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Quantitative analysis of digital transformation and employment inclusion for people with disabilities using big data insights

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Abstract
Digital transformation (DT) has become a key catalyst in reshaping employment ecosystems and promoting inclusion for individuals with disabilities through the integration of technology and data-driven systems. The research aims to conduct a quantitative analysis of DT and its impact on employment inclusion for people with disabilities, utilizing big data insights derived from workforce and organizational databases between 2019 and 2024. A quantitative analytical framework was established using SPSS and AMOS to assess relationships among DT indicators such as technological readiness, accessibility infrastructure, and digital competence and inclusion-related variables including employment participation, job sustainability, and digital engagement levels. Statistical techniques such as multiple regression analysis, and Structural Equation Modeling (SEM) were applied to evaluate inter-variable associations and the extent of influence. Strong positive effects are shown by path coefficients (β) with TR → EP (H1-0.42), AI → EP (H2-0.35), DC → EP (H3-0.38), EP → JS (H4-0.47), and TR → DE → EP (H5-0.15), with all associations statistically significant. The model validates the strong influence of DT indicators on inclusive employment outcomes. Overall, the findings highlight that leveraging big data analytics can substantially enhance evidence-based strategies for promoting equitable and sustainable employment inclusion for people with disabilities in the DT era.

Keywords: Digital transformation, employment inclusion, people with disabilities, big data analytics, quantitative analysis, accessibility technology

1. Introduction

Digital transformation (DT) denotes a fundamental restructuring of companies around the globe, requiring organizations from every sector to adapt their business models as they seek to remain competitive in quickly changing markets by leveraging digital technologies [1]. Due to its intrinsic transdisciplinary character, DT touches on approach, organizational design, Information Technology (IT), supply chains, and marketing, as well as requires proper investigation and discussion [2].

Administrators face an ever-increasing challenge from new digital technologies that destroy traditional market boundaries and redefine roles in business ecosystems where customers can be co-producers, competitors can become partners, and organizations can vertically integrate or eliminate others in the marketplace [3]. In addition to the technological aspects, organizations are faced with the responsibility to support, active, and equitable participation of all employees in the workforce and ensure economic equity and human rights [4].

In view of this, big data has emerged as an important enabler by offering large, complex, and rapidly generated datasets to support evidence-based decision-making and to discover actionable insights. The big data also raises ethical and privacy issues, such as transparency, bias, discrimination, justice, ownership, and control [5]. The research examines how DT, facilitated by big data analytics, assists employment inclusion for PWDs in the context of these technological, organizational, and ethical tasks. Despite growing emphasis on DT, limited empirical research explores how DT initiatives influence employment inclusion for people with disabilities. The research addresses this gap by quantitatively analysing the relationships between technological readiness, accessibility infrastructure, and digital competence and their impact on employment participation, job sustainability, and digital engagement using big data insights from 2019-2024.

Related works

The research [6] focused on the effects of the digital literacies of the employees in adopting cloud technology based on the Theory of Planned Behaviour as the framework of the data gathered. Digitization of the data revealed that there was a positive correlation among digital literacy and cloud technology, but the analysis was constrained by the nature of the data, which was exploratory and the small sample size.

The aspects of sustainable development in the financial services sector with respect to the role of DT (especially the digital payments) were analyzed in the research. The research [7] entailed review of the literature, secondary data analysis, and interviews. The findings showed that there were increased digital payment and positive influences on inclusion and efficiency outcomes, with the constraints being narrow in terms of social facets.

The spatial spillover effects of DT on Environmental, Social, and Governance (ESG) performance were examined in the research [8]. Approaches employed the spatial Durbin model. Results discovered that digital inclusion had a modest but positive effect on ESG, where digital public services and technological innovation were the important drivers, while constraints included the comparatively modest effect sizes.

The research [9] explored key indicators of employee involvement, like employee mobility, knowledge exchange, and psychological empowerment, during the DT of institutions. Statistical research of 205 non-academic employees was carried out and assessed using Multi-Group Analysis (MGA), and Importance-Performance Map Analysis (IPMA). Though convenience selection and a narrow geographic scope are limitations, the results showed significant influences.

The research [10] explored determinants of employee DT adoption in smart cities. Strategies included a survey of 1,180 individuals from different cities. The findings revealed that management support and perceived benefits were positive influences contributing to acceptance, while complexity of processes and inertia were barriers to acceptance. While process complexity and inertia were factors that led to rejection, with limitations of geographic clustering and cross-sectional design.

