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Brazilian farmer perception of dynamic capability and performance over the adoption of enterprise resource planning technology

RESEARCH ARTICLE

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Abstract

The study investigates the perceptions of the effects and impacts on the performance of agricultural and livestock farms based on the view of obtaining dynamic capabilities by the adoption of enterprise resource planning (ERP) technology. The dimensions for measuring farmers' perceptions of ERP adoption were technological, organizational and environmental and their diffusion and the impacts measured on dynamic capabilities were on internal operations, costs, sales and natural resources. A total of 502 farmers directly involved in managing the production, located in the main agricultural areas of Brazil were interviewed. The results indicated that the perception of obtaining dynamic capabilities in the farms by adopting the ERP was significant, but with lower levels in costs and natural resources. The influence of farm size on ERP adoption and its perception on farm performance was not significant. The proposed model proved to be adequate and can be validated and compared with other producing regions.

Keywords: enterprise resource planning, dynamic capabilities, farm performance, Brazil
JEL code: M100

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1. Introduction

The objective of the study was to evaluate the farmer's perception about the implementation of enterprise resource planning (ERP) technology, if this implementation generates dynamic capacities and, finally, if they could lead to a competitive advantage. We seek to understand the dynamic capabilities of Brazil's farms based on the premise that the adoption of the ERP system by the Brazilian farmer may still generate some distrust of their performance to the business and market (Junior *et al.*, 2019).

Three gaps and contributions to the literature were considered in the study. The first contribution of this work is to propose a research based on models already tested. Technology-organization-environment (TOE) theory has an organizational approach and a multiple perspective framework developed by Tornatzky and Fleischer (1990). It also integrates Rogers' theory of diffusion of innovation (DOI) (Zhai *et al.*, 2018), first proposed in 1962 (Stanton, 1963). Finally, the ERP diffusion model adapted from Hsu *et al.* (2006) and Benlian and Hess (2011). We introduce in our study two ERP diffusion factors: usage and increase.

The second contribution is empirical, for the performance literature with competitive advantage (Eisenhardt and Martin, 2000; Wang and Ahmed, 2007) by testing and validating results from studies in other countries to the context of Brazilian farmers, who are important production players of protein, fiber and energy to the planet. To measure the impacts of improved performance (Picoto *et al.*, 2014) of the farms, the antecedents linked to perception of adoption factors by the farmers were used (Chan and Chong, 2013): technological (Picoto *et al.*, 2014), organizational (Chan and Chong, 2013; Zhu *et al.*, 2006), environmental (Chan and Chong, 2013; Hsu *et al.*, 2006; Zhu and Kraemer, 2005; Zhu *et al.*, 2006), and the use of ERP (Hsu *et al.*, 2006; Benlian and Hess, 2011).

Finally, for the dynamic capabilities' literature, the third gap fits into the object studied, which is the rural context of food production. 'Dynamic capabilities are the organizational and strategic routines through which firms achieve new resource configurations as markets emerge, collide, divide, evolve, and die' (Eisenhardt and Martin, 2000). This article assesses whether there is a perception of value creation in this sector to leverage competitive advantage by developing dynamic capabilities (Teece, 2017), which brings together specific decision criteria for this business: costs (Kamble *et al.*, 2020; Wachter *et al.*, 2019), internal operations (Prajogo *et al.*, 2018; Yu *et al.*, 2018), sales and natural resource (Gillman *et al.*, 2019; Zheng *et al.*, 2019).

2. Background about enterprise resource planning, dynamic capabilities and hypotheses

2.1 Diffusion of innovation/technology-organization-environment and adoption

TOE is an organization-level theory and multi-perspective structure developed by Tornatzky and Fleischer (Tornatzky and Fleischer, 1990). This TOE framework allows us to say that the process of adopting a technological innovation is influenced by technological, organizational and environmental dimensions of an organization's context, making TOE advantageous over other adoption models in the study of the adoption, use and creation of value of technology (Bhattacharya and Wamba, 2015). The TOE framework can be used in any type of industry regardless of company size and has been extensively tested in information technology/ information systems adoption studies (Al-Hujran *et al.*, 2018). This background is adopted as one of the theoretical bases in this study. Rogers (Zhai *et al.*, 2018) DOI, first proposed in 1962 (Stanton, 1963), has long appeared in articles to understand the adoption of new product technologies. Wells and Nieuwenhuis (2018), argue in their study that this model is really only a half complete for the purpose of technology adoption, so we add TOE theory to DOI to better observe technology adoption.

