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Unveiling the drivers of digital intrapreneur behavior in the Peruvian mining sector: Insights from employee perceptions

Renata Vizcarra, *Universidad del Pacífico, Lima-Peru*, RS.VizcarraT@alum.up.edu.pe

Christian Fernando Libaque-Saenz, *Universidad del Pacífico, Lima-Peru*, cf.libaques@up.edu.pe

Abstract

Despite the growing emphasis on digital transformation in the global mining industry, intrapreneurial engagement among employees remains uneven. As digital intrapreneurship is still an emerging concept, its theoretical and empirical foundations continue to evolve. This study contributes to the literature by exploring digital intrapreneurial behavior from the perspective of employees in the Peruvian mining sector. Using a K-means approach, three distinct employee segments were identified based on their perceptions of Individual, Situational, Organizational, Intrapreneurial Work Practices, and Digital Technology dimensions influencing digital intrapreneurship. Notably, employees who perceived the strongest environmental support reported the least intrapreneurial activity, while those with moderate or limited perceptions about their environment demonstrated greater initiative. Regression results reinforced this pattern: the individual dimension emerged as the strongest and most consistent predictor across intrapreneurial stages, whereas the organizational dimension showed negative associations. These findings challenge conventional assumptions about the role of support structures, highlighting the importance of individual agency and awareness of constraints. The results offer actionable insights for designing targeted strategies to foster sustainable digital intrapreneurial behavior in Peru's mining industry.

Keywords: Digital intrapreneurship, typology, mining sector, Peru, employee perceptions

Introduction

One of the major challenges faced by companies today is sustaining long-term competitiveness in highly volatile and dynamic environments (Kaganer et al., 2023), with innovation and value creation serving as strategic levers for organizational differentiation amid rapid digital transformation (Kuratko & Morris, 2018; Pardo, 2025). Within this context, intrapreneurs—employees who transform ideas into innovations inside their organizations (Pinchot & Soltanifar, 2021)—play a critical role. Iconic examples like PlayStation, the iPod, and Gmail illustrate the value of internal entrepreneurial initiatives (Pinchot & Soltanifar, 2021). A more recent profile has emerged, the digital intrapreneur who use digital tools and media as critical components of these initiatives, ranging from strategic transformations to smaller process improvements. For example, digital intrapreneurs may drive value by tailoring customer experiences, strengthening supplier partnerships, leveraging data analytics for decision-making, automating diagnostic and operational tasks, and streamlining logistics and process control, alongside other initiatives.

Consequently, digital intrapreneurship has been identified as a key driver of organizational adaptation and competitiveness (Opland et al., 2022), with employees playing a vital role in advancing digital

transformation (Bitzer et al., 2021). However, fostering such behavior requires establishing appropriate conditions and incentives (Boston Consulting Group, 2021), which vary considerably across industries: while digital sectors can readily adopt agility, collaboration, and “fail-fast” approaches, traditional and highly regulated industries face significant obstacles to implementing such initiatives (Javanmardi Kashan et al., 2021; Kumar & Pathak, 2021; Radebe & Duh, 2023; Radebe, 2024).

The mining sector exemplifies these challenges. Industry leaders agree that innovation and new technologies are crucial for maintaining competitiveness, enhancing productivity, and generating value. Miners must embrace innovation to respond to societal demands for safety, environmental performance, and “green” products (Humphreys, 2015). Nevertheless, innovation in the mining sector is not merely about adopting new technologies; even substantial technology investments often fail to yield expected returns when foundational organizational adjustments are missing, such as fostering a culture that embraces digital transformation (World Economic Forum, 2022). Mining organizations often operate under rigid hierarchies, siloes, risk-averse cultures, capital-intensive structures, short-term goals, and strict regulatory frameworks, which prioritize safety and operational continuity (Kashan et al., 2022; Waggett & Partridge, 2025; Yeates, 2021). It appears that these structural characteristics and operational requirements, inherent to the industry, constrain innovation, making it challenging and slowing the implementation of new initiatives (Gruenhagen & Parker, 2020; Swart et al., 2021).

In Peru, these challenges are particularly relevant. Mining accounts for around 8.5% of Peruvian GDP and 63.9% of its total exports, making it a strategic pillar of the country’s economy. Innovation and digital transformation are increasingly critical to supporting the energy transition, reducing emissions, adopting renewable energy, and achieving broader sustainability goals (Saldarriaga, 2025). As Pamela Antonioli, General Manager of the Peruvian Mining Innovation Hub, notes, companies must develop organizational structures that capture and implement innovative ideas—even without formal innovation departments—while fostering collaboration to scale solutions effectively (El Comercio, 2025). However, only 6% of medium- and large-sized mining companies exhibit a consistent culture of innovation (Escobar et al., 2023), and challenges remain in developing digital competencies (Hub de Innovación Minera del Perú, 2025).

