

Research Article

Decision archetypes in the information technology governance: Reflections concerning small and medium-sized enterprises

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Abstract

Objective: To understand and analyze the configuration of decision archetypes, proposed by Weill and Ross (2004), in the context of Small and Medium Enterprises (SMEs). The study is justified by the increased organizational dependence on Information and Communication Technologies (ICT) and its high costs, which requires a close alignment between business strategies and the adoption of these technologies. **Methodology / Approach:** Qualitative approach, under an inductive logic; and data collected through semi-structured and in-depth interviews, involving five owner-managers of ICT service providers and 16 directors / managers of Information Technology (IT), in SMEs. **Main results:** It was observed that SMEs have characteristics that facilitate the integration between business and IT, with the duopoly decision archetype prevailing. The greater concentration of power in the owner-manager or the absence of structural power of the key IT professional in these companies can, however, favor archetypes of the type of federalism or monarchy, influencing misaligned decisions between IT and business. **Theoretical / Methodological contributions:** The findings of the study suggest that, within the organizational structures of SMEs, key IT professionals with decision-making power are supported by metrics based on quantitative aspects, supported by business intelligence systems and empirical knowledge of those involved in the process. **Relevance / Originality:** By proposing mechanisms for configuring decision archetypes in the Information Technology Governance (ITG) of SMEs, this study contributes significantly to the advancement of this theme, still incipient in the literature, as well as supporting new research.

Keywords: Decision archetypes; Information Technology Governance; Information and Communication Technologies; Small and Medium Enterprises; Decision-making process.

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Resumo

Objetivo: Compreender e analisar a configuração dos arquétipos de decisão, propostos por Weill e Ross (2004), no contexto das Pequenas e Médias Empresas (PME). O estudo se justifica pelo aumento da dependência organizacional por Tecnologias da Informação e Comunicação (TIC) e seus altos custos, o que requer um estreito alinhamento entre as estratégias dos negócios e a adoção dessas tecnologias. **Metodologia/Abordagem:** Abordagem qualitativa, sob uma lógica indutiva; e dados coletados por meio de entrevistas semiestruturadas e em profundidade, envolvendo cinco proprietários-gestores de prestadoras de serviços em TIC e 16 diretores/gerentes de Tecnologia da Informação (TI), em PME. **Principais resultados:** Observou-se que as PME têm características facilitadoras da integração entre negócios e TI, sendo prevalecte o arquétipo de decisão duopólio. A maior concentração de poder no proprietário-gestor ou a ausência de poder estrutural do profissional-chave em TI nessas empresas pode, todavia, favorecer arquétipos do tipo federalismo ou monarquia, influenciando decisões desalinhadas entre TI e negócios. **Contribuições teóricas/ Metodológicas:** As descobertas do estudo sugerem que, nas estruturas organizacionais de PME, estejam profissionais-chave de TI com poder de decisão, a ser respaldada por métricas pautadas em aspectos quantitativos, suportados por sistemas de inteligência de negócios e pelo conhecimento empírico dos envolvidos no processo. **Relevância/Originalidade:** ao propor mecanismos de configuração dos arquétipos de decisão na Governança de Tecnologia da Informação (GTI) das PME, este estudo contribui significativamente para o avanço dessa temática, ainda incipiente na literatura, bem como apoia novas pesquisas.

Palavras-chave: Arquétipos de decisão; Governança de Tecnologia da Informação; Tecnologias da Informação e Comunicação; Pequenas e Médias Empresas; Processo de tomada de decisão.

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INTRODUCTION

Information and Communication Technologies (ICT) play an increasingly important role in organizations (Jaeger-Neto, Luciano, and Becker, 2009), a fact that leads to reflections on topics such as investment in ICT, aggregation of business value through ICT, ICT strategies and infrastructures, and their products and services (Mendonça et al., 2013).

This growing dependence on organizations for ICT (Fernandes and Abreu, 2014) and their high costs require a better alignment between business strategies and the adoption of these technologies (De Haes and Grembergen, 2004; Frogeri et al., 2019a). In this context, the implementation of Information Technology Governance mechanisms (ITG) is discussed - practices that allow the alignment between corporate strategies and the adoption of ICT, to organize and structure the decision-making process (Oliveira, 2017; Weill and Ross, 2004).

Such discussions involve the "means", the way ("how") and the reason ("why") of a decision-making process, as well as the different theoretical perspectives to understand the behavior of the person responsible for this action, and what issues to raise (Weill and Ross, 2004). Therefore, in this context, the ITG defines those involved in the decision-making process and their responsibilities (Frogeri et al., 2019a), covering questions such as: What decisions must be taken to ensure the management and effective use of ICT? Who should make these decisions? And how these decisions will be made and monitored? (Weill and Ross, 2004).

To answer them, Weill and Ross (2004), in an extensive survey in 23 countries, with more than 200 companies, defined a matrix of ITG arrangements, which lists five key decisions and a set of archetypes representative of groups of borrowers decisions associated with ICT.

Although relevant to the ITG literature, the study by Weill and Ross (2004) analyzed only large multinational companies, leaving a gap regarding the definition of ITG decision archetypes in the scenario of Small and Medium Enterprises (SMEs) (Frogeri et al., 2019a; Min and Junhe, 2009; Silva et al., 2019; Silva et al., 2020).

Regarding this, Jankelová (2017) considers that SMEs use a restricted-rational model of time and resources for decision-making process, given the limited knowledge of their owners / managers, based on low-quality information, non-systematic and randomly obtained (via social relationships or customer demands), and in their intuitions - in some cases, assertive.

In SMEs, the decision-making process involving ICT is often concentrated on the owner-manager and / or a key IT employee (Bergeron et al., 2017; Nguyen, 2009). By an attitude of mimetic or even coercive isomorphism (Jacobson, 2009), external influences to SMEs, such as customers, business partners, ICT consultants / suppliers (Ghobakhloo et al., 2012), as well as the business environment (Neirotti and Raguseo, 2017), can motivate decisions about ICT that are out of line with the needs of the business (Frogeri et al., 2019b, 2020).

The different characteristics of SMEs - especially in the context of ICT (Neirotti, Raguseo, and Paolucci, 2018; Torrès and Julien, 2005) - encourage studies aimed at understanding phenomena observed in large organizations, but which are still under development in SMEs (Frogeri et al., 2019c; Huygh and De Haes, 2016; Silva et al., 2020).

