RCA Revista de Ciências da Administração

v. 27, n. 67, p. 1-30, 2025

DOI: https://doi.org/10.5007/2175-8077.2025.e100678

The Role of the Operational Leader for the Development of Dynamic Ambidexterity in a Traditional Company: AcerlorMittal Brasil

O papel do líder operacional para o desenvolvimento da ambidestria dinâmica em uma empresa tradicional: a AcerlorMittal Brasil

El papel del líder operativo en el desarrollo de la ambidestreza dinámica en una empresa tradicional: AcerlorMittal Brasil

Autorship

Marisa Delfino

Fundação Dom Cabral (FDC)
marisa@fdc.org.br
https://orcid.org/0009-0009-5880-4857

Ana Burcharth

Fundação Dom Cabral (FDC)
ana.burcharth@fdc.org.br
https://orcid.org/0000-0002-9921-5188

Maria Elisa Brandão Bernardes

Fundação Dom Cabral (FDC)
mariaelisa@fdc.org.br
https://orcid.org/0000-0003-3821-3397

ABSTRACT

Goal: The complex and unpredictable business environment requires organizations to become ambidextrous. The aim of the research was to investigate how (which mechanisms) lead to dynamic ambidexterity. **Methodology/approach:** From a process perspective, we studied the case of an incumbent organization that implemented dynamic ambidexterity, and the mechanisms that supported it. **Originality/relevance:** Little is known about the organizational mechanisms that allow companies to achieve ambidexterity in a dynamic way, and how it takes place over time, with the involvement of different areas of the organization. We investigated the case of a world reference company in the steel sector (ArcelorMittal Brazil) that has adopted ambidexterity. **Main findings:** We concluded that the flexibility to learn of the support areas (such as contracts and procurement) facilitated the adoption of exploration practices. We also identified that rigidity in traditional management procedures, typical of incumbent organizations, combined with pressure for short-term results, hindered, but did not prevent, the development of exploration activities. **Theoretical contributions:** We identified the importance of the frontline manager - an actor who has received little attention both in the literature and in managerial practices. **Management contributions:** We identified the importance of the frontline manager in making ambidexterity viable. They do this through their integrative actions and their attention to the shift from exploration to exploitation.

Keywords: ambidexterity. frontline manager. open innovation.

RESUMO

Objetivo: O ambiente de negócios complexo e imprevisível exige que as organizações se tornem ambidestras. O objetivo da pesquisa foi investigar como (quais mecanismos) alimentam uma ambidestria dinâmica. **Metodologia/abordagem:** A partir de uma perspectiva processual, estudamos o caso de uma empresa incumbente que implementou ambidestria dinâmica, e os mecanismos que a suportaram. **Originalidade/relevância:** Pouco se sabe sobre os mecanismos organizacionais que permitem às empresas alcançarem a ambidestria de forma dinâmica e como ela se agencia ao longo do tempo, com o envolvimento de diferentes áreas da organização. Investigamos o caso de uma empresa referência mundial no setor siderúrgico (ArcelorMittal Brasil) que adotou ambidestria. **Principais resultados:** Concluímos que a flexibilidade para aprendizagem de áreas de apoio (como contratos e suprimentos) facilitou a adoção de práticas de exploração. Também identificamos que a rigidez nos procedimentos de gestão tradicionais, típicos de organizações incumbentes, combinados à pressão para resultados de curto prazo dificultaram, mas não impediram, o desenvolvimento das atividades de exploração. **Contribuições teóricas:** Identificamos a importância do *frontline manager* – ator pouco focado tanto na literatura quanto nas práticas gerenciais. **Contribuições para a gestão:** Identificamos a importância do *frontline manager* para viabilização da ambidestria. Ele o faz através de suas ações integradoras e da atenção na inflexão da exploração para explotação.

Palavras-chave: ambidestria. frontline manager. inovação aberta.

RESUMEN

Objetivo: El complejo e impredecible entorno empresarial exige que las organizaciones se vuelvan ambidiestras. El objetivo de la investigación era investigar cómo (qué mecanismos) alimentan la ambidexteridad dinámica. **Metodología/enfoque:** Desde una perspectiva de proceso, estudiamos el caso de una empresa ya establecida que implantó la ambidexteridad dinámica, así como los mecanismos que la sustentaban. **Originalidad/relevancia:** Se sabe poco sobre los mecanismos organizativos que permiten a las empresas alcanzar la ambidexteridad de forma dinámica y sobre cómo ésta se produce a lo largo del tiempo, con la implicación de distintas áreas de la organización. Investigamos el caso de una empresa de referencia mundial en el sector siderúrgico (ArcelorMittal Brasil) que ha adoptado la ambidexteridad. **Principales resultados:** Llegamos a la conclusión de que la flexibilidad para aprender de las áreas de apoyo (como contratos y suministros) facilitó la adopción de prácticas de explotación. También constatamos que la rigidez de los procedimientos de gestión tradicionales, típica de las organizaciones sólidas, combinada con la presión por obtener resultados a corto plazo dificultó, aunque no impidió, el desarrollo de actividades de exploración. **Contribuciones teóricas:** Identificamos la importancia del gestor de primera línea - un actor poco valorado en la literatura o en las prácticas de gestión. **Contribuciones a la gestión:** Identificamos la importancia del gestor de primera línea para hacer viable la ambidexteridad. Lo hacen mediante sus acciones integradoras y su atención al paso de la exploración a la explotación.

Palabras clave: ambidexteridad. gestor de primera línea. innovación abierta.

INTRODUCTION

Organizational ambidexterity encompasses the complex challenge of finding the balance between efforts to be attractive in the current business through alignment, efficiency and refinement – defined as exploitation – and efforts to be adaptive to a changing environment through experimentation, the pursuit for new opportunities and flexibility, identified as exploration (March, 1991). The positive association between organizational ambidexterity and variables such as innovation (Chen et al., 2014; Hwang et al., 2023), performance (Marín-Idárraga et al., 2022), and survival (Kim & Huh, 2014; O'Reilly & Tushman, 2013) is sufficiently documented (Sartori & Garrido, 2023), suggesting that ambidexterity may be a significant predictor of business success.

Consequently, the challenge of promoting and developing organizational ambidexterity emerges as relevant to contemporary strategic management. The literature describes three distinct approaches to how an organization can become ambidextrous: structural ambidexterity (O'Reilly & Tushman, 2008; Raisch & Birkinshaw, 2008), contextual ambidexterity (Gibson & Birkinshaw, 2004), and temporal or sequential ambidexterity (Boumgarden et al., 2012). Until recently, these three approaches have been treated as mutually exclusive alternatives (Sun et al., 2023). However, in contexts marked by the discontinuous changes that companies experience, maintaining a single approach may not be enough. It can result not only in misalignment with context, but also in paradoxes that deteriorate organizational performance (Smith & Beretta, 2021). Exploration and exploitation activities need to be aligned, allowing the evolution of ambidexterity over time so that the organization is continuously proactive in responding to new market challenges (Zimmermann et al., 2018).

Recent literature proposes a model of dynamic ambidexterity, which emphasizes the need for continuous interaction and evolution among the three approaches (Luger et al., 2018; Raish & Zimmermann, 2017). In essence, this concept argues that ambidexterity should rely less on the design of stable solutions and allow for dynamic reshaping to address the persistent tensions relating to exploitation and exploration (Zimmermann et al., 2015). This suggests that ambidexterity should not be viewed as a one-time event (Escorcia-Caballero et al., 2024), but rather as a continuous process integrated within the organization's operations (Frogeri et al., 2022).

