Posthumanist Insights into the Adoption of Diffusion Dynamics in Vocational Education and Workforce Transformation

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Abstract

Vocational education operates within dynamic socio-technical assemblages shaped by rapid technological shifts, algorithmic governance, and evolving labour market demands. Traditional, anthropocentric models of diffusion fail to account for the distributed agency across human and non-human actors. A posthumanist reconceptualization of diffusion dynamics reveals innovation as a relational, emergent process shaped by intra-actions among learners, technologies, institutional logics, and digital infrastructures. Through the development and validation of the Academia-Industry Diffusion Dynamics Scale, three key dimensions of capability: Effective Utilisation of Resources, Sensing Capabilities, and Innovativeness, are identified. These dimensions reflect how vocational institutions adapt through entangled processes rather than linear decision-making. Factor analysis confirms the co-constitutive nature of capability formation, highlighting how institutions do not merely implement innovations but are reconfigured through them. Posthumanist theory thus offers a critical framework for understanding diffusion as an ontological transformation, positioning vocational education as a site of continuous reassembly within complex human–non-human ecosystems.

Keywords: Anthropocentric, Diffusion Dynamics, Vocational Education, Confirmatory Factor Analysis, Labour Market.

Introduction

Diffusion Dynamics in the Posthuman Condition

Diffusion dynamics, in the context of vocational institutions and labour markets, refers to the process by which various capabilities, such as technological, cognitive, social, and institutional, are adopted and operationalized to build resilience and responsiveness in the face of shifting conditions. Traditionally, the study done by Rogers (2003), regarding the diffusion of innovations theory, have assumed linear pathways of adoption, often centred on individual or organisational decision-makers. However, this perspective is increasingly insufficient in explaining how capabilities are mobilised in systems saturated with algorithmic governance, machine learning, and platform-mediated interactions.

Posthumanist thought, in contrast, reconfigures diffusion dynamics as non-linear, emergent, and co-constitutive, which challenges the linear, causal, and hierarchical frameworks often assumed in traditional models of institutional innovation. Within conventional diffusion theories, such as Innovation follows a predictable path where it originates from a source, spreads through a

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network, and is adopted or rejected by individual agents based on rational decision-making (Rogers, 2003). This model implies a certain intentionality, directionality, and clear boundaries between agents and systems. However, posthumanist thought fundamentally unsettles these assumptions by proposing that agency is distributed across assemblages of human and non-human actors, and that change does not unfold through isolated decisions but through relational intra-actions (Barad, 2003). In other words, the implementation of new capabilities within vocational institutions is not a sequence of planned steps carried out by administrators or policymakers acting upon inert tools. Rather, it is an emergent process shaped simultaneously by institutional policies, digital infrastructures, algorithmic logics, pedagogical habits, material environments, and the performativity of technological systems.

Diffusion dynamics, when viewed through a posthumanist lens, are non-linear in that they do not follow a fixed trajectory from innovation to adoption. They loop, iterate, and morph as technologies themselves evolve, as users reinterpret their functions, and as external conditions, such as labour market demands or funding structures, shift. What is being "diffused" is not merely a technology but a reorientation of subjectivity, temporality, and institutional logic. Moreover, this diffusion is co-constitutive, meaning that the actors and systems involved are not pre-given entities interacting with one another; rather, they are mutually shaped and brought into being through their interactions. The institution is shaped by the tools it adopts, just as those tools are shaped by institutional needs, discourses, and constraints. Students engaging with digital learning environments become different kinds of learners who are datafied, profiled, and modulated by the systems they inhabit. Educators, likewise, are reconstituted as facilitators, curators, or even algorithmic overseers, depending on how technologies reconfigure their roles.

The diffusion of capability is thus not about transferring a fixed function into a new setting, but about transforming what institutions, technologies, and humans are and do in relation to one another.This view resonates with the conception of rhizomatic systems, where change proliferates through connections and intensities rather than hierarchies and causal chains (Deleuze and Guattari, 1987). In this framing, innovation within vocational education is not a top-down decision to implement new technologies or curricula but a dynamic process of becoming, enacted through the interplay of practices, code, materiality, and meaning. Hence, by foregrounding emergence, entanglement, and mutual constitution, posthumanist theory offers a powerful conceptual framework for understanding diffusion dynamics not as a managerial function but as a complex ontological transformation. It highlights that the "what" and "who" of education and labour are always in flux, continuously reshaped through techno-social processes that exceed the intentions of individual actors. The boundaries between human intentionality and machine agency become blurred. Vocational institutions do not merely respond to labour market signals; they co-evolve with them through constant feedback loops mediated by technological infrastructures. Thus, posthumanist theory enriches the concept of diffusion dynamics by emphasising the distributed nature of agency and the entanglement of actors across human and non-human domains. The implementation of capabilities is no longer a unidirectional process but a recursive one, shaped by algorithmic decision-making, digital infrastructures, and institutional logics that are themselves shaped by broader socio-technical assemblages (Kitchin, 2014). As such, diffusion becomes an ontological process of becoming, an ongoing reconfiguration of systems, identities, and capacities that exceed the control or authorship of any single actor.