Most SMEs have limited financial and human resources (Bergeron et al., 2017; Guldentops, 2014); therefore, understanding how the archetypes of decision-making process

are configured in this type of organization can provide a better direction for the composition of the body of decision makers and investments, avoiding the inadequate commitment of the corporation's valuable resources, and allowing actions or applications of those able to leverage business.

Therefore, the guiding question of this study, which aims to understand and analyze the configuration of ICT decision archetypes (Weill and Ross, 2004) in SMEs, is: How are ICT decision archetypes configured (Weill and Ross, 2004) in the context of SMEs?

THEORETICAL FRAMEWORK

IT Governance Mechanisms

Unlike the ITG structural mechanisms, which deal with decision-making settings (Frogeri et al., 2019a), decision-making mechanisms (Table 1) focus on the individual responsible for the action and on the subject of IT involved (Weill and Ross, 2004), aiming to leverage IT resources in SMEs (Frogeri et al., 2019c).

Determining "who" and "what" in this decision-making process is essential to avoid making investments that are out of line with the business objectives (Luciano, Wiedenhof and Moron 2015; Moraes, Cunha and Terlizzi 2017; Weill and Ross, 2004); and relevant to better understand the interested parties, considering that they are perceived as having power, legitimacy and urgency.

This power can be seen from different angles; however, the Resource Dependency Theory has stood out as a conceptual framework for the phenomenon (Clarkson, 1995; Donaldson and Preston, 1995). In this view, power focuses on relationships structured around resources and their dependence. Legitimacy, in turn, is linked to the social context (mission, vision, values, ethics, culture, among others) where the company operates. And urgency, finally, establishes the extent to which an interested party's claim requires to immediate attention, thus making delays unacceptable (Messabia and Elbekkali, 2010).

Different authors use the term "IT capacity" as a reference to the intermediate event between ITG practices and organizational performance (Dale Stoel, and Muhanna, 2009; Neirotti and Raguseo, 2017; Neirotti et al., 2018; Xue, Ray and Sambamurthy, 2012). In this sense, it is argued that ITG is capable of expanding the capabilities of an organization in two ways: (1) regarding practices or internal guidance (IG), which, in general, do not add value to the organization through IT. Examples of this are the Integrated Business Management Systems or Enterprise Resource Planning (ERP), which use IT resources with an internal focus, to integrate operations and internal data to increase efficiency and reliability; (2) regarding practices or external guidance (EG), which aim to develop business through IT. Examples of this are the Customer Relationship Management System (CRM), which helps research on market and e-commerce interfaces focused on the customer, and innovative IT practices (Dale Stoel, and Muhanna, 2009; Neirotti and Raguseo, 2017; Neirotti and Raguseo, 2017).

Decision Archetypes on ITG and Related Studies

The decision archetypes, proposed by Weill and Ross (2004), were organized into six types, highlighting "who" makes IT decisions: (1) business monarchy - top business executives; (2) IT monarchy - IT professionals; (3) feudalism - each business

Mechanism ITG	Explanation	References
Defining who makes the decisions on IT Principles	Decisions made jointly by key stakeholders of the organization on the IT principles (it refers to decisions on how IT is used in the business, the desirable behavior for professionals and users of IT) may drive IT capabilities in accordance with business strategies.	(Mendonça et al., 2013; Oliveira, 2017; Visentini et al., 2016; Weill and Ross, 2004, 2009; Xue, Liang, and Boulton, 2008)
Defining who makes the decisions on IT architecture	Joint decisions between operational IT committees and IT strategic committees on IT architecture (it relates to decisions on the physical and logical IT architecture in the organization to support the business) may drive IT capabilities in accordance with business strategies.	
Defining who makes the decisions on investment and prioritization in IT	Decisions made jointly by key stakeholders of the organization on prioritization and investments in IT (it relates to decisions on the amount and where to invest in IT; this item involves three dilemmas: the amount to invest, where to invest in and how to meet the interests of all stakeholders) may drive IT capabilities in accordance with business strategies.	
Defining who makes the decisions on strategies of IT infrastructure	Decisions made jointly by all key stakeholders of the organization on the strategies of IT infrastructure (it relates to decisions on IT services that support the business and provide good cost-effectiveness with scalability) may drive IT capabilities in accordance with business strategies.	
Defining who makes the decisions on needs for business applications	Decisions made jointly by all key stakeholders of the organization on the needs for business applications (it refers to decisions on the business needs for IT applications; purchasing on the market (outsourcing) or developing internally) may drive IT capabilities in accordance with business strategies.	
Decision-making processes based on relevant information and based on quantitative and qualitative metrics	A decision-making process based on relevant information and quantitative and qualitative metrics may drive IT capabilities in accordance with business strategies.	(Mitra et al., 2011; Moraes et al., 2017)

Tab. 01
Decision-making mechanisms in ITG
Source: Developed by the authors.

unit; (4) federalism - central organizations; (5) duopoly - bilateral consensus between IT professionals and business executives; and (6) anarchy - individually or in small groups.

The decision domains, on the other hand, are associated with the key issues in IT: “which” decisions and “what” they deal with, considering their classification into five types: (1) IT principles - how IT is used in business; (2) IT architecture - logical organization of data, applications and infrastructure; (3) IT infrastructure - services that provide a foundation for the company's IT capabilities; (4) business applications - decision on purchase in the market (outsourcing) or internal development; (5) IT investment and prioritization - the amount and where to invest in IT (Weill and Ross, 2004).

Hereinafter Table 2, is the matrix of decisions in ITG, proposed by Weill and Ross (2004).

The results of the study by Weill and Ross (2004) highlight: (a) the predominance of the IT monarchy archetype for decisions related to technical aspects of IT architecture and infrastructure, that is, its execution is performed only by IT professionals ; and (b) business decisions (principles, business application needs, IT investments and prioritization) are evenly distributed among the archetypes: duopoly, federalism and business monarchy, that is, decisions involving financial aspects are made only by professionals from the business areas (monarchy), by business units with decision-making power (federalism) or jointly (IT and business - duopoly).

In the Brazilian scenario, Mendonça et al. (2013) developed a study with a methodology similar to that of Weill and Ross (2004), applied to private and public companies, concluding that both have standards very close to the IT decision-making process. Thus, IT specialists (IT monarchy) were identified as responsible for most decisions (principles, architecture, infrastructure strategies and the need for IT applications), data that corroborate the research by Jaeger-Neto et al. (2009), applied in the South of Brazil.

