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From Policy to Practice: A Principal Component Analysis of Systemic Constraints on Construction Learnership Implementation in the Eastern Cape, South Africa

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Abstract: The persistent shortage of skilled labour and high youth unemployment have rendered learnership programmes a crucial policy instrument for workforce development and socio-economic inclusion in South Africa. Notwithstanding an extensive legislative and institutional framework, concerns persist regarding the limited effectiveness of these programmes in meeting industry skills demands. This study investigates the systemic constraints that undermine the implementation and effectiveness of construction learnership programmes in the Eastern Cape Province of South Africa, with a focus on the gap between policy intent and practice. A descriptive, cross-sectional design was employed, utilising a structured questionnaire administered to 149 stakeholders, including employers, accredited training providers, and construction industry practitioners occupying roles such as project managers, administrative officers, supervisors, facilitators, and coordinators involved in learnership delivery. Data were analysed using descriptive statistics and Principal Component Analysis (PCA) to reduce the 34 observed barriers into a smaller set of interpretable components. The barrier items with the strongest loadings on the retained components included ineffective assessment methods, lack of regulatory compliance, and financial constraints on beneficiaries. The PCA reduced the barriers to five interrelated components, which collectively explain 69.73% of the total variance, indicating that the constraints are systemic rather than isolated. The findings underscore the necessity for strengthened inter-institutional collaboration, enhanced industry incentives, alignment of curricula with evolving construction practices, and robust quality-assurance mechanisms to translate learnership policy ambitions into effective practice. These findings contribute to the development of a resilient construction workforce in the Eastern Cape and, by extension, South Africa's broader construction sector.

Keywords: Construction education and training, human capital development, skills development, sustainable development, learnership programmes, South Africa.

1. Introduction

The construction industry plays a crucial role in employment creation, infrastructure development, and economic growth. However, its capacity to support economic development is contingent upon the availability of a suitably skilled workforce. Persistent skills shortages constitute a significant challenge within the sector, particularly as construction practices continue to evolve in response to technological advancements and changing industry requirements. In South Africa, this challenge is particularly pronounced, as employment opportunities coexist with a deficit of the technical skills necessary to access them (Akinshipe et al., 2022). The construction sector continues to face difficulties in attracting suitably skilled and adequately trained personnel, despite substantial investments in skills development initiatives (CETA, 2022). Consequently, skills development programmes remain

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critical not only for enhancing workforce capacity but also for linking unemployed individuals with opportunities in the labour market.

The skills deficit is closely associated with South Africa's persistent unemployment issue, especially among young people. Skill deficiencies impede the ability of unemployed youth to access available job opportunities, including those in technically oriented sectors such as construction (Akinshipe et al., 2022). Aigbavboa et al. (2016) contend that bridging skills and knowledge gaps through appropriate development programmes is fundamental to improving employment prospects and fostering opportunities for self-employment. More recently, Alenda-Demoutiez and Mügge (2020) observed that many young South Africans lack the skills that employers demand, thereby further reinforcing the relationship between skills development and labour market participation.

Learnership programmes represent one of the key policy mechanisms employed in South Africa to address the intersection between unemployment and skills shortages. A learnership is defined as a registered learning programme that integrates a theoretical learning component with practical workplace experience, culminating in an occupationally related qualification recognised on the National Qualifications Framework (SAQA, 2022). The programme is predicated on a formal agreement among the learner, the training institution, and the employer, thereby establishing a direct link between structured learning and workplace exposure. As a result, learnerships assume a significant role within the nation's skills-development system and continue to function as instruments for capability building and workforce development (Kruss et al., 2014). This combination of theoretical and practical learning is particularly pertinent within the construction sector, where occupational competence necessitates the practical application of acquired knowledge. Practice-oriented training facilitates learners' development of technical competence, whilst simultaneously enhancing their readiness for the labour market (Aliu et al., 2023). Consequently, construction learnerships may offer a critical pathway for learners to acquire both occupational knowledge and practical skills while gaining exposure to real-world industry environments. Furthermore, aligning training with industry-required expertise can enhance learners' employment prospects and ensure a greater responsiveness to evolving construction practices (Aigbavboa & Thwala, 2014; Malomane et al., 2022). Therefore, this paper seeks to examine the extent and structure of the constraints that impact the implementation and effectiveness of construction learnerships in the Eastern Cape Province of South Africa.