Posthumanist theory, as articulated by scholars such as Barad (2003) and Braidotti (2013), fundamentally disrupts humanist assumptions about bounded, autonomous subjects acting upon

passive objects. Instead, it proposes a relational ontology wherein agency emerges through intra-active encounters between heterogeneous entities, human actors, technological systems, institutional structures, and material environments. Within vocational education contexts, this theoretical framework illuminates how innovations do not simply transfer from human adopters to passive recipients, but rather emerge through complex webs of relations that exceed human intentionality and control.

The implications of this posthumanist turn for understanding diffusion dynamics are profound and find resonance in socio-technical systems theory, which similarly challenges reductionist approaches that view organisations as either purely social constructs or purely technical mechanisms. Socio-technical theory positions successful system performance as stemming from the joint optimisation of social and technical subsystems, where capabilities are not housed in any single node—such as the human worker or the machine—but emerge through their ongoing interaction (Abbas & Michael, 2023; Trist & Bamforth, 1951). This ontological stance aligns closely with posthumanist thought in rejecting anthropocentric exceptionalism and acknowledging distributed agency across human and non-human entities. The convergence of socio-technical and posthumanist theories offers a compelling framework for reconceptualising diffusion dynamics in vocational education. Both theoretical traditions reject rigid dichotomies between subjects and objects, humans and technology, agency and structure. Where socio-technical theory blurs the boundaries between humans and technology within organisational systems, posthumanism extends this dissolution of boundaries across broader networks of agencies that encompass human and non-human entities in ongoing processes of becoming. An optimal system, from this integrated perspective, achieves diffusion dynamics through the careful arrangement of human and non-human agencies in configurations that enable responsive adaptation to environmental changes.

The seminal diffusion of innovations theory, while foundational to the field, remains fundamentally anthropocentric in its conceptualisation of adoption processes. The five characteristics of innovation—relative advantage, compatibility, complexity, trialability, and observability—presuppose discrete human subjects evaluating and adopting bounded technological objects (Rogers, 1983). However, when viewed through this integrated socio-technical posthumanist lens, these characteristics become sites of relational emergence rather than predetermined attributes. Relative advantage, for instance, cannot be understood as an inherent property of an innovation, but rather as an effect of specific socio-technical assemblages that bring particular benefits into being through their relational configurations and joint optimisation processes. This reconceptualisation necessitates a shift from examining how individual human actors adopt innovations to investigating how innovations and adopters co-emerge through dynamic socio-technical assemblages. In vocational education, this means attending to how teaching practices, technological tools, institutional policies, industry demands, and student needs become entangled in ways that produce new educational realities through processes of joint optimisation. The emphasis on distributed agency reveals how innovations in vocational education are not simply implemented by human educators but emerge through the complex interactions between pedagogical intentions, technological affordances, institutional constraints, and student responses within open systems that evolve through feedback loops and environmental interaction.

The conceptualisation of dynamic capabilities as an organisation's capacity to "integrate, build, and reconfigure internal and external competencies" already gestures toward relational understandings of organisational agency that resonate with socio-technical principles of joint

optimisation (Teece, 2007, 2014). This extends the analysis of dynamic capabilities to examine the capabilities emerging through the entanglement of human expertise, technological infrastructures, institutional histories, and environmental pressures within open systems characterised by ongoing feedback loops and environmental interaction, rather than being possessed by organisations as discrete entities.