The preliminary status of the data and a small sample size are among the limitations [6]. The limitations included a cross-sectional research design [9-10], a focus on certain geographic regions, a narrow scope on the social aspect, relatively small impact sizes [7-8], and convenience sampling with limited spatial coverage. The research examines the variables, including Technological Readiness (TR), which refers to the ability of an organization to embrace digital systems. Inclusive technological facilities represent the Accessibility Infrastructure (AI), while the Digital Competence (DC) of employees reflects the digital skills and ability to effectively utilize technology in inclusive work environments. The outcomes of inclusion are Employment Participation (EP), Job Sustainability (JS), and Digital Engagement (DE), which together are indicators of how DT improves employment access, retention, and active participation of people with disabilities.

Hypothesis Development

The analyses established five hypotheses (H1-H5) related to the organizations' role in driving DT as a catalyst for inclusive employment of people with disabilities. The research concentrates on important DT variables like Technological Readiness (TR), Accessibility Infrastructure (AI), Digital Competence (DC), Employment Participation (EP), Job Sustainability (JS), and Digital Engagement (DE). The hypotheses were designed to investigate the combined effect of technological and organizational characteristics on inclusive employment outcomes in the context of DT, and they are presented in this manner.

- **H1:** TR positively influences EP.
  Organizations with increased TR provide digital equipment and methods to help people with disabilities in the EP.
- **H2:** AI positively influences EP.
  Accessible workplace platforms and adaptive technology are examples of adequate AI that facilitates the individuals with disabilities in the EP.
- **H3:** DC positively influences EP.
  People with greater levels of DC can navigate digital work settings more effectively, which improves their EP.
- **H4:** EP positively influences JS.
  Active EP maintained by digital readiness and competence contributes to long-term JS and career progression.
- **H5:** DE mediates the relationship among TR and EP.
  DE considers the way that TR yields greater EP. The conceptual framework in Figure 1 is employed to represent the influence of digital transformation on employment inclusion for people with disabilities.

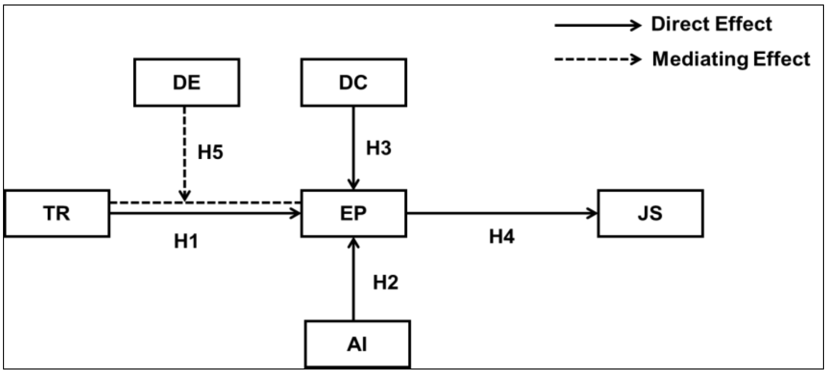

Fig 1: Conceptual Framework for Hypotheses Relationship

2. Materials and Methods

The investigation employed a quantitative design and analyzed big data from organizations between 2019 and 2024 to determine the influence of DT on staff inclusion for individuals with disabilities. The data from government databases, corporate reports, and workforce sites were examined using SPSS and AMOS in addition to regression, descriptive and SEM models to explore the connection between technology readiness, accessibility, competence, and inclusion outcomes.

2.1 Data collection

The data collection procedure is designed to enable the integration of baseline, representative, and dependable information, which provides knowledge into the development of DT and the patterns of employment inclusion for people with disabilities. A synthesis of data from multiple sites over the years 2019-2024 to integrate company records, workforce analytics systems and government databases. The stratified sampling method was used to achieve equal representation among the public, the private sector, and the education sector. It was a combination and cross-validation of these datasets across 18,000 individual-level observations of 165 organizations in diverse industries that resulted in the creation of a coherent analytical database.

Table 1: Demographic and Organizational Characteristics of the Research

Category	Subcategory	Frequency (n)	Percentage (%)
Sector Type	Public Sector	58	35.2
	Private Sector	79	47.9
	Non-Profit/NGO	28	16.9
Organizational Size	Small (<250 employees)	42	25.5
	Medium (250-1000 employees)	71	43.0
	Large (>1000 employees)	52	31.5
Geographic Distribution	Urban	102	61.8
	Semi-Urban	63	38.2
Disability Inclusion Representation	Physical Disabilities	7,920	44.0
	Cognitive/Neurodiverse	5,040	28.0
	Sensory/Other	5,040	28.0
Average Employee Digital Literacy Level	Basic	26	15.8
	Intermediate	87	52.7
	Advanced	52	31.5
Average Accessibility Compliance (WCAG 2.1)	Basic web accessibility	32	19.4
	Standard compliance with functional accessibility	95	57.6
	High-level accessibility with inclusive digital design	38	23.0

The sample comprised 165 organizations, mainly private (47.9%) and medium-sized (43%), with 61.8% urban presence. Disability inclusion showed 44% physical, 28% cognitive, and 28% sensory representation, and 57.6% achieved standard accessibility compliance (Table 1).