In response to these challenges, Peruvian mining companies are increasingly exploring collaborative approaches to innovation, including open innovation models that leverage external knowledge from suppliers, universities, and technological partners (Chesbrough, 2003). These external approaches, however, depend on organizations building internal capacity to absorb, process, and act on new knowledge (Cohen & Levinthal, 1990), and it is precisely this internal capacity that intrapreneurship cultivates. Evidence suggests that digital intrapreneurs can emerge within mining organizations, initiating projects that improve efficiency and decision-making (Escobar et al., 2023; Pinchot & Soltanifar, 2021). Intrapreneurs are vital agents of change, driving innovation, process improvement, and sustainability within an otherwise conservative industry (Radebe & Duh, 2023). This situation raises critical questions: if barriers are so pervasive, which enablers can be reinforced? And what types of intrapreneurs exist in this industry?

Building on these research questions, the central objective of this study is to determine the enablers of digital intrapreneurship and to examine the types of digital intrapreneurs within the Peruvian mining industry from the perspectives of employees. While organizational policies and leadership may formally support innovation, the actual drivers of intrapreneurial behavior are shaped by how individuals perceive their environment, including the enablers and barriers they directly encounter (Engzell, 2023). By identifying distinct intrapreneur profiles based on variables that influence their behavior, this study aims to provide actionable insights for organizations seeking to extend intrapreneurial capacity beyond a small group of innovation leaders and to design targeted strategies to build these capabilities.

Literature Review

Previous studies have highlighted the importance of intrapreneurs within organizations and sought to understand the individual, organizational, and environmental factors that stimulate intrapreneurial behavior. Theoretical models, such as those proposed by Neessen et al. (2019) and Sakhdari (2016), identified multiple levels of influence, including an individual level—such as self-efficacy, competence, optimism, autonomy, and motivation—and an organizational level—such as management support, organizational structure, reward systems, and availability of resources. Empirical studies further support these frameworks by providing more detail, examining individual drivers specifically (Gorgievski et al., 2023) and interactions between individual and organizational drivers (Engzell, 2023; Ye et al., 2023). Furthermore, instruments such as the Corporate Entrepreneurship Assessment Instrument (CEAI) were developed to measure organizational support of intrapreneurial behavior (Kuratko et al., 2014).

However, despite the maturity of intrapreneurship research, recent technological shifts have prompted scholars to revisit and expand this concept. The rise of digitalization and digital transformation has introduced new mechanisms and conditions that challenge traditional models. In this context, the notion of digital intrapreneurship—the use of digital technologies, platforms, and data to foster innovation within organizations—has emerged as a distinct yet related construct (Pinchot & Soltanifar, 2021). While existing intrapreneurship frameworks capture critical success factors for fostering innovation within firms, they do not fully account for the new logic, opportunities, threats, and dependencies created by digital technologies (Pigola et al., 2024). In fact, digitalization changes not only the available tools but also how collaboration, communication, and experimentation occur (Bitzer et al., 2021).

Considering this shift, scholars are investigating these mechanisms from different angles. For example, Hadi et al. (2024) and Karafakioglu and Afacan Findikli (2024) studied the effect of different leadership styles on boosting digital intrapreneurial behavior. Deloitte (2022) found that new skills and organizational practices are necessary to address the challenges of the current environment. Similarly, Boyles (2016) and Sagbas et al. (2023) highlighted the need for adaptive organizational designs and strategic frameworks that facilitate knowledge sharing and innovation. Nevertheless, although the literature on digital intrapreneurship continues to grow, theoretical models remain under development, and empirical evidence remains fragmented.

At the theoretical level, Pinchot and Soltanifar (2021) argue that digital intrapreneurs—characterized by specific attributes—are positively influenced by supportive sponsors with whom they maintain close relationships, a culture that embraces digital innovation and collaboration, and sufficient organizational knowledge of digital technologies. Similarly, Ortiz Sandoval et al. (2021) emphasized the role of situational conditions and intrapreneurial work practices, while Ghosh et al. (2021) and Neessen et al. (2019) noted the impact of environmental turbulence—such as market or technological disruptions—and the influence of path dependency, where initial conditions constrain subsequent intrapreneurial behavior. Despite these contributions, research remains limited in identifying the organizational and individual preconditions—such as structure, culture, learning, and leadership—that foster digital intrapreneurship, leaving an incomplete understanding of how these factors interact to enable this behavior.

