

The Employability Paradox in the AI Era: How the ‘Efficacy Gap’ In Business Curricula Hinders Technological Readiness

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ABSTRACT

Despite the Bologna Process’ emphasis on employability, concerns persist that higher education has not kept pace with the demands of Artificial Intelligence (AI)-intensive labour markets. This article examines the formal competence profile of Business Sciences curricula to explore this misalignment. Using quantitative content analysis, programme-level learning outcomes from 421 Business Sciences study cycles accredited by the Portuguese Agency for Assessment and Accreditation of Higher Education are analysed and mapped onto the USEM model through a validated competence matrix. The findings reveal a pronounced structural imbalance: while 85% of programmes explicitly include Knowledge-related outcomes (Understanding) and 63% include Technical-Scientific competences (Skills), only 35% refer to Efficacy-related transversal competences such as autonomous work, adaptation, continuous learning, or motivation for excellence. This configuration is conceptualised as an “Efficacy Gap” in the intended curriculum. Drawing on recent frameworks of AI Capital and Technological Readiness, the gap is interpreted as a structural condition that may constrain graduates’ capacity to convert disciplinary knowledge into adaptive, AI-enabled professional practice. The study contributes by (1) providing system-level evidence on the competence architecture of an entire national set of business programmes, (2) theoretically integrating the USEM model with emerging concepts of AI Capital and Technological Readiness, and (3) outlining implications for a transition from content-delivery towards readiness-oriented curricula that more explicitly foster autonomy, resilience, and lifelong learning as core conditions for employability in the AI era.

INTRODUCTION

The rapid integration of Artificial Intelligence (AI) into labour markets has accelerated the transformation of work, redefining the competences required of professionals. As AI technologies automate routine and analytical tasks, demand increasingly shifts towards advanced cognitive and behavioural capacities. Despite AI’s potential to enhance productivity and generate new industries, its adoption poses significant adaptation challenges for the workforce. Recent evidence points to a paradox: although graduates recognise the strategic relevance of AI for employability, many report feeling only “somewhat prepared” or “unprepared” to navigate these changes.

This perceived unpreparedness suggests a structural misalignment between academic training and professional demands. Contemporary literature indicates that employability in the AI era depends not solely on technical proficiency or digital literacy, but on the development of AI Capital — a composite of knowledge, skills, and strategic capabilities. At its core lies Technological Readiness, understood as the disposition and confidence to engage with evolving technological systems. Without such readiness, technical knowledge risks remaining underutilised.

In this context, the USEM employability model (Understanding, Skills, Efficacy beliefs, Metacognition), originally proposed by Knight and Yorke (2002), gains renewed relevance. While Higher Education Institutions (HEIs) have traditionally been effective in transmitting Understanding and Skills, the literature suggests a historical neglect of the Efficacy beliefs dimension – which includes autonomy, resilience, and the

motivation for continuous development. This dimension is particularly salient for the AI era: without self-efficacy, technical knowledge becomes rigid and fragile in the face of rapidly evolving algorithms.

The present study addresses this paradox through a comprehensive analysis of the formal learning outcomes of 421 study cycles in the field of Business Sciences in Portugal. Prior research on programme-level learning outcomes in management education has identified tensions between formal competence articulation and employability objectives (Soares et al., 2017), reinforcing the relevance of examining curricular architecture at system level. This investigation examines the formal curricular structure to diagnose the competence profile that is effectively proposed by academia. The analysis uses a validated competence matrix to map the relative weight of the USEM model dimensions within current curricula.

The results reveal a pronounced structural imbalance: a very strong emphasis on competences linked to theoretical knowledge and disciplinary understanding, in contrast with a markedly lower presence of competences associated with personal efficacy and autonomy. Specifically, 85% of programmes explicitly include Knowledge-related outcomes aligned with the Understanding dimension, and 63% include Technical-Scientific competences aligned with Skills, whereas only 35% explicitly refer to Efficacy-related transversal competences such as autonomous work, adaptation, continuous learning, or motivation for excellence. This configuration is conceptualised as an “Efficacy Gap” in the intended curriculum. Rather than claiming direct causal effects, this gap can be understood as a structural condition that is likely to constrain graduates’ Technological Readiness and their capacity to convert disciplinary knowledge into adaptive, AI-enabled professional practice.

This article contributes to the literature in three main ways. First, it provides robust empirical evidence, based on the analysis of the entire universe of study cycles in a scientific area within one national system, regarding the actual composition of higher education curricula. Second, it connects the classic USEM employability model with emergent concepts of AI Capital and Technological Readiness, highlighting the theoretical continuity between self-efficacy and digital adaptation. Third, it offers practical recommendations for curricular redesign, suggesting that promoting employability in the AI era requires HEIs to move from a predominantly content-delivery model towards one that is explicitly oriented to readiness, autonomy, and lifelong learning.

