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Article

Semi-Autonomous Groups and Work Management in Agribusiness: A Theoretical Model in the Agricultural Supply Chain

Grupos semiautônomos e gestão do trabalho no agronegócio: Um modelo teórico na cadeia de suprimentos agrícolas

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Abstract: The implementation of autonomous working groups has been a common focus of socio-technical system approaches to work redesign. There is an interest in understanding the design, structure and performance of semi-autonomous teams in different markets and economic sectors. Thus, this work seeks to propose a theoretical model that correlates the main factors considered in semi-autonomous teams in the agricultural supply chain. In addition, we seek to know the indirect effect of these factors and their relevance. To this end, exploratory research in the field of sociotechnics is applied to identify the variables of the model and previous studies. The data collection regards a survey of the agricultural market in Latin America in four countries, and the model is validated from the modeling of structural equations. The results indicate that the adoption of autonomy at work does not have a direct effect from the Human Resources Management (HR). The adoption of autonomy at work is moderated by work remuneration. Finally, the indirect effect that HR management has on the adoption of semi-autonomous teams may be related to its own functioning in the organization. Then, HR has an important influence on enterprise communication and on dealing with conflict.

Keywords: agriculture; operations management; sociotechnics; work organization.

Resumo: A implementação de grupos de trabalho autônomos tem sido um foco comum das abordagens de sistemas sociotécnicos para o redesenho do trabalho. Há interesse na compreensão do projeto, estrutura e desempenho de equipes semiautônomas em diferentes mercados e setores econômicos. Dessa forma, este trabalho busca propor um modelo teórico que correlacione os principais fatores considerados em equipes semiautônomas na cadeia de suprimentos agrícolas. Além disso, conhecer o efeito indireto desses fatores e sua relevância. Para tal, aplicou-se uma pesquisa exploratória no campo da sociotécnica para a identificação das variáveis do modelo e estudos anteriores. A coleta de dados deu-se por meio de uma pesquisa/levantamento em quatro países do mercado agrícola na América Latina, e validou-se o modelo a partir da modelação de equações estruturais. Os resultados do estudo apontaram que a adoção da autonomia do trabalho não possui efeito direto ocasionado pela gestão de recursos humanos (RH). Ademais, sua adoção é moderada pela remuneração do trabalho. Por fim, o efeito indireto que a gestão do RH possui na adoção de equipes semiautônomas pode estar relacionado ao seu próprio funcionamento na organização. Portanto, o RH tem uma influência importante na comunicação do empreendimento e no trabalho com conflitos.

Palavras-chave: agricultura; gestão de operações; sócio-técnica; organização do trabalho.

1. Introduction

The organization of work in teams can generate high commitment and work systems of considerable performance. In the case of semi-autonomous groups, there is an organization of production in self-directed teams, versatility, task rotation and functional flexibility. Information sharing occurs via team briefing, and work hierarchies are leveled. The discussion regarding semi-autonomous groups emerged with the concepts developed by the Sociotechnical School, after observing two different types of work organization for the same technology adopted[1]. The need to increase flexibility by semi-autonomous individuals is the main competitive factor that leads to the adoption of group work[2].

The implementation of autonomous working groups has been a common focus of socio-technical systems approaches to work redesign. Sociotechnical systems theorists have argued that self-regulated work groups have a favorable impact on members' attitudes and behavior[3], [4].

In addition, there is an interest in understanding the design, structure and performance of semi-autonomous teams. Considerable theoretical and empirical progress has been made on this topic, with a focus on understanding and modeling benefits in terms of motivation, satisfaction and performance[4], [5]. The literature has also shown the lack of legitimate control over team actions and decisions[6]. Marx[2] argues that semi-autonomous groups assume complete responsibility for the production of a product or product line. This group must not have fixed tasks for each component and supervision must not interfere with the way in which the group assigns tasks to itself.

The socio-technical school is an evolution of the organization of productive systems. This approach advocates a large participation of individuals in activities other than execution. Several authors such as Kanaga and Kossler[7]; Marx[2]; Biazzi[1] agree that the sociotechnical perspective is an open system, formed by two main subsystems: Technical: composed of machines, equipment and materials; Social: composed of individuals and groups. Thus, culture, skills, behaviors and feelings of individuals and social groups (factors intrinsic to human beings) are considered important factors for increasing work productivity.