However, little is known about the management mechanisms that allow companies to achieve ambidexterity in a dynamic way, especially those that enable feedback between exploitation and exploration. We still have little empirical evidence on how dynamic ambidexterity is cultivated and encouraged in organizations from traditional sectors (van Lieshout et al., 2021; Luger et al., 2018). Contextual factors, such as industry characteristics, influence the interaction patterns between exploitation and exploration (Sartori & Garrido, 2023). In addition, while there is a consolidated understanding of the role of senior management (Jansen et al., 2016; Campbell et al., 2025) and some advance in knowledge about the role of middle management (Greven

et al., 2023; Usman et al., 2024), theoretical-empirical research has neglected the relevance of operational leaders, who are responsible for the critical day-to-day operations of the organization, directly influencing the work of employees and answering to middle management (Curtis, 2023). Operational leaders, often seen as tactical executors who follow directives from senior management, have traditionally been characterized as peripheral and reactive implementers, with little involvement in strategy development or the design of ambidextrous organizational solutions (Zimmermann et al). Recently, the role of operational leaders in promoting organizational ambidexterity has been recognized, expanding the focus that was traditionally restricted to senior management teams (Mom et al., 2019). However, it remains to be fully understood how this role is played (Gianzina & Paroutis, 2025), especially considering that the emergence of ambidexterity at lower hierarchical levels is often mediated by the actions of senior management (Jansen et al., 2016).

Thus, we set out to investigate the following research question: *How do management mechanisms foster the development of dynamic ambidexterity in a traditional company?* To address this question, we started from four management mechanisms - strategic intent; senior management commitment and support; ambidextrous architecture, and vision, values and culture that constitute a cohesive identity - based on O'Reilly and Tushman (2016) and Chen (2017).

The object of study is the process of developing dynamic ambidexterity at ArcelorMittal Brasil. In this company, the strategic initiative "Charcoal Fines Challenge" emerged as an emblematic case. Initially launched in 2018 with a primary focus on the exploitation of operations in the BioForestry area, it eventually evolved into exploratory activities. This transition demonstrates the complexity of dynamic ambidexterity, showing how an initiative aimed at incremental improvements can, over time, generate significant and innovative changes in the production process of a traditional company.

Our study contributes to the theory of organizational ambidexterity by addressing the gap concerning its development within traditional companies. Specifically, we identified the management mechanisms that enable the transition between exploration and exploitation, highlighting the active role of operational leaders in the continuous reconfiguration of these activities. We demonstrated that dynamic ambidexterity is not only a reflection of senior management decisions but also results from day-to-day processes led by operational-level managers. From a practical standpoint, we offer insights on how traditional companies can structure strategic initiatives to reconcile short- and long-term demands, promoting both efficiency and innovation. Flexibility for learning in operational areas favors the adoption of new exploratory activities, whereas managerial rigidity and pressure for immediate results can limit, but not prevent, the development of exploration.

ORGANIZATIONAL AMBIDEXTERITY

The Origins of Exploration and Exploitation

In examining how contextual factors drive companies to continuously adapt to the market conditions and emerging technologies, Duncan (1976) was the first to introduce the term ambidexterity. He identified the core organizational tension as the need to engage in sufficient exploitation to ensure current profitability, while simultaneously dedicating energy to exploration to secure the long-term viability of the business. In his seminal work, March (1991) highlighted the importance of organizational learning for both activities. The essence of exploitation lies in refining existing knowledge and extending current competencies, technologies, and paradigms to support short-term performance. In contrast, the essence of exploration is rooted in experimentation and learning from new alternatives, derived from new knowledge bases that enable long-term sustainability.

Subsequently, March (1991) and other authors extended the concepts beyond the context of learning and knowledge (Gibson & Birkinshaw, 2004; Raisch & Birkinshaw, 2008). Lavie et al. (2010) suggest that exploration implies a change in the knowledge base and that exploitation is associated with existing knowledge in the organization. An organization develops exploration when it experiments with a new technology. When it repeats experiences or the application of knowledge already acquired, it practices exploitation. Therefore, exploration becomes exploitation in a certain moment (Lavie et al., 2010). Supporting this conceptual framework, Rothaermel and Deeds (2004) advocate for a feedback cycle between exploration- exploitation: whenever an exploratory activity ends, refinement activities naturally begin, which are identified as exploitation, making it difficult to delineate when one ends and the other begins.

Organizational Ambidexterity in a Dynamic Perspective

Balancing exploration and exploitation is challenging, as each activity entails conflicting—and often incompatible—requirements in terms of organizational structure, culture, performance objectives, and monitoring systems (Marín-Idárraga et al., 2022). Faced with these organizational tensions, three different approaches have been developed to help companies achieve ambidexterity by separating activities that promote exploration or exploitation in different structures (O'Reilly & Tushman, 2008; Raisch & Birkinshaw, 2008), or by integrating activities into a single unit in an ambidextrous context (Gibson & Birkinshaw, 2004) or by the temporal alternation between the two competing activities (Boumgarden et al., 2012; Sun et al., 2023).

Considering that organizational challenges can continue to be transformational, different ambidextrous approaches are necessary (Frogeri et al., 2022). This means that ambidextrous companies need not only to have the ability to deal with conflicting elements in their task environments, but also to nurture the monitoring of their external environments to proactively adapt exploration and exploitation (Chen, 2017; Walrave et al., 2017; Zimmermann et al., 2015).

The dynamic perspective places organizational ambidexterity as a capability-building process that is refined over time (Luger et al. 2018). This new conceptualization of ambidexterity emphasizes not only the balance but also synergies between exploration and exploitation activities. In this sense, a truly ambidextrous organization does not merely alternate between these activities; rather, it dynamically integrates the learning and outcomes from both. Exploration should fuel exploitation, driving continuous improvements and incremental innovation, while the knowledge acquired through exploitation should in turn, feed new exploratory cycles, strengthening organizational adaptation and competitiveness (Escorcia-Caballero et al., 2024). Chen (2017) points out seven dynamic practices that help foster ambidexterity: deliberate *vs.* emergent strategy; mechanistic *vs.* organic structure; performance-based rewards *vs.* tolerance for early failures; execution process *vs.* research; involvement of conventional customers *vs.* lead users; efficient *vs.* responsive supply chain; integrative *vs.* autonomous acquisition. From this perspective, for dynamic ambidexterity to be successful, we integrate the understanding of critical management conditions and mechanisms, as follows.

Development of Dynamic Ambidexterity

The four elements proposed by O'Reilly and Tushman (2016) outline an implementation model for ambidexterity. We will explore each of the four elements, integrating them into Chen's (2017) contribution.

Strategic Intent

Strategic intent predicts a desired future position and establishes the criteria the organization will employ to map its progress. Defined as the overriding element (O'Reilly & Tushman, 2016), empirical research indicates that the emergent process (Mintzberg, 1978) complements deliberate strategy and confirms strategic intent (Raisch & Zimmermann, 2017). This is one of the practices of dynamic ambidexterity enunciated by Chen (2017). The strategic intent needs to be convincing, to rationally justify the importance of exploration and exploitation actions. In addition, it must explicitly identify the assets and organizational capabilities that can be used to obtain competitive advantage through exploratory activity.