Although this study uses empirical data from the Portuguese higher education system, the relevance of the analysis extends beyond the national context. Portugal serves as a paradigmatic case (or critical proxy) for educational systems aligned with the Bologna Process. As a country that has fully implemented these reforms – whose central goal was to promote employability through competences – the persistence of curricular imbalances here suggests potential systemic flaws in the architecture of Western higher education. Thus, the “Efficacy Gap” identified in this comprehensive sample (N = 421) is unlikely to constitute an idiosyncratic local phenomenon; rather, it appears symptomatic of a broader curricular rigidity: the difficulty of universities in transitioning from “content transmission” models towards the formation of autonomous, technologically ready human capital. By exposing this fragility within a complete national system, the paper offers a diagnostic warning for HEIs facing similar pressures to adapt to the AI era.

Against this backdrop, the overarching aim of this study is to diagnose the extent to which business curricula are structurally aligned with the employability demands of an AI-driven labour market. More specifically, the study pursues three interrelated objectives:

- (1) to map the formal learning outcomes of Business Sciences programmes onto the USEM employability framework.
- (2) to quantify the relative prevalence of Understanding, Skills and Efficacy-related outcomes in the official curriculum of Business Sciences study cycles in Portugal.
- (3) to interpret this curricular profile in light of recent frameworks on AI Capital and Technological Readiness, with particular attention to the structural conditions that may enable or constrain graduates’ technological readiness.

In line with these objectives, the study addresses the following research questions:

- **RQ1.** How are the formal learning outcomes of Business Sciences programmes distributed across the USEM dimensions of Understanding, Skills, Efficacy beliefs, and Metacognition?
- **RQ2.** To what extent do current curricula explicitly include transversal competences associated with Efficacy beliefs – namely autonomy, adaptation, continuous learning, and problem solving – that are theoretically linked to Technological Readiness in the AI era?
- **RQ3.** How can the observed curricular profile be interpreted in light of recent evidence on AI Capital and Technological Readiness, and to what extent does the identified “Efficacy Gap” constitute a structural antecedent of graduates’ technological readiness and employability in AI-intensive labour markets?

THEORETICAL FRAMEWORK

This study establishes a theoretical bridge between the foundational employability models of higher education and the emergent demands of the Artificial Intelligence (AI) labour market. The "Efficacy Beliefs" dimension, originally conceptualised by Knight and Yorke (2002), is posited as a critical antecedent to "Technological Readiness" and the formation of "AI Capital" in the current era.

The USEM Model: The Foundation of Sustainable Employability

Employability is a complex construct that transcends the mere ability to secure a job; it encompasses a set of achievements that make graduates more likely to succeed in their chosen occupations. Central to this understanding is the USEM model proposed by Knight and Yorke (2002), which posits that employability is the synergistic result of four inter-related domains: *Understanding* (subject knowledge), *Skilful practices* (deployment of skills), *Efficacy beliefs* (personal qualities and self-regulation), and *Metacognition* (reflection and strategic thinking).

While Higher Education Institutions (HEIs) have traditionally excelled in delivering *Understanding* and *Skills*, the model emphasizes that these are insufficient without *Efficacy beliefs*. This dimension involves self-theories, personal agency, and the belief in one’s ability to be effective. In a volatile market, efficacy beliefs are the engine of adaptability; without them, technical knowledge becomes rigid and fragile. The thesis underpinning this study suggests that a structural neglect of this dimension – manifested in low curricular frequencies of autonomy, leadership, and excellence – creates a vulnerability in the graduate profile.

From Employability Skills to "AI Capital"

In the transition to Industry 4.0 and 5.0, the concept of employability has evolved to incorporate digital proficiency not just as a skill, but as a form of capital. Drydakis (2024, 2025) introduces the AI Capital framework, defining it as a vector of AI-related knowledge, skills, and capabilities that possess economic, social, and signalling value in the labour market.

The AI Capital framework mirrors the structure of the USEM model but applies it to the technological domain:

- **AI Knowledge:** Corresponds to *Understanding*, encompassing the theoretical grasp of algorithms, machine learning, and data ethics.
- **AI Skills:** Corresponds to *Skilful practices*, involving hands-on proficiency with tools like Python or generative AI platforms.
- **AI Capabilities:** Corresponds to *Metacognition* and *Efficacy*, reflecting the strategic integration of AI into decision-making and business innovation.

Recent empirical evidence indicates that AI Capital is a significant predictor of employment outcomes. Graduates who possess this capital receive more interview invitations and access to higher wage premiums, particularly in large firms that signal a demand for adaptability and innovation. However, the formation of this capital is not automatic; it requires a pedagogical approach that moves beyond technical instruction to foster "capabilities" and strategic thinking.

The Moderating Role of Technological Readiness

The critical link between the curricula provided by HEIs and the actual employability of graduates in the AI era is Technological Readiness (TR). Arooje et al. (2025) demonstrate that TR acts as a moderator: skill development only translates effectively into employability when individuals possess prominent levels of technological readiness.