H1a: Relative advantage has positive influence over adoption.

H1b: Compatibility has positive influence over adoption.

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ERP systems, by their very nature, require simultaneous changes in business processes, information sharing, and data utilization, making them very difficult to implement (Amoako-Gyampah and Salam, 2004). They integrate information packages and information processes within and across functional areas with the possibility to incorporate best business practices (Kumar and Van Hillegersberg, 2000; Madapusi and D'Souza, 2012).

According to Teece (2017), the multinational's organizational and managerial 'technology' and its competence in technology transfer, encompassed in routines and resources, are very much involved in the company's national and international capabilities and on its orchestration, enabling the delivery of differentiated products and services adding value to customers. Besides being extremely complex, they are difficult to replicate by competitors, due to the different experiences they have experienced along their path and because they represent different values for each company (Shuen *et al.*, 2014). Dougherty *et al.* (2004) recognize that innovation is a key behavioral factor for the company to expand, respond to market needs and revitalize its business. According to Teece (2015) the reconfigurations of the company's capabilities must be changed to predict market changes and technological innovations.

In high-dynamic markets, Wang and Ahmed (2007) highlight industry technological innovation, regulation, and changes in the economic scenario as key influenced factors to the development and recreation of enterprise capabilities. Therefore, companies with high dynamic capabilities build the scientific and technological capacities to adapt to market demands.

H2a: Technology competence has positive influence over adoption.

H2b: Technology integration has positive influence over adoption.

H2c: Financial competence has positive influence over adoption.

H2d: Top management support has positive influence over adoption.

Wang and Ahmed (2007) believe that dynamic resources are embedded in the company's process, incorporated through the company's ability to renew resources, reintegrate and reshape them in the processes. Barney (1991) suggests that when a company successfully develops its capabilities and resources, the result is the sustaining of company's competitive advantage over its competitors.

The integrated structure of dynamic capabilities suggests that the capabilities associated with an appropriate strategy provide conditions for sustaining superior company performance, especially in rapidly changing international environments (Shuen *et al.*, 2014; Wang and Ahmed, 2007). The dynamic capabilities framework was created to improve the strategic response in high technology-based multinationals operating internationally in a constantly evolving market (Shuen *et al.*, 2014).

H3a: Competitive pressure has positive influence over adoption.

H3b: Partner pressure has positive influence over adoption.

2.2 Enterprise resource planning adoption

We believe that the use and the rising usage of ERP can influence the adoption of technology. Our questions about the use are how far farm employees have access to information for correct day-to-day decisions immediately when needed and in an independent way from their leadership, how processes are conducted in an integrated and coordinated manner, how the activities of producing, selling, buying and caring for natural resources are supported by an integrated platform. We also want to find answers to how much the increase in ERP usage with adoption of the most up-to-date ERP solution and the level of stimulus and support for increased usage can influence and increase ERP adoption.

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H4a: Enterprise resource planning usage has positive influence over adoption.

H4b: Enterprise resource planning increase has positive influence over adoption.

2.3 Adoption of enterprise resource planning and dynamic capabilities

ERP systems have attracted increasing attention over the past two decades as companies continue to look for ways to gain strategic and competitive advantage. ERP are complex software packages that integrate information and business processes and an area in which professionals and researchers are always seeking to realize the benefits and full value of an ERP investment (Nwankpa, 2015). ERP system is a software package to meet a company's requirements, it is a company's knowledge structure that automates business tasks, can reduce total product costs by making the company more responsive to customer needs and can reduce deadlines of delivery (Efe, 2016).