Semi-autonomous groups are interdependent and generally have considerable authority to make decisions regarding personnel and other matters pertaining to their activities. However, "self-management" authority is not absolute, and the term does not imply the absence of direct management[8], [9]. The analysis of these groups, as well as the factors that influence the adoption or not of this type of work, cover issues such as Management of Sector Activities (SA), remuneration of individuals and the Human Resources Management (HR) itself.

Thus, this work seeks to propose a theoretical model that correlates the main factors considered in semi-autonomous teams. In addition, we seek to know the indirect effect of these factors and their relevance. To this end, exploratory research in the field of sociotechnics is applied to identify the variables of the model and previous studies. Data collection is made through a survey and the model is validated by modeling structural equations with Smart PLS SEM.

2. Methodology

This study applies the survey-type research approach, as it enables the acquisition of data for applying mathematical modeling and consequent proposition of the theoretical model. Surveys are investigations that collect data from a representative sample of a specific population, which are described and analytically explained. The results are intended to be generalizable to the universe of this population.

Simonetti and Marx[14] applied a similar methodology, aiming to survey the application of semi-autonomous groups, based on the hypothesis test. To this end, the authors considered an intersectoral sample, composed of 49 companies that recognize adopting the concept of autonomy.

Marx[2] used a tool called "Framework on dimensions and depth of autonomy" that served to "measure" the scope and depth of autonomy. The dimensions of autonomy were divided into production management, HR management and planning management. Based on Marx[2]; Simonetti[15] conducts research on semi-autonomous teams in the Brazilian context. For data collection, the author develops a questionnaire and applies a survey-type research. Thus, the data collection in this study used a questionnaire adapted from Simonetti[15]. The constructs that underlie the proposition of the model were also based on this author.

2.1 Production model

Taylor's and Ford's production model were fundamental for industrial development in the 20th century, allowing great productivity gains and consequent cost reductions. They are considered the pioneers in the organization

of work in industrial society. They are based on task division and specialization, task standardization, supervised work, flow-based work metrics, large-scale production of few items, and post-production offsite inspections.

In turn, the concept of autonomy applied to manufacturing and production, as well as semi-autonomous groups, represent an alternative to the classical model of organization[10]. While the classical school (Taylorism/Fordism) developed design tools from its perspective, independently of the operant, the traditional sociotechnical school only provides general guidelines, but do not propose in a more consistent way, as is the case of coordination between activities, area of action of the group with the process, resorting or not to direct supervision, closed group or open group project. Issues related to human resources management are also rarely discussed, such as career and remuneration systems[9].

Semi-autonomous groups allow their team members to have a high degree of empowerment, thus encouraging individuals to conduct themselves independently of external supervision, to take responsible actions and to control personal behavior[4]. The company must seek the satisfaction of its employees in the work activity, and ensure their fulfillment at work. The work must make sense, given the values it shares with society. It must lead to some sort of desirable future, not necessarily a promotion[11]. Thus, we propose have the following hypothesis(H): autonomy at work is not adopted by the direct influence of HR management (H1): the discussion of autonomy must be understood within the scope of direct work and its ramifications. In general, groups have responsibility for the performance of the process or part of the process in which they act[9]. Semi-autonomous groups adopt management-by-purposes instruments that direct the pursuit of missions and ensure a fluidity of roles among their members. The responsibility of employees and groups is thus based on performance objectives and their reconfiguration over time[10].

The socio-technical work project aims at a complete work content for operators, including top management tasks, teamwork with a minimum of specifications, self-regulation and a high degree of influence and participation as some of its pillars[12]. Thus, the tasks and functions of the teams must be minimally determined by people (engineers, supervisors, managers) from outside the team, but sufficiently and necessary to carry out the work within the technical, logistical and quality parameters[10].

As second hypothesis (H2) we have the management of team activities has a direct effect on HR management. That is, a semi-autonomous group dominates a larger cycle of tasks, performs a variety of functions in the team, participates in the division of tasks among themselves, participates in the formulation of work patterns. In addition, production SA management are shared by supervisors and managers with the teams and, in some cases, tasks such as quality control and maintenance are fully or partially assumed by the teams[9], [10]. Oudhuis and Tengblad[13] state that the associated leadership style emphasizes the importance of delegating responsibilities and authorities, providing opportunities for autonomy and development at work. The support functions (compensation, training, information systems, accounting, engineering) and interface with the teams (supply, sales, logistics) must have a coherent attitude with the organizational project, to work in harmony with the teams. The practices of performance evaluation, remuneration, training, selection of people must be consistent with the philosophy of the Sociotechnical approach.

