Innovation in ergonomics: a survey in the agribusiness sector of Brazil

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Abstract: The healthy organisation encourages participatory environments, is innovative, is centralised in the sense of human relations in the workplace, and has an anthropocentric essence of ergonomics. The aim of this study is to analyse the relationship between innovations in ergonomics, absenteeism and in the risk of lifting loads in six units of an agribusiness. The method we used was a quantitative survey of a descriptive nature, survey type with a sample of 419 workers, which used measures that explored the relationship between the study variables, through factor analysis and multiple linear regression. The results show that the workplace environment explains 46% of the occurrence of process and organisational innovations in ergonomics, since the process and organisational innovations in ergonomics justify by 40% the significant reduction of absenteeism. Healthy organisations have in their management processes the involvement of workers and make innovations that refine their performance and contribute to human relationships in the workplace, which positively affect both the organisation and the workers.

Keywords: process innovation; organisational innovation; ergonomics; absenteeism; agribusiness; Brazil.

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1 Introduction

Agribusiness is one of the sectors that generates development, jobs, and gross domestic product for the country, and stimulates family farming and exports. In this regard, in addition to a favourable universe of organisational growth, the concern for the health of workers is pertinent to the implementation of process and organisational innovations in ergonomics not only by the legalistic profile of a healthy environment, but also in the adoption of humanised managements.

The scenario of the organisations of the slaughter and meat processing sector in Brazil is shrouded in changes, both through processes of globalisation that require competitiveness, and by the approach demanded by regulatory norms (RNs), reiterating the need for changes and improvements in the process and organisation of the workplace for the protection and safety of workers. In this context, organisations need to reinvent their capabilities to innovate and overcome challenges, reaching their commercial goals, but fundamentally, those related to human relations in the workplace.

Labour relations are studied in the most diverse sectors and segments. According to Mallam et al. (2015), the human element is a critical component of safe and efficient operations, but has been widely accepted across the industry. Occupational diseases, work-related stresses, and turnover lead to absenteeism as well as poor health of individuals in organisations (Smedley et al., 2003; Sackey and Sanda, 2009; Magee et al., 2017). Such phenomena have damaging effects on human factors, as well as in work processes and social relationships, with dual effects, both for the worker and for the organisation itself.

In the organisational system, ergonomics has an explicit role, it contributes to satisfaction and well-being, promoting higher quality work, as well as greater productivity and less damage to health (Zeng et al., 2010; Falck et al., 2014; Zhou et al., 2016; Singh et al., 2017; Burgess-Limerick, 2018).

To recognise risk in load lifting activities, the tool in ergonomics is the ergonomic analysis, complementary risk analysis and measurement tools, such as the NIOSH by *Ocra* methodology, by Colombini and Occhipinti (2012), focusing on the ergonomic approach of eliminating or reducing the risk for the manual lifting of loads.

Process and organisational innovations, according to the essence of the anthropocentric approach to ergonomics, can represent a favourable dynamic of improvements in the well-being and life quality of workers, encouraging a work organisation focused on human relations. Furthermore, they can allow ergonomic risks to be reduced, taking into account the company's need vis-à-vis the inspection agencies, but fundamentally, aiming a priori, the health and safety of workers.

Organisations increasingly recognise their employees not only as human resources but also as talents essential to business development. The technological advancement and the continuous changes of the market demand that companies invest more and more, and even if they mix humans and machines (Zink et al., 2008), the human being is (or should be) the differential with distinct capacities and competences for the organisation, which may be the key to the success of innovations (Calantone et al., 2010; Kato and Zhou, 2018; Chapman and Hewitt-Dundas, 2018).

Competing for the consideration of this deferential, ergonomic studies, through the ergonomic workplace analysis (EWA), which encompass process and organisational innovations in lifting activities involving ergonomic risks, change the routine, the methods and the overall performance of the worker and the workplace. Thus, they may have an impact on the epidemiological data of absenteeism, with these being an ergonomic management tool that involves the research dynamics of ergonomics, necessary for the understanding of innovation efficiency of ergonomics in the organisation.

In view of the above, this study aims to analyse the relationship between innovations in ergonomics, absenteeism and risk in the lifting of loads in six units of an agroindustry in the south of Brazil. This research is based on the premise that the innovations of processes, related to ergonomics, can positively influence the reduction of absenteeism and minimise the effects of risks in the lifting of loads. For effective management of manufacturing operations, it is critical to understand the factors that influence workers' health and well-being, in order to develop processes that can improve working conditions.

2 Theoretical framework

2.1 Process and organisational innovation

Schumpeter (1934) was the first author who highlighted the importance of innovations for the development of a country and, according to him, innovations are a stimulus to new economic cycles because they break the static equilibrium of a closed economy in both goods and services and strip of the circle of constancy. The OECD (2005) and Obwegeser and Müller (2018) highlight process innovations, as new or improved processes, with different technologies, methods or equipment, in production support activities.