Dynamic capability is defined as the company's ability to integrate, build and reconfigure internal and external competencies to address rapidly changing environments (Dj *et al.*, 1997). Essentially, these capabilities derive from the clever grouping or orchestration of company-owned resources (Teece, 2015). Dynamic capabilities are processes for integrating, reconfiguring, earning and releasing resources, for combining and even creating market changes (Eisenhardt and Martin, 2000; Wang and Ahmed, 2007).

Dynamic capability propose a reengineering of the concept and format of applicability in complex and evolutionary markets (Shuen *et al.*, 2014), it is dedicated to shaping a robust business theory (Vahlne and Johanson, 2013) to clarify strategic issues of superior performance and how internal capabilities and competitive advantage are built, grounded and orchestrated in dynamic markets (Eisenhardt and Martin, 2000).

Dynamic capability integrates the concepts of entrepreneurship, resources and capabilities to understand management and organizational decision making based on tangible and intangible assets (Teece, 2015), enabling the company to analyze market conditions, reorganize its resources and structures to create innovative strategies (Dj *et al.*, 1997). Solid and essential resources for promoting Dynamic capabilities are: tacit and organizational knowledge, structure, financial power, human capital, company reputation, relational ability, information holding, and legal remedies (Morgan, 2012). The combination of these features allows companies to recreate market conditions (Wang and Ahmed, 2007).

Companies that have promoted internationalization since their foundation fully capitalize on opportunities (Shuen *et al.*, 2014), as capacities need to be built and cannot be bought (Dj *et al.*, 1997).

A multinational uses its differentiated resources, experience, culture, creativity and best practices (Teece, 2015) to develop, enhance and incorporate dynamic capabilities combined with market orientation and ensure unmatched superiority in the international market. Companies seek to build corporate strategy-driven capabilities (Wang and Ahmed, 2007).

In this context, it is crucial to clarify that companies develop common capabilities and dynamic capabilities. Common capabilities are easy to imitate and are directly related to operational, administrative and governmental capabilities, i.e. they are geared to the company's technical aptitude (Teece, 2015). While the dynamic capabilities are built through processes, positions and paths focused on detection, apprehension and transformation, and their differences, supporting a company's evolutionary aptitude.

H5a: Adoption has positive influence over costs dynamic capability.

H5b: Adoption has positive influence over internal operational dynamic capability.

H5c: Adoption has positive influence over sales dynamic capability.

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H5d: Adoption has positive influence over natural resource dynamic capability.

H5e: Adoption of enterprise resource planning has positive impact over farm performance.

2.4 Capability and farm performance

In this context, incorporated companies with strong dynamic capabilities demonstrate greater technological agility, rapid market responsiveness and better development of differentiated processes, enabling them to identify new opportunities and face challenges to stand out from the competition (Eisenhardt and Martin, 2000; Teece, 2015). As mentioned, companies that efficiently develop and orchestrate key dynamic capabilities will remain relevant to the market and anticipate new technology opportunities (Teece, 2015).

Capabilities are critical to a company's success in competing in both domestic and international markets, as they are the organizational processes through which resources are combined and transformed into value offerings, resulting in companies' competitive advantages (Murray *et al.*, 2011).

Organizational processes make existing resources available (Eisenhardt and Martin, 2000) and integrate corporate strategy (Teece, 2015), allowing the company to build dynamic capabilities and develop their uniqueness according to business routine. Teece (2015) identifies three process models/management functions: 'coordination/integration; guided learning and reconfiguration/transformation'. In this context, Eisenhardt and Galunic (2000) state that managers promote interdependent evolution by associating routines with collaborative networks between various areas of the company to produce an array of new resources.