From a contextual standpoint, most of the literature on digital intrapreneurship remains generic and detached from industry-specific characteristics (Gruenhagen & Parker, 2020; Opland et al., 2022). Both intrapreneurship and digital intrapreneurship are inherently context-dependent, and the mining sector presents unique challenges that must be considered when studying the field (Gruenhagen & Parker, 2020; Javanmardi Kashan et al., 2021; Kashan et al., 2022). A review of prior studies shows that most research is qualitative, based on interviews with small samples, and explores general drivers or enablers of innovation from the perspective of experts (Javanmardi Kashan et al., 2021; Kumar & Pathak, 2021). In particular, a

few studies have investigated drivers of intrapreneurship in mining through interviews with African and Australian employees and firms (Kumar & Pathak, 2021; Radebe & Duh, 2023; Radebe, 2024). However, they do not provide a basis for prioritizing interventions or translating findings into actionable strategies. In a similar vein, applied research in Peru using structured surveys of mining innovation experts identifies practices for fostering intrapreneurship, including dedicated innovation leaders, clear objectives, structured plans, budget allocation, recognition of creative ideas, prototyping, and trend monitoring. Nevertheless, this research remains descriptive, leaving unclear why certain practices were prioritized over others.

On the other hand, quantitative research in the mining sector, particularly on digital intrapreneurship, is scarce. An exception is Setiawati et al. (2024) in the Indonesian mining sector, which shows that digital intrapreneurship mediates the relationship between organizational practices and business sustainability outcomes, highlighting that sustainable human resource management cannot achieve sustainability outcomes without fostering digital intrapreneurship. This study illustrates the added value of a quantitative approach: by identifying which drivers truly influence performance, it provides clear managerial guidance and actionable insights. Said study thus serves as an example of the type of evidence-based insight that a similar quantitative study could generate in Peru, helping to prioritize interventions and inform actionable strategies.

In short, most existing studies adopt a cause-and-effect logic and rely primarily on top managers' perceptions of organizational climate, often portraying optimal conditions rather than day-to-day realities. Consequently, little is known about how digital intrapreneurs themselves perceive their working environment, which combinations of factors shape their behavior, and why some ideas progress. In contrast, others remain blocked or abandoned before formal presentation. This finding highlights the need to focus on the employee perspective, particularly on those who initiate ideas and directly experience enablers or barriers. Addressing this gap can reveal how different combinations of experience, organizational support, and cultural factors shape intrapreneurial patterns, offering practical implications for mining companies aiming to both foster enablers and remove critical obstacles.

Conceptual Framework

This study adopts the Digital Intrapreneurship Model developed by Ortiz Sandoval et al. (2021), which conceptualizes digital intrapreneur behavior as an outcome of an integral work experience influenced by the Digital Intrapreneurship Experience, which encompasses individual, situational, and organizational dimensions. According to this framework, this experience is sustained and transformed into concrete digital intrapreneurial initiatives when supported by a Digital Intrapreneurship Infrastructure that encompasses Intrapreneurial Work Practices and Digital Technology. The original model also incorporates Environmental Factors, understood as external conditions such as market turbulence, regulation, or technological change that influence organizational dynamics (Honig & Samuelsson, 2021). However, since this study focuses on the Peruvian mining sector—a shared context for all respondents—these factors are treated as constant and therefore excluded from the analysis (see Figure 1).

Digital Intrapreneurial Behavior

Digital intrapreneurial behavior constitutes the dependent variable of this study. It refers to the extent to which employees actively engage in innovation processes using digital tools and approaches within their organization. Following the conceptual framework of Neessen et al. (2019) and adapted to the digital context as suggested by Pinchot & Soltanifar (2021), this behavior is conceptualized as a process unfolding across three progressive stages: identifying opportunities for digital improvement (DI1), attempting to develop or promote a digital solution (DI2), and successfully implementing a digital innovation (DI3).

Together, these stages capture the full concept of intrapreneurial action, from initial awareness to concrete outcomes.