In process innovations, Garcia and Calantone (2002) acknowledge the main focus is on improving the efficiency of production process to product innovation, where the concept of innovation is presented as being the measure for the degree of novelty of an innovation.

Process innovation is continuously used to improve the performance of organisations, these can be identified in companies that promote improvements in production processes

in order to increase productivity, reduce losses and production costs, as well as to value workers who assist in the development of improvement projects (Love et al., 2014; De Guimarães et al., 2016; 2017; Severo et al., 2017; Roper et al., 2017).

According to Terziovski and Guerrero (2014), innovation of process also aims at the restructuring and application of the internal client concept. For Brem et al. (2016), the process innovation is promoted by the occurrence of a dominant design, which affects the performance of the organisation. However, Maine et al. (2012) highlight that organisations that explore process innovation face greater uncertainty in their positioning in the value chain, market amplitude, customisation and the changes required by their customers, in contrast to the enterprises based on product innovation.

According to the Analytical Report of the OECD (1996), technology, productivity and job creation, technological and organisational changes are closely associated. In this context, in a continuum, non-technological innovations are inclined to organisational and management innovations in an organisational-management relationship.

With regard to organisational innovation, Birkinshaw et al. (2008) emphasise that the literature links both technological and organisational; however, it is recognised that certain types of organisational innovation contribute more to competitive advantage.

Organisational innovation can be a response to technical change, but it can also be a necessary condition for technical innovation (Lam, 2005). Also, according to the author, organisational innovation is not only a support to innovations of product and process, because they themselves can impact in a way relevant to the performance, as well as improving the quality and efficiency of work, the organisation's ability to learn and the usability of knowledge and technologies.

In this context, companies must formulate a structure that enables the human beings to develop their skills, and find opportunities to perform within the organisation. According to Haneda and Ito (2018) organisational and human resources management must provide an environment for research and development (R&D), which can lead to innovation. For this purpose, Simantob and Lippi (2003) state that the profile of a manager in process innovation has essential characteristics, such as:

1 stimulating and giving autonomy to the team's decision-making

2 demonstrating urgency in solving problems with a high degree of uncertainty

3 measuring return on investment with flexibility to risk

4 having responsibility and resistance to risk

5 producing the culture of experimentation

6 being committed to learning, both internal and external to the company

7 understanding their work in order to persuade others, whenever it is a good idea.

In this scenario, Zeng et al. (2010) and Seeck and Diehl (2016) claim that creativity present a triggering agent for innovations, because the power of creativity is a determinant of competitive advantage (Hill and Hug, 2004; De Guimarães et al., 2017), as well as aspects of functionality, security, usability, among others, in ergonomic design projects.

However, process and organisational innovation can influence ergonomics (Zeng et al., 2010; Aqlan et al., 2017), which demands a new way of looking at innovation,

developing ergonomic innovations, which benefit employees' quality of life, bringing greater security in environmental, cognitive and organisational interfaces (Hill and Hug, 2004).

2.2 Ergonomics and the lifting of loads

When entering the knowledge of ergonomics it is important to remember the workplace, since it is a precedent (Mothé, 1995). This understanding of the workplace is important and redeems its value to the lives of people, it brings a revaluation for the ergonomic intervention because, as a process, it mediates the individual and the environment, which has been studied by several researchers (Rabardel et al., 1998; Quellet and Vézina, 2014; Guimarães et al., 2015; Asjad and Mallick, 2017; Aqlan et al., 2017).

Ergonomics thus presents itself as a two-way street, seeking to modify the environment and satisfy the material and spiritual needs of the workers (Ferreira, 1998). However, Guimarães et al. (2015) highlight that it is possible to balance the ergonomics and the demands of production, and it is necessary to make it clear to management.

In this context, the International Ergonomics Association (IEA) classifies ergonomics as being a scientific discipline that studies the interactions of people with other elements of the system, making applications of theory, principles and projects methods, with the aim of improving human well-being and the overall system performance (Dul and Weerdmeester, 1994).

In the quest to understand human action and work activity (Banerjee, 2016), ergonomics emphasises that the individual is not passive in face of what happens, both in relation to the characteristics of the socio-technical context where they are established, and in relation to one's health and what results from its practice (Ferreira, 1998; Smedley et al., 2003). The work is inherent to the individual and socio-technical system in a triple-dimensionality, whose manifestations are addressed by Rabardel et al. (1998), in the commitment relationship with the production or execution of services, in a relationship with oneself (body-reason and affection) and in a social relationship with the other individuals (professional partner relationship).

Coherently, the EWA is a tool that contributes to the recognition of all the characteristics in the workplace of human factors. According to RN17, it is appropriate to detect aspects of health conditions, safety, training and data relevant for work organisation and, through the book of recommendations there may be contributions related to organisational and process innovations from the detected findings (Brasil, Ministério do Trabalho e Emprego, 2007).