Winter (2003) promotes the idea that routine is an organizational capacity of the company to perform high-level tasks repeatedly, in order to produce efficient and meaningful results, since they are directly related to tacit knowledge learned and are supported by solid company principles. 'Managerial and organizational capabilities as determinants of competitive advantage' (Teece, 2015). Therefore, the evolution of the company is based on the managerial, organizational and strategic paths defined by the company to overcome its challenges and learning. The company's managerial, entrepreneurial, and leadership skills contribute to the design, development, implementation, and modification of these routines, and the manageability to design, develop, implement, and modify these daily practices, which are shaped by management decisions.

Promoting knowledge management, internally and externally, as it offers learning and value creation for employees and interacts with strategic alliances, stimulating knowledge exchange and strengthening partnership. Continuous and programmed learning, conducted through a well-developed knowledge transfer model, enables the building of multinational's dynamic capabilities, offering solid conditions to take advantage of the multiple contexts experienced by the company to develop processes and models in different markets, even considering knowledge management as a complex process of structuring and applying. Eisenhardt and Martin (2000) suggest that dynamic capabilities can be developed by processes focused on better practices, as they include regular resources to other company processes, allowing the design of a model to strengthen organizational capacity.

In multinationals, market intelligence and tacit knowledge are difficult to convey because they are transferred to multiple business units in different countries that have different procedures, performances, and cultures, indicating different paths and outcomes for each organization (Teece, 2018).

Therefore, dynamic capabilities enable the company to create sustainable competitive advantages that are difficult to be imitated as they promote synergy in its resources and competencies in response to the dynamism of the market in which it operates.

H6a: Costs dynamic capability has positive influence over farm performance.

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H6b: Internal operational dynamic capability has positive influence over farm performance.

H6c: Sales dynamic capability has positive influence over farm performance.

H6d: Natural resource dynamic capability has positive influence over farm performance.

Day (1994) and Teece *et al.* (1997), capabilities are incorporated as the reconfiguration of complex resources and skills are promoted at all organizational levels and in diversified activities. Capacities assume the dynamic condition when they allow the introduction of new strategies to respond to the situations presented by the market, thus recombining and renewing the resources available by the company. In this sense, the company's ability to encourage knowledge production and incorporate learning processes, at all levels of the organization, allows the construction of efficient standards inserted as better practices (Eisenhardt and Martin, 2000) and standardizing them (Morgan *et al.*, 2017) allowed replication in other areas of the company.

Therefore, it is understood that this ability to incorporate learning processes and encourage production and transfer of knowledge is more easily achieved on larger farms because it has more resources to invest in technologies and is more focused on the international market.

H7: The bigger the farm size the better the positive impact will be on adoption.

3. Methods and data

After the study and survey of fundamentals and theoretical assumptions we study the adoption of ERP systems as a dependent variable. We also seek to understand how ERP technology can contribute to the development of dynamic capabilities in post adoption of ERP on farms. Finally, we understand the importance of marketing dynamic capabilities variables to accelerate farm performance as another dependent variable. The determinants of the use of ERP applied in the research model (Figure 1) were selected from DOI theory (technological factors), TOE theory (organizational factors and environmental factors) and ERP diffusion (usage and increase). Farm size, which is a TOE theory organizational context variable was used as the control variable in our model. The TOE theory allowed us to identify the diffusion stages and the most relevant determinants. On the other hand, DOI theory helped identify the most visible determinants of technological elements within farms. Supplementary Table S1 shows the data collection instrument for the research model.

The questions, with some exceptions, were measured using a numerical scale ranging from 1 for 'completely disagree' to 7 for 'completely agree'. The questionnaire was tested with 36 farmers. Pretest results showed that the measurement scale was reliable and valid. We collected 502 complete questionnaires (Supplementary Table S1), which formed our sample. Data collection was performed through personal interviews with each farmer. This way we avoid problems with the difficulties of finding this audience over the phone and with online interviews. We have 74% of farmers who produce grains (soybean, corn, cotton, wheat, coffee, beans, and peanuts), 14% who raise cattle, 9% are sugar cane producers and 3% are fruit producers. Our sample has a concentration of 53% of farms in the Midwest region, which is justified by the higher concentration of planted areas in this region. We identified 42% of farmers who already use the ERP, as show in Table 1.