The remuneration of teams has a direct effect on HR management, as hypothesis 3 (H3). The organization benefits from the creativity and innovative capabilities of workers, contributing to an increase in productivity, quality and efficiency. Thus, an important aspect of the socio-technical work project is self-management, that is, groups of operators are able to carry out activities commonly associated with decision-making powers and work supervision, such as work scheduling, coordination, contact with suppliers and customers[13].

Salerno[9] also warns about the autonomy given to the group, considering that limits must be clearly explained so as not to generate false expectations in the organization as a whole and in the components of a particular group. Marx[2] still considers that the different modalities of group work differ by the degree of autonomy given. In the Japanese model, the author considers an enriched group to be one that has restricted autonomy, controlled by supervision. In the socio-technical approach, autonomy is increasingly given to the group, aiming at decentralizing the decision-making process on methods, allocation and management of resources. In other words, specific aspects of the functioning of the teams must be described, such as the division of tasks, the interface relationships of the teams, the forms of remuneration and recognition, etc

And, the adoption of autonomy at work is directly influenced by remuneration as hypothesis 4 (H4). Finally, based on the hypothesis presented (Figure 1), this work seeks to propose a theoretical model that correlates the main factors considered in semi-autonomous teams. In addition, we seek to know the indirect effect of these factors and their relevance. To this end, exploratory research in the field of sociotechnics is applied to identify the variables of the model and previous studies.

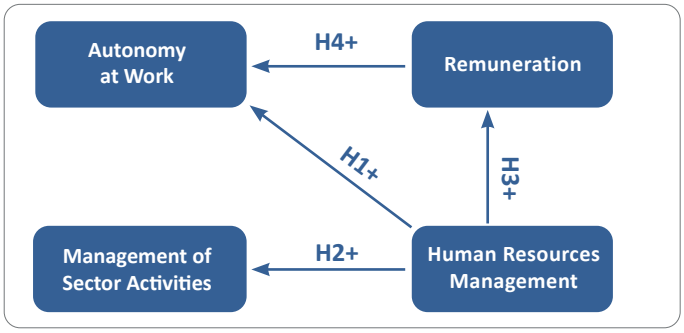

Figure 1. Relationship between the hypotheses
Source: Elaborated by the author.

2.2 Sampling process

The company chosen operates in six segments of the chemical market along global value chains to address the needs of our customers with differentiated solutions and business strategies. The company aims to differentiate their businesses from their competitors and establish a high-performance organization to enable success in an increasingly competitive market environment. It has about 110,000 employees globally, of which 5,993 are in Latin America, and a turnover of 4.4 million euros in the same region.

The questionnaire was sent via electronic mail (e-mail) to the professionals of an organization that adopts semi-autonomous teams in four branches. The questionnaire was sent on September 20, 2021 and closed for responses on the 30th of the same month. A total of 37 valid responses were obtained. It addresses general questions to identify the general characteristics of respondents and then focuses on questions that reflect the variables manifest in this work (Table 1).

Table 1. Composition of model variables that guided the questionnaire

Latent Variable	Manifest Variable	Code
Autonomy at Work (AW)	Workers' resistance	AW_01
	Union resistance	AW_02
	Did not achieve expected results	AW_03
	Lack of support from senior management	AW_04
	Resistance to management	AW_05
	The directors who sponsored the project left the administration	AW_06
Remuneration (RE)	Individual goals	RE_01
	Goals set for each team	RE_02
	Evolution of individual skills	RE_03
	Collective goals	RE_04
	Function/position	RE_05
	Time in the company/time in the role	RE_06
	Education	RE_07
Management of Sector Activities (SA)	Divide sector tasks among team members	SA_01
	Set the default job speed	SA_02
	Define the sequence of execution of the products or services	SA_03
	Trigger support services	SA_04
	Reject non-conforming raw material or inputs	SA_05
	Interfacing with other sectors	SA_06
	Release finished product for shipment to the customer	SA_07
Human Resources Management (HR)	Choosing and formalizing internal leaders	HR_01
	Plan a vacation stopover	HR_02
	Meet when needed	HR_03
	Influence the entry and exit of team members	HR_04
	Participate in the assessment of the team and its members	HR_05
	Define training needs	HR_06
	Define and measure individual/group performance indicators	HR_07

Source: Elaborated by the author based by Marx[2]; Simonetti[15].