It is evident, in the face of the above and with the corroboration of Karwowski (2007), Koradecka (2010) and Pereira et al. (2016), that ergonomics requires a holistic vision in its approach, being linked and dependent on the whole organisational field, in its physical and cognitive aspects, as in social, organisational and environmental aspects.

For Karwowski (2007), it focuses on the nature of human-artefact interactions, views from the unified perspective of science, engineering, design, technology, and human resource management. Perhaps it is in this interweaving that its complexity lies. Coherently, Quellet and Vézina (2014) emphasise that ergonomics facilitates the development of training contents and recommendations on learning conditions, aiming to prevent musculoskeletal disorders and occupational health.

The studying of human factors and working conditions in companies can improve and develop operational methods. It develops techniques that ensure ways that are safe, comfortable and healthy in the work environment, through the implementation of ergonomic programs and adaptation activities in accordance with the norms of safety in the workplace, imposed by the Ministry of Labour and Employment (MLE) (Carvalho et al., 2011).

Within some organisations, there is still a low degree of mechanisation and the operations are carried out manually or are semi-mechanised, which generates the need for a large contingent of workers (Iida, 2005). For the author, these situations can compromise productivity and cause discomfort, increase the risk of accidents and susceptibility of damage to the health and safety of workers. With this perspective, it is fundamental for the application of the ergonomic concepts for an analysis of the human being and the work environment, with the aim of improving health and safety conditions (Koradecka, 2010).

According to the MLE, through the Technical Note 060/2001 (Brasil, Ministério do Trabalho e Emprego, 2001), the most appropriate posture for the worker is that which is free, and can be varied over time, and it is important that the jobs in general and those of manual lifting of loads favour this variation, alternating the same between sitting, standing and walking. When a worker adopts a forced stance, such as in manual load lifting activities, both in relation to the lifted weight, as well as in relation to the anthropometry of the post and inadequate postural biomechanics, in several work environments. As reinforced Quellet and Vézina (2014) and Pereira et al. (2016), there is the imminent risk of physical overload, and this can be a generator of pain and imbalances of force.

In this context, ergonomics aims to improve postural biomechanics in various workplace environments (Asjad and Mallick, 2017), which reduces the risks in lifting loads (Quellet and Vézina, 2014), minimising sick leave resulting from occupational diseases, which impacts on the reduction of absenteeism (Kremer and Steenbeek, 2010), which is a primordial element for the process of production and organisational development.

2.3 Absenteeism

Knowledge of human health can drive improvement both in practice and in capacity for innovation (Henderson et al., 1999) moreover a preliminary view of this complexity is needed to assess the relationship between scientific knowledge, health, and improvements in living conditions.

As highlighted by Porter (1998), there is a difficult and far-reaching range of knowledge and ruptures between failures and correct answers (Kumar et al., 2015) in the understanding of the phenomena related to health and disease. The paradoxes still prevail in health practices, but history contributes through the growth of knowledge for the sustainability of scientific and innovative activity in health. Such practices affect the working conditions of individuals, i.e., the health of the worker.

Iida (2005) cites elements of concern, such as conflicts with co-workers, the structure of the organisation with regard to company culture, internal politics, the processes of participation, extending beyond the organisation of production, but that deal with social relations within the world of work and, as such, impact on absenteeism.

The literature highlights that absenteeism can be of known cause, such as absences recognised by the force of law, such as vacations, marriages, deaths, among others, or of unknown causes, usually justified by changes in the health of the worker, family or uncertain (Smedley et al., 2003; Kremer and Steenbeek, 2010). In addition, the causes of absenteeism can be proven diseases or not, involuntary delays or force majeure, difficulties and financial problems, transportation problems, poor motivation towards work, as well as poor supervision and inadequate policies of the organisation. According to Lee and Ericksen (1990), the control of absences from absenteeism are the indexes of periods outside normal working hours or the sum of absences from work in general.

3 Method

The method used in this study was a quantitative research, of descriptive character, which proposed to analyse the relationship between ergonomic innovations, absenteeism and risk in the cargo lifting activities in six business units of an agroindustry, with the purpose of providing and cooperating scientifically with knowledge on the subject.

The study population comprised 9,386 workers, (Hair et al., 2010), using a sample made up of 419 workers who perform lifting activities. The sample is considered non-probabilistic for convenience (Hair et al., 2010), and the data on said workers were extracted from the system information and documents made available by the units. In this context, data collection occurred between the months of April and May 2016.