2.2 Statistical analysis

The statistical analysis was conducted using AMOS for SEM and SPSS for descriptive and regression statistics. Descriptive statistics summarized the characteristics of the DT and inclusion variables, while multiple regression analysis evaluated the predictive influence of the indicators on to employment inclusion. SEM evaluated the overall conceptual model, identifying both direct and indirect relationships among technological readiness, accessibility infrastructure, digital competence, and inclusion outcomes such as employment participation, job sustainability, and digital engagement.

3. Results

The research looked at how employment inclusion for individuals with impairments is affected by digital transformation in a variety of industries between 2019 and 2024. The research, which combined evidence from 165 different organizations and 18,000 individuals, showed multi-faceted that digital competence, infrastructure accessibility and technology readiness are the main factors that significantly propel employment participation, job retention and digital engagement, thus validating the existence of a strong inclusive digital ecosystem.

3.1 Descriptive analysis

Data is categorized and condensed utilizing descriptive analysis to find distributions, trends, and patterns. The goal of descriptive analysis is to better understand indicators of DT and employment inclusion, and to provide a general summary of engagement practices and accessibility outcomes for people with disabilities in the workforce.

$$\bar{Y} = \frac{\sum_{j=1}^{n} Y_j}{n} \quad (1)$$

Equation (1) represents the mean value of a dataset. Here, $\bar{Y}$ denotes the mean of all observed values, providing a measure of central tendency, Y_j refers to the individual observation. Where j ranges from 1 to n. Y_j is added together from the first observation ($j = 1$). Finally, n represents the total number of observations.

$$\sigma^2 = \frac{\sum_{j=1}^{n}(Y_i - \bar{Y})^2}{n} \quad (2)$$

In Equation (2), σ^2 denotes the variance of the dataset, $(Y_j - \bar{Y})^2$ represents the squared difference between each observation and the mean, $\sum_{j=1}^{n}(Y_i - \bar{Y})^2$ indicates that these squared deviations are added across all observations before dividing by n.

Table 2: Descriptive Statistics of Key Variables

Variable	Mean (M)	Standard Deviation (SD)	Minimum	Maximum
Technological Readiness (TR)	76.45	8.72	54.00	94.00
Accessibility Infrastructure (AI)	71.32	10.18	48.00	93.00
Digital Competence (DC)	68.54	9.03	42.00	88.00
Employment Participation (EP)	12.78	3.56	5.00	21.00
Job Sustainability (JS)	84.12	6.84	65.00	97.00
Digital Engagement (DE)	73.95	8.10	50.00	91.00
Overall Inclusion Index (OII)	76.31	7.45	58.00	92.00

Table 2 presents descriptive statistics for key variables. TR (76.45), AI (71.32), DC (68.54), EP (12.78), DE (73.95) and JS (84.12) variables show greater mean results. It exhibits moderate to high average levels to indicate the diverse workforce inclusion patterns contributing to the overall inclusion index mean (76.31).

3.2 Multiple regression analysis

The statistical technique termed multiple regression analysis looks at the link between several independent variables and one dependent variable. These techniques are specifically used to assess the effect of the various DT indicators on employment inclusion with people with disabilities, determining the major predictors and the strength effect.

$$\hat{x} = \alpha + \beta_1 y_1 + \beta_2 y_2 + \cdots + \beta_k y_k + \epsilon \quad (3)$$

In Equation (3), $\hat{x}$ denotes the predicted value of the dependent variable, α is the intercept representing the constant term, $\beta_1, \beta_2, \ldots, \beta_k$ are the regression coefficients, $y_1, y_2, \ldots, y_k$ are the independent variables, and ϵ indicates the error term.

