharing information, the freedom to ask questions and share ideas, the level of resistance to change in the team has the tendency to decrease, whereas it increases the

understanding and the loyalty towards change and obviously face to face communication is more appropriate than any other form of written announcements. We should mention that effective communication during the process of change cannot be considered the sole presentation and discussion of the subject. It must have the form of a continuous dialogue which lasts until the real materialization of change and often continues after its materialization.

#### **4. Empirical analysis**

In order to analyze the relation among changes and stress and productivity, we conducted a study with the use of stratified sampling on 355 individuals, in both the private and public sectors in the year 2009. Specifically, a list of all companies operating in Greece was provided by ICAP and this list was our sampling frame. A summary of this information is presented in Table 1. Using ICAP's database and a sequence of random numbers, companies were selected at an increasing order. Information gathering was conducted by means of personal interviews.

Specifically, we focus our study on three factors that influence change: teamwork, independent action and leadership. For this reason we have chosen a number of questions regarding the influence of the "team" to the course of change (first two questions), the influence of independent action and the freedom of labour (next two), the motives (next three) and the leadership (last question). Specifically and on a scale of 1 (very little), 2 (little), 3 (enough), 4 (much), 5 (very much), 0 (don't know/don't answer) the respective questions are:

- Individual effect of teamwork in relation to satisfaction, stress, and productivity
- Importance of a good team operation (relations, performance, etc.)
- Individual effect of a larger independent action within the organization in contrast with the excessively explicit determination of activities that exist know (if they exist) in relation to satisfaction, stress, and productivity
- The importance of independent individual action within the organization



- The existence of a balance between employee production and rewards
- The importance of creativity within the organization
- The importance of rewards and other fringe benefits within the organization
- Willingness to participate in the operation of an organization when, the leader inspires trustworthiness, the anticipations and capabilities of advancement are great, but the rewards within the organization, will be the same for at least the next two years, or will be less than employees expectations.

**Table 1:** The sampling frame used in our analysis

SECTOR	CODE	TOTAL NUMBER OF COMPANIES	TOTAL NUMBER OF EMPLOYEES	SAMPLED COMPANIES	SAMPLED EMPLOYEES
Agriculture and related	A-B 01	249	3.300	3	11
Fish farming	A-B 05	114	3.920	2	8
Manufacturing (Food-Drinks)	D 15	1.214	62.626	5	13
Manufacturing (Tobacco)	D 16	4	1.973	1	1
Manufacturing (Textile-Leather)	D 19	73	2.010	1	1
Manufacturing (Chemicals)	D 24	286	22.362	3	11
Constructions	F 45	1.879	36.066	3	10
Retail Trade	G 52	1.304	101.561	7	21
Cars trader -leasing	G 50	906	23.864	5	20
Telecommunication - internet	I 64	115	35.867	4	17
Financial Services	J 65	25	74.127	9	22
Insurance	J 66	239	8.829	3	11
Vehicles and equipment	KMNO 71	266	3.027	4	14
Information Technology	KMNO 72	464	11.932	2	9
Other sectors	KMNO 74	1.967	65.061	9	36
Education	KMNO 80	244	9.066	2	6
Health	KMNO 85	342	20.453	7	34
<b>TOTAL PRIVATE COMPANIES</b>		<b>9.691</b>	<b>486.044</b>	<b>70</b>	<b>245</b>
<b>TOTAL PUBLIC COMPANIES</b>				<b>24</b>	<b>110</b>
<b>TOTAL</b>				<b>94</b>	<b>355</b>

Source: ICAP (personal communication)

Before we proceed to the sampling of the influence of change on productivity and stress, below are some simple statistical findings. Based on the results from the analysis of the questionnaires, we calculated the influence of changes on productivity and stress. Changes cause stress in the employees, destabilize their behaviour and initially lead to resistance (53% much or very much, and only 23% little or very little).