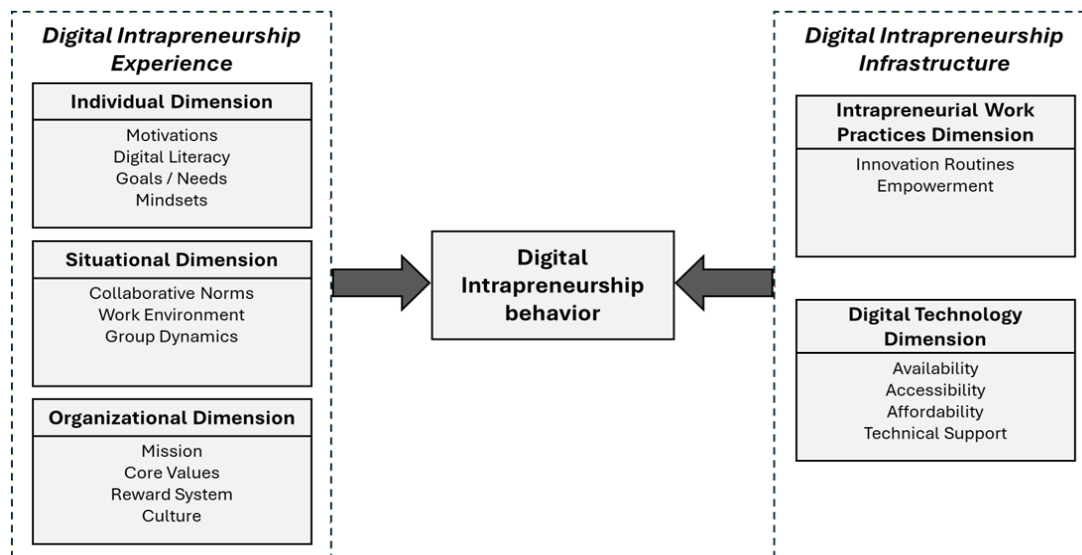


Figure 1. Digital Intrapreneurship Model adapted from Ortiz Sandoval et al. (2021)

Digital Intrapreneurship Experience

This concept is the central analytic unit for this study. It defines how employees experience the workplace as a digital innovation arena. Intrapreneurs are products of their social environment, and they are conditioned by its features (Honig & Samuelsson, 2021). Digital Intrapreneurship Experience is a multidimensional concept that can be divided into three interrelated strata.

Individual Dimension

This dimension refers to the personal characteristics and competencies of employees that influence their ability to be a digital intrapreneur. It includes four variables: Motivations, Digital Literacy, Goals/Needs, and Mindsets. Table 1 presents the definition of each of these variables.

Table 1. Variables Related to the Individual Dimension

Variable	Definition
Motivations	Based on self-determination theory. Motivations can be intrinsic—driven by enjoyment, curiosity, or personal growth—or extrinsic, when actions are pursued to obtain external rewards or recognition (Cnossen et al., 2019).
Digital Literacy	The ability to use digital tools or digitally enabled processes to identify, manage, access, analyze, and create information. It integrates technical, cognitive, and socio-emotional skills (Young et al., 2020). Openness, adaptability, agility, risk appetite, and initiative are the aptitudes that best complement digital literacy.
Goals/Needs	Refers to employees taking ownership of their company's growth; this means a strong sense of "psychological ownership" that is well beyond the call of duty—emotional commitment to work and effective communication with stakeholders (Seshadri & Tripathy, 2006).
Mindsets	Refers to a self-sufficiency mindset that leads employees to work independently, design their work, make their own decisions, and not conform to regular roles (Echebiri et al., 2020).

Situational Dimension

This dimension refers to the environment and relationships to which the employee is exposed in daily work. It includes three variables: Collaborative Norms, Group Dynamics, and Work Environment. Table 2 presents the definition of each of these variables.

Table 2. Variables Related to the Situational Dimension

Variable	Definition
Collaborative Norms	Refers to the practice of pausing, asking questions, sharing ideas and data, paying attention to self and others, and presuming positive intentions (Ortiz Sandoval et al., 2021).
Group Dynamics	Refers to high levels of trust in each other, common goals, collective decision-making process, efforts to hold each other accountable, and networking (Feisal, 2020).
Work Environment	Refers to a warm and welcoming environment that provides the tools and resources necessary to learn new behaviors by observing others (Garmston & Wellman, 2013).

Organizational Dimension

Refers to the formal structures and guiding principles that shape intrapreneurial activity. When workers feel that their objectives are out of reach or that situational barriers are high, they tend to disengage from such behaviors (Ortiz Sandoval et al., 2021; Ye et al., 2023). This dimension includes four variables: Mission, Core Values, Reward System, and Culture. Table 3 presents the definition of each of these variables.

Table 3. Variables Related to the Organizational Dimension

Variable	Definition
Mission	The organization's fundamental purpose—why it exists and what it seeks to achieve. It provides direction and communicates long-term aspirations to guide strategy and employee actions (Denison & Neale, 1999).
Core Values	Shared beliefs and risk-taking behaviors shape the organization's culture and openness, ensure consistency amongst employees' mindsets and beliefs, and ensure successful collaboration (Denison & Neale, 1999).
Reward System	Refers to the formal and informal mechanisms through which organizations recognize and incentivize desired behaviors. They include monetary compensation, promotions, and non-financial rewards (e.g., recognition and opportunities for growth).
Culture	Encompasses shared beliefs, norms, and practices within the company. A culture that embraces collaboration, experimentation, and tolerance for failure enables intrapreneurs to test and refine ideas without fear of sanctions.

Digital Intrapreneurship Infrastructure

Ortiz Sandoval et al. (2021) emphasized that the digital intrapreneur must be supported by infrastructure to produce sustained intrapreneurial outputs. This infrastructure has two pillars.