2.3 Data analysis

The study applies the Partial Least Squares Structural Equation Modeling (PLS-SEM) for the empirical evaluations proposed by the survey. PLS-SEM was the most suitable for this type of study due to the nature of the data and the exploratory and confirmatory approach, together with the sample size[16], [17]. Given the proposition of a conceptual model based on the literature and the proposal to analyze the model exploring associations between a series of constructs, the PLS-SEM is considered the most appropriate according to Hair et al.[16].

The PLS-SEM modeling is composed of two main categories of variables, the overt (measured by the questionnaire) and the latent variables that show the underlying constructs associated with the overt variables. This modeling allows for multivariate analysis, so that each manifest variable is grouped into a latent variable[16], [18].

The first step in using PLS-SEM involves creating a path model that connects variables and constructs based on theory and logic. This allows the researcher to analyze and validate the relationships between latent variables of their theoretical model and the manifest variables[16]. Note that the PLS-SEM modeling estimates the parameters by a series of least squares regressions, while the term e derives from the procedure of iterative estimation of the parameters in blocks (by latent variable) to the detriment of the entire model, simultaneously[16].

The questionnaire was developed based on the identification of the main constructs based on the literature available and on knowledge management and communication in projects. In this work, the constructs identified were treated as variables. The data were imported into SmartPLS 3.0 which allows evaluating the model from its outputs.

3. Results

3.1 Sample characterization

After wide dissemination, the questionnaire obtained 37 valid responses. Most employees are allocated to the unit in Brazil, followed by Argentina, Colombia and Paraguay, as shown in Figure 2. The adoption of semi-autonomous teams is adopted in some sectors of the organization for better alignment with the strategic objective. The organization itself seeks performance in innovation and operations as the leading producer in the industry. It is a chemical industry and plant operator. Its product and service portfolio are constantly evolving in innovation-driven growth areas.

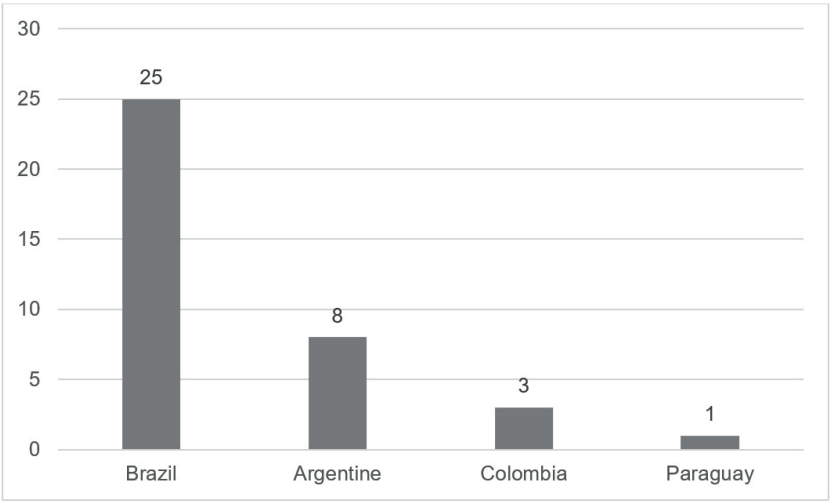

Figure 2. Number of questionnaire respondents by country
Source: Elaborated by the author.

Employees in semi-autonomous teams are made aware of their responsibilities and attributions with a view to contributing to the success of the business. The organization itself aims to attract and retain new talent as a strategy for developing new opportunities. For this, it has a career guide for each employee. In the case of the sample of this study, most are at the analyst level. Regarding the sector of activity, most of the respondents work in production, followed by planning (Table 2).

Table 2. Number of professionals who answered the questionnaire by function

Role	Quantity
Analyst	24
Manager	8
Operator or assistant	5
Area	**Quantity**
Production	14
Planning	7
Purchasing	5
Customer service	5
Quality	5
Logistics	1

Source: Elaborated by the author.

Unions defend the collective or individual rights and interests of a professional category. In legal or administrative matters, unions represent and defend the interests of the category. However, most respondents state that the union does not have a strong presence, as 62% of respondents do not belong to unions.