In pursuit of this aim, the study is guided by two specific research questions: (i) what underlying components can meaningfully account for the barriers reported by stakeholders involved in the implementation of construction learnerships? and (ii) how are these components interconnected, and what insights does this provide regarding whether the constraints on learnership implementation are systemic rather than isolated? The remainder of the paper is organised as follows: Section 2 reviews the pertinent literature and situates the study's identified gap; Section 3 describes the methodology; Section 4 presents the results of the descriptive and Principal Component Analysis; Section 5 discusses these results in relation to existing literature; and Sections 6 (Conclusion), 7 (Limitations), and 8 (Recommendations and Future Research) conclude the paper.

1.1 Literature review

Learnerships in South Africa are regulated by the Skills Development Act 97 of 1998, which established the Sector Education and Training Authorities (SETAs), including the Construction Education and Training Authority (CETA), and the associated levy-grant system. This system necessitates that employers contribute a skills development levy, which partially funds accredited training. A learnership is defined as a structured programme registered on the National Qualifications Framework (NQF) that integrates institutional learning with organised workplace experience, formalised through a tripartite agreement among the learner, an accredited training provider, and a participating employer. This institutional architecture establishes the regulatory and

funding context within which the barriers discussed below arise, and it will be referenced at several points in the subsequent discussion.

Despite their potential, evidence indicates that the existence of learnership programmes and ongoing investment in skills development do not necessarily result in effective outcomes. The construction sector continues to report shortages of suitably trained personnel, despite the number of learners trained through sectoral skills-development initiatives (CETA, 2022). Similarly, skills-development initiatives in South Africa necessitate continuous improvement and realignment in response to evolving industry conditions and the increasing influence of digitalisation (Telukdarie et al., 2022). The persistence of these challenges raises critical questions regarding the conditions under which learnership programmes are implemented and their capacity to translate policy intentions into sustainable skills-development outcomes.

A significant concern pertains to the coordination among the multiple stakeholders involved in the implementation of learnerships. These programmes rely on interactions among government institutions, Sector Education and Training Authorities, training providers, employers, and learners. Stakeholder involvement is particularly crucial, as employers provide the workplace environment in which learners acquire practical experience, while training institutions and regulatory bodies support the educational and administrative components of programme delivery. O'Neil et al. (2023) underscore the value of learnership programmes for organisational capacity building and highlight the importance of stakeholder involvement in preventing learner exploitation and facilitating appropriate workplace learning. Insufficient coordination among these actors may consequently undermine the integration of institutional training and workplace experience necessary for effective programme delivery compromise the integration of institutional training and workplace experience required for effective programme delivery.

Employer participation constitutes another important component of this implementation environment. Employers are required not only to provide workplace exposure but also to identify suitable projects, accommodate learners, and provide appropriate mentoring capacity. Jackson et al. (2017) identified difficulties related to suitable project placement, learner selection, learner performance, and employers' capacity to provide mentorship. Ncube (2021) similarly highlights challenges in identifying learners who are genuinely interested in acquiring construction skills rather than participating primarily as a response to unemployment. These challenges demonstrate that workplace participation involves considerably more than merely placing learners within construction companies; the quality and suitability of the workplace environment are also important to the learning experience.

The effectiveness of learnerships is further influenced by the extent to which training responds to changing industry requirements. The construction sector is increasingly shaped by technological innovation and emerging approaches to project delivery, creating a need for continuous upskilling and reskilling of the workforce (Ncube, 2021; Vranceanu & Sutan, 2021; Vranceanu & Sutan, 2023). Recent construction training literature emphasises the importance of exposing learners to current industry practices and emerging technologies (Aigbavboa & Thwala, 2014; Malomane et al., 2022). However, the adoption of Fourth Industrial Revolution technologies in construction remains constrained by shortages of relevant skills, inadequate training capacity, and associated implementation costs (Malomane et al., 2022). This reinforces the need for learnership curricula and training environments to remain responsive to evolving industry demands. Beyond training and industry alignment, programme effectiveness is influenced by broader institutional and operational conditions. Existing evidence identifies administrative and operational barriers as significant impediments to learnership implementation (Akinshipe et al., 2022). Employer participation may also be constrained where training is perceived as costly, risky, or administratively complex (Chankseliani & Anuar, 2019). Technological infrastructure presents an additional challenge, with

inadequate utilisation of information and communication technologies potentially limiting learning and skills development within construction environments (Ozumba & Shakantu, 2018). These conditions indicate that programme effectiveness is shaped by a broader implementation environment that extends beyond the immediate interaction between the learner and the training provider.