Senior management's commitment and support to the new venture

Supporting and safeguarding new ventures, that is, the exploratory activity, is crucial to ensure they are not perceived as a threat or a waste of resources in light of short-term demands. As the returns from exploration are uncertain and the rewards more distant, leaders of traditional companies, especially successful ones, often prioritize short-term goals and rewards. Sustaining long-term competitiveness, however, requires intentional leadership that remains committed to consistently supporting and funding new ventures (O'Reilly & Tushman, 2016).

Another mechanism to protect exploration is to establish control and management systems that keep pace with progress. Although such systems

are traditionally perceived as instruments for the use (exploitation) of existing resources, they can also be used to support exploration (Simons, 2010).

In an analysis of ambidexterity in the innovation process, Rosing et al. (2011) point out that, despite the planning and structuring of exploration activities, the implicit uncertainty makes it difficult to anticipate all stages, and planning needs to be continuously adapted (Blount & Janicik, 2001). Therefore, specific systems and processes are needed to ensure exploration and "long-term thinking" (O'Reilly & Tushman, 2016).

Ambidextrous architecture

Ambidextrous architecture addresses the challenge of effectively separating the mature, exploitation-focused side of the organization, so that the exploration-focused side can develop with its own structure and alignment—while managing the necessary interfaces to coordinate critical assets and resources. This element is endorsed by authors who advocate structural ambidexterity (Jansen et al., 2009) and is less relevant to those who adhere to the contextual approach (Gibson & Birkinshaw, 2004). Managing ambidexterity with cross-functional or project teams within a functional organization increases the likelihood that they will face political and cultural resistance, making it difficult to conduct exploratory business (O'Reilly & Tushman, 2016). The integration between exploration and exploitation activities is achieved by formal mechanisms, such as multifunctional interfaces, and/or informal ones, through social interactions (Jansen et al., 2009). Ambidexterity implies a balance between exploration and exploitation, whether by structure, time or context (Sartori & Garrido, 2023).

Vision, values and culture that constitute a cohesive identity

Despite the differing logics of exploration and exploitation, it is essential that all employees see themselves as part of a unified collective. Organizational culture plays a crucial role in guiding employee behaviors that support exploratory initiatives (Tripathi & Dhir, 2024). O'Reilly and Tushman (2016) argue that organizations must foster a shared vision and common values across both exploitation and exploration units to help individuals feel part of the same team, thereby cultivating a cohesive identity. While certain values and behaviors must be shared organization-wide, specific norms and practices may vary depending on the alignment required by each business context.

Synthesis

Based on the analysis of the four elements proposed by O'Reilly and Tushman (2016) and the practices presented by Chen (2017), we combined these two theoretical perspectives to broaden the understanding of how to develop dynamic ambidexterity. Table 1 shows this intersection.

Table 1

Management mechanisms for the development of dynamic ambidexterity

Elements proposed by O'Reilly and Tushman (2016)	Management practices for the implementation and maintenance of dynamic ambidexterity proposed by Chen (2017)
Strategic Intent	■ Encourage *emerging* strategies to create new exploration possibilities and use *deliberate* strategies to guide exploitation.
Commitment and support from senior management	■ Drive exploitation through performance-based compensation, while motivating exploration with incentives that tolerate failure and reward long-term success, even within exploitation units, to encourage employees to conduct exploration.
Ambidextrous architecture	■ Adopt mechanistic structures for exploitation units, and organic for exploration units, gradually discovering appropriate patterns of specialization and coordination. ■ Manage exploitation projects through execution and exploratory projects through research-oriented methodologies, such as the effectuation approach (Sarasvathy, 2008), the lean *startup* method, the *design sprint* (Knapp et al., 2016) and the agile process (Rubin, 2012). ■ Involve customers, recommending that conventional ones be considered in their exploitation projects and lead users in their exploratory projects. ■ Use different supply chains. ■ Carry out exploitative acquisitions, which are aimed at complementing core businesses, while exploratory acquisitions are aimed at developing new businesses.
Vision, values and culture that constitute a cohesive identity	■ All seven practices.

Note. Adapted from: *Lead and disrupt: how to solve the innovator's dilemma, by* O'Reilly III Charles A. and Michael L. Tushman, 2016, and *Dynamic ambidexterity: How innovators manage exploration and exploitation*, by Chen, Y., 2017.

From the perspective of strategic intent, the rationale is to leverage the organization's assets and capabilities in order to advance the most appropriate strategies. This mechanism allows managers to integrate emerging and deliberate strategies into exploration and exploitation activities, aligning them with ongoing contextual changes (Raisch & Zimmermann, 2017). The commitment and support of senior management is manifested through the adoption of various incentive mechanisms that foster both exploration and exploitation (Chen, 2017). The stability and reinforcements of managers in the forms of reward allow the creation of an incentive structure that facilitates the development of dynamic ambidexterity. For the management mechanism related to ambidextrous architecture, some practices proposed by Chen (2017) are the adoption of mechanistic structures for exploitation activities, and organic (with low levels of formalization and standardization) for exploration activities, and the implementation of different processes for the execution of exploratory and exploitative projects. In addition, the involvement of different types of clients in these types of projects and the use of different supply chains contribute to the ambidextrous architecture. The practice of acquiring other companies also legitimizes this mechanism, in the view that acquisitions must be considered in the exploitative or exploratory logic. In terms of the mechanism of vision, values and culture for building a cohesive identity, it can be understood that it encompasses all seven practices for implementing the dynamic ambidexterity proposed by Chen (2017). Managers play a key role in helping employees develop a common identity and vision of the future, even with sometimes different goals, depending on the alignment required by the business (O'Reilly & Tushman, 2016).

Although in recent years there has been a proliferation of research on organizational ambidexterity, important questions remain about the role

of leaders in its empowerment (Usman et al., 2024). In the ambidexterity literature, responsible for designing and influencing both exploitation and exploration strategies, and even influencing them with their emotional state (Campbell et al., 2025). There are also indications that middle managers, under servant leadership, have access to essential psychological and social resources, which can be leveraged to influence results of ambidexterity (Usman et al., 2024). According to the prevailing view in the literature, when senior management can balance exploration and exploitation activities at the organizational level, ambidexterity can spread to lower hierarchical levels (Gianzina & Paroutis, 2025). In most studies, operational leaders are portrayed as implementers, without exerting influence or engaging in ambidextrous solutions (Mueller et al., 2020). However, a few authors (e.g. mom et al., 2019; Tarba et al., 2020; Zimmermann et al., 2015, 2018) have recently emphasized the strategic importance of operational leaders in driving dynamic ambidexterity. According to them, operational leaders are required to coordinate exploration and exploitation activities and implement emerging opportunities (mom et al., 2019). These managers work directly with the teams and are closer to the customers and their demands, therefore, they have more contact with ambidextrous situations.

Prominent studies on organizational ambidexterity acknowledge that it can be driven by operational leaders who shape systems and processes to balance both exploitation and exploration (Zimmermann et al., 2018). This phenomenon is attributed to the fact that the development of ambidexterity at lower hierarchical levels is often considered to be driven by the actions of senior leadership (Jansen et al., 2016), rather than stemming from the active involvement of operational leaders. Despite the recognition of the importance of operational leadership in innovation processes, its specific role remains little explored in the management literature (Thøgersen, 2021). Also in practice, these leaders are not acknowledged as effective decision makers (Edgar et al., 2015) and are sometimes even stereotyped as lacking competence (Boehme et al, 2023). Therefore, little is yet known about understanding of how organizational ambidexterity unfolds as a dynamic, multi-level phenomenon (Mueller et al., 2020)—one that can also emerge from the bottom up, driven by the management practices employed by operational leaders as they navigate the challenges of exploration and exploitation (Mom et al., 2019).