Intrapreneurial Work Practices Dimension

This dimension refers to formal or semi-formal routines and practices that provide procedural legitimacy and lower the friction of experimentation for employees. It includes two variables: Innovation Routines and Empowerment. Table 4 presents the definition of each of these variables.

Digital Technology Dimension

This dimension refers to the technological infrastructure and resources that enable intrapreneurs to design, test, and scale digital solutions within the organization. It includes four variables: Availability, Affordability, Accessibility, and Technical Support. Table 5 presents the definition of each of these variables.

Table 4. Variables Related to the Intrapreneurial Work Practices Dimension

Variable	Definition
Innovation Routines	Refers to formal or semi-formal routines such as ideation sessions, cross-functional forums, rapid-prototyping spaces, structured pathways for piloting employee-led projects, and open channels for evaluating and submitting new ideas (Pinchot & Soltanifar, 2021).
Empowerment	Refers to the extent to which managers empower all employees to generate ideas and participate in their development and implementation, through consistent support and encouragement (Pinchot & Soltanifar, 2021).

Table 5. Variables Related to the Digital Technology Dimension

Variable	Definition
Availability	Refers to having access to sufficient qualified staff and adequate IT resources (Federal Ministry for Economic Cooperation and Development, 2019).
Accessibility	Concerns the ease with which individuals can reach, use, or obtain those resources, including removing barriers such as complexity, hierarchy, or location. Weak digital infrastructure, slow Internet, or restrictive regulations reduce accessibility (Ranković & Ilić, 2024).
Affordability	Refers to the cost of acquiring digital tools, infrastructure, or skilled employees.
Technical Support	Refers to the ongoing assistance and expertise available to help entrepreneurs use and sustain digital technologies.

Research Methodology

This study adopted a quantitative, descriptive, non-experimental, and cross-sectional research design to determine the types of intrapreneurs and the determinants of intrapreneurship level.

Measurement Instrument

All variables were measured with established scales from the literature, contextualized to the study setting, and rated on a 5-point Likert scale. Items marked with the superscript “a” used a Strongly Disagree / Strongly Agree scale, while items marked with “b” used a Never / Always frequency scale (adapted from: Avey et al., 2009; Cnossen et al., 2019; De Jong & Den Hartog, 2010; Denison & Neale, 1999; Engzell, 2023; Federal Ministry for Economic Cooperation and Development, 2019; Kuratko & Morris, 2018; Neessen et al., 2019; Vuorikari et al., 2016). The full list of items and sources is available at this link: <https://tinyurl.com/3n8yk98t>.

Data Collection and Analysis

Data were collected through a self-administered online survey, distributed in Spanish via Google Forms. A convenience sampling technique was used, whereby mining companies were selected through the authors’ professional network. Participants were reached through gatekeepers, who distributed the survey within

their respective teams, thereby ensuring that all respondents were employed in a mining company at the time of completion.

The analytical strategy consisted of two stages. First, a K-Means clustering algorithm was applied to identify distinct employee profiles based on patterns across the studied variables (Brandtzæg et al., 2011). Subsequently, linear regression analyses were conducted to quantify the influence of each dimension on digital intrapreneurial behavior across its three stages, from opportunity identification to implementation. All analyses were performed using SPSS.

Sample

The sample comprised 74 participants from three medium-sized Peruvian mining companies, including 19 females (25.7%) and 55 males (74.3%). Regarding job positions, 21 participants (28.4%) held operational/technical roles, 30 (40.5%) held middle management positions, 14 (18.9%) held senior management or director roles, and 9 (12.2%) held other roles. In terms of age, 3 participants (4.1%) were between 18 and 25 years old, 18 (24.3%) between 26 and 34, 27 (36.5%) between 35 and 44, 22 (29.7%) between 45 and 54, and 4 (5.4%) were 55 or older. The sample encompassed roles across multiple organizational levels and functional areas, thereby strengthening the representativeness of employee perceptions of digital intrapreneurial behavior.

Results

Identification of Clusters

The clustering decision was based on employee perceptions of the 17 drivers of digital intrapreneurial behavior described in the Conceptual Framework. Since K-means requires the number of clusters to be specified in advance, this study followed the two-stage procedure proposed by Punj and Stewart (1983): Ward's hierarchical method was first applied to determine the optimal number of clusters, after which K-means assigned each respondent to the corresponding group.

Ward's method is an agglomerative technique that minimizes within-cluster variance by merging the pair of clusters producing the smallest increase in the overall error sum of squares (Ward, 1963), making it well-suited when the number of clusters is unknown. Both the dendrogram and the agglomeration schedule were analyzed to detect natural breakpoints in the data (Everitt et al., 2011). The analysis indicated that a three-cluster solution best represented the distinct employee typologies. With this input, K-means generated three clusters, which were compared in all the dimensions. Afterward, this study analyzed cluster differences with one-way ANOVA for each driver of digital intrapreneurship behavior. ANOVA results show significant differences between the clusters for all drivers at the 5% or 10% significance level, except for Digital Literacy, which had a p -value > 0.1 .