Learner-related circumstances also form part of this implementation environment. Ncube (2021) identifies learner attitudes, motivation, and the characteristics participants bring into learnership programmes as factors that can influence programme success. The changing nature of work further necessitates that workers continuously develop and renew their skills rather than treating training as a one-off intervention (Vranceanu & Sutan, 2021; Vranceanu & Sutan, 2023). Mentorship is particularly important in this process because learners require guidance as they navigate unfamiliar workplace environments. Aderibigbe and Mosia (2019) demonstrate that effective mentoring can enhance learners' perceptions of the depth and value of their learning experience. Thus, learner outcomes cannot be separated from the support structures and workplace conditions surrounding programme participation.

Taken collectively, the literature indicates that the effectiveness of construction learnerships is influenced by multiple challenges, including stakeholder coordination, employer participation, learner circumstances, technological capacity, curriculum responsiveness, industry alignment, and operational implementation. Recent research has significantly contributed to the identification of these individual impediments, encompassing employer and learner challenges (Jackson et al., 2017; Ncube, 2021), technological and training capacity limitations (Malomane et al., 2022), market alignment challenges (Botha et al., 2023), and operational and administrative barriers (Akinshipe et al., 2022). However, the identification of individual barriers provides limited insight into whether ostensibly separate challenges reflect broader underlying dimensions within the learnership implementation system. This represents a significant gap in understanding the divide between policy intent and implementation practice. Addressing barriers in isolation may result in interventions that target visible symptoms without recognising the broader structures through which implementation challenges interact and reinforce one another. There is, therefore, a need to move beyond the identification and ranking of individual barriers towards an understanding of their underlying systemic structure. Determining whether observable challenges converge into broader composite dimensions can yield a more integrated understanding of the conditions undermining the effectiveness of construction learnerships and enable interventions to target the systemic context within which these challenges arise, rather than addressing individual barriers in isolation.

Accordingly, this study investigates the systemic constraints that undermine the implementation and effectiveness of construction learnership programmes in South Africa, with a particular focus on the gap between policy intent and actual practice. Principal Component Analysis (PCA) is employed to reduce the identified barriers to a smaller set of composite dimensions that capture the maximum shared variance among the observed variables, thereby determining whether the barriers converge on broader underlying structures that shape programme implementation and effectiveness. In doing so, the study advances the existing discourse by shifting the focus from merely identifying which barriers affect construction learnerships to understanding how these barriers are structurally interconnected, thus providing an empirical basis for more coordinated institutional, policy, and industry responses.

2. Research Methodology

This study employed a quantitative, descriptive cross-sectional research design to investigate the underlying structure of the barriers affecting the implementation and effectiveness of construction learnership programmes in the Eastern Cape Province of South Africa. This research is part of a broader investigation into the implementation of construction learnership programmes, with this

paper specifically focusing on identifying the underlying dimensions of the observed barriers using Principal Component Analysis (PCA). Data were collected using a structured questionnaire administered to stakeholders involved in the implementation of construction learnership programmes in the Eastern Cape Province. The target population comprised employers, accredited training providers, and construction industry practitioners with direct knowledge and experience of learnership implementation. The Eastern Cape Province was purposively selected as the study site due to the concentration of CETA-registered construction learnership activity in the province, its persistently high youth unemployment, and the researchers' established access to stakeholders in the region. However, the findings should be interpreted as evidence from this province rather than as a national account. A non-probability sampling approach, combining purposive and snowball sampling, was employed to identify eligible respondents. This approach facilitated access to specialised stakeholders with practical experience in construction learnership programmes. Initial respondents (seeds) were identified through the researchers' professional networks with CETA-accredited training providers and construction employers in the province. Furthermore, each seed was requested to refer other eligible stakeholders. No formal sampling frame (e.g. a comprehensive CETA-accredited provider list) was available; thus, statistical generalisation to the national population of learnership stakeholders is not claimed, although the findings support analytical generalisation to comparable implementation contexts. A total of 210 questionnaires were distributed, with 149 valid responses returned, resulting in a response rate of 71.0%. The non-probability, self-selecting nature of the sample and the associated risk of non-response and self-selection bias are addressed further in the Limitations (Section 7). A total of 149 valid questionnaires were received and analysed.

The questionnaire comprised closed-ended questions measured on a five-point Likert scale and was developed from barriers identified in the literature. Respondents rated their level of agreement with each of the 34 barrier statements (1 = strongly disagree to 5 = strongly agree). The initial item pool was generated from a systematic review of the construction learnership and skills development literature and was subsequently reduced to 34 non-redundant items through discussion among the research team. The instrument was piloted with ten stakeholders drawn from the target population, whose feedback informed minor refinements to item wording. Content validity was further supported through review by two academics with expertise in construction management and psychometrics. The questionnaire was administered online, with training providers and employer contacts assisting in circulating the survey link to eligible respondents. The reliability of the barriers section of the instrument was assessed using Cronbach's alpha, yielding a coefficient of 0.985. This high value of Cronbach's alpha indicates excellent internal consistency. While it exceeds the widely recommended minimum of 0.70, a value this high across 34 items more plausibly reflects a degree of item redundancy than an unqualified strength, and is interpreted with this caveat throughout. Subscale-level reliability could not be computed for the present analysis and is recommended for future refinements of the instrument.