METHODOLOGICAL PROCEDURES

Empirical research employed a qualitative approach to investigate a complex phenomenon: the development of dynamic ambidexterity. In order to explain the implementation of an ambidextrous strategic initiative in a traditional company in a basic sector, a single case study was carried out, ideal to investigate a current phenomenon, without prior systematic knowledge, and to answer questions of “how” or “why” (Yin, 2013). The research data were collected from the projects developed under the strategic initiative “Fines Reduction Challenge”, specifically those that advanced to the pilot phase. These projects, co-created with startups, addressed different challenges throughout the production process, allowing us to analyze the dynamics of organizational ambidexterity at ArcelorMittal Brasil.

Data collection and analysis

Data collection included secondary data (documentary records, such as presentations and company documents, videos, such as web series and podcast, posted on social media) and interviews, which were used to build the case history. Exploratory interviews were conducted with the person responsible for the strategic initiative and the other interviews with a wider audience, as shown in Table 2. In all, 16 interviews were conducted throughout different phases of the study. Data collection was conducted across three distinct phases: in November 2020, to gather initial information; in February and March 2021, through videoconferences, to understand the intermediate phases; and between July and September 2021, to obtain the final data of the development path. Using the "snowball" technique (Patton, 2002), the process begin with the person in charge of the initiative and their Business Partners (BP), who indicated technical managers for interviews. These persons then indicated other members of the teams, startup representatives, leaders and those responsible for other areas of the company. Participant selection was driven by the need to obtain relevant information to understand the case and ensure source triangulation in the reconstruction of the strategic initiative. Interviews were conducted individually, in a semi-structured format via videoconference, and were recorded. Each session lasted approximately 60 minutes, totaling 768 minutes of interview time.

Table 2.

List of respondents

Code	Position	Number	Duration	Time in the Company	Education	Date
ENTRV 01	Business Partner innovation Açolab	4	1) 46min 2) 57 min 3) 1h 03min 4) 38 min	1 year and 3 months	Engineering and graduate studies in finance	1) 11/04/2020 2) 02/04/2021 3) 07/01/2021 4) 09/09/2021
ENTRV 02	Production Technical Coordinator	2	1) 1h 07min 2) 1h 02min	11 years	Forestry engineering	1) 03/11/2021 2) 08/06/2021
ENTRV 03	Logistics Technical Coordinator	2	1) 1h 19min 2) 1h 06min	34 years	Agricultural Technician, MBA in Administration	1) 02/24/2021 2) 08/03/2021
ENTRV 04	BioForesttry Area Manager	2	1) 1h 06min 2) 43min	19 years	Environmental engineering, Master in forest entomology	1) 11/04/2020 2) 02/24/2021
ENTRV 05	Intelligence Manager and People Performance	1	1h20min	1 year and 8 months	Computer science and graduate studies in management (3)	07/01/2021
ENTRV 06	Founding partner of startup 1	1	1h 02 min	6 years	PhD in Materials Engineering.	02/Jun/2021
ENTRV 07	Founding partner of startup 2	1	54 min	3 years	Master in Materials Engineering.	06/23/2021
ENTRV 08	Senior Legal Counsel	1	45 min	5 years and 10 months	Law with postgraduate degree in Public Law	06/14/2021
ENTRV 09	Purchasing Manager	1	46 min	10 years and 3 months	International Trade and MBA	06/14/2021
ENTRV 10	Commercial Director of startup 3	1	36 min	10 years	N/A ???	06/22/2021

All recordings were transcribed and encoded using NVIVO. The first coding was performed following the temporal clustering strategy with the defined phases. Within each phase, each narrative was submitted to the deductive category (Hyde, 2000), within the four mechanisms of managing ambidexterity. After the first classification, the role of leadership was added as another category of analysis, which emerged inductively, according to the following examples.

Table 3

Analysis example

Categories of Analysis	Interview report
Strategic Intention	"We didn't stop with the briquetting, we continued to work and develop. It's a very challenging project. The difficulty is the binder because it needs to be strong enough to withstand the temperature of the blast furnace. It must reach 600/800 degrees, it cannot turn to dust in the blast furnace. But, if it works, it is a game changer in the coal sector " (INTERV 02).
Senior management commitment and support for the new venture	"These eight companies that stayed had all our support, from training on how to make a project, how to calculate the minimum viable product that was worthwhile, the MVP, legal support because it had a contract, NDA [non disclosure agreement], etc." (INTERV 04)
Vision, Values and Culture	"There's also the issue of culture. Sometimes people are resistant to change. Often, people do not believe, they have prejudice". (INTERV 04)

Empirical Context: ArcelorMittal Brasil and the Fines Reduction Challenge

ArcelorMittal Brasil is a world leader in the steel and mining sector, , with operations in 60 countries. In Brazil, the metallurgical industry has successfully integrated the use of charcoal, which has a positive carbon emission balance, which has driven efforts to enhance productivity.

The organization undertook a strategic initiative called the "Charcoal Fines Challenge", covering all stages of the production process, from the forestry area (planting, cultivation, drying the wood, transport to the furnace), through the carbonization process, to the plant. The initiative was developed at Açolab – ArcelorMittal Brasil's open innovation laboratory – through crowdsourcing, in which a broad challenge is launched to the market to submit ideas or proposals for solutions. Açolab is responsible for making the connection between the innovation ecosystem and the company's business opportunities. The initiative followed the phases summarized in Table 4.

Table 4

Phases of implementing ambidexterity

Phase 0	Phase 1	Phase 2	Phase 3	Phase 4
Identification of the strategic initiative: definition of the scope and indicators.	Launch/ Presentation of potential partners/ Definition of the chosen ones.	Signing of the technical collaboration agreement with the startups. Laboratory tests of the chosen ones and Demo-day.	Development of projects and tests on an industrial scale. Measurement, analysis and definition of which ones to implement.	Definitive implementation.

For our study of ambidexterity, this strategic initiative proved to be ideal because it addressed an important improvement challenge for the company, which also became a fundamental change for the charcoal development process. It is a different case from what the literature advocates: it began as an exploitation activity and became exploration.

RESULTS

ArcelorMittal Brasil began investigating charcoal in 2013, when the production of fines was identified as its main challenge. To address this issue with innovative solutions, innovation programs were created, supported by campaigns to attract ideas and boards for the selection of projects and the open innovation initiative.

Initially conceived as a strategic initiative focused on the exploitation of the current operations of the BioForestry area, the Fines Reduction Challenge gave rise to exploration activities at ArcelorMittal Brasil. Launched in September 2018, its outreach campaign achieved received significant media attention, with over 50,000 views and 56 registered projects. After a few rounds of selection, seven projects co-created with startups and responding to different problems throughout the fines production process were initially approved, as listed in Table 5. Of these, only four made it to the pilot stage: 1 - the air injection control project for carbonization using valves; 2 - the curves project; 4 - the impact attenuation/damping attenuation project;.8 - the design project that evolved into the construction of the first fully plate-based furnace. At the time of completion of this research, the projects were in different stages of implementation. Only one of the seven original projects passed "officially" to the implementation phase. It is the simplest project, without the use of advanced technology, with little need for investment by the company and with results within expectations. The others are still being completed and continue to provide learning opportunities during their implementation.