The network structures and partnering tendencies identified by Gibbons (2004) and Kim et al., (2015) as crucial to diffusion processes can be reconceptualised through this integrated socio-technical posthumanist framework as open systems comprising both human relationships and non-human elements including technological platforms, data flows, material infrastructures, and regulatory frameworks. These networks do not simply facilitate diffusion but actively participate in constituting the innovations that spread through them via processes of joint optimisation between social and technical subsystems. Understanding diffusion as occurring through such heterogeneous socio-technical networks reveals how vocational education innovations emerge through complex processes of co-evolution and mutual adaptation rather than linear adoption, where optimal arrangements between human and non-human agencies enable sustained diffusion dynamics.

The integrated approach to diffusion dynamics in vocational education challenges researchers and practitioners to move beyond instrumental understandings of technology adoption toward more nuanced analyses of how educational innovations emerge through relational becoming within optimally configured socio-technical systems. It calls for attention to the material-semiotic practices through which educational assemblages continuously reconfigure themselves in response to changing conditions, while maintaining the delicate balance of joint optimisation that enables effective diffusion dynamics. This perspective highlights the agency of non-human actors—from learning management systems to industry standards—in shaping educational futures, while emphasising the critical importance of achieving optimal arrangements between social and technical elements for sustained innovation diffusion.

Posthumanism and Labour Markets Dynamics

Posthumanist theory reconfigures the figure of the worker in contemporary labour markets. As automation, platform labour, and AI-driven decision-making increasingly shape employment landscapes, the notion of a stable, autonomous worker becomes untenable (OECD, 2023; Schaupp, 2023). Instead, the labour market is populated by posthuman workers—hybrid entities whose labour is mediated by technologies, whose identities are fragmented across platforms, and whose value is determined by data metrics and algorithmic visibility (Casilli, 2024; Cant et al., 2024; Chen et al., 2022). These workers are not only digitally visible but also algorithmically governed, as platforms and AI systems manage, rate, and reward them in opaque and often exploitative ways (Munn, 2024; Deranty & Corbin, 2022). Rather than being replaced by machines, many workers find themselves entangled in socio-technical assemblages where agency and labor are redistributed and redefined (Ganuthula, 2024). This has direct implications for vocational training, which must now prepare learners not just to acquire skills, but to navigate assemblages of labour that are volatile, precarious, and non-linear.

The diffusion of capabilities is not merely a technical process but a socio-ontological transformation. Workers are not only adapting to new tools; they are becoming new kinds of subjects—networked, datafied, and relational (Amoore, 2020). Vocational institutions, therefore, must reconceive their role not as transmitters of stable competencies but as facilitators of becoming within posthuman ecologies. This also calls for new pedagogical practices that

cultivate what Braidotti (2013) terms "posthuman subjectivity"—an ethical and affective orientation that embraces complexity, interdependence, and the multiplicity of being. In practical terms, this might involve curricula that emphasise systems thinking, digital literacy, ecological awareness, and critical engagement with technology. It also entails institutional willingness to embrace non-linear learning paths, collaborative knowledge production, and co-design with human and non-human stakeholders.

The following analysis employs this integrated socio-technical posthumanist framework to examine how vocational education institutions navigate contemporary challenges not as bounded human organisations adopting external innovations, but as complex open systems continuously becoming through their entangled relations with technological, economic, and social forces. This theoretical reorientation offers new insights into the factors that enable or constrain educational innovation while highlighting the critical importance of achieving optimal arrangements between human and non-human agencies for sustained diffusion dynamics. Furthermore, it illuminates the ethical and political implications of recognising distributed agency in educational processes and the need for joint optimisation approaches that honour both social and technical dimensions of educational transformation.

Methodology

Grounded in posthumanist theory, which reconceptualizes the human subject as entangled within complex assemblages of technology, data systems, and non-human actors (Barad, 2007; Braidotti, 2013; Wolfe, 2010), the research adopted a quantitative, cross-sectional survey design to explore how capabilities and innovations diffuse through vocational education environments. Posthumanism rejects the notion of isolated human agency, emphasizing instead that knowledge and adaptation emerge through distributed, relational processes—a perspective that informed both the conceptual and methodological choices of the study.

The data were collected from students enrolled in Technical and Vocational Education and Training (TVET) institutions across Rajasthan, India through a simple random sampling method. Rajasthan serves as a compelling state for study to examine the connection between industry and vocational education in India due to its diverse industrial landscape, substantial investment in technical and vocational education, and its demographic significance (Planning Department, Government of Rajasthan, 2020; National Skill Development Corporation, 2019). As one of the largest states in India by area and population, Rajasthan presents a varied economic structure that includes both traditional sectors, such as mining, handicrafts, and agriculture and rapidly growing industries like textiles, automotive components, and renewable energy (Planning Department, Government of Rajasthan, 2020). This mix of established and emerging industries creates a dynamic environment for understanding how vocational education aligns with labour market needs.