Technological Readiness is defined not merely by technical competence, but by the "disposition to embrace and effectively use new technologies". It encompasses psychological factors such as confidence, optimism, and the willingness to engage with complex systems. This definition aligns directly with the *Efficacy beliefs* dimension of the USEM model. Low efficacy beliefs manifest as resistance to technology and lower adaptability.

Current research by Portocarrero Ramos et al. (2025) reveals a disconnect: while 95.6% of graduates express a desire to learn AI tools, most of them feel only "somewhat prepared" to face labour market changes. This gap is not necessarily due to a lack of technical courses, but a lack of structural preparation in "functional competences" and the confidence to apply them. The 'Efficacy Gap' identified in business curricula can therefore be seen as a structural weakness that is likely to undermine Technological Readiness. Without the autonomy and self-belief fostered by efficacy-oriented learning outcomes, graduates struggle to convert their academic knowledge into the "AI Capital" required by employers.

Consequently, this study argues that the deficit in Efficacy beliefs identified in the analysis of 421 study cycles offers a plausible structural explanation for the current friction in AI adoption among graduates. By failing to prioritise the 'self' dimensions of the USEM model, HEIs may be contributing to the production of graduates who understand the theory of business but lack the Technological Readiness required to navigate its AI-driven future.

METHODOLOGY

Research design

This study adopts a quantitative content analysis design to examine the formal learning outcomes explicitly stated in Higher Education Institutions' (HEIs) official accreditation documents. Content analysis is appropriate in this context because it enables the systematic, replicable, and quantifiable description of manifest textual content, allowing us to infer the competence profiles that are structurally embedded in the curriculum. Rather than focusing on students' perceptions or self-reported skills, the analysis targets the intended curriculum as it is formally specified in programme documentation.

The dataset and analytic framework build on a previous doctoral study on learning outcomes in Portuguese higher education (Soares, 2018), which developed and validated a competence matrix for the Portuguese context. In the present article, the subset of Business Sciences programmes is reanalysed through the lens of the USEM model and recent debates on AI Capital and Technological Readiness.

Data source and sample

The empirical corpus comprises the universe of 421 study cycles in the field of Business Sciences (CNAEF Area 34 – "Ciências Empresariais") submitted to the Portuguese Agency for Assessment and Accreditation of Higher Education (A3ES) between 2009 and 2015. These 421 cycles correspond to approximately 15% of all cycles (N = 2,890) submitted to A3ES in that period (Soares, 2018). The dataset therefore covers all accredited Business Sciences programmes in Portugal within the defined period, rather than a sample.

The study cycles are stratified by academic degree, subsystem, and sector:

- **Academic degree:** 52% Bachelor's (first cycle), 44% Master's (second cycle) and 4% Doctoral programmes (third cycle).
- **Subsystem:** 52.5% University and 47.5% Polytechnic institutions.
- **Sector:** 67% Public and 33% Private institutions.

The data were provided directly by A3ES in anonymised form. For each study cycle, the section of the accreditation form titled “competences to be acquired by students” was examined, as it contains, within a 1,000-character limit, the programme-level learning outcomes associated with the degree. Each of the 421 programmes therefore contributes one programme-level competence description to the corpus, yielding a comprehensive overview of how Business Sciences curricula formally articulate the competences they aim to develop.

By focusing on these accreditation documents, the analysis targets the officially intended learning outcomes, as recognised by the national quality assurance agency, rather than informal or ad hoc descriptions at course level.

Although the accreditation documents analysed date from 2009–2015, their analytical relevance remains substantial. Programme-level learning outcomes function as relatively stable structural artefacts within higher education systems, particularly in regulatory environments governed by formal accreditation cycles. In the Portuguese context, A3ES procedures involve extensive documentation, peer review, and multi-year validation periods. Once accredited, study cycles tend to retain their formally stated competence profiles with limited structural revision until the subsequent evaluation cycle. Previous research on accreditation processes in Portugal has shown that formal quality assurance cycles tend to reinforce structural stability in programme design, often privileging compliance and formal articulation over rapid curricular innovation (Silva & Soares, 2021).

This institutional configuration introduces curricular stabilisation, especially in the Social Sciences, where innovation tends to evolve incrementally rather than through rapid technological restructuring. The dataset therefore captures the underlying architectural logic of curriculum design rather than short-term pedagogical adjustments. The purpose is not to assess AI-specific updates, but to diagnose structural competence configurations whose inertia may condition programmes' responsiveness to AI-driven transformations.

Instrument for content analysis: the Competence Matrix

The learning outcomes were coded using the Competence Matrix developed and validated by Dias and Soares (2017) and further detailed in Soares (2018). This matrix was originally constructed through a systematic review of the literature on learning outcomes, employability, and competence frameworks, followed by iterative empirical testing and expert validation in the Portuguese higher education context.

The matrix distinguishes three macro-dimensions:

1. **Knowledge** – including theoretical knowledge, practical knowledge, and general knowledge.
2. **Technical-Scientific Competences** – discipline-specific competences related to analysis, application, and synthesis within the scientific area of the programme.
3. **Transversal Competences** – generic competences such as communication, teamwork, autonomy, adaptation, continuous learning, problem-solving, leadership and motivation for excellence.