Data were analysed using the Statistical Package for the Social Sciences (IBM SPSS Statistics). Initial descriptive statistics were performed to summarise the barrier variables prior to conducting Principal Component Analysis (PCA), which aimed to reduce the 34 observed barrier variables into a smaller number of composite dimensions underlying the data. PCA was preferred over a common-factor extraction method associated with Exploratory Factor Analysis (EFA) because the primary objective was to derive a parsimonious set of components that accounts for the maximum possible variance in the observed variables, rather than to model unobserved latent constructs presumed to underlie the manifest indicators (Yong & Pearce, 2013). Given the 34 barrier items and a sample size of n = 149, the subject-to-variable ratio was approximately 4.4:1, which is below the commonly cited minimum of 5:1 and the more conservative guideline of 10:1 for factor-analytic work (Hair et al., 2019; Tabachnick & Fidell, 2013). This constraint on the analysis is acknowledged and revisited in the Limitations section (Section 7), although the subsequently obtained KMO value of 0.944 provides

countervailing evidence of sampling adequacy. Missing values on individual barrier items (one to two non-responses per item, as footnoted in Table 1) were addressed using pairwise deletion, and all analyses were conducted in IBM SPSS Statistics version 28.

Prior to component extraction, the suitability of the data was assessed using the Kaiser–Meyer–Olkin (KMO) Measure of Sampling Adequacy and Bartlett's Test of Sphericity. The data were determined to be suitable for component analysis (KMO = 0.944; Bartlett's Test: $\chi^2 = 4378.278$, df = 561, $p < 0.001$). Components were extracted using Principal Component Analysis and rotated using Direct Oblimin (oblique) rotation, which allows for correlation among the extracted components to facilitate interpretation of the component structure. Direct Oblimin rotation was applied with the default delta value of 0. Components were retained based on the Kaiser criterion (eigenvalue > 1), corroborated by visual inspection of the scree plot (Figure 1), as Component 5's eigenvalue (1.006) lies only marginally above this threshold. While Component 6 (0.900) lies just below it, the decision regarding retention is finely balanced; a parallel analysis is recommended in future applications of this instrument to confirm the component count. Ethical clearance for the study was obtained from the University of Johannesburg, Faculty of Engineering, Built Environment and Information Technology, with reference number UJ_FEBE_FEPC_01142. Ethical clearance was secured from the university's Research Ethics Committee prior to data collection, and the principles of voluntary participation, informed consent, anonymity, and confidentiality were upheld throughout the study.

3. Results

This section presents the study's results, beginning with the demographic and professional profiles of the respondents, followed by an assessment of the data's suitability for Principal Component Analysis (PCA). Thereafter, the extracted components, the total variance explained, the component structure of the construction learnership barriers, and the relationships among them are reported.

3.1 Demographic profile of respondents

A total of 149 valid responses were obtained from stakeholders directly involved in implementing construction learnership programmes in the Eastern Cape province. This group included project managers, administrative officers, programme supervisors, facilitators, programme coordinators, programme directors, monitoring officers, programme administrators, assessors, and moderators. Table 1 summarises the demographic and professional profiles of the respondents. Project managers constituted the largest segment of the respondent group (66 of 149), which is consistent with the composition of the snowball sample obtained and does not necessarily reflect the underlying structure of the sector.

Most respondents (91) had less than five years of professional experience, while only a small proportion (eight) had more than 15 years of experience. In terms of educational qualifications, the majority held a diploma (50) or a bachelor's degree (30), although a substantial proportion (27) held only a matriculation certificate. Respondents were predominantly drawn from the private sector (76), followed by the public sector (45) and public–private partnerships (27), while their involvement with the Construction Education and Training Authority (CETA) sub-sectors was concentrated in building construction (102).