Mendonça et al. (2013) observed the duopoly archetype in decisions about business investments and needs for IT applications, indicating that IT professionals and the business sector decide together on these aspects. These results, however, were not found in Jaeger-Neto et al. (2009), who identified the archetype business monarchy as dominant in these decisions. Therefore, decisions about IT resources are made by professionals in the field; and those involving financial values vary between organizations (Weill and Ross, 2004).

The theoretical basis of the studies by Weill and Ross (2004) is supported by the following views: (a) rationalist, which seems to dominate IT decisions, as professionals in the area have full knowledge of the context in which they are inserted, whether in ICT or in relation to business; (b) politics, observed in the archetypes duopoly and federalism, since business decision makers are involved in financial matters or under the influence of expectations that IT can add value to their activities; and (c) garbage can, represented by the anarchy archetype, in which

Decision/Archetype	IT Principles	IT Architecture	IT Infrastructure Strategy	IT Application Needs	Investments in IT
Business Monarchy	27%	6%	7%	12%	30%
IT Monarchy	18%	73%	59%	8%	9%
Feudalism	3%	0%	2%	18%	3%
Federalism	14%	4%	6%	30%	27%
Duopoly	36%	15%	23%	27%	30%
Anarchy	0%	1%	1%	3%	1%
Unknown	2%	1%	2%	2%	0%

Tab. 02
Array of decisions in ITG proposed by Weill and Ross (2004)
Source: Weill and Ross (2004, p. 66).

decisions are made by a single individual or by a small group of professionals in the field, being subject to mimetic and coercive isomorphisms (DiMaggio and Powell, 2000; Oliveira, 2017).

The arguments presented here lead to different reflections and impacts on the ICT decision-making process, in small, medium or large companies. The way in which the ICT decision maker understands his role in the organizational context can compromise the decision-making process. In this sense, an ICT professional, who does not realize the potential advantages of IT for the organization, limits the ability to adopt innovative technologies, capable of adding value to the business (Neirotti and Raguseo, 2017; Neirotti et al., 2018). Similarly, a technical lens of the policymaker can lead to the adoption of an ICT that is inappropriate to business strategies (Bergeron et al., 2017; Teodoro, Przybilowicz and Cunha, 2014).

Therefore, a heterogeneous ICT decision-making structure can minimize the weaknesses of its policymakers (ICT or business sectors) (Huang, Zmud and Price, 2010; Wilkin and Chenhall, 2010), with support from management of these decisions is important to achieve alignment between IT and business objectives (Héroux and Fortin, 2017; Nfuka and Rusu, 2011; Silva et al., 2019; Weill and Ross, 2004).

METHODOLOGY

In order to comply with good practices in scientific research involving people, this study was submitted to the Research Ethics Committee, from Plataforma Brasil, and is approved under number 06464819.7.0000.5155.

For that, the qualitative approach, the inductive method and the interpretative epistemology were adopted, with data collection carried out through in-depth semi-structured interviews (Minayo, Assis and Souza, 2005).

The selection of organizations participating in the research was based on registration data from the Information Technology Projects and Management Group (G2TI) in southern Minas Gerais - an initiative of the Centro Universitário do Sul de Minas (UNIS / MG), which aims to discuss topics relevant to the IT area with companies in the region. In January 2020, there were 106 members in the group, most of whom were SME IT managers.

Next (Table 3), from the application of qualitative and quantitative inclusion criteria to characterize small and medium-sized companies, is the concept of small business and its antithesis (opposite concept of a small company).

The concept "small size - small company" is not, therefore, automatic, that is, a small company is not necessarily a small company, and may even have characteristics of large corporations (Torrès and Julien, 2005).

In this sense, it is believed that SMEs operating in competitive, dynamic, complex or munific markets (Dale Stoel, and Muhanna, 2009; Leone, 1991; Torrès and Julien, 2005), which have organizational structures with an information technology sector integrated with decision-making process, adopt ITG mechanisms (Bergeron et al., 2017; Ghobakhloo et al., 2012; Giotopoulos et al., 2017; Nguyen, Newby and Macaulay, 2015; Olutoyin and Flowerday, 2016).

In this study, the subjects were identified by the letter "E", followed by the order in which they were interviewed; and companies, by a Greek letter, associated with their respective subjects. The following (are highlighted in Table 4): the identifier of the company participating in the study, the branch of activity,

Small Business Concept	Opposite concept to a small business
Small-sized	Small-sized
Centralized management.	Decentralized management.
Low level of labor specialization.	High level of labor specialization.
Intuitive and short-term strategy.	Explicit and long-term strategy.
It has internal and external information systems that are simple and informal.	It has internal and external information systems that are complex and formal.
It operates on market niches with low dynamic and complexity environments.	It operates on Global Market, especially in dynamic and complex environments.
Limited vertical integration and geographic reach.	Higher level of vertical integration and geographic reach.
Reduced need for information processing.	Higher level of processing resources of information using independent units and more ICTs.
Centralized. Low formalization and standardization of organizational processes	More decentralized and more departments. More formal and standardized organizational processes.
Small-sized	Small-sized

Tab. 03

Characterization of a small company and its antithesis

Source: Adapted by the authors from Torrès and Julien (2005) and Neirotti et al. (2018).

the identifier of the respondent, their academic background, the number of employees in the organization, the title and time in the position held.

The structure of the data is in accordance with each group formed by the research subjects, with 21 individuals and 20 companies participating in it. Alpha had two research subjects: E1 (IT Coordinator) and E5 (IT Director). E1 and E2 participated in the pilot test, as suggested by Prasad (2008) (Figure 1).

Unlike quantitative research, whose focus is on variables, qualitative works with content analysis categories, which, according to Prasad (2008, p. 11), can be defined as:

(...) compartments with limits explicitly declared in that the content units are coded for analysis (...) should be anchored in a review of the relevant literature and related studies. Analysis categories are constructed responding to the following question:

Which classification would most efficiently produce the data needed to answer the research question?

According to Prasad (2008), content analysis is usually performed in six stages (Table 5), categorized and briefly described below, with the indication of the respective literary references.