In the validation phase reported by Dias and Soares (2017), the matrix was applied by multiple coders to a set of learning outcome texts from different scientific areas. Inter-rater agreement reached approximately 90% for the allocation of text segments to categories, with Cohen's Kappa coefficients around 0.50 across dimensions

(Soares, 2018), values considered acceptable given the complexity and multidimensionality of the task. This prior validation supports the use of the matrix as a reliable coding instrument for the present study.

For the purposes of this article, the Competence Matrix was theoretically aligned with the USEM employability model (Knight & Yorke, 2002) and with recent frameworks on AI Capital (Drydakís, 2024, 2025) and Technological Readiness (Arooje et al., 2025):

- **Understanding (AI Knowledge)** was mapped onto the Knowledge dimension of the matrix (theoretical, practical, and general knowledge). This reflects foundational conceptual understanding, including the kinds of disciplinary knowledge that underpin AI literacy in business contexts.
- **Skills (AI Skills)** were mapped onto the Technical-Scientific Competences dimension (analysis, application, synthesis). These correspond to skilful practices in deploying disciplinary tools and methods, including data-driven and technologically mediated forms of analysis and decision-making.
- **Efficacy beliefs (AI Capabilities / Readiness)** were operationalised through a subset of Transversal Competences that are theoretically linked to Technological Readiness and self-efficacy, namely:
 - Autonomous Work (Trabalho Aut3nomo),
 - Adaptation to New Situations (Adapta33o),
 - Continuous Learning (Aprendizagem Cont3nua),
 - Problem Solving (Resolu33o de Problemas),
 - and, where explicitly present, Leadership and Motivation for Excellence.

These transversal competences capture elements of autonomy, resilience, and self-regulated learning that the literature identifies as psychological antecedents of Technological Readiness in the AI era. In this study, as shown in figure 1, the frequency with which these competences appear in programme-level learning outcomes is treated as a structural proxy for the extent to which curricula formally support the development of Efficacy beliefs.

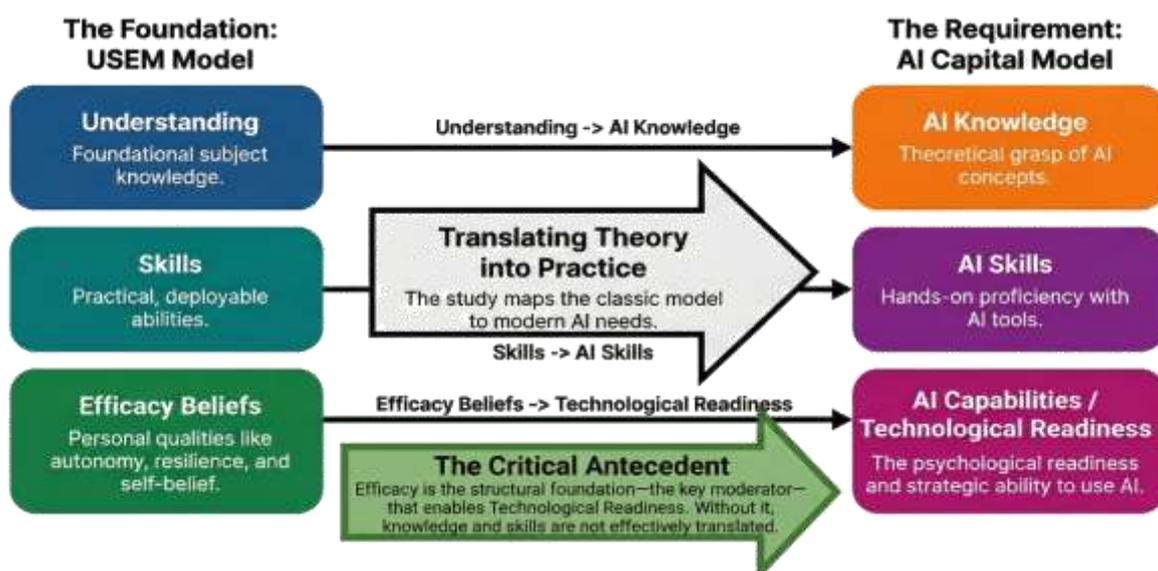


Figure 2 - Conceptual and Methodological Framework

It is important to underline that the study does not measure AI Capital or Technological Readiness at the individual level. Rather, it analyses the curricular architecture that, considering existing evidence, can be understood as a structural antecedent of those constructs.

Coding procedures and data analysis

The content analysis was conducted using MAXQDA®. The unit of analysis was the programme-level competence description for each study cycle. Within each description, the text was segmented into meaning units corresponding to distinct learning outcomes or competence statements, and these segments were then coded according to the categories of the Competence Matrix.

Coding was performed by a single researcher who had previously participated in the development and validation of the matrix (Soares, 2018). This prior experience contributed to the consistent application of category definitions. The coding followed a deductive approach based on the existing matrix, complemented by constant comparison across programmes to ensure that similar formulations were coded homogeneously across different institutional and disciplinary contexts within Business Sciences.