4. Results and discussion

4.1 Model consistency assessment

The model had a good adjustment (R squared 40.7 for ERP adoption and dynamic capabilities and R squared 62.5% for dynamic capabilities and performance) and all hypotheses could be tested. The alpha coefficients were significant and there was discriminant validity for the evaluated dimensions (Figure 1).

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Table 1. Research sample composition (n=502).

Agriculture type	
Grain[1]	74%
Cattle raising	14%
Sugar cane	9%
Fruits	3%
Regions	
MAPITOBA (Maranhão, Piauí, Tocantins and west of Bahia)	23%
Midwest	53%
South East	16%
South	9%
Phases of enterprise resource planning adoption	
Never considered adoption	15%
Have researched about but do not consider adoption	9%
Have researched and consider adoption	34%
Pilot test	19%
Already in use	23%

[1] Soybean, corn, cotton, wheat, coffee, beans or peanuts.

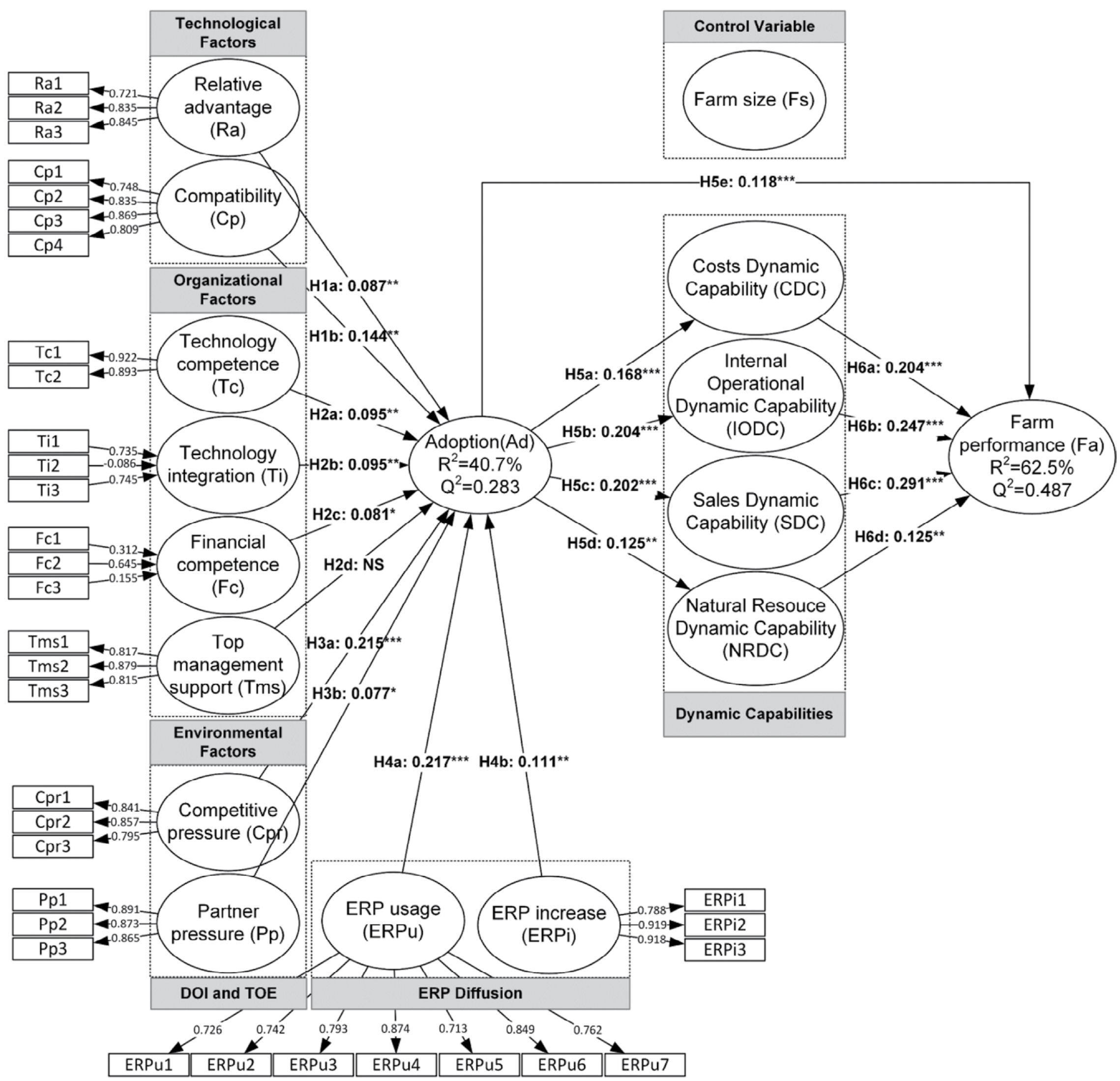

Figure 1. Measurement model results (n=502).

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The psychometric scales used demonstrated adequate predictive abilities to estimate the model and the relationships between the constructs. The values of the variance inflation factor range from 1.088 to 1.738 (less than 5), which demonstrates that there are no collinearity problems in the structural model (Supplementary Table S4).

The reflective measurement model assessment was performed for internal consistency, indicator reliability, convergent validity, and discriminant validity (Hair *et al.*, 2014). The internal consistency was evaluated by Cronbach's alpha and composite reliability. All latent variables show good performance in terms of internal consistency with Cronbach's alphas between 0.66 and 0.95 and composite reliabilities between 0.80 and 0.97. To evaluate convergent validity, we used average variance extracted that should be higher than 0.50. Table 2 shows the validity of our model. As can be seen in the same Table 2, all constructs present average variance extracted values above 0.5 (between 0.55 and 0.81), indicating that the constructs represent one dimension and the same underlying construct, and also that the constructs are able to explain more than a half of the variance of its indicators.