Through the technique of analysis content, a qualitative examination of the data was carried out (Prasad, 2008), which was supported by the MAXQDA Analytics Pro 2018 software - version 18.2.3, for the transcripts of the interviews, the organization, the categorization and the analysis of the information collected. The choice of software was based on a comparison of the literature of the main Computer Assisted Qualitative Data Analysis packages (CAQDAS). The number of subjects was defined by data saturation, according to Fontanella et al. (2012), and Malterud, Siersma and Guassora (2016).

Fontanella et al. (2012) consider the interruption of observations, when the eligible subjects have not yet been exhausted, justified by theoretical saturation, and the process



Company ID.	Branch of the Company	ID	Academic Education	# of Employees in the Company	Position of the Interviewee	Time in role
GROUP 1 – KEY PROFESSIONALS IN IT						
ALFA	Logistic	E1	Graduation in Analysis and Development of Systems	50 to 249	IT Coordinator	1 to 3 years
BETA	Agribusiness	E2	Degree in Computing Science	50 to 249	IT Manager	1 to 3 years
DELTA	Industry of concrete blocks	E4	Master of Business Administration in IT Management	50 to 249	IT Manager	Less than 1 year.
ALFA	Logistic	E5	Degree in Computing Science	50 to 249	IT Director	3 to 6 years
ZETA	Healthcare	E6	Master of Business Administration in IT Management	50 to 249	IT Coordinator	3 to 6 years
ETA	Agribusiness	E7	Specialist in Cybersecurity and Computer Forensic Expertise	Over 249	Supervisor of IT	3 to 6 years
THETA	Agribusiness	E8	Master of Business Administration in IT Management	Over 249	Supervisor of IT	1 to 3 years
IOTA	Foreign Trade and Consulting	E9	Master of Business Administration in Project Management	50 to 249	IT Coordinator	Over 9 years
KAPPA	Petrochemical	E10	Graduated in Information Systems	50 to 249	IT Coordinator	6 to 9 years
MI	Healthcare	E12	Graduation in Analysis and Development of Systems	50 to 249	IT Manager	Less than 1 year
NI	Retail	E13	Master of Business Administration in Project Management	Over 249	IT Manager	3 to 6 years
OMICRON	Educational	E15	Degree in Computing Science	Over 249	Director of IT and Innovation	1 to 3 years
TAU	Agribusiness	E19	Master of Business Administration in IT Management	Over 249	Supervisor of IT	Less than 1 year
UPSILON	Agribusiness	E20	Specialist in Software Engineer	Over 249	IT Coordinator	1 to 3 years
QOPPA	Logistic	E21	Graduation in Analysis and Development of Systems	50 to 249	IT Coordinator	1 to 3 years
OMEGA	Retail	E22	Graduation in Analysis and Development of Systems	Over 249w	IT Manager	Less than 1 year
GROUP 2 – OWNERS-MANAGERS OF SMES THAT PROVIDE IT SERVICES						
GAMA	Technology	E3	Specialist in Cybersecurity and Computer Forensic Expertise / Specialist in Software Engineer	Up to 10	Executive Director	Over 9 years
LAMBDA	Technology	E11	Graduated in Information Systems	Up to 10	Infrastructure Analyst	6 to 9 years
PHI	Tax consulting, accounting and software	E16	Master of Business Administration in IT Management	10 to 49	Director of IT, R&D	Over 9 years
RHO	Technology	E17	Technical Education	Up to 10	Director/Owner	Over 9 years
SIGMA	Technology	E18	Master of Business Administration in IT Management	10 to 49	Executive Director	Over 9 years

Tab. 04
Identification of research subjects relates the position and branch of the company
Source: Developed by the authors.

of closing the sample must be graphically observable, with the eight procedural steps exposed in a sequence of treatment and analysis of data collected in interviews.

On the other hand, when not considering new information, for Malterud et al. (2016), the definition of data saturation in qualitative research can be compromised, considering that lesser knowledge of the researcher on the topic or the use of empirical data with little variation is likely to lead to early

saturation. Thus, the concept of information power is used as "an aspect of internal research validity considering the potential of the available empirical data to provide access to new knowledge through theoretical analysis and interpretation" (Malterud et al., 2016, p. 1758). The proposed theory is based, then, on the principle that the more information relevant to the study the sample has, the fewer participants will be needed.

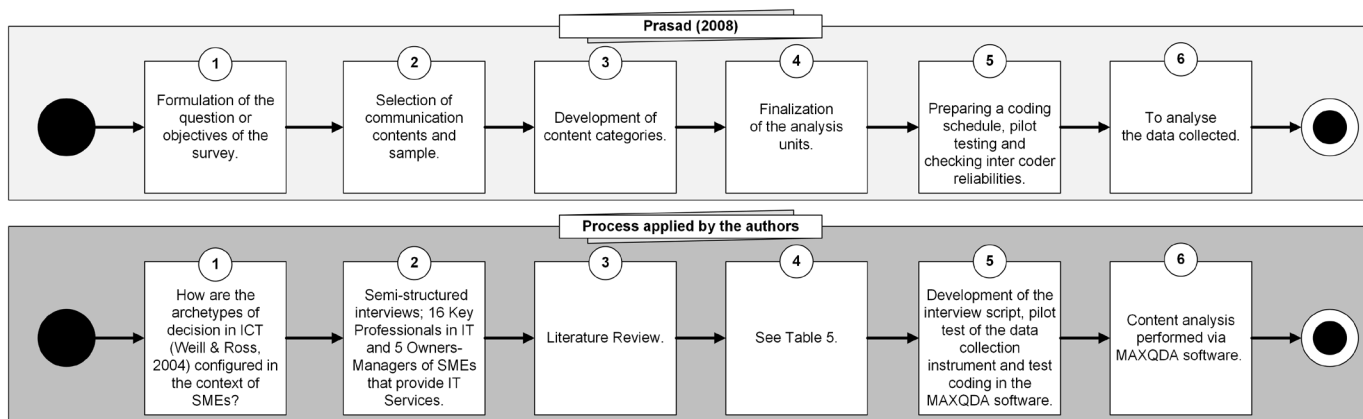


Fig. 01
Step to content analysis according to Prasad (2008)
Source: Developed by the authors.