Importantly, Rajasthan has seen significant efforts to strengthen Technical and Vocational Education and Training (TVET) through both public and private initiatives. Government programs like the Rajasthan Skill and Livelihoods Development Corporation (RSLDC) and partnerships with industrial training institutes (ITIs) and polytechnics have contributed to a robust network of skill development centers across the state (National Skill Development Corporation [NSDC], 2019). These centers provide a range of vocational training opportunities that are directly linked to employability in local and regional industries, making Rajasthan an ideal location to explore how vocational education is shaped by and responds to industrial demand.

The demographic profile of Rajasthan further underscores its relevance for this study. With a large youth population, over 50% of residents under the age of 25, the state is a microcosm of India's demographic dividend (Census of India, 2011). Understanding how this young population engages with vocational training can offer valuable insights into national-level strategies for addressing youth unemployment and skills mismatches.

Given this context, Rajasthan emerges as a suitable site to study the industry-education interface, providing a lens to evaluate whether vocational programs are aligned with real-world job demands. Its industrial diversity, youth population, and proactive skill development policies collectively contribute to its significance in national conversations about employability and education reform in India. The sample consisted of 272 students, aged 15 to 29. Participants were drawn from five engineering streams: Computer Science, Electrical and Electronics, Mechanical, Civil, and Electrical Engineering. These disciplines are critical to skill development in rapidly transforming labor markets, particularly within developing economies (Rikala et al., 2024). Random sampling method ensures broad representation across streams (Acharya et al., 2013), while forced-response items on the survey eliminated missing data, following best practices for survey integrity (Dillman et al., 2014).

Ethical standards were upheld through voluntary participation and anonymization of all responses. Data collection was conducted in person through institutional visits—a method known to improve participation rates and data quality in educational contexts (Fowler, 2014). To examine the structure and validity of the capability constructs, Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA) were conducted using JASP, a widely adopted open-source platform in applied social science research (Goss-Sampson, 2019).

Posthumanism as a Theoretical Lens

Posthumanism, as a critical theoretical lens, challenges the enlightenment humanist ideal of the rational, autonomous subject who stands apart from and above nature, technology, and non-human others. Instead, posthumanist theory positions the human as fundamentally entangled with technological apparatuses, non-human entities, ecological systems, and machine intelligence (Braidotti, 2013; Wolfe, 2010). It does not merely celebrate technological enhancement or transhumanist augmentation; rather, it interrogates the philosophical, ethical, and ontological assumptions that privilege human agency and cognition as central. Posthumanism insists on decentring the human subject and recognising the agency of the non-human, the machinic, and the systemic. Within this framework, knowledge, learning, and labour are no longer strictly the product of individual human cognition or action but emerge from distributed networks of actors, both organic and inorganic (Barad, 2007).

The perspective has implications for the structures, purposes, and operations of vocational institutions. When viewed through a posthumanist lens, the diffusion of innovation or adaptation of new capabilities within vocational systems can no longer be attributed solely to human decision-making or institutional intentionality. Rather, these dynamics are understood as emergent phenomena arising from intra-actions as explained by Barad (2007) using the term "entangled agency" between human learners, educators, technologies, data systems, institutional policies, and labour market algorithms. Such a framing allows for a more nuanced, relational understanding of how change is enacted and how capabilities are constructed in vocational settings. The following section discusses the instrumentation of the tool to measure the diffusion dynamics in a vocational education institution, followed by the analysis of the factors and agencies that construct the idea of diffusion dynamics in an institution.

Development of the tool

The Academia-Industry Diffusion Dynamics Scale was administered as a self-assessment tool in both English and Hindi, the predominant language in the region. This bilingual approach enhances accessibility and response validity in multilingual contexts (Oliveri et al., 2015). The instrument consists of 18 items distributed across five distinct factors identified through comprehensive literature review, following the methodological framework proposed by for scale development (Villarino, 2024).