Table 5

Projects co-created with startups under the strategic initiative

	Project	Objective	Process
1	Valve project	Control of air injection in carbonization.	Carbonization
2	Curve project	Optimization of wood drying in the furnaces.	Carbonization
3	Skip project	*Roll-on/roll-off* skip system to reduce charcoal handling and minimize fines generation.	Transport and storage
4	Impact /damping / attenuation project	Feed chute that halves the height in charcoal loading. Feed project to reduce the charcoal drop height by half during loading operations.	Transport and storage
5	Film project	Anti-dust coating to enhance charcoal resistance.	Transport and storage
6	Particle size distribution measurement project.	Accurate reading of the amount of fines and automatic recording of the measurement.	Measurement
7	Briquette design	Production of a briquette using eucalyptus bark as an alternative to charcoal.	Co-product
8	Plate furnace project	Adequate control of oxygen injection	Carbonization

During the strategic initiative, new opportunities emerged, both for productivity improvement (exploitation) and radical innovation (exploration). We observed that, under pressure for immediate results, the operational areas prioritized the exploitation efforts. At the steel plant, there was less effort to engage in exploration activities.

In the *air injection control project for carbonization using valves* (1), the results of laboratory-scale tests validated the use of the valve, but not in the actual furnaces. Several adjustments were made to its components, which would require a greater investment, pending approval. During the tests of the valves in the furnaces, the operational leaders identified the possibility of adapting them for use in another equipment, the gas burner. After statistical validation, this adaptation advanced to the implementation phase in some units.

The drying optimization curves project (2) was implemented as the tests progressed, due to the need to install the monitoring system and to provide training for the teams. However, during the testing phase, challenges related to inconsistencies in production controls emerged. The professionalization of the monitoring process was essential to overcome these difficulties, generating new knowledge and skills (exploration). As a result, a design review led to the implementation of an automated operational control, which improved productivity and reduced carbonization time. This cycle demonstrates that, in practice, exploration and exploitation do not occur in a linear way, but rather in an interdependent way, feeding back throughout the process.

Both the *valves project* (1) and *the curves project* (2) brought advances to the BioForesry area as a whole, in addition to providing an expansion of the original strategic initiative.

The *impact/attenuation damping project* (4), to reduce waste during transportation was also successful, thanks to a collaborative partnership to build a new type of trailer. This innovation could lead to a hared patent in the future. Multiple design adaptations were required during industrial-scale testing to statistically validate the benefits for the company. These ranged from adjustments to the valve electronic components to a complete redesign of the project. The adaptations generated learning that led to new, unforeseen opportunities, creating cycles of exploitation-exploitation.

In *the briquette project* (7), there was an expectation of a breakthrough innovation aimed at developing a new business. However, the departure of the operational leader (the project's initial technical coordinator) led to a shift in priorities, as his/her replacement focused on routine production activities. This project was then discontinued.

In the *plate furnace project* (8), an innovative furnace was developed in six months by a startup. It stood out for its unique design and material and was described as a radical innovation. Built during the Covid-19 pandemic, it faced logistical challenges and initial operational failures. After adjustments and specialized consulting, the furnace had its operation stabilized, proving to be crucial for the automation of carbonization (Interviewee 03). Not initially contemplated in the selection, this project emerged after the proposal of valve and curve projects, and exemplifies the dynamics of exploitation followed by exploration, materializing dynamic ambidexterity.

DISCUSSION OF THE RESULTS

We will discuss these results in light of the management mechanisms that made dynamic ambidexterity possible, as listed in Table 6: Strategic intent, Commitment and Support of senior management with the new venture, Ambidextrous Architecture, and Vision, Values and Culture that constitute a cohesive identity.

Table 6

Dynamic ambidexterity management mechanisms identified in the case

Constructs	References	Empirical Evidence in the Case
Strategic Intent Definition of the ambidextrous initiative	March (1991); O'Reilly e Tushman (2016); Lavie et al. (2010); Rothaermel e Deeds (2004); Raish e Zimmermann (2017); Zimmermann et al. (2018); Chen (2017).	The company has deliberate strategy initiatives, but is open to emerging strategies, increasing the possibilities of exploration and exploitation activities: ■ The continuity of the briquette project, despite not having passed the laboratory tests. ■ Emergence of new *bottom-up* projects, such as the construction of a plate furnace (project 8). ■ The identification of both exploitation initiatives, followed by exploration, as well as exploration, which generated exploitation initiatives.
Commitment and support from senior management	O'Reilly e Tushman (2016); Rosing et al. (2011); Blount e Janicik (2001); Chen (2017); Simons (2010); Jansen et al. (2009); Gibson e Birkinshaw (2004); Simpson e Tamayo (2020)	Encourage exploitation through performance-based compensation, while motivating exploration with incentives that tolerate failure and reward long-term success—even within exploitation units—to encourage employees to conduct exploration. ■ The critical tasks of encouraging innovation included in the methodology structured by Açolab were identified. The people involved in the projects that prevailed demonstrated more entrepreneurial skills and motivation for innovation, although not all projects were prepared to incorporate innovations from exploration. ■ "The successful plans have been constantly adapted. ■ There was a clash of procedures and rules used in the management of exploitation projects versus speed and dynamics of exploration processes. ■ One project did not advance (briquetting) due to the lack of technical monitoring and funding for laboratory tests. ■ For employees in general, the lack of performance measures related to innovation made it difficult to explore. ■ The instruments of control systems traditionally used for resource exploitation did not support the exploration of potential resources and new opportunities. ■ There were no practices to encourage the development of initiative or to tolerate failure and reward long-term success.
Ambidextrous architecture	Gibson e Birkinshaw (2004); O'Reilly e Tushman (2016); Jansen et al. (2009); Chen (2017); Sarasvathy (2008); Knapp et al. (2016); Rubin (2012)	Organic vs. mechanical structure: the company adopts mechanistic structures for exploitation units, and organic ones for exploration units, gradually discovering appropriate patterns of specialization and coordination. It manages exploitation projects by execution and exploratory projects through research-oriented methodologies such as the effectuation approach, the lean startup method, *sprint design* and the agile process. ■ Contextual ambidexterity was achieved, positively related to performance, despite the size of ArcelorMittal Brasil. With more than 50,000 suppliers, the company was able to rethink and readjust its *startup* hiring processes. ■ Ambidexterity was exercised through cross-functional teams (or projects) within the functional structure. ■ In the carbonization process, it was necessary to separate the innovation function from the operational leader (area coordinator), which helped to overcome resistance and generate new innovative projects. ■ In the logistics area, the carriers were incorporated as part of the project 4 team, showing flexibility in adapting the work structure. ■ The development of emerging exploration and exploitation projects have been integrated through coordination mechanisms.