We based the quantitative approach on a data collection technique using a questionnaire. The questionnaire (Table 1) presents 19 affirmations on a five-point Likert scale (totally disagree to totally agree), which were adapted from the studies by Simantob and Lippi (2003), from the OECD (2005) and Pintec 2014 (IBGE, 2015). The constructs of ergonomic innovations, absenteeism, innovative environment and risk in the lifting of loads were adapted from the research by Kremer and Steenbeek (2010), Colombini and Occhipinti (2012), Guimarães et al. (2012a, 2012b), Quellet and Vézina (2014), Guimarães et al. (2015), De Guimarães et al. (2016). It is worth mentioning that three experts of the thematic areas of study also validated the questions. The questions were elaborated from the following theoretical precepts:

a Process and organisational innovation in ergonomics: the precepts expressed in the studies by Simantob and Lippi (2003), from the OECD (2005), Pintec 2014 (IBGE, 2015) and Guimarães et al. (2015) show that process and organisational innovations and innovations related to ergonomics have focused on meeting safety standards and improving the physical environment in the workplace, which involves adaptations of machines and equipment, as well as a concern of developing new methods of work management that involve and value workers, to enhance people's commitment through open and positive leadership.

b Innovative environment: this factor was elaborated on the premise that organisational innovations can contribute to the expansion of people's involvement in innovation, creating an environment conducive to teamwork in leveraging new solutions (Simantob and Lippi, 2003; OECD, 2005; IBGE, 2015; Guimarães et al., 2012a).

c Absenteeism: absenteeism cannot be considered only as a result of the absence of a worker, but it must consider the organisational actions that prevent workers from having to take leave. Among the actions, we highlight that organisations can develop ergonomic studies on job roles, actions to minimise risks and involve people in the care of health and safety (Kremer and Steenbeek, 2010; Quellet and Vézina, 2014).

d Risk: the studies on the risk of lifting loads address the health and safety implications of the worker in the exercise of professional activities that can directly impact the physical conditions (Colombini and Occhipinti, 2012).

In order to meet the objective of the study and to determine the influence of observable variables on dependent variables, in order to establish relations of dependence and influence, we opted for the use of the exploratory factor analysis (EFA), with the use of the varimax rotation and we later applied the multiple linear regression.

For data analysis we used the multivariate data analysis (Hair et al., 2010), with specificity in EFA and multiple linear regression, as these explore the relationships between variables of the study. The use of the varimax rotation has a class of processes to summarise the data, as well as condensing the original information of the group of variables into a set of factors (Hair et al., 2010). According to Pestana and Gageiro (2005), the factor analysis aims to discover implicit factors in a group of variables, for a phenomenon.

EFA is a technique that contributes to the statistical validation of observable variables and factors, which were initially elaborated based on theoretical precepts. In this way, statistical techniques are used to test the reliability, integrity and normality of the data and the scale (Hair et al., 2010; De Guimarães et al., 2018; Severo et al., 2018). Among the tests we used include Cronbach's alpha, Kaiser-Meyer-Olkin (KMO), Bartlett's test of sphericity, variance explained, factor loading, commonality and in addition we calculate Pearson's correlation matrix, to verify the correlation between observable variables and the possibility of multi-collinearity. In this context, Table 1 shows the observable variables, constructs, factor loadings and commonality.

Pestana and Gageiro (2005) emphasise that the multiple linear regression is a statistical, descriptive and inferential technique of the analysis between a dependent variable (Y), and independent variables (X's). The technique includes more explanatory variables to the model and its applicability should be observed if the correlations between the explanatory variables are high. If this occurs, it means that one is very dependent on the other (Hair et al., 2010). Coherently, this technique was used for the analysis and interpretation of the research data.

As an addition to the research, we performed the ANOVA to verify whether there was a difference between the respondents of the surveyed units, in order to verify if the management of the units can act as moderator, influencing the results of the evaluation of the dimensions process and organisational innovation in ergonomics, innovative environment, absenteeism and risk.

Table 1 Observable variables and constructs – varimax rotation

Observable variables		*Loads*	*Commonality*
	Process and organisational innovation in ergonomics		
POIE1	The improvements of the lay out, machines and equipment contributed to make my day to day easier.	0.766	0.686
POIE2	I feel at ease contributing to the day to day with ideas because I am aware of my activities.	0.670	0.524
POIE3	The improvements have resulted in gains for the company.	0.810	0.675
POIE4	The improvements generated earnings to workers.	0.706	0.659
POIE5	The improvements with training, qualification, breaks have improved my ergonomic conditions.	0.535	0.514
POIE6	I have participated in training to improve ergonomics.	0.481	0.468
POIE7	My sector, boss and ergonomic improvements have contributed to my satisfaction, motivation and involvement at work.	0.515	0.640
POIE8	I notice that the company meets the regulatory norms RN36 and RN17.	0.298	0.233
	Innovative environment		
IE1	My manager seeks to get involved in improvements and organisation of my sector.	0.502	0.522
IE2	I notice that the work team of my industry respects the idea of others about changes.	0.740	0.585
IE3	The work environment of my industry is pleasant and I understand the team spirit.	0.853	0.771
IE4	I attend meetings in my industry and realise that the environment is reliable and sincere.	0.803	0.743
	Absenteeism		
ABS1	I notice that the company has groups of studies for Ergonomics, CQAs, CIPA.	0.679	0.590
ABS2	I am informed about goals that my sector needs to meet.	0.627	0.514
ABS3	I notice that the company has support staff working on a daily basis for continued improvements.	0.721	0.594
ABS4	I notice that the company monitors data through indicators of absence from work.	0.721	0.615
ABS5	I was advised on ways of how to properly lift loads to avoid risks.	0.569	0.505
	Risk		
RIS1	I believe that lifting four boxes of 10 kg in a minute is easier than lifting two boxes of 20 kg in a minute	0.610	0.445
RIS2	I realise that my activity is at risk of generating problems for my spine	0.647	0.452