In this study, the concept of information power, proposed by Malterud et al. (2016) was fulfilled, according to the literature review, which established the categories of research analysis (Table 5). There was also a saturation of the interview data, as pointed out by Fontanella et al. (2012), observed in the trend line (Figure 2), with 21 responders (E22 and E14 were excluded due to abandonment), with only 15 respondents contributing relevant information to the research discussions (highlighted in the analysis by the statements provided).

The results allow us to infer that the IT sector is directly or indirectly involved in many decisions related to IT in organizations, especially those concerning architecture (81.3%) and infrastructure (100%). They occur, in most of the organizations surveyed, based only on the perspective of the IT sector (monarchy). It is believed that this practice is justified by the decisions involving more technical aspects in IT than in business.

Analysis categories	Description	References
Existence of a key IT professional in the decision-making structure.	Refers to existence an IT professional in decision-making process. e.g. existence of an IT Director, IT Manager or IT coordinator that is always involved in the organization's decision-making process.	(Bergeron et al., 2017; Bradley et al., 2012; Jankelová, 2017; Thomas, 2010; Wilkin, 2012)
CIO(Chief Information Officer) Structural Power	Refers to CIO reporting level and CIO-TMT (Top Management Team) membership.	
Decisions on IT principles.	Refers to decisions on how IT is used in business and what behavior is desirable for IT professionals and users.	(Bradley et al., 2012; Mendonça et al., 2013; Oliveira, 2017; Visentini et al., 2016; Weill and Ross, 2004, 2009; Xue, Liang e Boulton, 2008)
Decisions on IT architecture.	Refers to decisions about the organization's logical and physical IT architecture to support the business.	
Decisions on IT infrastructure strategy.	Refers to decisions in IT services that support business and are cost-effective with scalability.	
Decisions on IT application needs.	Refers to decisions about business needs for IT applications; procuring in the market (outsourcing) or developing internally.	
Decisions on IT Investments.	Refers to decisions about how much and where to invest in IT; this item involves three dilemmas: how much to invest, where to invest and how to serve all stakeholders.	
Influence on IT decisions from managers of sectors.	Refers to the level of influence of sector managers on decisions involving IT, e.g.: the manager of the administrative sector may have greater decision-making power than the IT sector on matters involving IT.	
Decision-making processes based on quantitative or qualitative metrics	Decision making process based on qualitative metrics (e.g. background of IT manager) and quantitative metrics (e.g. data from Business Intelligence system)	(Mitra et al., 2011; Moraes et al., 2017)

Tab. 05
Research categories of analysis
Source: Developed by the authors.

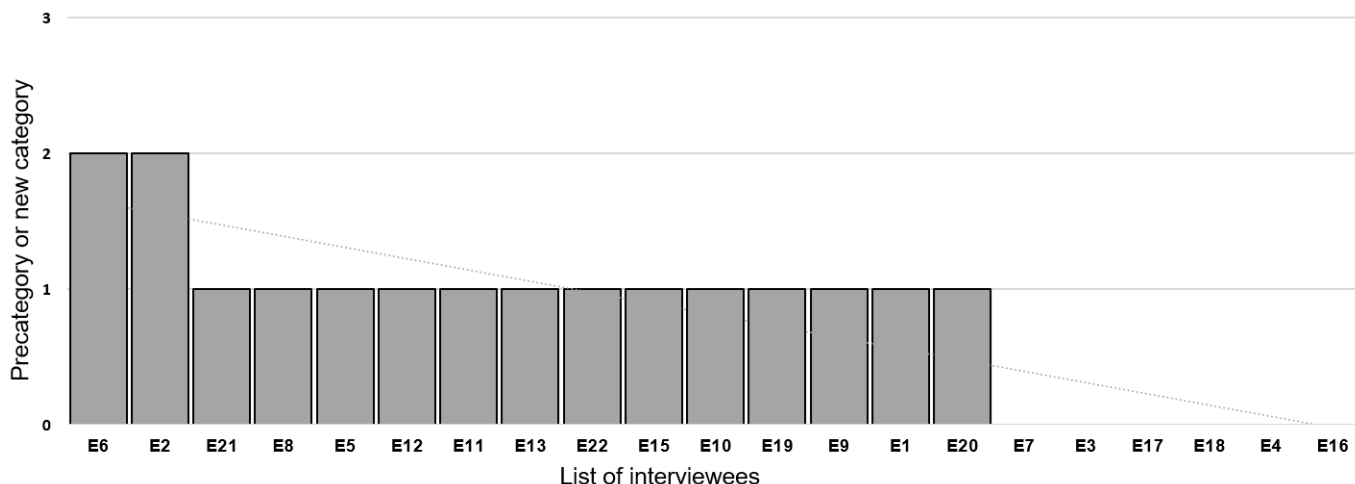


Fig. 02
Theoretical data saturation graph.
Source: Prepared by the authors, based on Fontanella et al. (2012).

ANALYSIS AND DISCUSSIONS

Based on the fundamental decisions proposed by Weill and Ross (2004), the interviewees were asked about “who” makes the decisions and “what” is done in the organization. Below (Table 6), the matrix of decision archetypes is presented, according to the interviewees' reports.

The association between archetypes and types of decision (data are presented as a percentage, according to the interviewees' reports), is shown below (Table 7).

In the study by Min and Junhe (2009), carried out in China, on the other hand, there was a prevalence of the duopoly archetype - IT and business sectors jointly make decisions about IT architecture and infrastructure. Taking E13's report as a reference, however, this situation may make sense in the context studied here:

“(…) the decision to adopt cloud computing services, we involved the presidency and even the expansion board to be sure that that cost was worth it if we thought about long-term IT infrastructure”.