Drawing from contemporary theoretical models, the scale encapsulates five domains, including Technological Resources, Sensing Capabilities, Innovativeness, Institutional Effectiveness, and Organisational Culture which is shown in Figure 1.
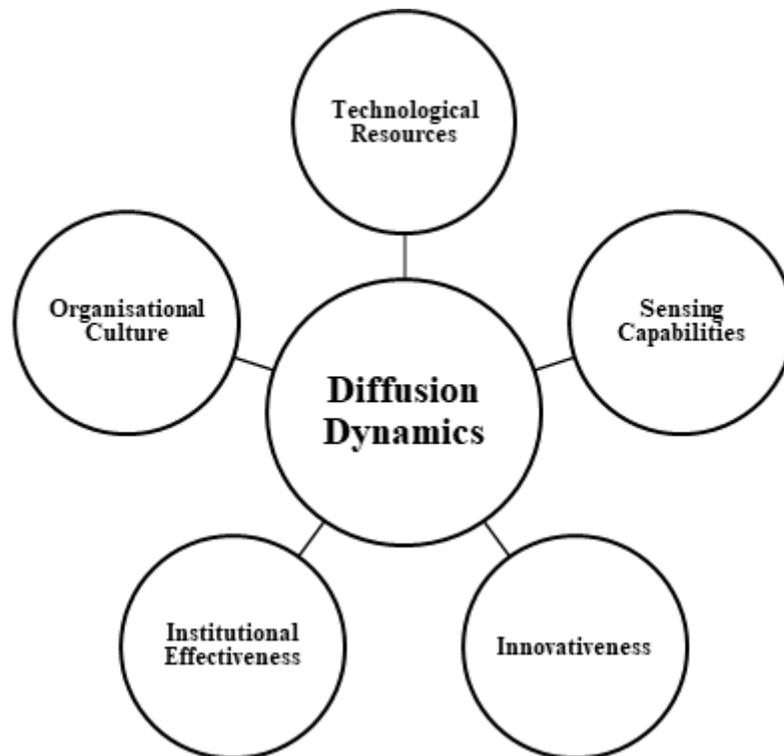

Figure 1: Dimensions of Diffusion Dynamics

The instrument measured the dimensions with their corresponding item codes. The instrument utilized a five-point Likert scale response system ranging from 1 ("strongly disagree") to 5 ("strongly agree"), consistent with contemporary psychometric standards for attitude and self-efficacy measurement (Boateng et al., 2018). This response format facilitates nuanced assessment of competency levels while maintaining ease of comprehension for respondents (Taherdoost, 2019).

Results and Discussion

Exploratory Factor Analysis (EFA)

The EFA was conducted to detect underlying dimensions of institutional capability from a set of observed indicators, without pre-imposed structural assumptions. Using an equamax rotation, a method that balances simplicity and clarity in the loading matrix, the analysis revealed a three-factor solution, accounting cumulatively for approximately 40.5% of the total variance in the dataset. Factor 1 emerged with strong loadings from items such as DIE3 (.644), DOC1 (.609), and DTR5 (.532), DIE2 (0.486), DOC3 (0.433), representing what we interpret as the *Effective Utilisation of Resources (EUoR)*. Factor 2 was characterized by loadings from DTR2 (.553), DTR4 (.619), and DSC1 (.542), DTR3 (0.524), DSC2 (0.438) corresponding to *Sensing Capabilities*. Finally, Factor 3 included high loadings from DSC3 (0.548), DI2 (.495), DOC4 (.482), DIE1 (.464), DOC2 (0.447), DI1 (0.405) suggesting a construct of *Innovativeness*. The following table 1 depicts the factor loadings.

Factor Loadings

	Factor 1	Factor 2	Factor 3	Uniqueness
DIE3	0.644			0.457
DOC1	0.609			0.518
DTR5	0.532			0.563
DIE2	0.486			0.568
DOC3	0.433			0.641
DSC2	0.418	0.438		0.588
DOC2	0.409		0.447	0.581
DTR4		0.619		0.495
DTR2		0.553		0.621
DSC1		0.542		0.600
DTR3		0.524		0.603
DSC3			0.548	0.653
DI2			0.495	0.697
DOC4			0.482	0.581
DI4			0.465	0.593
DIE1			0.464	0.668
DI1			0.405	0.616
DTR1				0.675

Note. Applied rotation method is equamax.

Table 1: Factor Loadings of the Academia-Industry Diffusion Dynamics Scale

The statistical emergence of factors can be read through a posthumanist lens as revealing the co-constitution of institutional identity and capability through complex entanglements of material, technological, and human elements. Institutions do not "possess" capabilities in isolation; rather, these capabilities are effects of assemblages where competencies, technologies, and cultural logics interact. EFA, in this context, is not merely a classificatory act but an ontological mapping of these assemblages.