To facilitate interpretation, each cluster mean was classified into Low, Medium, or High categories. Following a distribution-based approach, thresholds were established using the overall sample mean $\pm$ one-half standard deviation. Cluster means below (Mean $- 0.5$ SD) were classified as Low, values above (Mean $+ 0.5$ SD) as High, and intermediate values as Medium. These categories were used solely for descriptive, not for statistical, interpretation. The resulting classification is reported in Table 6. Based on the above results, this study proposed the following names for each cluster:

- 1) **Moderate-Potential Intrapreneur Group:** The members of this group report moderate levels of individual intrapreneurial characteristics—such as motivation, mindset, and collaborative norms—but perceive limited Organizational support and low Organizational Infrastructure (including

Intrapreneurial Work Practices and Digital Technologies). Their perception of moderate support positions them as capable contributors whose potential can be amplified with targeted resources and empowerment.

- 2) **Low-Potential Intrapreneur Group:** The members of this group evidence low levels across nearly all drivers of both Digital Intrapreneurship Experience and Infrastructure, positioning them as the group least encouraged toward digital intrapreneurship.
- 3) **High-Potential Intrapreneur Group:** This group reports the highest perceived levels of Digital Intrapreneurship Experience and Organizational Infrastructure, with most perceived drivers in place—particularly strong organizational support.

Table 6. K-Means Results

Dimension (ANOVA results)	Cluster 1 23 (31.1%)	Cluster 2 5 (6.8%)	Cluster 3 46 (62.2%)
Digital Intrapreneurship Experience			
<i>Dimension: Individual</i>			
1) Motivations (F = 2.895, p < 0.10)	4.174 (Medium)	4.400 (Medium)	4.533 (Medium)
2) Digital Literacy (F = 1.665, p = 0.196)	3.565 (Medium)	4.000 (Medium)	3.957 (Medium)
3) Goals/Needs (F = 24.058, p < 0.05)	4.252 (Medium)	2.460 (Low)	4.620 (Medium)
4) Mindsets (F = 15.415, p < 0.05)	4.196 (Medium)	2.460 (Low)	4.457 (Medium)
<i>Dimension: Situational</i>			
5) Collaborative Norms (F = 63.419, p < 0.05)	3.435 (Medium)	1.200 (Low)	4.337 (Medium)
6) Group Dynamics (F = 51.740, p < 0.05)	3.217 (Medium)	1.300 (Low)	4.239 (Medium)
7) Work Environment (F = 6.078, p < 0.05)	2.978 (Medium)	2.800 (Low)	3.478 (Medium)
<i>Dimension: Organizational</i>			
8) Mission (F = 59.260, p < 0.05)	3.478 (Medium)	1.000 (Low)	4.413 (Medium)
9) Core Values (F = 103.415, p < 0.05)	3.239 (Low)	1.100 (Low)	4.424 (High)
10) Reward System (F = 57.090, p < 0.05)	3.100 (Medium)	1.260 (Low)	4.061 (High)
11) Culture (F = 67.612, p < 0.05)	3.022 (Low)	1.100 (Low)	4.087 (High)
Digital Intrapreneurship Infrastructure			
<i>Dimension: Intrapreneurial Work Practices</i>			
12) Innovation Routines (F = 3.973, p < 0.05)	2.652 (Medium)	3.200 (Medium)	3.163 (Medium)
13) Empowerment (F = 12.133, p < 0.05)	2.978 (Low)	3.900 (Medium)	3.989 (Medium)
<i>Dimension: Digital Technologies</i>			
14) Availability (F = 18.410, p < 0.05)	2.413 (Low)	3.400 (Medium)	3.804 (Medium)
15) Accessibility (F = 21.746, p < 0.05)	2.957 (Low)	3.400 (Medium)	4.185 (Medium)
16) Affordability (F = 10.518, p < 0.05)	3.261 (Low)	3.300 (Low)	4.185 (Medium)
17) Technical Support (F = 15.617, p < 0.05)	2.413 (Low)	2.800 (Medium)	3.652 (Medium)

Profiling Clusters Based on Their Demographics and Digital Intrapreneurial Activity

ANOVA tests on demographic variables found no statistically significant differences across the three clusters, indicating they do not differ in demographic composition. This study then compared the three clusters with respect to recent digital intrapreneurial activity. The chi-squared test shows that the association between clusters and having led a digital innovation initiative in the last six months is significant at the 10% level ($\chi^2 = 4.738$, $p = 0.094$). Descriptively, the first two clusters show similar levels of recent intrapreneurial behavior: 60.87% of employees in Cluster 1 (Moderate-Potential Intrapreneur Group) and 60.00% in Cluster 2 (Low-Potential Intrapreneur Group) reported having led at least one digital innovation initiative in the past six months. In contrast, only 34.78% of employees in Cluster 3 (High-Potential Intrapreneur Group) reported engaging in such activity, indicating that this group is surprisingly less engaged in digital intrapreneurship than the other two clusters. Figure 2 illustrates this relationship.