Constructs	References	Empirical Evidence in the Case
Culture, values and cohesive identity	Andriopoulos e Lewis (2009); O'Reilly e Tushman (2016); Rosing et al. (2011); Smith et al. (2011); Zimmermann et al. (2018)	Culture with tolerance for initial failures encouraging the team to explore; adapted management based on data and research: ■ The purpose of ArcelorMittal Brasil created a direction that boosted performance. ■ Some rules and procedures have been adapted in BioForestry and in the corporate areas. ■ Entrepreneurial culture and experimentation in Bioforestry, but it needed resilience for implementation. ■ Innovation processes were non-linear, developing in exploration and exploitation cycles, requiring people to manage resulting tensions. ■ Operational leaders (coordinators) continuously adapted and aligned themselves with organizational contexts, enabling them to effectively manage tensions in their day-to-day activities.
Ambidextrous Leadership	Zimmermann et al. (2018)	Dynamic analysis considers that organizational challenges can continue to be transformational, and do not need to remain stable over time. ■ People responsible for Açolab and the board of directors created a favorable environment, with no barriers to innovation. ■ Constant communication inspiring the development of new ideas. ■ ArcelorMittal Brasil has defined a cross-functional team to deal with exploration and exploitation. ■ The team experienced change in leadership and was unable to establish itself (briquette project). ■ Radical emerging projects with leadership participation. ■ Operational leaders (coordinators) constantly adapted and aligned themselves to organizational contexts.

About strategic intent

The strategic initiative called the Fines Reduction Challenge was launched by ArcelorMittal Brasil, in 2018, through Açolab, as an open innovation. It emerged as a consequence of the global target set by Aditya Mittal, President of ArcelorMittal, to be carbon neutral by 2050, as published on September 20, 2020, at the Financial Times Commodity Conference. It was operationalized through seven initially approved projects. However, financial and unforeseen issues, such as the Covid-19 pandemic, led to the decision to discontinue three projects. At the same time, there were specific decisions that strengthened the effectiveness of the initiative, one of which was the incorporation of a new project related to the design and construction of a plate furnace (project 8), whose potential would mean a great technological advance in the charcoal industry:

> *A sealed furnace represents a huge technological advancement. Currently, we make our furnaces more or less sealed through intensive effort—every cycle requires extensive patching and sealing work. (INTERV 02).*

Another incorporation was the briquetting project, which, despite not proving viable in laboratory tests, continued with new tests due to its strategic relevance:

> *We're not stopping with briquetting, we're continuing to work and develop. It is a very challenging project, but if it works it is a game-changer for the charcoal sector. Depending on the associat-*

> *ed costs, it is worth grinding the charcoal and making only briquette. It is a very complex project, involving many variables, requiring a high initial investment in machinery because the process needs to be extremely controlled, etc. (INTERV 02).*

Since the pre-launch, there has been a clear definition that the strategic intention of the Fines Reduction Challenge would be to reduce the percentage of fines in the production process, prioritizing preventive actions. This intention is characteristic of an exploitative activity. The company's expectation was the development of incremental innovations. Radical solutions, such as the agglomeration of briquette with fines, which could lead to a new business opportunity, were possible. The intention was clear to the people involved, but it was negatively affected by the leadership's decision to suspend three projects. It can be said that there has been an extrapolation of the initial strategic intention, moving away from the exclusive focus on cost and productivity, typical of exploitation activities, to a focus on innovation, characteristic of exploration activities. New projects emerged, typical of dynamic ambidexterity (Chen, 2017) and extrapolated those initially defined.

On the commitment and support of senior management to the new venture

The second management mechanism to implement ambidexterity is to take care of the new strategic initiative so that it can evolve. ArcelorMittal Brasil, through Açolab, structured a specific methodology and ensured its implementation. Those involved initially met with interested startups, generating an increase in listening to potential innovations brought to ArcelorMittal Brasil from other industries. In the case of the BioForestry area, the initial stimulus led to the development of new skills and the engagement of teams that generated everything from simple improvements (exploitation) to changes in the charcoal production model, motivating teams to create and innovate (exploration).

Teams reported that during the pilot stages they were encouraged to experiment and propose changes to the projects. However, any new investments required the approval of the area leader responsible for providing funding. Flexible and dynamic posture was reported, with risk taking, but accompanied by anxiety and concern, and errors occurred throughout the process. In at least three projects, senior management made risky decisions, and implementation took place under conditions that diverged from the initial plan. As an informant's statement attests:

> *I think this culture of innovation only has weight if there is a leadership engagement. From our CEO, through general management, to our manager preaching almost daily, at all times. Our leadership is very engaged in this process. (...) I've been with the company for thirty-odd years and I'm the greatest witness to this (INTERV 03).*

The discontinuity of the project, which was initially seen as one that could become an exploratory business (*briquetting project*), corroborates that it did not receive support from senior management, especially after the operational leader left the company. On the other hand, the *control project*

with valves was used in other units. This is evidence of the dynamism of ambidexterity in traditional companies, in which projects can be changed or discontinued for different reasons.

We found that the testing phase was the most challenging for project continuity from the point of view of senior management support, because it involved transforming ideas into actual products and processes on an industrial scale, requiring intentional actions to offset short-term pressures - exploitation for exploration. The management and control systems used demanded rigid and mechanistic control, contrasting with the typical uncertainties of exploration (Blount & Janicik, 2001). The teams expressed difficulty in meeting less flexible schedules and budgets (Blount & Janicik, 2001; Rosing et al., 2011). There was a clash between the procedures and rules used in the management of traditional projects *versus* the speed and dynamics of innovation projects (Chen, 2017; Rubin, 2012; Sarasvathy, 2008). Dealing with error, reviewing and redoing, not complying with schedules and budgets caused disappointment in traditional management, impacting the motivation of the teams. The autonomy of the area's leadership was manifested in several opportunities. The case studied here contradicts Simons' (2010) assertion, which suggests that control system instruments traditionally used for exploitation could also be used to support the exploration of potential resources and new opportunities. The rigidity of control systems aimed at managing existing activities was a perceived difficulty for the development of dynamic ambidexterity:

> *We work with both physical and financial schedules, tracking the time commitment of the people involved and the overall project costs. However, it's not like purchasing an off-the-shelf technology solution where costs are clearly defined through a contract with a company. In our case, we're trying to develop something new—something that carries the risk of not working out. There's a real possibility that we could invest all this time and money and still not end up with a viable product. Of course there is learning, but not necessarily with a viable product. The main difficulty I see is within this schedule and cost estimates. It is not as if we do not need to incur any cost, we need to have a very well calculated order of magnitude of costs, but on the other hand it is very difficult to have this cost 100%. (INTERV 02).*

Another aspect to be highlighted is related to the viability of investment. Three approved projects were suspended, among other reasons, due to a lack of financial feasibility. In some cases, there was a need to renegotiate investment (CAPEX, "capital expenditures"). As there are no specific processes suggested for innovation projects, it was necessary to go through the approval bureaucracy typical of mature projects. Thus, we identified another challenge of ambidexterity in traditional companies: the senior management's intention to support exploratory initiatives often runs up against the inherent bureaucracy in decision-making processes, such as those for approving large resources.

We confirm the impact of evaluation and reward systems on securing senior management support. We observed that the absence of innovation as a criterion in the definition of goals in the units made it difficult to imple-

ment exploratory projects. Furthermore, we did not identify any additional incentive systems promoting ambidexterity at ArcelorMittal Brasil (Chen, 2017; Simpson & Tamayo, 2020).

The people responsible for implementation were involved from the early stages of the projects (Jansen et al., 2009), enabling a gradual alignment of the areas with the innovation to be adopted. In *the impact/damping attenuation project* and in the *curves project*, the impacted areas received training, and the projects were implemented while the tests were carried out on an industrial scale. In the *plate furnace* project, in which this involvement did not occur from the beginning, we observed that the operational leaders (coordinators) faced a series of tensions, which could have been mitigated if the areas had been prepared. Raisch and Zimmermann (2017) warn that implementing ambidexterity requires well-connected operational leaders who are behaviorally and cognitively prepared to deal with the problems of a new venture.