The chi-squared test of model fit further confirmed the statistical adequacy of this structure (χ^2 = 174.164, df = 102, p < .001), validating the coherence of these groupings while acknowledging the presence of unexplained variance—an echo of posthumanist indeterminacy and the limits of representational models.

Confirmatory Factor Analysis (CFA)

Following the exploratory phase, Confirmatory Factor Analysis was employed to test the robustness and theoretical adequacy of the proposed three-factor model. This model reflects the hypothesized relational structure between the observed variables and latent constructs identified through EFA.

The CFA results confirmed the goodness-of-fit of the model, with χ^2 = 220.301 (df = 116, p < .001), suggesting an acceptable model fit under the DWLS (diagonally weighted least squares) estimator. Standardized loadings were uniformly strong, with indicators such as DIE2 (1.231), DIE3 (1.270), and DOC1 (1.187) loading highly on "Effective Utilisation of Resources," while DTR2 (1.000), DSC1 (1.040), and DOC3 (1.107) loaded significantly on "Sensing Capabilities." Innovativeness was likewise substantiated by high loadings from DI1 (1.344), DI4 (1.372), and DOC4 (1.404).

These results do more than validate a measurement model; they constitute an affirmation of the underlying ontological commitments of the theoretical framework. The distinct but correlated nature of the three factors (e.g., covariance between "Effective Utilisation of Resources" and "Sensing Capabilities" at .332, p < .001) illustrates the interdependence and intra-action of institutional capabilities in a more-than-human system in the following figure 2.
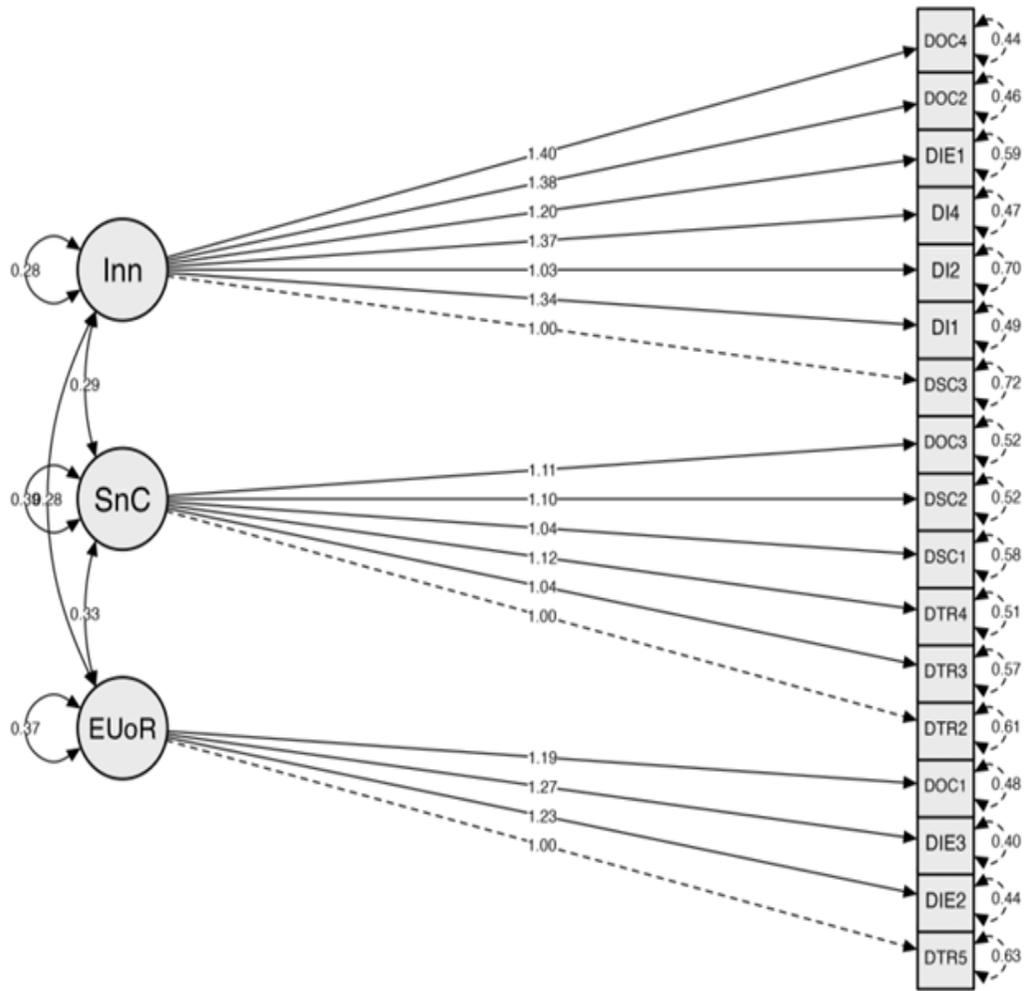
Figure 2: Confirmatory Factor Analysis Model