Table 2. Reflective measurement model.[1]

Constructs	**Cronbach's alpha**	**Rho_A**	**Composite reliability**	**Average variance extracted**
Relative advantage	0.723	0.723	0.843	0.643
Compatibility	0.830	0.830	0.887	0.662
Technology competence	0.787	0.787	0.903	0.824
Technology integration	(F)	1.000	(F)	(F)
Financial competence	(F)	1.000	(F)	(F)
Top management support	0.787	0.794	0.875	0.701
Competitive pressure	0.779	0.797	0.870	0.691
Partner pressure	0.852	0.881	0.909	0.768
Enterprise resource planning usage	0.893	0.899	0.916	0.611
Enterprise resource planning increase	0.849	0.875	0.909	0.770
Adoption	0.841	0.853	0.904	0.759
Farm performance	0.898	0.900	0.936	0.830
Costs dynamic capabilities	0.887	0.890	0.914	0.640
Internal operational dynamic capabilities	0.847	0.847	0.897	0.686
Sales dynamic capabilities	0.859	0.864	0.899	0.641
Natural resource dynamic capabilities	0.883	0.887	0.920	0.741
Farm size	0.854	0.896	0.908	0.767

[1] F = formative.

Table 3. Formative measurement model.[1]

Constructs	**Indicator**	**Loadings (convergent validity)**	**Variance inflation factor**	**Outer weights**	**t-value**	***P*-value**
Technology integration	Ti1	0.934	1.57	0.735	16.450	***
	Ti2	0.734	3.20	-0.086	7.459	***
	Ti3	0.793	2.85	0.475	8.559	***
Financial competence	Fc1	0.888	2.95	0.312	13.341	***
	Fc2	0.977	3.54	0.645	28.681	***
	Fc3	0.598	1.39	0.155	4.813	***

[1] Collinearity of indicators: each indicator's tolerance value should be higher than 0.20 (lower than 5). *** $P<0.01$.

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For the evaluation of the formative measurement model, multicollinearity was not verified. The variance inflation factor is below the cutoff value of 3.3 (Henseler *et al.*, 2014), except for the variable Fc2. Table 3 also presents the weights and their significance with loads greater than 0.5.