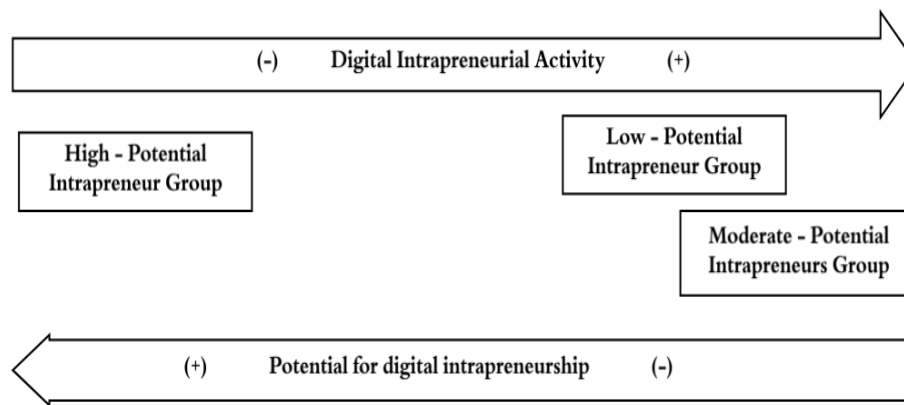


Figure 2. Employee Groups by Level of Digital Intrapreneurship

Linear Regression Analysis

Additionally, linear regression was conducted to quantify the impact of influential drivers on digital intrapreneur behavior. Separate linear regression models were estimated for each stage—identifying opportunities (DI1), attempting to innovate (DI2), and implementing solutions (DI3)—including Individual, Situational, Organizational, Intrapreneurial Work Practices, and Digital Technology Dimensions as simultaneous independent variables, with each dimension computed as the average of its item values. Multicollinearity was assessed using VIF values; all were below 5, suggesting that the model does not have a multicollinearity issue (Field, 2009). The highest observed VIF was for the Organizational Dimension (VIF = 3.466). All models were significant based on F-tests, indicating that at least one predictor had a meaningful impact on each dependent variable.

For DI1 ($R^2 = 34.5\%$, $F = 7.163$, $p < 0.001$), the Individual Dimension ($\beta = 1.006$, $p < 0.05$) and Intrapreneurial Work Practices ($\beta = 0.365$, $p \leq 0.05$) showed significant positive effects, while the Organizational Dimension had a significant negative effect ($\beta = -0.399$, $p < 0.05$). The Situational and Digital Technology Dimensions were not significant ($p = 0.883$ and $p = 0.738$, respectively). The same procedure was followed for the other two stages. For DI2 ($R^2 = 36.7\%$, $F = 7.875$, $p < 0.001$), only the Individual Dimension had a significant positive effect ($\beta = 1.332$, $p < 0.001$), indicating that attempting to innovate relies primarily on individual-level factors. Finally, for DI3 ($R^2 = 31.8\%$, $F = 6.534$, $p < 0.001$), the Individual Dimension remained the strongest positive predictor ($\beta = 1.246$, $p < 0.001$), while the Organizational Dimension showed a marginal negative effect ($\beta = -0.431$, $p = 0.064$).

Discussion and Implications

This study examined the drivers of digital intrapreneurship in Peruvian mining employees by identifying employee typologies and assessing the predictive power of the Individual, Situational, Organizational, Work Practices, and Digital Technologies Dimensions. Three distinct clusters emerged, revealing a fragmented intrapreneurial landscape.

The High-Potential Intrapreneur Group, despite reporting the strongest perceptions of Situational, Organizational, Work Practices, and Digital Technologies dimensions, reported the lowest share of recent intrapreneurial activity. Although this association is only marginally significant and should therefore be read as exploratory, it is consistent with research on organizational complacency, and one possible interpretation is that higher perceived structural stability and resource availability may be associated with lower perceived urgency to initiate digital innovation (Hughes, 2016), thereby lowering the motivation to act. In contrast, the Moderate-Potential Intrapreneur Group—solid on the Individual dimension but lower on perceived organizational support and digital infrastructure—displayed the highest level of activity, suggesting that employees reporting fewer organizational enablers also reported higher levels of intrapreneurial activity, suggesting an association that warrants further investigation. Even the Low-Potential Group, despite perceiving the weakest situational and organizational support, reported a level of activity comparable to the most active cluster and above the High-Potential Group, further indicating that intrapreneurial activity in this sample was not contingent on a supportive perceived environment. This interpretation remains tentative given the cluster's limited size ($n = 5$).