Younger individuals (25-45 years old) see change (much or very much) as a challenge for creativity, action and evolution. We also notice that the level of stress is enhanced for employees in the private sector obviously because their jobs are not secure, the increased demands, and the greater pressure toward meeting goals. The percentages of respondents answering much or very much were 66% and 42% in the private and public sectors respectively.

The results are more obvious as far as productivity is concerned. A percentage of 77% of the respondents believe that productivity will increase much or very much. This implies that everybody recognizes the necessity and the interdependence of change with productivity. The anticipated augmented productivity appears with higher rate (percentage) in the private sector (62% much or very much) but the relatively high rates of the public sector (40% much or very much) show that even the public sector employees agree to the fact that changes will lead to such a thing.

As far as anticipated productivity after the changes are implemented, in all ages (25-65 years old) and both for men and women, the rates are high which delineates that everybody recognizes that apart from stress and forthcoming resistance, productivity will increase after the materialization of changes.

## 5 **Modelling the effect of changes on productivity and stress**

After presenting the basic variables and the corresponding answers of the respondents, we will proceed with the modelling of the effect of changes on productivity based on those variables. More specifically, the effect of changes on productivity and stress will be used as dependent variables. The answer to the specific question varies in the range between "very little" to "very much". Those who answered at the extreme ends ("very little" or "little") seem to view the effect of change on productivity and stress as not important (value of 0), whereas those who answered "enough", "much" and "very much" seem to consider the effect of changes as important (value of 1). Those who did not reply because they were not willing to were excluded from our analysis.

Independent variables included socio-economic factors (age, marital status, income, sex) as well as various other qualitative variables among which are "creativity within the organization", "labour accountability", "higher rewards", and the level of education. Various dummy-variables were constructed in relation to the ranking within the organization (employee, supervisor, manager) as well as the impact on productivity based on different age groups.

Those variables were used in a logistic regression. The method was preferred from the multiple regression analysis as the dependent variable is dichotomous and discontinued. Additionally the logistic regression is a more appropriate monotonic function for the sampled data compared to the ordinary least squares method. Also, the logistic regression was preferred from a discriminant analysis since the latter is based on the hypotheses of the multivariate normality and of equal variance-covariance matrices among groups. Those hypotheses are not required in the logistic regression.

Here the dependent variable is a dichotomous variable Y which takes the value 1 with probability  $\Theta$  and the value 0 with probability  $1-\Theta$ .<sup>4</sup> More specifically in our sample the first  $n_1$  out of  $n$  observations correspond to the substantial influence of changes on productivity ( $Y_1=Y_2=\dots=Y_{n_1}=1$ ) whereas the rest of the observations correspond to insignificant influence ( $Y_{n_1+1}=Y_{n_1+2}=\dots=Y_n=0$ ). This means that the likelihood function is

$$L(Y, \Theta) = \left( \prod_{i=1}^{n_1} \Theta_i \right) \left[ \prod_{i=n_1+1}^n (1 - \Theta_i) \right] \quad (1)$$

If  $X_i = (X_{i1}, X_{i2}, \dots, X_{ik})$  is the total of  $k$  explanatory variables  $X_1, X_2, \dots, X_k$  for every  $i$  person, then the logistic regression model calculates that there is a relation between  $\Theta_i$  and  $X_{ij}$

presented as

$$\Theta_i = \frac{1}{1 + e^{\left[ -\left( \beta_0 + \sum_{j=1}^k \beta_j X_{ij} \right) \right]}} \quad i=1,2, \dots, n \quad (2)$$

Substituting  $\Theta_i$  in (1) we get the likelihood function dependence as<sup>5</sup>

$$L(Y, \beta) = \frac{\prod_{i=1}^{n_1} e^{\left( \beta_0 + \sum_{j=1}^k \beta_j X_{ij} \right)}}{\prod_{i=1}^n \left[ 1 + e^{\left( \beta_0 + \sum_{j=1}^k \beta_j X_{ij} \right)} \right]} \quad (3)$$

The regression parameters ( $\beta$ s) of the proposed model, quantify the relationship between the independent variables and the dependent including also the so-called Odds Ratio (OR). As Odds Ratio we specify the ratio where numerator is the probability of serious effect because of the production changes and denominator is the probability of no effect. That is:

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<sup>4</sup> For more details about applications of logistic regression see Halkos (2011); Kleinbaum (1994), Hosmer and Lemeshow (1989), Collett (1991), Kleinbaum *et al.* (1999), Hair *et al.* (1998), Sharma (1996).