Each text segment could be assigned to more than one category when it clearly encompassed multiple competences (e.g., an outcome that simultaneously referred to autonomous work and problem-solving). In addition, a residual category was used for text fragments that did not correspond to knowledge or competence (e.g., generic descriptions of the programme or references to the institutional mission), ensuring that 100% of the text was accounted for in the coding scheme (Soares, 2018).

For the purposes of the present article, the coded data were aggregated at the programme level. A given competence was considered present in a study cycle if at least one learning outcome segment in that programme had been coded with the corresponding category. This allowed us to compute the percentage of programmes in which each competence (e.g., Autonomous Work, Adaptation, Leadership) appears explicitly in the intended learning outcomes.

Subsequently, the overall distribution of competences across the USEM-aligned dimensions was calculated:

- **Understanding** – proportion of programmes including at least one Knowledge category.
- **Skills** – proportion including Technical-Scientific Competences.
- **Efficacy-related transversal competences** – proportion including at least one of the Efficacy-related transversal categories (autonomy, adaptation, continuous learning, problem solving, leadership, motivation for excellence).

Descriptive statistics (frequencies and percentages) were used to characterise this distribution across the 421 study cycles. This design enables us to diagnose the “Efficacy Gap” at the level of curricular architecture by contrasting the prevalence of outcomes related to theoretical knowledge and technical skills with the much lower prevalence of outcomes related to autonomy, adaptation and continuous learning – competences that the literature identifies as critical for Technological Readiness and AI-related employability.

RESULTS: THE STATISTICAL PARADOX

The content analysis of 421 study cycles reveals a significant structural imbalance within Business Sciences curricula. The data indicates a curriculum design paradigm that prioritises static knowledge acquisition over the dynamic psychological traits required for the AI era. Findings were categorised into three critical dimensions: the saturation of 'Understanding', the deficit in 'Efficacy', and the crisis of 'Autonomy'.

The Saturation of 'Understanding': A Content-Heavy Curriculum

The analysis confirms that Higher Education Institutions (HEIs) in Portugal remain firmly anchored in the delivery of content. The competence of "Theoretical Knowledge" (*Conhecimento Teórico*) is the most prevalent learning outcome, explicitly present in 85% of all study cycles analysed, as shown in figure 3. Similarly, "Critical Analysis" (*Análise Crítica*) – often taught as a cognitive exercise rather than a behavioural disposition – appears in 85% of the curricula.

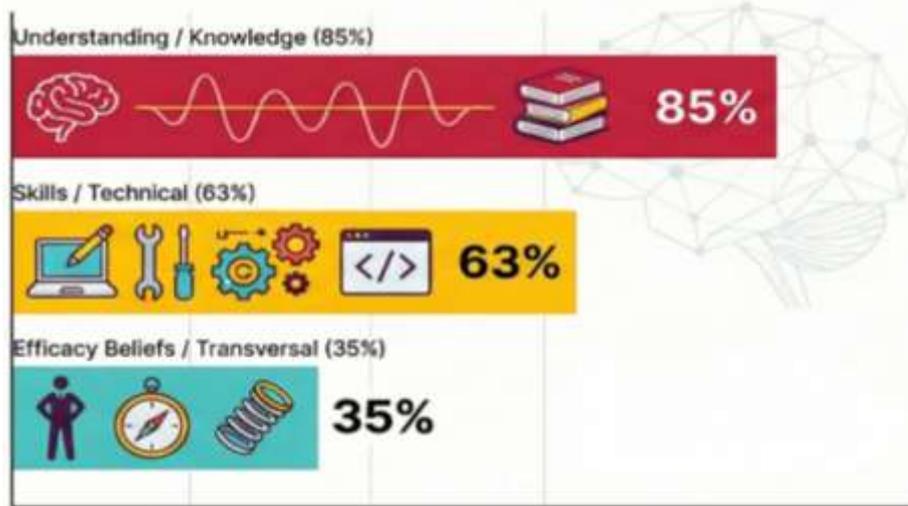


Figure 4 - Prevalence of USEM Dimensions in Business Sciences Curricula.

While this focus ensures graduates possess the foundational "AI Knowledge" described by Drydakís (2025), the overwhelming dominance of this dimension suggests a pedagogical reliance on the *transfer* of information. In the context of the USEM model, the "Understanding" pillar is fully saturated. However, as noted by Portocarrero Ramos et al. (2025), technical knowledge alone is insufficient; while graduates may "know" the theory, this saturation does not translate into preparedness for labour market changes if unaccompanied by practical adaptability.