Some operational leaders (coordinators) and middle managers (area leaders) acknowledged that they initially had a negative view of ideas coming from outside the business, but that they changed after the relationship with startups. With greater openness to collaborate, they began to understand that the solutions could bring inputs to the various stages of the process, complementing each other. One of the startups also acknowledged that the leaders, especially those responsible for Açolab and the board of directors, inspired the development of new ideas:

> *They did a very good job in many ways. This outreach that begins with this startup environment through Açolab, bringing people and their collaborators to the center, showing in different ways even in the media... this one matters! It creates a "twinkle in the eye" aspect in the very people who feel they own the company and the processes. We work with people who believe in what they're doing—who want to drive change. Sometimes there's no immediate financial return, but they're motivated by the opportunity to create impact, disrupt internal processes, and make things better. It's very interesting (INTERV 06).*

When the teams were formed and the project leaders appointed, the operational leaders showed commitment to the innovations, resolving tensions and getting involved in the implementation of the initiative. During the testing phase, several tensions occurred, some were overcome, while others led to frustration. The most common tensions were over the conflict of strategic initiative *versus* mature business. However, these challenges served as learning opportunities in the teams' daily operations. We cannot affirm that specific HR practices were mobilized to "increase the capacity and motivation for ambidextrous behaviors among operational managers" (mom et al., 2019, p. 3027).

About ambidextrous architecture

To implement the strategic initiative, ArcelorMittal Brasil set up cross-functional teams to oversee the projects. Each team included a main coordinator from Açolab, a sponsor, the mid-level manager from the BioForestry area,

common across all projects, and a technical coordinator from the specific operational area serving as the operational leader. The operational leader mobilized the other employees and coordinated the interfaces between the areas, which was fundamental for a better understanding of the Challenge and the functioning of the company's processes. From the outset, the implementation of the strategic initiative had a significant impact on the corporate support areas, such as supplies, legal and others, which had to restructure their way of working to make the relationship with the startups viable. A multidisciplinary team was formed to define the form of hiring startups, proposing solutions to enhance the partnership. It was necessary to adapt internal procedures, up to a certain level of informality:

> *We've been going through a growth phase in our contracting process. In practice, it felt almost like a "war room" scenario—several days of intense discussions focused on rethinking our contracting workflow. Early on, we brought together multiple departments to get a comprehensive view of the situation and identify potential areas for improvement and value creation (INTERV 08).*

ArcelorMittal Brazil challenged conventional expectations in the literature by creating this team, integrating support functions such as legal and supplies. This enabled greater process flexibility and played a critical role in successfully implementing the initiative. They used existing assets and capabilities on the mature side to gain a competitive advantage in the new business. This constitutes a new finding, which is the development of ambidexterity in the functional support areas, going beyond the specific and expected locus of the business areas, in this case the BioForestry area.

The project teams were created with the responsibility of mobilizing the area's resources (people and financial) internally, when necessary. Several authors (O'Reilly & Tushman, 2016; Tarba et al, 2020) warn that managing ambidexterity with cross-functional or project teams within a functional organization increases the likelihood of facing political and cultural resistance, given that exploitative and exploratory activities compete for resources and require compensation. In the case studied, we identified three different configurations. In the carbonization process in which more projects were developed and tested and with a greater degree of innovation, they structurally designated a person in charge within the area. He was an operational leader dedicated to the exploration project, allowing greater tolerance for error and with some autonomy to take risks, which expanded the innovative degree and the emergence of actions and projects specific to dynamic ambidexterity. ArcelorMittal Brasil successfully enabled a level of autonomy that allowed for the development of new ideas driven by a different mindset—while maintaining integration. This approach leveraged existing assets and capabilities to create competitive advantage.

The *briquette project*, until the end of this research, had not left the laboratory tests. One possibility for this scenario is that there is no dedicated operational leader. The *impact /damping attenuation project*, on the other hand, did not require an exclusive focus on innovation separate from the routine due to its exploitation characteristics. However, there was a partial delay in the project timeline. However, regarding the team structure, this situation allowed us to observe the incorporation of a new member, the carrier,

co-owner of the invention. Thus, we saw the flexibility of adapting the team as another component of ambidexterity and the dynamically ambidextrous company, as standards are gradually established:

> *If the solution proves successful, we'll need to adapt all skips accordingly. However, the fleet is not owned by us—we rely on third-party carriers. In fact, one of those carriers is partnering with us on this project; we modified one of their skips to make the project feasible. We need to be sure of the test results to know what the implementation will be like (INTERV 01).*

Another aspect that becomes relevant in the implementation are the rules and procedures demanded by the organization also for innovation projects. For example, when a project required additional capital investment, it needed to be included in the subsequent annual planning and was validated after going through several stages, as one interviewee revealed to us. This delayed the implementation, which at first would require agility:

> *The change is happening gradually and in an organized way, i.e. there is a plan which, obviously, is validated by the production area, the control area and aligned with the CAPEX strategy to support the necessary investments (INTERV 04).*

As happened in the *curves project*, the employees of the areas are not always open to the new roles required by the changes in routines. This creates a challenge for the organization, which must deal with exploitative practices to the extent that it encourages exploration in a dynamic way. The implementation of *the new furnace project* requires fewer employees and with different skills. This situation creates conflict between the project developers and the employees of the existing operation, because those with more seniority in the routines are often the least open to automation.

Vision, values and culture that constitute a cohesive identity

At ArcelorMittal Brasil, the culture of operational efficiency prevails. The system for managing, evaluating and recognizing exploration followed the traditional method of controlling projects - which require a high degree of reliability and focus on production volume, such as physical (man hours) and financial (project cost) schedules - which was not always suitable for evaluating exploration.

The strategic initiative of fines generated resistance regarding the interest of employees but ended up becoming an invitation to change the culture. The reports indicated that the culture of innovation is in the process of maturing. However, the attitudes of the people involved stand out, especially those of the operational leaders, who were critically involved in the development of the innovation projects.

The company offered support to startups, from training on project design, calculation and production of MVP (minimum viable product), to legal support for the contract. The Bioforestry area developed the solutions with startups, aligning projects and approaches. There are several reports of reactive behaviors and attitudes:

> *There's also the issue of culture. People are still resistant to change. Often, people do not believe, they have prejudice. They say: "I've been studying this for 30 years—I'm not going to take direction from some kid with big glasses who looks like a wannabe Professor Gadget telling me what to do." (INTERV 03).*

When developing the projects with the startups, the charcoal production areas gradually realized that they had specialized, useful and relevant knowledge. Those responsible for Açolab created an environment conducive to new ideas. The startups felt welcomed and saw participation in this initiative as a business opportunity, recognizing it as a lever in their development:

> *We did our proof of concept, and that was a major turning point for us. After almost a year of doing our POC (proof of concept), our turnover has already increased fivefold, and we expect it to grow even more next year (INTERV 07).*

When carrying out the tests on an industrial scale within the plant for the *impact/ damping attenuation project*, resistance was countered with communication and training, highlighting the strategic importance of adjusting and incorporating new values into existing activities. The project was put on hold for over a month when one of the measuring equipment broke down, as it was not a priority for the existing business. For the final adoption of the project, confirmation of financial gain was required, based on strict evaluation criteria. The team's openness to experimentation and the search for solutions in an agile way (trial-and-error) was evident, strengthening the culture of exploration, according to the interviewee's report:

> *When we plan, we try to foresee everything that could go wrong, but even if we manage to foresee a good part, we can't foresee everything. We must adapt, change, evolve. That's what this experience has been like (INTERV 02).*

It is interesting to note important changes in the values and behaviors of the corporate support areas (legal and supply), which have demonstrated a willingness to operate with greater agility, flexibility, and a degree of informality. This reflects a clear intention to actively support innovation across the organization. This was a first indication of the impact of the strategic initiative on corporate culture. The startups confirmed that ArcelorMittal Brazil, through Açolab, made it possible to create smooth connections with them and successfully influenced changes in the company's practices—with no major inconvenience in hiring or collaboration. This was especially noteworthy given the unique challenges posed by the COVID-19 pandemic.