Decision/Architect <i>IT decision maker</i>	IT Principles <i>As IT is used in business</i>	IT Architecture <i>Logical organization of data, applications and infrastructure</i>	IT Infrastructure <i>services that provide the basis for the company's IT capability</i>	Business Applications <i>deciding on purchasing on the market or developing internally</i>	Investments and Prioritization in IT <i>How and where to invest in IT</i>
Business Monarchy <i>senior executives of business make the decisions</i>	Eta (E7), Kappa (E10)			Eta (E7)	Eta (E7)
IT Monarchy <i>Professionals of IT makes the decisions</i>	Alfa (E1 e E5), Beta (E2), Ni (E13)	Alfa (E1 e E5), Beta (E2), Delta (E4), Zeta (E6), Eta (E7), Theta (E8), Kappa (E10), Ni (E13), Omicron (E15), Qoppa (E21), Tau (E19), Ômega (E22)	Alfa (E1 e E5),Beta (E2), Delta (E4),Zeta (E6), Eta (E7),Theta (E8), Iota (E9), Kappa (E10), Mi (E12),Ni (E13),Omicron (E15), Tau (E19), Upsilon (E20), Qoppa (E21), Omega (E22)		
Feudalism <i>Each business unit makes decision on IT</i>					
Federalism <i>Central bodies are responsible for decisions in IT</i>	Zeta (E6)			Beta (E2), Zeta (E6), Theta (E8),Kappa (E10), Omicron (E15), Upsilon (E20)	
IT duopoly <i>Bilateral consensus among IT executives and business executives</i>	Delta (E4), Theta (E8),Iota (E9), Mi (E12), Omicron (E15), Tau (E19), Upsilon (E21), Qoppa (E21), Omega (E22)	Iota (E9), Mi (E12), Upsilon (E20)		Alfa (E1 e E5), Delta (E4),Theta (E8), Iota (E9), Kappa (E10),Mi (E12), Ni (E13), Omicron (E15), Upsilon (E20), Qoppa (E21), Omega (E22), Tau (E19)	Alfa (E1 e E5),Delta (E4), Iota (E9), Mi (E12), Ni (E13), Qoppa (E21), Omega (E22), Tau (E19)
Anarchy <i>Decisions made individually or by small groups</i>					

Tab. 06

Array of archetypes of decision for the surveyed organizations

Source: Prepared by the authors.

Note: The association between archetypes and types of decision (data are presented as a percentage, according to the interviewees' reports), is shown on [Table 7](#)

METHODOLOGY

According to the previous report, the decision to use cloud computing services (infrastructure and IT architecture) involved a board (expansion) in the organization, charged with "thinking" eventually. So, even if the infrastructure or IT architecture services or products are based on technical aspects, invariably dominated by IT professionals, the need to involve other areas and the long-term vision of the organization must guide decisions. In this scenario, it is possible to reaffirm the need for alignment between IT and business, including regarding the technical aspects of IT (Henderson and Venkatraman, 1993).

In some situations related to financial values, the reports of the interviewees denote the role of TI as a "consultant" to decision makers and, therefore, part of the final decision:

"It depends on the impact that this decision will take. An impact for the company as a whole and that will generate a higher cost goes to the committee. TI does not participate in the committee". (E2).

"Whenever there is going to be a change, planning takes place, but not a study of the real need, and IT does not always follow it. And suddenly this demand comes to us. I happened to be informed of a certain demand, which I knew existed, but that I was taken surprisingly overnight to answer. I don't call that planning". (E6).

This characteristic refers to what Weill and Ross (2004) call "federalism" (when central bodies are responsible for IT decisions) - an archetype based on the political view that decision makers in the organization are involved in financial matters or under the influence of IT expectations to add value to its activities. This can inhibit the structural power of the

Major decisions on IT					
Decision	IT Principles	IT Architecture	IT Infrastructure	Business Applications	IT Investments and Prioritization
Business Monarchy	12.5	0.0	0.0	6.3	6.3
IT Monarchy	25.0	81.3	100.0	0.0	0.0
Feudalism	0.0	0.0	0.0	0.0	0.0
Federalism	6.3	0.0	0.0	12.5	37.5
Duopoly	56.3	18.8	0.0	81.3	56.3
Anarchy	0.0	0.0	0.0	0.0	0.0

Tab. 07

Array of arrangement of ITG in SMEs

Source: Developed by the authors.

CIO, who is the IT representative at the top of the company's decision-making hierarchy (Bradley et al., 2012), in addition to expanding the dispersion of responsibilities, strengthening the belief that only the industry IT or business organization should consider organizational solutions involving technology. In this sense, a careful alignment between IT and business management offers better opportunities for companies to identify and then implement IT solutions (Boynton, Jacobs and Zmud, 1992; Wilkin et al., 2016).

In addition to the predominance of the IT monarchy archetype associated with IT architecture and infrastructure, the results of this study (Table 7) highlight: (a) 81.3% of decisions related to business applications were presented under the duopoly archetype of IT (IT and business executives decide together); and (b) decisions related to IT principles (how IT is used in business), and investment and prioritization in IT (when and where to invest) had similar percentages (56.3), with the prevalence of the archetype of IT duopoly.

For comparison, this study considered the results of Weill and Ross (2004), Jaeger-Neto et al. (2009) and Mendonça et al. (2013), and reached the following conclusions: (a) the decisions on IT architecture and infrastructure did not differ, being predominantly centered on the IT sector and its decision maker; (b) there are significant differences relates the federalism-type decision archetype (the central bodies are responsible for IT decisions), with the studies by Weill and Ross (2004) and Jaeger-Neto et al. (2009) indicating a relevant percentage of decisions related to business applications via central agencies - a fact that was not observed in the surveyed SMEs; (c) the vast majority (81.3%) pointed to decision characteristics associated with the IT duopoly archetype (IT and business executives make decisions); (d) another distinct result was observed in the study by Mendonça et al. (2013), who identified the archetype of IT monarchy in decisions associated with the needs of business applications.

The mentioned differences can be explained by the fact that the studies address companies with different organizational characteristics and size. Weill and Ross (2004) analyzed only large corporations, distributed in several countries; whereas, in Jaeger-Neto et al. (2009), 48% of the companies had more than 1,000 employees, and 14%, between 501 and 1,000 employees - data similar to those found by Mendonça et al. (2013), in which large private organizations reached 44%. According to Devos, Van Landeghem and Deschoolmeester (2012), organizations with greater vertical integration, typical of multinationals or large companies, have greater decentralization and more departments. In these configurations, there are substantial coordination problems between the units, which requires to be consolidated governance structures (Neirotti et al., 2018).

The results found here were also compared to works carried out in smaller organizations, with emphasis on Min and Junhe (2009) (Figure 3), which allowed us to observe several similarities, except for decisions related to investments and prioritization in IT, since the federalism stood out in that study, while in this one, the IT duopoly archetype was prominent (as in the results by Jaeger-Neto et al., 2009).

The analysis allows us to infer that decision archetypes, in the context of SMEs, may have differences relates large companies, due to the specific characteristics of these organizations: SMEs have simplified organizational environments, in which relational practices flow with greater intensity (Devos, Landeghem and Deschoolmeester, 2009; Devos et al., 2012), facilitating decisions involving top management and the IT sector (IT duopoly).