Factor Loadings and Thresholds as a Posthuman Metrics

One particular aspect of the CFA is its treatment of thresholds and factor loadings. Threshold estimates across multiple items (e.g., DIE2 t1 = -1.705, p < .001; DOC1 t3 = -0.629, p < .001) signal gradations of latent construct intensity across categorical indicators, reflecting how capabilities manifest in nuanced and context-dependent ways. In posthumanist terms, these thresholds can be seen as the points at which affective, cognitive, and material intensities coalesce into action or perception—what Deleuze and Guattari (1987) might call "lines of flight" that indicate emergent potentiality.

The CFA model thus operates not merely as a confirmation of structural coherence but as a cartographic practice—charting the territories of posthuman capability within vocational institutions. This reframes educational systems not as bounded containers of human agency but as porous, adaptive, and co-evolving systems.

Implications of the Study

The exploratory and confirmatory factor analysis conducted in this study revealed three interrelated but distinct dimensions in the posthuman framework: Effective Utilisation of Resources, Sensing Capabilities, and Innovativeness. While these categories resonate with existing literature on organizational adaptation and capability development (Teece, 2007; Eisenhardt & Martin, 2000), this research extends their conceptualization through a posthumanist lens, foregrounding the entanglement of human and non-human actors in the configuration and diffusion of institutional capacities.

Effective Utilisation of Resources

Effective Utilisation of Resources, the first factor, reflects the institution's ability to integrate and operationalize both human and non-human elements, encompassing traditional personnel and curricula alongside algorithmic platforms, data infrastructures, and digital governance mechanisms. The high loadings point to a convergence between conventional administrative structures and emerging technological modalities. This synthesis illustrates what posthumanist theorists describe as "entanglement", the mutual constitution of agency across human and technological systems (Barad, 2007). Unlike classical views that treat technology as a passive instrument leveraged by human agents (Tippins & Sohi, 2003; Winter, 2003), this study underscores the agency of technological systems as active participants or actants in institutional operations (Latour, 2005). Decision-making processes are increasingly shaped by predictive analytics, and from this standpoint, institutional resource utilization cannot be reduced to human efficiency. Such processes must be viewed as a relational dynamic, enacted across socio-technical assemblages. Institutions that demonstrate high capability in this domain do not merely "use" technology, they co-evolve with it, developing infrastructural elasticity that facilitates adaptive reconfiguration in response to shifting environmental demands, which shall facilitate the human and non-humans be agencies of development.

Sensing Capabilities

Sensing Capabilities, the second factor, captures the institution's and individual's responsiveness to external stimuli and its capacity for environmental scanning. Traditionally framed as a firm's ability to detect and interpret opportunities and threats (Teece, 2007; Day & Schoemaker, 2005), sensing has often been conceptualized as a managerial function relying on structured information systems and human judgment. However, in digitally mediated vocational environments, sensing emerges as a distributed process that transcends individual cognition. Drawing on theories of distributed cognition (Hayles, 1999; Hutchins, 1995), this study argues that vocational institutions act as sensory apparatuses embedded in wider techno-social ecosystems. In this configuration, responsiveness is co-constituted through interactions between administrators, educators, machine-learning algorithms, labour market dashboards, and social media analytics. Such a reframing challenges the linear and anthropocentric assumptions of diffusion models (Rogers, 2003) by highlighting how institutions are attuned to their environments not through deliberate scanning alone, but through ambient, recursive feedback loops with digital infrastructures. In this view, diffusion of practices and capabilities is less about deliberate imitation and more about intra-active responsiveness in which institutions "feel" their environments through embedded sensing technologies and reorient accordingly.