Notes: Cronbach's alpha 0.833; KMO 0.866. Cronbach's alpha 0.818; KMO 0.788. Cronbach's alpha 0.756; KMO 0.767. Cronbach's alpha 0.102; KMO 0.5. Five-point Likert scale usage: 1 totally disagree; 2 partially disagree; 3 do not agree, do not disagree; 4 partly agree; 5 totally agree.

4 Results and discussions

In the validation process of the observable variables and the scale, we used the Cronbach's alpha, KMO and Bartlett's test of sphericity, in order to verify the reliability and possible normality of the data, since these are fundamental requirements of the EFA. Subsequently, in the application of the EFA techniques, the tests of variance explained, factor loading, commonality and the calculation of Pearson's correlation matrix.

4.1 Exploratory factor analysis

KMO and Bartlett's test of sphericity were performed as shown in Table 2, certifying that the KMO test presents a value above 0.8 (0.878), which indicates that the factor analysis is a suitable technique to be applied in the data of the present research (Pestana and Gageiro, 2005; Hair et al., 2010). Bartlett's test of sphericity (Table 2), found degree of significance of 0.000, value below 0.05, which refutes the hypothesis that the correlation matrix is an identity matrix, demonstrating that there is a correlation between the variables.

Table 2 Result of the KMO and Bartlett's test

Test		*Value found*
KMO		0.878
Bartlett's test of sphericity	Chi-square	2,094.643
	Significance	0.000*

Note: *p < 0.001.

In this context, it is important to perform the correlation matrix, in order to investigate the existence of multi-collinearity, which happens when the variables present a correlation above 0.8 (Hair et al., 2010). The analysis points to the Pearson correlation matrix indicating that there is no multi-collinearity in the variables, Therefore, the use of factor analysis is adequate for this research. From the verification of the adequacy of the sample, we began the validation process of the instrument.

For the intra-block analysis, we considered the four constructs identified in the EFA. In this context, the analysis structure includes:

1 Construct 1: process and organisational innovation in ergonomics.

2 Construct 2: innovative environment.

3 Construct 3: absenteeism.

4 Construct 4: risk.

Table 3 presents the validation of the data for intra-block analysis of construct 1: process and organisational innovation in ergonomics, indicating favourable indexes for the confirmation of the scale. In this direction, the Cronbach's alpha points to adequacy, since it is above 0.7, the KMO above 0.8 (0.866) and Bartlett's test of sphericity with significance at 0.000, value below 0.5, are acceptable (Hair et al., 2010), also an explained variance result of 51.4%.

Table 3 Validation of data for construct 1: process and organisational innovation

Cronbach's alpha	0.833
KMO	0.866
Bartlett's test of sphericity	1,022.693*
Variance explained	51.4%

Note: *Level of significance $p < 0.001$.

For construct 1, process and organisational innovation in ergonomics, we found values that proved valid for scale validation, pointing to the factor loading of the eight observable variables, values above 0.4 with indices higher than that recommended by Hair et al. (2010). In the analysis of commonality, five variables present acceptable commonality, the variables are POIE1 and POIE4 (of perception that improvements make everyday life easier and generate gains for workers) presented the highest indices, which were 0.795 and 0.799, respectively, demonstrating that these contribute significantly to compose the construct. The perception of the facilities and gains with the improvements by the workers, are in agreement with the assumptions of De Guimarães et al. (2016), since besides it being a tool of competitiveness, it improves the usability and contemplates the motivation and creativity of workers, focusing on practices of organisational processes.

Table 4 depicts the validation of the data for intra-block analysis of construct 2: innovative environment, indicating that the Cronbach's alpha is above 0.7 (0.818), the KMO is very close to 0.8 (0.7888), as the Bartlett's test of sphericity is acceptable with significance 0.000, and the explained variance is 65%.