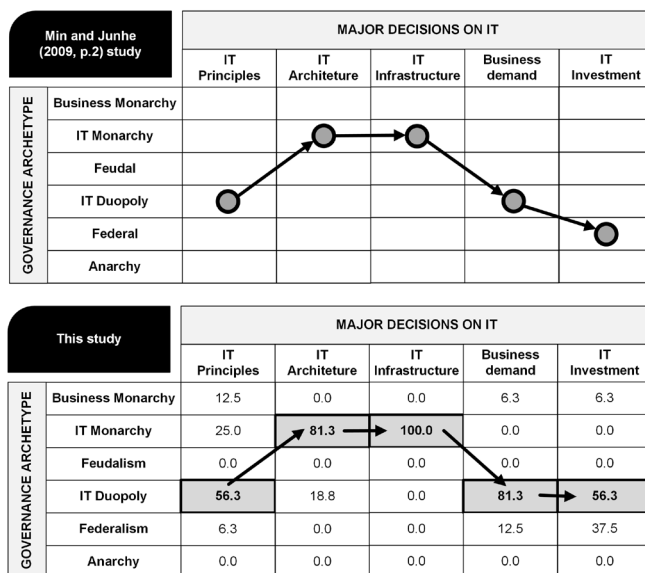


Fig. 03 Comparison with the results of Min and Junhe (2009)
Source: Developed by the authors.

However, the predominance of the IT monarchy archetype, in decisions involving aspects of IT architecture and infrastructure, can allocate resources incompatible with business strategies and, thus, compromise the already scarce finances of SMEs (Guldentops, 2014). To solve this problem, decisions on the IT architecture can be made through the IT duopoly archetype, associating only those related to the IT infrastructure to the IT monarchy archetype.

Respondents were also asked about the use of quantitative or qualitative metrics in the business decision-making process, and how IT is positioned in this regard. In addition to these formal mechanisms assisting the alignment between business and IT, and the communication of IT value to the organization (Mitra et al., 2011; Moraes et al., 2017), this study believes in its potential to mitigate common mimetic decisions between SMEs.

The results of the analyses pointed to the predominance of decisions based only on quantitative data (43.75%), mostly originating from the organization's own ERP system (31.25%), spreadsheets (6.25%) and QlikView and PowerBI software, of the type Business Intelligence (BI) (6.25%), according to the reports below.

"(...) we are quantitative. Nowadays, it is an Excel spreadsheet. It is data from projects that are in this spreadsheet. The data that feeds this spreadsheet that is used for the decision-making process is an additional control to the system". (E2).

"(...) the directors present, the partners analyzed and decide based on numbers and control. (...) we work with performance, and we have very high goals. (...) we use graphics. The PowerBI with data generated from the ERP". (E5).

"Nowadays we already have many indicators. (...) several areas already have their indicators that are used in these decisions. We think about having a BI, but at the moment it doesn't. There is a coordinator who is responsible for integrating the data and generating information compiled from the organization". (E22).

Among the interviewees, four (26.6%) stated that the organization bases its decisions only on qualitative metrics, guided by the "feeling or intuition" of the parties involved. The

use of an ERP system stood out in three reports (20%) as a source of information for decisions, with only one organization having a BI system:

"Even today, although I try to show quantitative values, decisions are still made by the feeling of those involved. We have a tool that is not BI, but in which you extract various information and indicators". (E6).

"I think that today, more on the experience and the feeling of those involved. Greater maturity is still lacking, even with the indicators that we have the feeling still prevails in decisions". (E10).

"Strategic decisions are based more on experience and that is what we are trying to change. (...) we are implementing a BI to control data and assist in decisions". (E19).

"I think more about the experience and feeling of those involved. Today we have BI, some things in that sense, but it is still more due to the knowledge of those involved, especially the President". (E21).

From the interviewees' reports, it is possible to notice that, even in organizations where there are BI tools, the perception of the main decision maker seems to prevail. In SMEs, it is common for the owner-manager to make decisions based on his experiences, including considering data and indicating the opposite path (Jankelová, 2017).

The five reports on the use of qualitative and quantitative metrics totaled 33.33%, and in this group, one interviewee indicated the use of an ERP system in the organization, to guide decisions, and three, that of BI systems (PowerBI and QlikView):

"Both (...) We have some indicators today, we work today with BI and CRM. We have a BI platform - PowerBI, but the analysis and graphics are built on top of our processes". (E8).

"Qualitative and we are migrating to the quantitative. We hired a guy just from BI, and we're just measuring. I'll tell you that in a few months we will be in the quantitative. Today we have, for example, PowerBI and QlikView. When I tell you that we are looking for quantitative metrics, we have more detailed data because of the macro we already have in these tools. Some comparisons are not yet possible to make because there are details that we do not yet know". (E9).

"I believe both. We are always looking for improvement, and we are always looking at the numbers. To guide the decisions, we use budget control with the forecast of scenarios, we have the BI solution where we evaluate our numbers. They are basically BI and financial tools". (E15).

"(...) we have indicators, statements of financial results, market research, research that is carried out with the cooperative members. It depends on what you decide, we have several indicators to guide the decisions". (E20).

For Moraes et al. (2017), the management of IT indicators, in retail companies in Brazil, is still associated with the operational management of IT, with the performance and value of IT (as a whole) being measured from perception. This corroborates the view of Mitra et al. (2011) about the CIO, often based on

Construct	Composition
Mechanisms of decision-making ITG in SMEs context	The IT duopoly archetype should prevail in decisions involving IT in SMEs.
	IT infrastructure may occur through the monarchy archetype in IT.
	Decisions on aspects of IT architecture should involve IT and business (duopoly) from a long-term perspective (expansion of businesses with IT support - scalability).
	IT involvement in the decision-making body of the organization - CIO structural power.
	IT performance indicators in relation to the business should be encouraged as a way of communicating the value of IT to the organization. IT metrics that are essentially operational may not be effective to demonstrate IT value to the organization (ITG principle).
	The use of Business Intelligence (BI) systems may be able to provide broader visions of business and facilitate the communication of IT value to the organization.