Table 3: Multiple Regression Analysis of Predictors of Digital Inclusion

Predictor Variables	Unstandardized Coefficients (B)	Standardized Coefficients (β)	Standard Error	t-value	Sig. (p)	VIF
(Constant)	9.862	—	1.384	7.12	0.000***	—
Technological Readiness (TR)	0.241	0.316	0.044	5.47	0.000***	2.01
Accessibility Infrastructure (AI)	0.438	0.467	0.050	8.76	0.000***	2.15
Digital Competence (DC)	0.187	0.241	0.048	3.90	0.000***	1.84
Employment Participation (EP)	0.128	0.198	0.037	3.46	0.001**	1.72
Job Sustainability (JS)	0.203	0.254	0.041	4.95	0.000***	1.96
Digital Engagement (DE)	0.174	0.231	0.039	4.46	0.000***	1.88

Multiple regression results are summarized in Table 3. All predictors varied widely, but all were statistically significant influences on inclusive employment outcomes. The regression results reveal significant positive effects, with AI (β=0.467) showing the strongest influence, followed by TR (β=0.316) and DC (β=0.241). EP (β=0.198), JS (β=0.254), and DE (β=0.231) that contribute positively, all significant at p<0.01 with acceptable VIF values.

3.3 Structural Equation Modeling (SEM)

The research found the proposed interactions of technological readiness (TR), accessibility infrastructure (AI), digital competence (DC), digital engagement (DE), employment participation (EP) and job sustainability (JS) with a structural model through SEM. Path coefficients, t-values, and p-values were determined to determine the importance of the proposed relationships (Figure 2).

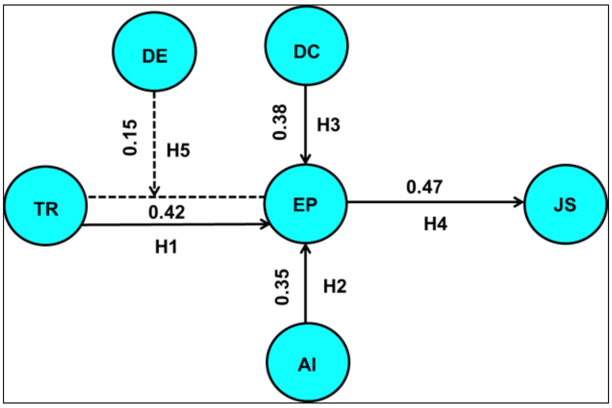

Fig 2: SEM Architecture for Hypotheses Relationship

Table 4: Hypothesis Testing Results with Path Coefficients and Significance Levels

Hypothesis	Path	Path Coefficient (β)	p-value	t-value	Result
H1	TR → EP	0.42	<0.001	5.12	Supported
H2	AI → EP	0.35	<0.001	4.28	Supported
H3	DC → EP	0.38	<0.001	4.85	Supported
H4	EP → JS	0.47	<0.001	6.10	Supported
H5	TR → DE → EP	0.15	0.001	3.22	Supported (Mediated)

Table 4 presents strong positive impacts shown by path coefficients (β) with TR → EP (H1-0.42), AI → EP (H2-0.35), DC → EP (H3-0.38), EP → JS (H4-0.47), and TR → DE → EP (H5-0.15), with all associations statistically significant. The model demonstrates the strong influence of DT indicators on inclusive employment outcomes.

4. Discussion

The research was designed to establish the role of digital transformation in investigating the relationship between technology preparation, accessibility support, and digital capacity on employment engagement, job sustainability, and digital engagement to provide inclusive and equitable workforce outcomes for people with disabilities. Constraints include the preliminary state of data and a limited sample size [6]. The constraints included a narrow scope on the social aspect, comparatively small effect sizes [7-8], convenience sampling with restricted spatial coverage, and a focus on particular regions of geography along with a cross-sectional research design [9-10]. The research tackles these shortcomings with the help of a large multi-source dataset across a variety of areas and industries, stratified sampling and longitudinal studies, and an effective statistical modelling approach that produces evidence based generalizable findings. These findings would recommend inclusive digital practices in organizations and policymaking, enhanced accessibility infrastructures, and greater employee digital capacities to equal employment participation, better job sustainability, and greater digital inclusion of persons with disabilities in the framework of DT.

1. Conclusion

The research was intended to numerically examine the effects of the DT indicators on employment participation, job sustainability, and digital engagement of people with disabilities. The research combined massive government, corporate, and workforce analytics data (2019-2024) to analyze such variables as technological preparedness, access infrastructure, digital efficiency, job participation, job sustainability, and digital engagement. The strong positive impacts are shown by path coefficients (β) with TR → EP (H1-0.42), AI → EP (H2-0.35), DC → EP (H3-0.38), EP → JS (H4-0.47), and TR → DE → EP (H5-0.15), with all associations statistically significant. The model demonstrates the strong influence of DT indicators on inclusive employment outcomes. The framework also lacked in terms of secondary data used and low coverage of industries, which fails to capture all of the contextual variation. More studies are expected to broaden the availability of cross-global datasets, qualitative research results, and new technologies such as artificial intelligence succession technology to advance the knowledge about the use of DT in sustainable and inclusive employment of the disabled.

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