3.2 Model validation

The model was estimated considering that the relationships between the latent variables are treated as correlations, so that it was possible to know the factor loadings. The maximum number of interactions considered was 300 and the stopping criterion was 10-7 (the PLS algorithm stops when the change in external weights between two consecutive iterations is less than this stopping criterion value, where this value must be sufficiently small). The associations between the constructs were defined based on the coding from Table 1. For validating the proposed model, several requirements were analyzed, aiming to ensure that the results of the formative models are reliable.

All the variables are reflective, and it took two rounds of calculations to validate the model. In the first round, it was necessary to remove the latent variables AW_04 and AW_05 from the autonomy at work dimension. In the second round, the variables SA_06 and SA_07 were removed from the mnagement of sector activities. This removal is justified by the low value of the cross load of each variable, which raises the square root of the average variance extracted (AVE), thus invalidating the model[16]. Table 3 shows the model validation analysis, which resulted in an AVE above the minimum value of 0.5 and with a composite reability (CR) above 0.7, as predicted by Hair et al.[16].

Table 3. Indicators that validate model

	AW	SA	HR	RE
Autonomy at Work (AW)	0.605			
Management of Sector Activities (SA)	0.168	0.808		
Human Resources Management (HR)	0.377	0.704	0.726	
Remuneration (RE)	0.540	0.222	0.514	0.626
Composite Reability (CR)	0.701	0.849	0.882	0.817
Average Variance Extracted (AVE)	0.502	0.653	0.527	0.526

Source: Elaborated by the author.

The assessment of discriminant validity at the level of latent variables is presented in Table 3, which shows that the correlations between the latent variables are lower than the square root of the average variance extracted (values on the diagonal of the matrix). The proposed evaluation model exhibits adequate convergent validity, discriminant validity and reliability.

The collinearity of the manifest variables was analyzed. If the level of collinearity for formative indicators of a construct is too high (VIF≥5), the variable must be removed from the model before performing any further analysis. The results show that all constructs must be kept as they do not exceed this value (Table 4).

Table 4. Indicators that shows collinearity of manifest variables

Code	Variance Inflation Factor (VIF)	Code	Variance Inflation Factor (VIF)
AW_01	1,224	RE_05	1,235
AW_02	1,281	RE_06	1,859
AW_03	1,194	RE_07	2,083
AW_06	1,276	HR_01	2,264
SA_03	1,576	HR_02	1,493
SA_04	1,784	HR_03	1,434
SA_05	1,307	HR_04	1,945
RE_01	2,548	HR_05	2,649
RE_02	2,018	HR_06	3,576
RE_03	3,314	HR_07	2,807
RE_04	1,728		

Note: Autonomy at Work (AW); Management of Sector Activities (SA); Human Resources Management (HR); Remuneration (RE).
Source: Elaborated by the author.

3.3 Hypothesis test

Another criterion to be evaluated is the significance of the loadings of the manifest variables using bootstrapping. The larger, the stronger, the path in the structural (internal) model. All t values above 1.96 are significant at the 0.05 level, which is the case for all t values for the model[16]. For this, 5,000 bootstrap subsamples were used as a conservative configuration to calculate the significance of external weights[16]. The t values were calculated after bootstrapping was performed (Figure 3).