A bidirectional relationship between perceived constraints and intrapreneurial behavior may also exist. An alternative explanation is that employees who report greater intrapreneurial activity may also become more aware of organizational barriers. This rationale could explain why the Moderate-Potential Intrapreneur Group, with greater intrapreneurial activity, also reported pronounced limiting perceptions, while the High-Potential Group may remain unaware of structural gaps simply because they engage less in intrapreneurial efforts. Given the cross-sectional design, causality cannot be established, underscoring the need for longitudinal or mixed-methods research in future studies.

Regression analysis results complement these patterns. The Individual Dimension was the strongest and most consistent driver across all three stages (DI1, DI2, DI3), while Intrapreneurial Work Practices supported opportunity identification (DI1). Organizational factors showed a negative association with DI1 and a marginal negative trend with DI3, while Situational and Technology factors were not significant. Together, these findings suggest that, in this sample, digital intrapreneurship occurs “despite the environment” rather than “because of it”—a pattern that, while highlighting employee-driven innovation as a strength, exposes a structural vulnerability: overreliance on personal initiative risks burnout, attrition, and a weakened innovation pipeline.

Theoretical Implications

This study makes several theoretical contributions. First, it responds to the gap identified by Opland et al. (2022), whose systematic review concluded that research remains limited in identifying the individual and organizational preconditions that foster employee-driven digital innovation and in understanding how they interact, noting the lack of empirical models that test these interactions holistically. By quantitatively examining how the Individual, Situational, Organizational, Work Practices, and Digital Technologies dimensions are jointly perceived, this study offers one of the first empirical tests of these interactions. Foregrounding employees' own perceptions further moves the field beyond the manager- and expert-centered accounts that dominate prior research.

Second, the study operationalizes the Digital Intrapreneurship Model of Ortiz Sandoval et al. (2021)—previously formulated at a conceptual level—in a resource-constrained, highly regulated context, through a quantitative, employee-level analysis. The identification of three intrapreneurial typologies—and the finding that higher perceived organizational support did not correspond to higher activity in this sample—qualifies the conventional assumption that “more support leads to more intrapreneurship”, suggesting instead that, in this setting, individual-level drivers carry greater weight than structural support.

Practical Implications

The findings suggest that mining companies require tailored, not uniform, interventions. Because intrapreneurial behavior in this sector ultimately serves as a vehicle for digital transformation, these interventions should be oriented not toward intrapreneurship as an end in itself, but toward concrete digital outcomes: improving operational efficiency, enabling data-driven decision-making, and advancing the sustainability and energy-transition goals that increasingly define the industry’s agenda. First, since Individual factors are the strongest predictors, organizations should intentionally strengthen autonomy, confidence, and digital self-efficacy through continuous development and reduced micromanagement, while positioning entrepreneurial employees as internal champions. However, models built primarily on individual initiative are unlikely to scale without complementary structural support, making it critical to balance stability with enough change-driven tension: enough structure to work effectively, but not so much comfort that innovation loses urgency.

Second, strengthening Intrapreneurial Work Practices—through innovation contests, challenge-based programs, and dedicated spaces—supports opportunity identification and, under current conditions, is the only dimension, aside from individual capabilities, that positively influences digital intrapreneurial behavior. Finally, the three employee profiles call for differentiated strategies: High-Potential Intrapreneurs need a “push” through accountability measures and explicit expectations to overcome inertia. The Moderate-Potential Intrapreneur Group already demonstrates initiative and active engagement, so they can be “pulled” through targeted technological resources and empowerment. Finally, the Low-Potential group needs to rebuild trust and establish structured innovation pathways so that this initiative can be sustained and channeled rather than left to rely on isolated effort; given the small size of this cluster, these recommendations remain tentative. Across these interventions, framing efforts around tangible digital objectives, rather than innovation in the abstract, helps ensure that individual initiative translates into the organizational digital transformation the sector requires.

Limitations and Future Research

This study presents several limitations that should be considered when interpreting the results. First, the cross-sectional design restricts causal inference; longitudinal and qualitative extensions would help unpack how perceptions and behaviors evolve. Second, the sample was relatively small and recruited through professional networks and gatekeepers (non-probability convenience sampling), which may introduce selection bias and limits generalizability; accordingly, the findings should be read as exploratory. Specifically, the small size of Cluster 2 limits the robustness of comparisons involving this group. Future research should replicate the study with larger, more diverse samples drawn through probability sampling to allow more robust and generalizable inferences. Third, all constructs relied on self-reported perceptions, which may introduce recall or social desirability biases; multi-source data (supervisor assessments, objective innovation metrics) would strengthen validity. Finally, this study captured perceived rather than actual structural conditions, leaving room for future work to compare both and identify alignment gaps.

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