<sup>5</sup> Although we assume that the without restrictions dependence of maximum likelihood could lead to subjective appreciators  $\beta$  because the sample size is big, it seems that this conditional problem does not seem to be that serious.

$$\text{Odds}(E | X_1, X_2, \dots, X_n) = \frac{\text{Pr}(E)}{1 - \text{Pr}(E)} \quad (4)$$

Instead of maximizing the residuals' sum of squares as in a multiple regression, the logistic regression maximizes the probability of an event (here the effect of the production changes) to take place.

$$\ln \frac{\text{Pr}}{1 - \text{Pr}} = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_k X_k \quad (5)$$

Or

$$P = \frac{1}{1 + e^{-(\beta_0 + \sum_{i=1}^k \beta_i X_{ij})}} \quad (6)$$

Where P is the probability of changes in productivity in regards to independent variables  $X_1, X_2, \dots, X_k$ . Function (5) models the logarithm of Odds as a linear function of the independent variables and is equal to a multiple regression with the logs of Odds as an independent variable.

The form of the logit model is a transformation of the probability  $\text{Pr}(Y=1)$  that is specified as the natural logarithm of the event  $E(Y=1)$ . That is

$$\log it [\text{Pr}(Y = 1)] = \log_e [\text{odds}(Y = 1)] = \log_e \left[ \frac{\text{Pr}(Y = 1)}{1 - \text{Pr}(Y = 1)} \right] \quad (7)$$

As our basic interest focuses on the primary influences, we have omitted the interactions of the variables. The finalized model was selected on the base of statistical significance of the variables and in the case of the first proposed model formulation we have:

$$\begin{aligned} \log it [\text{Pr}(Y=1)] = & \beta_0 + \beta_1 \text{Work experience (total)} + \beta_2 \text{Work experience (at this job)} + \\ & + \beta_3 \text{Education Level} + \beta_4 \text{Satisfaction about the organization} + \epsilon_t \end{aligned}$$

where Y is specified as the dependent variable, with values of 1 for important influence of changes in productivity and 0 for non-important effects.

The significance levels of the individual statistical tests (i.e. the P-values) are presented in brackets and in the case of the individual statistical significance of the  $\beta$  estimates

correspond to  $\Pr > \text{Chi-square (Wald)}$ . In the first model (dependent variable change-productivity) using the socioeconomic variables as independent variables we see that the variables *education* and *satisfaction from organization* are statistically significant for the levels of 0.05 and 0.1. Similarly, the variables *work experience (totally)* and *work experience (at this job)* are statistically significant for the level of 0.1

In the second model (dependent variable change-stress) we see that the variable *job stress can affect the rest*, is statistically significant for the levels of 0.05 and 0.1 and the variables *place of residence*, *duration of residence in the same place*, *the work load upset the people* and *age* are statistically significant for the level of 0.1. The rest of the variables are statistically insignificant.

In the third model (dependent variable change-productivity) we see that the variables *education level*, *satisfaction of cooperation-communication with others*, *stress about lack of creativity*, *stress about salary*, are significant in all statistical levels. The variables *job stress can affect the rest*, *stress about job security*, *stress about chance further education* are statistically significant for the levels of 0.05 and 0.1. The variables *work experience (totally)*, *work experience (at this job)*, *stress about work environment*, *satisfaction about the variety of job*, *satisfaction about job creativity*, *satisfaction about the relations with management-leadership*, are statistically significant for the level of 0.1. The rest of the variables are statistically insignificant.