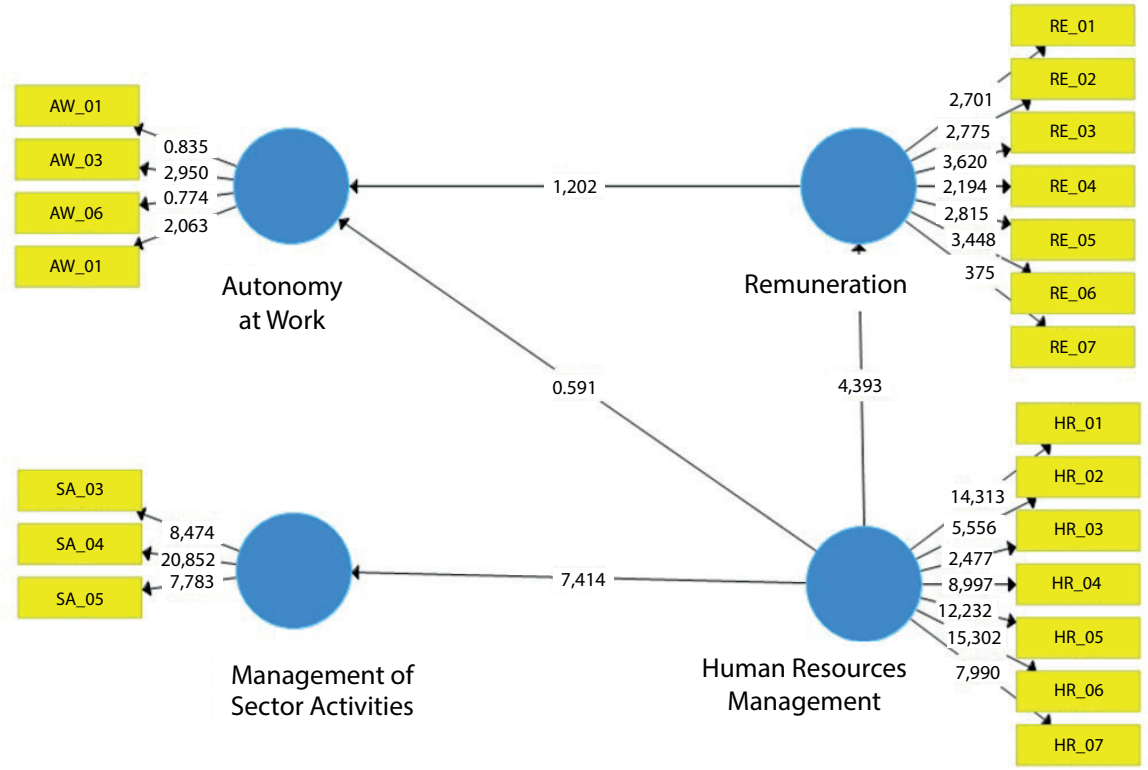

Figure 3. Links between the validated model
Note: Autonomy at Work (AW); Management of Sector Activities (SA); Human Resources Management (HR); Remuneration (RE).
Source: Elaborated by the author.

The highest correlation values are noted to be found between the latent variables SA management and HR management. The same is true between HR and compensation. In SA management, the variable that has the

highest load is SA_04, denoting that semi-autonomous teams must have greater freedom to trigger support services. For this, there is a highlight in variable HR_06, elucidating the importance of training. In terms of remuneration, the highest factor loading is in RE_06, which regards the time that the employee has worked in the company/function. Regarding the factors that hinder the adoption of semi-autonomous teams, the failure to achieve the results expected (AW_03) was the most prominent (Figure 2).

The results of the hypothesis test between the latent variables and their constructs are shown in Table 5. All VIF values are adequate for a significance level of 5%, showing considerable correlations between the variables. Only two of the four hypotheses were confirmed.

Table 5. Hypothesis test results

	Hipothesis	Variance Inflation Factor (VIF)	Original Sample (O)	Standard Derivation (STDEC)	T Statistics (IO/STDEV)	P Values	R Square	R Square Adjusted
(HR) –> (AW)	H1	1,358	0.134	0.227	0.591	0.555	0.305	0.265
(SA) –> (HR)	H2	1,000	0.704	0.095	7,414	0.000	0.305	0.265
(RE) –> (HR)	H3	1,000	0.514	0.117	4,393	0.000	0.305	0.265
(RE) –> (AW)	H4	1,358	0.471	0.392	1,202	0.230	0.264	0.243

Note: Human Resources Management (HR); Autonomy at Work (AW); Management of Sector Activities (SA); Remuneration (RE); Autonomy at work is not adopted by the direct influence of HR management (H1); The management of team activities has a direct effect on HR management (H2); the remuneration of teams has a direct effect on HR management (H3); The adoption of autonomy at work is directly influenced by remuneration (H4).
Source: Elaborated by the author.

The results of the study indicate that the adoption of autonomy at work does not have a direct effect deriving from HR management. The evidence shown by p=0.555 suggests the absence of this direct effect, even the variable having acceptable collinearity (VIF=1.358 and O=0.134), which confirms its significance in the model, but does not support H1. The evidence for H4 is moderate, given that p<0.05. In this case, H4 is partially accepted, as p=0.230, O=0.471 and VIF=1.358. That is, the adoption of autonomy at work is moderated by work remuneration.