Tab. 08

Elements associated to decision-making ITG mechanisms in SMEs
Source: Developed by the authors.

non-quantifiable measures, such as his intuition, although he believes in metrics and measures as essential elements for improving the alignment between IT and business. Thus, the discussion of metrics and performance helps to guide possible decisions (Mitra et al., 2011) and, according to Moraes et al. (2017), communicating the value of IT to the organization.

In short, decisions based on qualitative and quantitative data, with the help of BI systems, can provide broader business views and facilitate the communication of IT value to the organization, thereby influencing the development of IT capabilities (Neirotti et al., 2018).

Table 8 is a compilation of the analyses associated with the ITG decision-making mechanisms, in the context of SMEs.

This study understands that the maturity of ITG, through its decision-making mechanisms, can guide the alignment between business and IT, in the context of SMEs. The composition of such mechanisms, now broken down (Table 8), complements the framework proposed by Silva et al. (2019), being able to assist the company in this process.

Based on the information presented (Table 6 and 7), this study also believes in the potential of ITG in enabling, through the development of specific resources, the addition of business value by TI (De Haes and Grembergen, 2004; Frogeri et al., 2019a). To this end, it promotes new reflections on the decision matrix, built by Weill and Ross (2004), especially regarding this purpose, eclipsed by the authors' emphasis on determining the types of decision archetypes and their respective associations. It is suggested, then, that said matrix be redefined, according to the context of SMEs (Table 9).

MAJOR DECISIONS ON IT					
Decision/ Archetypes	IT Principles	IT Architecture	IT Infrastructure	Business applications	IT investments and prioritization
Business Monarchy					
IT Monarchy					
Federalism					
Duopoly					

Tab. 09

Matrix of IT governance decision archetypes in SMEs context
Source: Developed by the authors.

The decision-making processes, based on relevant information and quantitative and qualitative metrics, were observed here as elements capable of influencing the alignment between IT and the business; and IT can demonstrate value to the organization through: (a) data analysis tools with a strategic perspective, such as the BI system; (b) quantitative metrics, to facilitate the communication of this value; and (c) expanding the structural power of the CIO.

In this scenario, SMEs with archetypes such as business monarchy or IT can adopt a duopoly archetype for decisions on principles, architecture, business applications and IT investments. The federalism-like archetype (the central bodies are responsible for IT decisions) would thus be associated with the decisions of the IT sector relating to the IT infrastructure. Thus, in the context of SMEs, feudalism archetypes (each business unit makes its own decisions about IT) and anarchy (IT decisions are made individually or in small groups) do not make sense, as they are associated with environments larger business units, in which groups or decision units may arise.

FINAL CONSIDERATIONS

This study was guided by the search for understanding in relation to the configuration of the ICT decision archetypes, in the context of SMEs. The analysis showed a different configuration of large corporations, considering that SMEs have characteristics that facilitate the integration between business and IT, making the IT archetype type prevail in the decision-making process.

On the other hand, in these companies, it was observed that the great concentration of decision-making responsibility in the owner-manager and / or the absence of structural power of the main IT professional can direct decision archetypes, such as federalism and business monarchy, capable of promote incompatible decisions between business and IT.

In addition, the aforementioned concentration of ownership in the manager / owner of the business can lead to risk aversion and a lack of willingness to make strategic changes, such as the composition of a heterogeneous board of directors (main decision makers), the development of innovations products or access to new markets.

In this scenario, SMEs develop technologically only driven by the influence of their competitors (mimetic behavior) or based on suggestions from IT service providers. The asymmetry of information / knowledge between the owner-manager and the service provider, in this case, can lead to a misalignment between the technology acquired by the SME and its real needs - a problem that, according to the findings of this study, could be minimized by greater CIO structural power.

It is suggested that the IT duopoly archetype prevails in decisions related to IT, except for purely technical ones, concerning, for example, the IT infrastructure. In addition, the involvement of a key IT professional in the decision-making body is essential to ensure the political-normative character of decisions. Regardless of the possibility that the owner-manager's decision will often prevail, this structure makes it possible to maintain the duopoly-type decision archetype, in addition to providing the organization's top IT employee with the opportunity to discuss strategic decisions.

Finally, this study understands that, to better support decisions in SMEs, the metrics must be based on quantitative aspects, guided by BI systems, and qualitative, based on the perception and empirical knowledge of the parties involved. The integration between quality information, guided by the analysis of specialized BI systems, and the perceptions of SME owners-managers can mitigate mimetic decisions and are often influenced by customers or business partners.

As a practical application of the findings of this study, SMEs are recommended to have an IT representative with decision-making power in their organizational structures; and that IT decisions are guided by an integrated perspective between the business and IT areas (duopoly). Therefore, IT must function as a mechanism to facilitate corporate strategies, with the possibility of adding value to the business.

The main academic contributions of this study, which was based on the classic research by Weill and Ross (2004), involve the expansion of the literature on ITG in SMEs, through: (a) explanation of how the decision archetypes are configured in these companies; (b) presentation of a set of decision mechanisms compatible with SMEs; and (c) suggestion to adopt the duopoly-type archetype for decisions involving IT and business, in this context.

Even with the use of rigorous methodological principles, required in scientific research, limitations can still occur. This study was limited to observing a group of companies, operating in a specific region of Brazil - the south of Minas Gerais. External environmental characteristics, to which organizations may be subject, or cultural aspects, may have influenced the definition of ITG decision archetypes, in the context of the analyzed SMEs. The investigation, the detailing and the understanding of these factors can constitute the source for new scientific studies.

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Authors' statement of individual contributions

Roles	Authors Contributions			
	Frogeri, RF	Pardini, JD	Cardoso, AMP	Júnior, PSP
Conceptualization	X	-	-	-
Methodology	X	X	X	-
Software	X	-	-	-
Validation	X	X	X	X
Formal analysis	X	X	X	-
Investigation	X	-	-	-
Resources	X	-	-	-
Data Curation	X	X	X	X
Writing - Original Draft	X	X	X	X
Writing - Review & Editing	X	X	X	X
Visualization	X	X	X	X
Supervision	-	X	X	-
Project administration	X	-	-	-
Funding acquisition	-	X	X	X



Conflict of interest statement

None of the authors of this paper has a financial or personal relationship with other people or organizations that could inappropriately influence or bias the content of the paper. We specifically state that "No Competing interests are at stake and there is No Conflict of Interest" with other people or organizations that could inappropriately influence or bias the content of the paper.

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