The discriminant validity was tested with two criteria: the Fornell-Larcker (1981) (AVEs should be greater than the squared correlations and each indicator should have a higher correlation to the assigned construct than to any other construct) and the cross loadings analysis. As can be seen in Supplementary Tables S2 and S3 both criteria are satisfied for all constructs and indicators, which indicates that the instrument has good discriminant validity.

Overall, the instrument presents good indicator reliability. Indicator reliability was evaluated in Supplementary Table S3 and presents a good result.

4.2 Hypothesis discussion

The adoption of ERP technology enables the perception of dynamic capacity generation and increases the performance in Brazilian farms. We will discuss some important points divided into three phases: (a) adoption determinants analyzed in Hypotheses 1, 2, 3 and 4: (b) generation of dynamic capabilities analyzed in Hypotheses 5; and (c) performance of farms analyzed in Hypothesis 6.

Table 4 shows the constructs with results that are adoption determinants, in the order: competitive pressure, ERP usage, compatibility, ERP increase, technology competence and technology integration, relative advantage, partner pressure, financial competence and, finally, top management support (Tms) which was an invalid hypothesis.

We question whether Tms is a non-valid hypothesis and we can conclude the following: The variables we measure in this construct are involvement of Tms in establishing a vision and formulating strategies, communicating their support, analyzing the occurrence and responsibility the risks involved in adopting ERP. Thus we can say that Tms supports the assessment of adoption and does not necessarily engage directly in adoption (Junior *et al.*, 2019).

By analyzing Table 5, ERP adoption generates dynamic capabilities outlined in the following order: internal operational, sales, costs and, finally, natural resources.

The results indicated that the perception of obtaining dynamic capabilities in the farms by adopting the ERP was significant, but with lower levels in costs and natural resources. The involvement of the farm decision

Table 4. Hypotheses on enterprise resource planning adoption.

Hypothesis	Results[1]	
H1a	Relative advantage has positive influence over adoption	$\hat{\beta}$ = 0.087**
H1b	Compatibility has positive influence over adoption	$\hat{\beta}$ = 0.144**
H2a	Technology competence has positive influence over adoption	$\hat{\beta}$ = 0.095**
H2b	Technology integration has positive influence over adoption	$\hat{\beta}$ = 0 0.095**
H2c	Financial competence has positive influence over adoption	$\hat{\beta}$ = 0.081*
H2d	Top management support has positive influence over adoption	$\hat{\beta}$ = -0.071 NS
H3a	Competitive pressure has positive influence over adoption	$\hat{\beta}$ = 0.215***
H3b	Partner pressure has positive influence over adoption	$\hat{\beta}$ = 0.077*
H4a	Enterprise resource planning usage has positive influence over adoption	$\hat{\beta}$ = 0.217***
H4b	Enterprise resource planning increase has positive influence over adoption	$\hat{\beta}$ = 0.111**

[1] *, ** and *** means P<0.10, P<0.05 and P<0.01, respectively. NS = not significant.

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maker was not significant. This may lead to a discussion of how much top management support has sufficient tactical and operational elements to make decisions about the functional areas of the farm, made available by the information systems of input supply companies (fertilizers, pesticides, seeds) and agricultural machinery.

We were able to assess the impacts of ERP adoption by defining dynamic capabilities (Shuen *et al.*, 2014; Teece, 2015; Vahlne and Johanson, 2013) as levels for farm performance.

In addition, we will discuss how this affects your strategic decisions that create value for the farm (Table 6). The influence of farm size on ERP adoption and its perception on farm performance was also not significant (Table 6). We believe this data is important to state that technology adoption is already under discussion for any farm size, region and type of crop. The proposed model proved to be adequate and can be validated and compared with other producing regions.

5. Conclusions

We have been able to present the research model conceptualized with the concept of ERP system, the dimensions chosen to explain user acceptance of the technology, the definition of dynamic capabilities and previous research on this topic.