Innovativeness

The third emergent dimension, Innovativeness, encapsulates the institution's and individual's

capacity to not simply generate new ideas, but to reorganize and reconfigure practices, technologies, and policies in ways that sustain adaptability and sustainability. While mainstream dynamic capabilities literature posits innovation as a function of strategic intent and resource orchestration (Teece, 2007), this study positions innovativeness as an emergent, relational phenomenon which is a view supported by posthumanist perspectives on creativity and change.

Innovation, in this context, does not originate from isolated agents or managerial foresight but arises from the entangled interactions of institutional actors, learning technologies, regulatory norms, and cultural scripts. These interactions form what Deleuze and Guattari (1987) term "assemblages," where novel capacities are not invented ex nihilo but co-produced through iterative engagement with heterogeneous elements. Such a view reconfigures vocational innovativeness as a condition of ongoing morphogenesis rather than discrete innovation events. The institution becomes a site of continuous experimentation and affective negotiation, where curricular reform, digital transformation, and organizational restructuring are entangled with external labour dynamics and internal technological capacities. This aligns with Barad's (2007) notion of "intra-action," in which the boundaries between actors are not pre-given but emerge through relational encounters.

Implications for Diffusion Dynamics

The findings collectively challenge the linear, anthropocentric models that have traditionally dominated research on organizational diffusion and change. Rather than viewing vocational institutions as passive recipients or rational adopters of innovations, the posthumanist rearticulation presented here positions them as active, affective nodes within complex socio-technical ecosystems. Diffusion, accordingly, becomes a relational event where dynamic unfolding shaped by infrastructural affordances, material-discursive entanglements, and non-linear feedback mechanisms constitute an adaptable ecosystem. This reconceptualization has significant implications for policy and practice in vocational education. Through the posthumanist lens calls for a shift from static capability assessments to more dynamic evaluations that consider how institutions co-produce knowledge, governance, and change in partnership with technological systems. It also highlights the need for reflexivity in institutional design by recognizing how tools and digital infrastructures shape not only what institutions do but how they understand themselves and their futures. The posthumanist framework foregrounds the standpoint of capabilities that are distributed across humans and non-human actors as through the issues of equity, visibility, and agency must be rethought beyond traditional humanist categories.

The integrated findings of the EFA and CFA reveal a latent architecture of diffusion dynamics that is deeply entangled with posthumanist insights. The identified constructs such as resources, sensing, and innovation, are not stable entities but emergent properties of dynamic institutional ecologies. They highlight the necessity of vocational institutions to think and act beyond anthropocentric paradigms, embracing machines and tools, data-driven decision systems, and complex feedback loops that challenge traditional notions of control, authorship, and agency.

In practical terms, this suggests a shift in institutional design toward fostering permeability between human actors and non-human affordances, cultivating capacities not simply for knowledge transmission but for adaptive reconfiguration. The ability to "sense" emerging needs, to marshal diverse resources across material and symbolic domains, and to enact change recursively becomes essential in the context of dynamic labour markets.

Conclusion

By applying EFA and CFA within a posthumanist framework, this analysis not only delineates the structural contours of vocational capabilities but also reimagines the ontological basis of institutional action. The statistical practices themselves, far from being neutral instruments, participate in the co-production of knowledge and agency. They render visible the otherwise imperceptible networks of force, influence, and interrelation that drive diffusion dynamics in vocational settings. This reconceptualisation is essential in addressing the exigencies of a world where education, labour, and technology are no longer discrete spheres but elements of a shared posthuman condition. The challenge and opportunity lies in designing institutions that do not merely adapt to this condition but co-evolve with it.

Posthumanist theory provides a rich and provocative framework for reimagining diffusion dynamics in vocational institutions and labour markets, by decentring the human, recognising the agency of non-human actors, and embracing relational ontology, posthumanism enables a more accurate and ethically attuned understanding of how capabilities are adopted and operationalised in complex systems. It challenges the assumptions of linear progress, individual mastery, and technological neutrality that often underpin vocational education and calls for a new ethos of learning, one that is collaborative, adaptive, and attuned to the emergent realities of a posthuman world. This framing does not reject the value of human agency or humanist values entirely. Rather, it seeks to expand the horizon of educational and labour thinking to include the full range of actors and forces that shape the 21st Century requirements. In doing so, it offers vocational institutions a way to navigate the uncertainties of the present while cultivating the capacities needed for the future. As technological systems become increasingly autonomous and labour markets more fragmented, the ability to understand, anticipate, and participate in posthuman diffusion dynamics may prove essential not only for institutional survival but for the flourishing of diverse forms of life in a rapidly changing world.

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