Due to the autonomy of the teams in the execution and planning of activities, HR ends up adapting to the reality of work. For this reason, the variables have a direct effect on each other, supporting H2 (p<0.01 and O=0.704). The same happens with H3 which is also sustained p<0.01 and O=0.514). That is, the remuneration of work groups has a direct effect on HR management. In both cases, VIF values are acceptable.

The values of H1 and H4 suggest that even if the direct effect of a latent variable on the other is non-existent or low, there is still an indirect effect to be analyzed. For this reason, the analysis of the performance and the importance between these variables is justified (Figure 4).

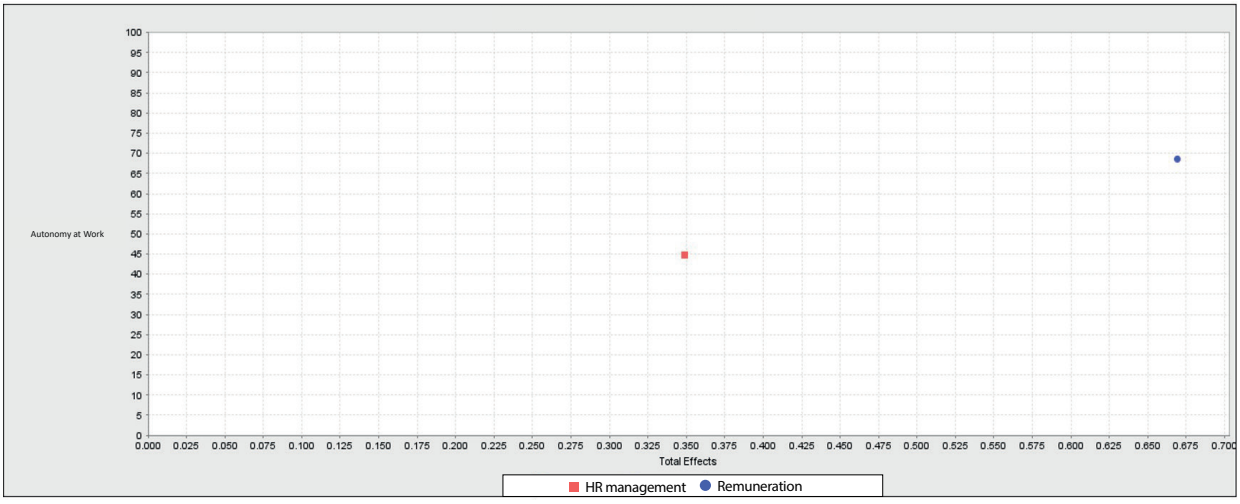

Figure 4. Indirect effect of autonomy at work, importance perfomance map
Source: Elaborated by the author.

As expected and suggested by the VIF and p values, the adoption of autonomy at work is indirectly influenced by HR management and remuneration. Compensation has a greater indirect effect, with an importance of 0.670 for an indirect performance of 70% in the variables of the model. HR management has an importance of 45% and an indirect performance of 0.350.

4. Conclusion

This work aimed to propose a theoretical model to correlate the main factors considered in semi-autonomous teams. From the model, it was possible to know the direct and indirect effects of the addition of semi-autonomous teams, remuneration, management of sector activities and HR. The model denoted a strong performance of HR, even if indirectly.

The indirect effect that HR management has on the adoption of semi-autonomous teams may be related to its own functioning in the organization. HR has an important influence on enterprise communication and on dealing with conflict. The people management sector must build a training plan focused on the development of soft skills, with special attention to conflict management, so that the employees themselves can work on these issues individually. Additionally, for structural conflicts, they can also mediate the dialogue between the parties and offer training and events focused on the development of good working relationships.

The Human Resources sector has a strategic role in organizations. By the activities carried out in this area, motivation can be encouraged and increase the quality of life at work. Likewise, the organizational climate improves and impacts productivity. The functional area manager must understand that motivation is directly related to improving individual performance. This is how one can be able to work this aspect strategically to leverage the results achieved by the organization, which justifies the direct effect of hypotheses two and three.

This study has limitations due to the number of valid responses. Furthermore, it reflects the context of the employees of an organization that has three branches. Thus, the results here should not be generalized. For future work, and the continuation of this study, the sample can be expanded, and a more robust model proposed.

Author contributions: All authors contributed in Design, Data Collection, Data Analysis, Methodology Definition, Writing and Editing.

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