The 'Efficacy Gap': The Neglect of Self-Beliefs

In stark contrast to the dominance of cognitive outcomes, the dimension of "Efficacy Beliefs" – critical for fostering *Technological Readiness* (Arooje et al., 2025) – is structurally marginalized in the curricula. The data reveals critically low frequencies for competences associated with personal agency and resilience:

- **Motivation for Excellence:** Only 7% of study cycles explicitly mention the drive for excellence as a learning outcome. This suggests that intrinsic motivation is assumed rather than cultivated.
- **Leadership:** Despite being a key "AI Capability" for strategic decision-making in business, leadership appears in only 20% of the analysed courses.
- **Adaptation:** The competence of "Adaptation to new situations" – the core of resilience in an AI-disrupted market – is found in only 28% of curricula.

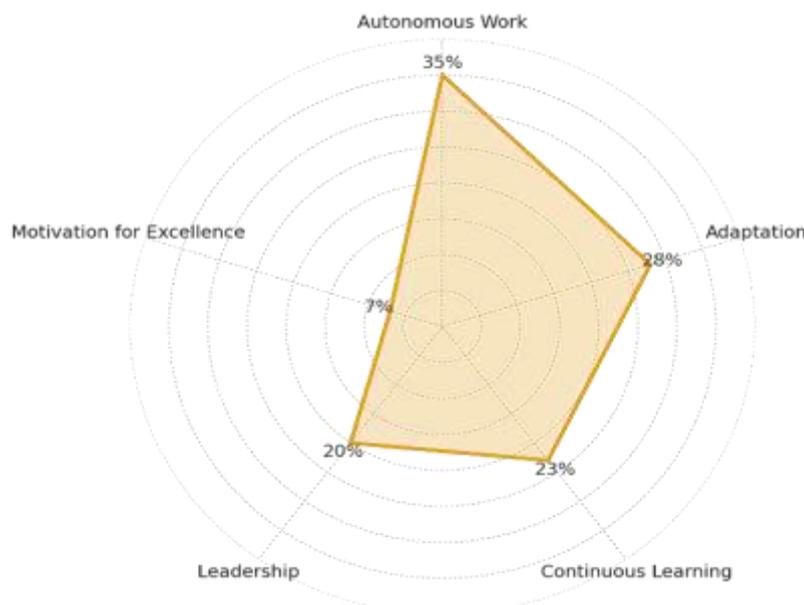


Figure 5 - Prevalence of Efficacy-related Transversal Competences in Business Curricula.

This "Efficacy Gap" presents a major barrier as shown in figure 6. Arooje et al. (2025) argue that technological readiness (a moderator for employability) depends on the *disposition* to embrace technology. The curriculum data shows that HEIs are failing to formally develop this disposition, leaving graduates psychologically ill-equipped to navigate the uncertainty of AI integration.

The Autonomy Deficit: A Barrier to Lifelong AI Learning

The rapid evolution of generative AI tools requires professionals who can engage in self-directed upskilling. However, our analysis uncovers a worrying "Autonomy Deficit". The competence of "Autonomous Work" (*Trabalho Autônomo*) appears in only 35% of the study cycles. Furthermore, "Continuous Learning" (*Aprendizagem Contínua*) – the ability to update one's skills post-graduation – is explicitly fostered in only 23% of courses.

This finding is particularly alarming when triangulated with the work of Portocarrero Ramos et al. (2025), who found that 95.6% of graduates express a desire to continue learning about AI tools. While the *desire* exists among students, the *structural preparation* for autonomy is absent in 65% of the degrees. Without the curricular enforcement of autonomous work habits, graduates are likely to struggle with the self-regulated learning required to keep pace with AI advancements, leading to the "somewhat prepared" sentiment currently observed in the labour market.

To enhance clarity and facilitate comparative interpretation, Table X consolidates the distribution of learning outcomes across the USEM-aligned dimensions for the full sample of 421 study cycles.

Table 1 - Distribution of USEM Dimensions across Business Curricula (N=421)

USEM Dimension	% of Programmes Included
Understanding (Knowledge)	85%
Skills (Technical-Scientific Competences)	63%
Efficacy Beliefs	35%
Autonomous Work	35%
Adaptation	28%
Continuous Learning	23%
Leadership	20%
Motivation for Excellence	7%

While Figures 2 and 3 illustrate specific competence patterns, the summary table provides a system-level overview of the relative weight attributed to Understanding, Skills, and Efficacy-related competences in the formal curriculum. This synthesis makes visible the structural imbalance that underpins the "Efficacy Gap" identified in the analysis.

DISCUSSION

This study set out to diagnose the employability profile of Business Sciences curricula through the lens of the USEM model. The results reveal a significant "Efficacy Gap" that is obscured by a strong emphasis on theoretical content. In this section, the analysis moves beyond description to interpret these findings as structural conditions that are likely to shape graduates' readiness to operate in AI-intensive labour markets. In particular, the under-representation of Efficacy-related competences constitutes a structural vulnerability that is consistent with the low levels of Technological Readiness reported in recent empirical studies.