Previous research has focused on the factors that influence ERP system adoption by considering adoption variables using the DOI and TOE theories as assumptions for successful adoption. Based on the premise that the adoption of ERP system by the Brazilian farmer can still generate some distrust of its performance for business and market, we introduced in our study two ERP Diffusion factors: usage and increase, besides value creation by developing dynamic capabilities, which meets specific decision criteria for this business: costs, internal operations, sales and natural resource. Another contribution of the paper was the joining of two existing and empirically validated models (DOI and TOE) with the performance development based on the dynamic capabilities theory, which should also serve as important constructs to understand the determining factors influencing farmers to adopt ERP system.

Table 5. Hypotheses on obtaining dynamic capabilities.

Hypothesis	Results[1]	
H5a	Adoption has positive influence over costs dynamic capability	$\hat{\beta}$ = 0.168***
H5b	Adoption has positive influence over internal operational dynamic capability	$\hat{\beta}$ = 0.204***
H5c	Adoption has positive influence over sales dynamic capability	$\hat{\beta}$ = 0.202***
H5d	Adoption has positive influence over natural resource dynamic capability	$\hat{\beta}$ = 0.125**
H5e	Adoption of enterprise resource planning has positive impact over farm performance	$\hat{\beta}$ = 0.118***

[1] *, ** and *** means P<0.10, P<0.05 and P<0.01, respectively.

Table 6. Hypotheses for farm performance.

Hypothesis	Results[1]	
H6a	Costs dynamic capability has positive influence over farm performance	$\hat{\beta}$ = 0.204***
H6b	Internal operational dynamic capability has positive influence over farm performance	$\hat{\beta}$ = 0.247***
H6c	Sales dynamic capability has positive influence over farm performance	$\hat{\beta}$ = 0.291***
H6d	Natural resource dynamic capability has positive influence over farm performance	$\hat{\beta}$ = 0.125**
Control variable		
H7	The bigger the farm size the better the positive impact will be on adoption	$\hat{\beta}$ = -0.021 NS

[1] *, ** and *** means P<0.10, P<0.05 and P<0.01, respectively. NS = not significant.

For the entire food, protein, fiber and energy production chains to take advantage of the adoption of these technologies, it is relevant to analyze farmers' perceptions of the main reasons for adopting an ERP system and how this adoption can develop dynamic capabilities needed to increase farm performance.

In recent years there has been growing interest in studies that seek to understand the adoption of technologies and the performance of farms. In Brazil this interest grows for observable reasons such as the delay in this adoption. Some studies indicate that there is pressure from farm business partners, characterized as input suppliers, credit providers and food processing industries, for farmers to adopt this technology. The adoption of ERP drives performance in certain segments. However, studies on ERP adoption with dynamic capacity development were not found in the context of farms in Brazil.

Despite the benefits that an ERP system can do on farms, its adoption is still low in Brazil as identified in the study by Junior *et al.* (2019). ERP providers or developers could better understand these farmers' needs for the development of their products and services. This may be closely linked with the effective perception of improvements in decision-making and business capabilities provided by management tools such as ERP system. Also, there is interest from local and world governmental authorities, companies, farmers and countries that depend on Brazil's production so that the development of higher yields and food quality continue to grow.

However, some obstacles to this research are important to mention: (a) Lack of interoperability between software of electronic equipment and devices used by producers. In this paper we treat ERP as a technology that enables this interoperability. (b) Digital transformation using real-time ERP technology on farms in Brazil will only make sense with online communication and internet of things. Online services on farms in Brazil are still precarious. (c) If we want to overcome these obstacles, we must think about agriculture 4.0 and we are pointing out in this paper some ways that should be better cultivated.

Supplementary material

Supplementary material can be found online at https://doi.org/10.22434/IFAMR2020.0029

Table S1. Empirical instrument.
Table S2. Discriminant validity model (Fornell-Larcker criterion) AVE and latent variables correlations.
Table S3. PLS loadings and cross-loadings.
Table S4. Collinearity assessment.

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