### **Table 2 about here**

We may compute the difference  $e^{\hat{\beta}_i} - 1$  which estimates the percentage change (increase or decrease) in the odds  $\pi = \frac{\Pr(Y = 1)}{\Pr(Y = 0)}$  for every 1 unit in  $X_i$  holding all the other  $X$ 's fixed. Being more specific, in case we run the last model with the change against productivity the coefficient of *education level* is  $\hat{\beta}_4 = -0.368$ , which implies that the relative

risk of this particular variable is  $e^{\hat{\beta}_4}=0.692$  and the corresponding percentage change is  $e^{\hat{\beta}_4} - 1=-0.308$ . This means that in relation to education level the odds of persons' ability to increase productivity decreases by almost 31% ceteris paribus. When the education level increases, the importance of change decreases because we will have to be explicit about the necessity, the utility and the reason of change.

In the case of *work experience (totally)*  $\hat{\beta}_2=-0.211$ , which implies that the relative risk of this particular variable is  $e^{\hat{\beta}_2}=0.810$  and the corresponding percentage change is  $e^{\hat{\beta}_2} - 1= -0.190$ . This means that in relation to work experience (totally) the odds of persons' ability to increase productivity decreases by almost 19%. Thus, work experience is not a necessary factor to support change and many people prefer the stability (no change) from the uncertainty (change).

In the case of the salary stress  $\hat{\beta}_{18} = 0.323$ , which implies that the relative risk of this particular variable is  $e^{\hat{\beta}_{18}} = 1.382$  and the corresponding percentage change is  $e^{\hat{\beta}_{18}} - 1= -0.382$ . This means that in relation to salary stress the odds of persons' ability to increase the relation change-productivity increases by almost 38% ceteris paribus. Thus, the tightened concern of the employees about their salary allows for greater acceptance of change and lessens the reaction.

In the same model we see that the coefficient *creativity stress* is  $\hat{\beta}_{17} = 0.364$  which implies that the relative risk of this particular variable is  $e^{\hat{\beta}_{17}} = 1.439$  and the corresponding percentage change is  $e^{\hat{\beta}_{17}} - 1= -0.439$ . This means that in relation to creativity stress the odds of persons' ability to increase the relation change-productivity increases by almost 44% ceteris paribus. So, when the creativity is very important to someone, the acceptance of change and the relation change-productivity increases.

**Table 2:** Results of the logistic regression model formulations (P-values in brackets).

Variables	Estimates	Odds Ratio	Estimates	Odds Ratio	Estimates	Odds Ratio
Constant	1.513 [0.004]	4.539	-2.610 [0.000]	0.074	0.271 [0.764]	1.312
Work experience (totally)	-0.152 [[0.092]	0.859			-0.211 [0.053]	0.810
Work experience (at this job)	0.158 [0.095]	1.172	0.090 [0.330]	1.095	0.205 [ 0.071]	1.228
Education level	-0.189 [ 0.044]	0.828			-0.368 [0.001]	0.692
Satisfaction from organization	-0.238 [ 0.047]	0.789				
Job stress can affect the rest			0.340 [0.020]	1.405	-0.254 [0.043]	0.776
Place of residence			-0.200 [0.084]	0.819		
Duration of residence in the same place			0.125 [0.089]	1.133		
Workload upset			0.254 [0.076]	1.289		
Sex			0.284 [0.213]	1.328		
Age			-0.325 [0.073]	0.723		
Stress about job environ.					0.190 [0.085]	1.210
Satisfaction about job variety					0.242 [0.054]	1.274
Stress about job security					-0.210 [0.030]	0.811
Satisfaction of cooperation with others					-0.420 [0.002]	0.657
Creativity satisfaction					0.272 [0.064]	1.313
Creativity stress					0.364 [0.007]	1.439
Salary stress					0.323 [0.003]	1.382
Satisfaction of relations with MNG-leaders.					0.206 [0.083]	1.229
Satisfaction of personal work-method					0.168 [0.150]	1.183
Stress about personal work-method					-0.192 [0.117]	0.825
Stress about chance further education					-0.257 [0.013]	0.773
Nagelkerke R <sup>2</sup>	0.038		0.124		0.208	
Hosmer Lemeshow	6.788 [0.560]		17.394 [0.022]		6.957 [0.541]	
Likelihood Ratio	550.781		488.91		440.864	