The "Knowledge Trap": Teaching About Business vs. Developing Adaptive Professionals

The analysis shows that 85% of study cycles explicitly prioritise Understanding (Theoretical Knowledge), while only 35% include outcomes related to Efficacy beliefs. This pattern suggests that Higher Education Institutions (HEIs) may be caught in what can be termed a "knowledge trap": the curriculum is strongly

oriented towards the transmission of disciplinary knowledge, but less so towards the development of the personal and behavioural capacities required to mobilise that knowledge under conditions of uncertainty.

In a pre-AI context, such an emphasis on Understanding might have been relatively adequate. However, Drydakís (2025) reframes employability assets as “AI Capital”, comprising Knowledge, Skills, and Capabilities – the latter referring to the strategic ability to integrate AI into decision-making and innovation. From this perspective, the findings suggest that while HEIs are plausibly supplying the “AI Knowledge” component (as evidenced by the 85% focus on theoretical knowledge), they are structurally less effective in fostering the “Capabilities” component linked to Efficacy beliefs – for example, leadership (20%), adaptation (28%) and motivation for excellence (7%).

This imbalance does not in itself prove a direct causal effect on individual employability outcomes. However, it can be interpreted as a curricular configuration that is more conducive to producing graduates who “know about” business than graduates who are equipped to function as adaptable professionals. In AI-intensive environments, where tasks and tools change rapidly, this knowledge-heavy, capability-light profile is likely to limit the extent to which graduates can convert their disciplinary literacy into strategic use of AI tools and data-driven practices.

A Plausible Mechanism: Efficacy as a Structural Antecedent of Technological Readiness

Recent literature suggests that Technological Readiness (TR) moderates the relationship between skill development and employability: competences translate more effectively into labour market outcomes when individuals exhibit high readiness to engage with technology. Against this backdrop, a plausible mechanism linking curricular architecture and TR can be identified.

Within the USEM framework, Efficacy Beliefs encompass personal agency, self-regulation, and confidence in one’s capacity to act effectively. The findings indicate that learning outcomes associated with this dimension — such as Motivation for Excellence (7%) and Adaptation to New Situations (28%) — remain marginal within current curricula. Structurally, this under-prioritisation suggests limited formal emphasis on cultivating the autonomy and resilience that underpin technological engagement.

While our design does not allow us to establish causal relationships at the individual level, the convergence between our curricular evidence and existing TR research is notable. Studies such as Arooje et al. (2025) indicate that technological readiness depends on a disposition to embrace new technologies, which is closely aligned with efficacy-related competences. In that light, the “Efficacy Gap” identified in this study can be understood as a structural antecedent that may constrain the development of TR among graduates: curricula that give limited formal salience to autonomy, adaptation and continuous improvement are less likely to provide systematic opportunities for students to build the psychological resources required to engage with evolving AI tools.

Graduates who possess strong disciplinary knowledge, but weaker efficacy-related capacities may perform adequately in stable, predictable environments. However, as algorithms evolve and organisational processes are reconfigured, their knowledge risks becoming obsolete more quickly if it is not supported by the self-regulatory and adaptive capacities needed to re-skill and up-skill. In this sense, the “Efficacy Gap” offers a plausible explanation at the structural level for why technical skills, even when present, may remain underutilised in AI-intensive workplaces.

Bridging the Perception Gap: Why Graduates Feel “Somewhat Prepared”

The structural pattern identified in the curricula also helps to illuminate the perception gap reported in recent empirical studies. Portocarrero Ramos et al. (2025) find that while 95.6% of graduates express a desire to continue learning AI tools, only 16.9% feel “very prepared” to face labour market changes. Our analysis does not directly measure these perceptions, but it offers a curricular context within which they can be interpreted.

On the one hand, the strong emphasis on Understanding (85% of programmes) ensures that graduates develop a vocabulary and conceptual framework that allow them to recognise the strategic importance of AI. On the other hand, the relatively low prevalence of outcomes related to Autonomous Work (35%) and Continuous Learning (23%) indicates that curricula are less explicit about fostering the habits and dispositions required for self-directed, lifelong learning.

This misalignment suggests that students may leave university with a clear sense that AI is important, but with fewer structured opportunities to practise autonomous learning and adaptive problem-solving in their formal programmes. As a result, they may have to rely heavily on informal and self-guided efforts to acquire AI-related competences, even though the curriculum has not systematically prepared them for this mode of learning. The widespread feeling of being “somewhat prepared” can thus be read as a symptom of a structural outsourcing of adaptability: the responsibility for developing readiness is implicitly shifted to individuals, while the formal curriculum remains predominantly content centred.

Taken together, these findings indicate that the barrier to AI-related employability is not solely technological. It is also curricular and psychological. Business curricula that prioritise theoretical knowledge and technical skills while under-emphasising Efficacy-related competences may inadvertently limit graduates’ capacity to translate their disciplinary learning into sustained, technology-enabled career adaptability. Strengthening the Efficacy dimension of the USEM model within programme-level learning outcomes therefore appears to be a key lever for enhancing Technological Readiness and, by extension, employability in the AI era.