Table 4 Validation of data for construct 2: innovative environment

Cronbach's alpha	0.818
KMO	0.788
Bartlett's test of sphericity	470.883*
Variance explained	65%

Note: *Level of significance $p < 0.001$.

The intra-block factor analysis for the innovative environment construct indicates values favourable to scale validation, since the commonality is acceptable, in the same way as the factor loadings of observable variables.

Table 5 Validation of data for construct 3: absenteeism

Cronbach's alpha	0.756
KMO	0.767
Bartlett's test of sphericity	361.080
Variance explained	50.92%

Note: Level of significance $p < 0.001$.

In the formation of the innovative environment construct, the question IE4 (regarding the team spirit and pleasant atmosphere) showed the most significant factor loading (0.865), showing that where the team spirit is perceptible and the environment is considered

pleasant, an innovative, participatory and conducive environment for innovations and worker satisfaction is stimulated (Simantob and Lippi, 2003).

Table 5 shows the validation of the data for the analysis of construct 3: absenteeism, signalling that the Bartlett's test of sphericity is acceptable, as well as the KMO appears close to 0.8 (0.767) (Hair et al., 2010), and an explained variance of 50.92%.

The intra-block factor analysis for construct 3: absenteeism the commonality above 0.5 is satisfactory, presenting values favourable to the validation of the scale. The values of the factor loadings of the observable variables are above 0.7 (ABS1, ABS3, ABS4), which reinforces the importance of communication and support teams, information and monitoring perceived by workers. The values represent acceptable relations to the validation of the scale, reinforcing the high demand rate in organisations to reduce absenteeism. The constant work in favour of the minimisation of this is perceived by the workers and contributes to the environment of innovation and reduction of absenteeism, if carried out by the organisation from its managers, as well as by the involvement of all in this line of management.

It is worth emphasising that dialogue-oriented participation is necessary (Zink et al., 2008), for it offers the possibility of closing knowledge gaps and reinforces acceptance and trust. Similarly, information cannot be isolated, but dealt with the people affected by them. According to Iida (2005), the organisational elements are paramount for the maintenance of health.

Table 6 shows the validation of the data for the analysis of construct 4: risk, signalling that both the Bartlett's test of sphericity, Cronbach's alpha (0.102), as well as the KMO (0.5) are not acceptable, indicating lower values than those recommended, which do not present favourable values for the validation of the scales (Hair et al., 2010).

Table 6 Validation of data for construct 4: risk

Cronbach's alpha	0.102
KMO	0.5
Bartlett's test of sphericity	0.933* sig 0.334
Variance explained	52.6%

Note: Level of significance $p < 0.001$.

However, the intra-block factor analysis for the risk construct, the values of the factor loadings of the observable variables are above 0.7 (0.726), even then, commonality is acceptable. Both variables contribute to the composition of the factor and its explanatory power of 52.6%is significant.

We can observe in the risk construct that the observable variables are associated with the perception of the workers with the risk questions in load lifting activities, the focus of this study. The workers express this perception of risk corroborating with construct 1: process and organisational innovation in ergonomics linked to the POIE5 training of ergonomic conditions in the workplace, and the construct 3: absenteeism, ABS3 and ABS1, reinforcing active study groups and teams to support continuous improvement in the workplace.

4.2 Multiple linear regression

We performed the analysis of relationships through multiple linear regression with the means for the constructs, with the mean of the questions of process innovation and organisational in ergonomics (POIE1, POIE2, POIE3, POIE4, POIE5, POIE6, POIE7, POIE8) as the dependent variable (Y1) and, the questions of innovative environment (IE1, IE2, IE3, IE4) as the independent variable (X1). That demonstrates that the innovative environment contributes to process and organisational innovation in ergonomics, as the R^2 (0.460) indicates in this researched context, according to Table 7.

Table 7 Regression tests for the questions of process and organisational innovation in ergonomics and the questions of innovative environment

Tests	*Values*
R	0.679[a]
R^2	0.460
R^2 adjusted	0.454
Standard error	0.557

Note: [a] Predictors: IE4, IE1, IE2, IE3. Dependent variable: mean of innovation.
[b] $p < 0.001$.

In this scenario, the analysis of the relationship between the mean of the questions (ABS1, ABS2, ABS3, ABS4, ABS5) of absenteeism (Y2) as the dependent variable, and the questions of process and organisational innovation in ergonomics as the independent variable (POIE1, POIE2, POIE3, POIE4, POIE5, POIE6, POIE7, POIE8) (X2), showing how much innovation contributes to the reduction of absenteeism demonstrated by an R^2 value of 0.403, according to Table 8.

Table 8 Regression testing for process and organisational innovation in ergonomics questions and absenteeism questions

Tests	*Values*
R	0,635[a]
R^2	0.403
R^2 adjusted	0.390
Standard error	0.544

Note: [a] Predictors: POIE8, POIE6, POIE2, POIE1, POIE7, POIE3, POIE4. Dependent variable: mean of absenteeism. [b] $p < 0.001$.