Similarly, it can be seen that the coefficient *satisfaction about cooperation with others*  $\hat{\beta}_{15} = -0.420$  implies that the relative risk of this particular variable is  $e^{\hat{\beta}_{15}} = 0.657$  and the corresponding percentage change is  $e^{\hat{\beta}_{15}} - 1 = -0.343$ . This means that in relation *satisfaction about cooperation with others* the odds of persons' ability to increase the relation change-productivity decreases by almost 34% ceteris paribus. Thus, when satisfaction about cooperation increases, the management of change gets more complicated. This is normal because no one wishes to adapt changes when the relations are good. This may cause the leadership to rethink the necessity and utility of change.

The Nagelkerke R square is a measure of predictability of the proposed models (similar to  $R^2$  in a regression). To assess the model fit we compare the log likelihood statistic ( $-2 \log \hat{L}$ ) for the fitted model with the explanatory variables with this value that corresponds to the reduced model (the one only with intercept). The likelihood ratio statistic is quite high in all cases rejecting  $H_0$  and concluding that at least one of the  $\beta$  coefficients is different from zero.

Finally, the Hosmer and Lemeshow values equal to 6.788, 17.394 and 6.957 (with significance equal to 0.560, 0.022 and 0.541) for the three model formulations respectively. The non-significant  $X^2$  values in models 1 and 3, indicate a good model fit in the correspondence of the actual and predicted values of the dependent variable.

## 6. Conclusions

In this paper we used logistic regression analysis in order to identify the responsible factors for the correlation among a large number of variables and their influence on change. Our results showed us that change is an element affected by some qualitative factors (stress, productivity). Following this, logistic regression presented us with a lot of useful elements concerning the function of change on productivity. Initially it showed us the effect of financial and social elements such as the importance of work experience, creativity, salary, education level, job satisfaction are elements that can lead the change to success. Thus, we can see that the work experience is not a factor to support change but the creativity is a very important factor for success of change.

The timely and continuous adaptation of companies to the rapid changes that take place is the major precondition for survival and growth. The need for innovation and change requires the adaptability of enterprises, the need for constant reconstruction, and the appropriate management of elements such as the awareness of the system, the adaptation of new standards and prototypes.

Based on the sample and the gathered information, we calculated the ratios of probability for substantial effect of changes on productivity in relation to the level of education, creativity, labour responsibility, and higher rewards. More specifically, creativity enhances the importance of the effect of changes by 44% *ceteris paribus*, labour responsibility enhances the importance of the effect of changes by 31% *ceteris paribus* whereas higher rewards and the education level decrease the possibilities by 21% and 15% respectively.

Each proposed change, even the most insignificant, can meet some form of resistance. The role of the leader in the introduction of change and the decrease of opposition is vital. It is necessary to explain the reasons, the purpose and the goal of change, but also the ways to achieve these goals. The leader must challenge the continuation of operational services,

products, customers when it is not expected to contribute to enhanced productivity. It is useful for any change to be tested on smaller channels of the organization and on a limited scale. The pilot application can be used to locate problems and weaknesses of change and to re-examine things that were considered definite.

Dialogue, the explanation of “what is going to happen” and the gathering and exchange of views and opinions can help toward this direction. Organizations that are going to redesign their organizational models before this is imposed can have a relative advantage, versus the organizations that are going to change after the crisis hits. Drucker (2000), in order to emphasize the importance of change before the crisis, mentions a medical proverb “there is nothing more difficult, expensive and useless than to preventing a dead body to rot”. For this reason, the goal must be to create organizations that foresee change and will create their own future.

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