> *This early engagement, the ease of transit and the ongoing efforts to reduce the "bureaucracy" — that the business had precisely because it was structured for a very robust supply chain and now needs to relate to a much more agile environment and much more flexible. At the same time, there's a need to assess whether this increased level of informality may pose any risks to the business. Given these*

> *needs, there is a new vision and a pre-disposition of the business, because all areas of the company are getting involved. It is a culture that is being generated within the company. (INTERV 09).*

Interestingly, we identified more characteristics of a culture focused on exploration in the carbonization area, in which the team reported greater openness to experimentation, showing flexible attitudes and behaviors, seeking solutions in an agile way and assuming limited risks, when necessary. The competence to innovate is the result of experimentation with a "twinkle in the eye", as described by the representative of one of the startups (interviewee 06). The need to exploit and the opportunity to explore energize passion and foster discipline in employees, creating individual knowledge (Andriopoulos & Lewis, 2009). For example, the *plate furnace project* emerged as the team's proposal for a radical change in the carbonization process, originating from the startup's expert knowledge. It is the exploration of new knowledge, along with exploitation efforts, generating learning synergies that feed virtuous cycles of ambidexterity (Andriopoulos & Lewis, 2009). However, the teams also mentioned the high effort required. The operational leader commented that, in addition to learning to live with constant change, it requires questioning some beliefs, such as that "things can't go wrong at ArcelorMittal Brasil" (interviewee 01).

Thus, we can point out that the existence of a cohesive identity of the different exploration and exploitation units can help align ambidexterity in traditional companies, but not without conflict. Some areas end up being more open to the risks and possible gains of exploratory innovation, while others remain conservative. A cohesive identity helps settle disputes but does not eliminate them.

FINAL REMARKS

This research aims to study how the development of dynamic ambidexterity at ArcelorMittal Brasil took place. In this sense, the unfolding of ambidexterity was examined not as a single event, but as part of a strategic initiative that seeks to adapt to the constant changes in the context.

We found that the organization leveraged organizational ambidexterity by engaging different areas in the challenge of scaling up exploitation beyond the initially assigned teams. This process was more successful in the corporate support areas, while it encountered greater difficulties in the main business area. The flexibility to learn of the corporate support areas (such as contracts and supplies) facilitated the adoption of innovative activities and the adaptation of procedures. However, rigidity in management procedures and instruments, including schedules, performance evaluations, and policies for resource approval, combined with pressure for short-term results of exploitation activities – especially at the plant – has hindered, but not prevented, the development of exploration activities. There were no significant changes in procedures or project management between different types of activities, nor was there direct involvement of customers. Finally, this study showed concrete cases in which exploitation initiatives evolved into exploration, as observed in the valve and impact/ damping attenuation projects.

An important theoretical contribution of our study deals with the importance of operational leaders to enable dynamic ambidexterity (Escorcia-Caballero et al., 2024), through their integrative and proactive actions. This is a significant addition, besides the reactive role highlighted in many previous studies (Jansen et al., 2016; Gianzina & Paroutis, 2025). The presence of a technical manager with an exclusive innovation function within the cross-functional team, "separate but also integrated", without competing with the routine, seems to be decisive for the success of ambidexterity initiatives. It is necessary to recognize that, to launch an initiative of this magnitude in a traditional company, senior leadership needs to demonstrate sufficient appetite for risk to welcome various innovation projects with different objectives and proposals. However, it can be said that the impact of senior leadership support weakens as the implementation phases progress, and decisions are left to the middle manager. The performance of the operational leader stands out, especially in times of greater complexity at the operational level. Although not explained in the model of O'Reilly and Tushman (2016), it was evident in this research the fundamental role of operational leaders for the development of ambidexterity. The authors recognize the role of senior management, but did not identify, as Zimmermann et al. (2018) did, the role of the operational leader. Even while admittedly important for innovation, their role was unclear (Thøgersen, 2021). In line with Annosi et al. (2024), these managers play a critical intermediary role, promoting alignment between short- and long-term activities and facilitating interaction between different units and groups within the organization. Operational leaders are key to giving teams a voice, discussing problems that result in new opportunities and allocating resources to support ambidexterity (as in the case of building a new furnace and using the valves on the gas burner). The configuration activities of operational leaders have a greater impact than the initial decisions of senior management, as they continually adjust to organizational contexts, using personal, social and behavioral factors to promote ambidexterity (Gianzina & Paroutis, 2025). In this way, a spiral path is built in which, thanks to operational leaders, tensions between existing and new processes are resolved. We infer that there are leaders more suitable for exploitation activities, averse to risks, also very necessary in ambidextrous organizations.

As for the conditions listed by Chen (2017) for dynamic ambidexterity, we expanded the existing literature by identifying the management mechanisms that allow the emergence of exploratory activities from initiatives initially aimed at exploitation. Flexibility in the composition of the cross-functional teams responsible for exploration is decisive, since it allows adjusting structures according to needs (organicity) and compensates, albeit partially, for the lack of clear incentives for exploration activities. Another mechanism relevant to dynamic ambidexterity refers to diversification in supply chains, which contributes to the expansion of innovation possibilities. By adapting supplier hiring procedures and incorporating new suppliers, changes in supply chains can support ambidexterity dynamically. Thus, we conclude that the dynamism existing in a traditional company, analyzed in the light of Chen (2017), reflects a rhythm that aligns with the characteristics of the organization. Although the predominant bureaucracy in exploitation activities can hinder the agility necessary for exploratory strategies, it does not necessarily prevent exploration from taking place.

For practice, in addition to clarifying the importance of the role of the operational manager, stereotyped by the company and HR (Boehme et al., 2023), our contribution refers to the importance of moving between the phases of developing ideas to their execution. In successful projects, we have identified the engagement of employees working in the operation with the strategic intent, the use of less rigid control systems with tolerance for error, time and resource controls that consider the unpredictability of innovation, and stable funding for innovation.

The research has the intrinsic limitations of a case study, and of choosing a company in a context that is not very dynamic, which is why we encourage future research to analyze initiatives in companies in sectors that require greater agility in terms of change and response. Although we identified the importance of the role of the operational manager for dynamic ambidexterity, our research did not investigate its micro-foundations. We suggest that future research investigate the individual characteristics of leaders (Tuncdogan et al., 2024), which lead to behaviors that favor exploitation or exploration, as well as teams that can deal with ambidexterity in their activities (Jansen et al., 2016).

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Publishers

- Rosalia Aldraci Barbosa Lavarda
- Leandro Dorneles dos Santos

History

Recieved:	17-06-2024
Approved:	26-03-2025
Published:	22-04-2025