Although the USEM model conceptualises Metacognition as a distinct dimension encompassing reflective capacity, self-monitoring, and strategic learning regulation, this study did not operationalise metacognitive learning outcomes as a separate category within the coding scheme. The analytical focus was placed primarily on the Efficacy dimension due to its documented relationship with Technological Readiness in recent AI literature. Nonetheless, metacognitive competences could theoretically be identified through learning outcomes referring to critical reflection, self-evaluation, or strategic decision-making. Extending the competence matrix to explicitly capture this dimension would allow for a more comprehensive operationalisation of the USEM framework and offer a richer understanding of how curricular architecture may shape graduates’ adaptive capacity in AI-driven labour markets.

CONCLUSION AND IMPLICATIONS

This study aimed to diagnose the structural alignment of business curricula with contemporary labour market demands. By analysing 421 study cycles through the USEM framework, a significant “Efficacy Gap” was identified: whereas Understanding (85%) and Skills (63%) are strongly represented, Efficacy Beliefs (35%) remain comparatively under-emphasised. In the context of AI-driven transformation, this imbalance constitutes not merely a pedagogical concern but a strategic structural vulnerability. The findings indicate that current curricular architectures may be contributing to the production of graduates who possess substantial disciplinary knowledge yet insufficient Technological Readiness to operate adaptively within algorithmically mediated environments.

As Artificial Intelligence continues to reshape organisational processes and professional roles, this curricular configuration acquires systemic relevance. The challenge is therefore not confined to the incorporation of new technical content, but to the recalibration of competence architectures so that autonomy, resilience, and continuous learning are institutionally embedded as core conditions of employability. The following implications outline potential pathways through which Higher Education Institutions (HEIs) may respond to this structural gap.

The findings point to the need for a structural recalibration of competence design within business education. If employability remains a declared objective of higher education under the Bologna framework, accreditation and quality assurance mechanisms should move beyond the formal enumeration of knowledge and technical skills to ensure that Efficacy-related competences are explicitly articulated and institutionally reinforced.

From a policy perspective, AI Capital should not be treated as a specialised or peripheral domain restricted to STEM programmes. Rather, it requires transversal integration across business curricula, embedding not only AI-related knowledge and tools, but also the adaptive capabilities necessary to mobilise them strategically. Without such integration, a segmentation risk emerges in which graduates from social science domains remain structurally disadvantaged in signalling AI-readiness to employers.

In this regard, national qualification frameworks and accreditation templates may play a pivotal role. By explicitly incentivising the articulation of autonomy, continuous learning, and adaptive problem-solving within programme-level learning outcomes, regulatory bodies can mitigate curricular inertia and foster more readiness-oriented competence architectures. Strengthening the Efficacy dimension at system level therefore constitutes not merely a pedagogical adjustment, but a structural intervention aligned with the evolving demands of AI-intensive labour markets.

Beyond system-level adjustments, the findings carry significant implications for programme design and pedagogical practice. If Technological Readiness functions as a moderator between skill acquisition and employability, then curricular design should consider moving beyond the accumulation of disciplinary content and explicitly cultivate the psychological and behavioural capacities that enable its strategic mobilisation.

In practical terms, this implies embedding Efficacy-related competences — such as autonomy, adaptability, resilience, and initiative — within programme-level learning outcomes and assessment strategies. Rather than treating these dimensions as implicit by-products of academic training, curricula may benefit from making them structurally visible and pedagogically intentional. This shift would help align formal competence statements with the adaptive demands of AI-mediated professional environments.

Given the accelerating obsolescence of specific technical tools, the capacity for Continuous Learning and Autonomous Work becomes central to long-term employability. Strengthening these competences within curricular architecture may therefore enhance graduates' ability not merely to use AI tools, but to evolve alongside them. In this sense, the transition from content-delivery models to readiness-oriented design represents a strategic repositioning of business education in response to technological transformation

Limitations and future research

This study has limitations that should be acknowledged. First, the analysis is restricted to programme-level learning outcomes in Business Sciences in Portugal and covers study cycles accredited between 2009 and 2015; future research should replicate and extend this curricular mapping to other countries and more recent cohorts of programmes, particularly those redesigned after the diffusion of generative AI tools. Second, the study focuses on the intended curriculum as expressed in accreditation documents and does not capture how competences are developed and assessed at course level or in classroom practice. Third, Technological Readiness, AI Capital, and employability outcomes were not measured at the individual level: our interpretation is therefore confined to structural conditions at the curricular level. Combining curricular analysis with graduate surveys or longitudinal data on labour market trajectories would allow future work to examine more directly how specific competence profiles translate into technological readiness and career outcomes in AI-intensive labour markets.

Final Remark

The "Employability Paradox" identified in this study reveals that the barrier to AI adoption is not just technological, but structural and psychological. By ignoring the *Efficacy* dimension of the USEM model, universities are equipping students with disciplinary knowledge while insufficiently institutionalising the autonomy required to mobilise it effectively. To secure the future of work, higher education must urgently treat *AI Capital* and *Efficacy Beliefs* not as optional soft skills, but as the fundamental currency of the 21st-century labour market.

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