Recognition in the work environment is associated with the profile of the manager, as well as the dimensions that predispose the innovative environment on the aspects of respect in the work team, as well as the team spirit and confidence described by Simantob and Lippi (2003). For Smedley et al. (2003) and Zhou et al. (2016), in adopting projects, integrating ergonomics restructures the work and the main focus on the human being as subject of the system, with all its capabilities and limits, which will involve the work environment.

In this context, we performed the ANOVA to evaluate each of the constructs and their significance, observing whether there were significant differences from the mean. We used ANOVA to detect the difference between the units, from the mean of process and

organisational innovation in ergonomics, innovative environment and absenteeism. The significance of the mean in process and organisational innovation in ergonomics and innovative environment obtained a result of 0.000 showing significant difference between the units.

The process and organisational innovations in ergonomics and the innovative environment of the distinct organisation corroborate the fact that the company's management prioritise improvements as evidenced during the research and with the different improvements in the different business units being evident. The questions related to the innovative environment are perceived, since each manager has different models and processes from the practical way of performing procedures and the workers perceive this management in different ways.

According to Simantob and Lippi (2003), the profile of a manager is important and the dimensions for the innovative environment are dependent on it. Process and organisational innovation in ergonomics has the lowest mean in unit B (3.101) as well as the lowest perception of innovative environment (2.813). The highest mean of innovation is present in unit D (4.938) and the highest mean of innovative environment in unit F (4.462). According to data collected in unit D, there were innovations related to robotics, which generated a relevant and effective ergonomic improvement to workers.

In relation to unit F, whose mean of Construct 2: Innovative Environment appears to be the highest; we can observe that the manager of the sector of load lifting is the oldest in the company in terms of time, and makes it clear that all workers have participatory processes to some degree in relation to decisions. In addition, he emphasises that he seeks to involve workers and believes that it is important to qualify them so that they can present an idea and anticipate changes.

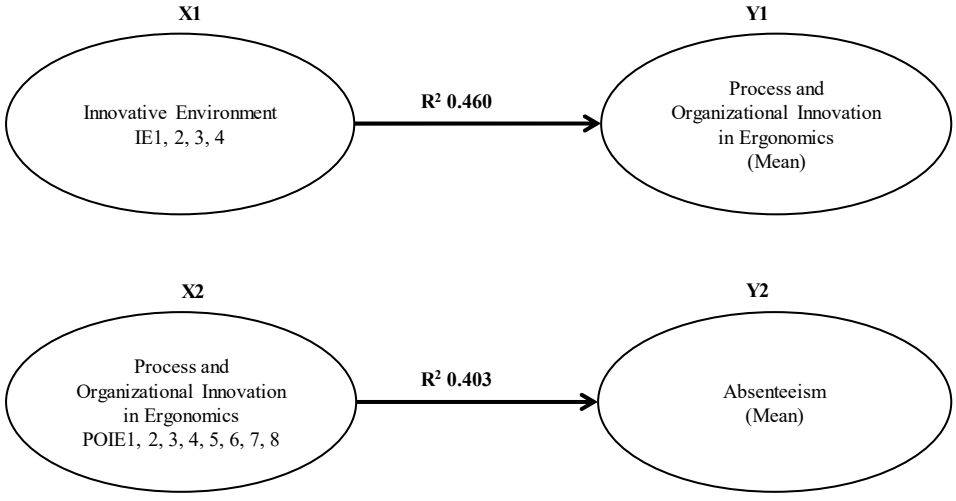
Absenteeism (0.133) does not present significant differences between the means of the business units, which is evident in all the analysed documents of the units. In this context, absenteeism, according to Lee and Ericksen (1990), needs to be prevented by eliminating the causes, this must be almost zero and it is highlighted that individuals must be partners of the organisation, taking into account the specificities of the workers. The worker's need for this specificity in the workplace may be a reflection of the results, since individual specificities are not always directly involved in labour relations, but rather in a sectorial support of the set of workers. Guimarães et al. (2012b, 2015) emphasise to the ergonomics team that if the improvement processes are evaluated and studied together with the workers, participatively, it will have a positive impact on health and safety, which is in line with their specificities.

In this context, through the multiple linear regression technique, we developed Figure 1 to present the results the generated models, and the results highlight that the highest relation of 46% (R^2 0.460), occurs between the innovative environment (X^1) and the process and organisational innovation in ergonomics (Y^1) explaining 46% of process and organisational innovations in ergonomics through the innovative environment.

Still according to Figure 1, the process and organisational innovations in ergonomics explain in 40% (R^2 0.403) the reduction of absenteeism in the business units surveyed, positively impacting the organisation. Such relevance is perceived in the performance of the productive process and its references regarding social responsibility, emphasis on workers in multiple aspects, from their permanence in the workplace, their safety and health as well as favouring the integrity of their social relations. The positive impact of reducing absenteeism also extends to supervisory bodies and public policies, who

demand from organisations compliance with the RNs that meet the reduction of expenses to the public coffers and, a priori, to the most important matter, the worker's quality of life.

Figure 1 Results of regression between constructs



5 Conclusions

5.1 Contributions of the paper

Innovations add value to products, reduce rework and wastage, increase employee satisfaction with the reduction of risks in the activities and make possible strategic management orientations. In this regard, we confirmed the assumptions by Schumpeter (1934), the OECD (2005), Calantone et al. (2010) and Severo et al. (2017), which advocate that innovation is capable of enhancing competitiveness and organisational performance.

The monitoring of absenteeism and the occurrence of multiple process and organisational innovations in ergonomics is a necessary and reliable method for evidencing changes and transformations, both for productive processes, as well as for data on absenteeism related to workers, which occurs in the business units. In this scenario, innovations with an ergonomic focus contribute to the satisfaction and well-being of employees, in addition to promoting a higher quality of life and less damage to health.

Regarding the relation of process and organisational innovation in ergonomics and the reduction of absenteeism, we highlight that they improve the performance of the organisation, the achievement of goals and the reduction of losses for the company. This relationship means, a priori, healthier workers, positive effects in social relations, as for decades, absenteeism has had an inverse effect on workers and organisations.

With regard to the contribution of the Innovative environment for process and organisational innovation in ergonomics, whether through its motivational, participatory,

challenging, and trustworthy character, as well as through the involvement of workers and the aggregation of knowledge, we reaffirm that organisations need to mobilise towards the programs aimed at the qualification of their managers. Such understanding is justified in the study about the importance of the innovative environment in the perception of the workers for the occurrence of process and organisational innovations in ergonomics.

This finding reinforces the research by Simantob and Lippi (2003) when they affirm that the profile comprises capacities that stimulate and propitiate the innovative environment for the development or improvements in the existent processes.

However, ergonomics, with its primary tool of analysis of the workplace, has the participation and involvement of the workers as its concept, for they are the greatest experts of the real activity and of the methods and forms by which they solve the daily problems. Considering the studies by Hill and Hug (2004), by being able to involve the members in an active role and dialogued role, it makes it possible to clarify expectations in participatory management approaches.

In relation to what was discussed, it is noticed that the business units have developed process and organisational innovations in ergonomics in a favourable and proactive innovative environment. Similarly, process and organisational innovations in ergonomics contributed by 40% to the reduction of the absenteeism in load lifting activities, with multidisciplinary monitoring and participation in favour of improvements in the work environments, which satisfy the productive process, the labour relations and the health of the worker.

It is evident that the innovative environment contributes to the process and organisational innovations in ergonomics in the context of agroindustry, as well as process and organisational innovations in ergonomics in load lifting activities reducing absenteeism in organisations. Workers, whether through engagement, satisfaction or motivation related to the environment, or by the reflection of the mix of process and organisational innovations in ergonomics, remain healthy, encouraging the absence of health disorders resulting from the activity and remain in the day to day in their jobs.

Congruently, we can understand the managements that provide innovative environments for all those involved in the dynamics of the workplace, enabling process and organisational innovations in ergonomics that reduce absenteeism in load lifting activities. In this scenario, the management of labour relations and organisational dynamics for human beings is of paramount importance, characterised by the proactivity, both in the understanding and in the treatment of the ergonomic aspects that promote the health and workers' quality of life, who carry out the lifting of manual loads in the organisations, especially in agro-industries.

5.2 Theoretical and management implications

Management contributions allow managers to be aware of the stage of a significant sample of lifting activities, assisting them in strategies in order to overcome the current obstacles in the relationship of process and organisational innovations in ergonomics, the innovative environment and absenteeism. As far as academic contributions are concerned, it serves as a basis for other comprehensive research on innovation, ergonomics, load lifting and absenteeism, since they are often about themes discussed in the literature.

One possibility of research refers to the evaluation of the financial return caused by process and organisational innovations in ergonomics, because it is expected that there will be a superior performance and an additional gain due to the reduction of workers' absences.

5.3 Research limitations and future research

We suggest future research should compare the units in both phases, qualitative and quantitative, with the intent of identifying greater possibilities of aggregation of actions to the management processes in the practices of innovation.

Although the survey data do not represent all of Alpha's business units, we cannot generalise the study. Another limitation is operational, as there were only two questions that corresponded to the risk construct, which may reveal a lack of information regarding the said construct.

It is worth mentioning that the study portrays the perception of the respondents of the business units surveyed in the south of Brazil, which encourages analysing, in future studies, in other companies and in other sectors, with longitudinal comparative analyses with different sizes and branches of the industrial sectors.

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