This demographic profile indicates that the sample was dominated by relatively early-career professionals occupying frontline implementation and supervisory roles, rather than senior policymakers. This composition represents a significant strength, as respondents possess direct, first-hand operational experience; however, it also poses a limitation, with 61.1% of respondents holding less than five years of experience and 18.1% holding matriculation as their highest qualification. The sample's capacity to assess systemic and institutional constraints, as distinct from day-to-day operational frictions, is consequently limited. Several barrier items (e.g., regulatory compliance, supporting standards and frameworks, undue political interference) may require a vantage point

that most respondents do not occupy. The identified barriers are therefore best interpreted as reflecting implementation-level rather than strategic-level perspectives. The formal testing of whether experience level or job title moderates barrier ratings was beyond the scope of the present analysis and is noted as a direction for future research.

Table 1: *Demographic and professional profile of respondents (n = 149)*

Category	Sub-category	Frequency (n)	Percentage (%)
Job Title	Project manager	66	44.3
	Administrative officer	19	12.8
	Programme supervisor	15	10.1
	Facilitator	11	7.4
	Programme coordinator	10	6.7
	Programme director	9	6.0
	Monitoring officer	9	6.0
	Programme administrator	4	2.7
	Assessor	3	2.0
	Moderator	3	2.0
Years of Experience	Less than 5 years	91	61.1
	6–10 years	35	23.5
	11–15 years	15	10.1
	16–20 years	4	2.7
	More than 20 years	4	2.7
Highest Qualification	Diploma	50	33.6
	Bachelor's degree	30	20.1
	Matriculation	27	18.1
	Honours degree	18	12.1
	Technical certificate	12	8.1
	Master's degree	8	5.4
	Competency certificate	4	2.7
Employment Sector [1]	Private sector	76	51.4
	Public sector	45	30.4
	Public–private partnership	27	18.2
CETA Sub-sector Involvement [2]	Building construction	102	69.4
	Built environment professions	23	15.6
	Road and civil construction	12	8.2
	Material manufacturing	7	4.8
	Electrical	3	2.0

[1] n = 148 for the employment sector (one non-response).
[2] n = 147 for CETA sub-sector involvement (two non-responses).

3.2 Suitability of data for principal component analysis

As reported in Section 3 and summarised in Table 2, the KMO and Bartlett's Test results confirmed that the data were suitable for component extraction. These results affirmed the dataset's suitability for reducing the barrier variables into a smaller set of meaningful underlying dimensions.

Table 2: *KMO and Bartlett's test*

Kaiser–Meyer–Olkin Measure of Sampling Adequacy		0.944
Bartlett's Test of Sphericity	Approx. Chi-Square	4378.278
	df	561
	Sig.	0.000

3.3 Component extraction and total variance explained

Component extraction yielded a five-component solution that collectively accounted for 69.7% of the total (unrotated) variance, as presented in Table 3. It is important to note that the five-component structure was not cross-validated through split-sample replication or parallel analysis, which represents a limitation of the study (Section 7). In the initial (unrotated) extraction, Component 1 accounted for 54.3% of the variance, followed by Component 2 (5.4%), Component 3 (3.6%), Component 4 (3.5%), and Component 5 (3.0%). However, due to the application of an oblique rotation, these unrotated percentages cannot be attributed to the rotated, labelled components discussed in Section 4.4 and interpreted in Section 5. In the rotated solution, the rotation sums of squared loadings were 15.758 for Component 1, 9.007 for Component 2, 1.359 for Component 3, 12.752 for Component 4, and 7.178 for Component 5. As correctly noted in the table footnote, these rotated values are not additive and do not sum to a total variance. Consequently, Component 1 is identified as the most substantial dimension. Component 4 (Employer Incentives and Recognition Challenges) is deemed the second most substantial, rather than the fourth, while Component 3 (Learner Mismatch with Industry Requirements) is distinctly the weakest. The interpretive sections below report the rotated loadings alongside the unrotated percentages and revise the claims of dominance accordingly.

***Table 3**: Total variance explained for the barriers*

Component	**Initial Eigenvalues**			**Extraction Sums of Squared Loadings**			**Rotation Sums of Squared Loadings[a]**
	Total	**% of Variance**	**Cumulative %**	**Total**	**% of Variance**	**Cumulative %**	**Total**
1	**18.465**	54.310	54.310	18.465	54.310	54.310	15.758
2	**1.835**	5.397	59.707	1.835	5.397	59.707	9.007
3	**1.223**	3.596	63.303	1.223	3.596	63.303	1.359
4	**1.178**	3.465	66.768	1.178	3.465	66.768	12.752
5	**1.006**	2.958	**69.726**	1.006	2.958	69.726	**7.178**
6	0.900	2.646	72.371				
7	0.818	2.406	74.778				
8	0.734	2.158	76.936				
9	0.682	2.007	78.943				
10	0.657	1.932	80.875				
11	0.573	1.685	82.560				
12	0.545	1.603	84.163				
13	0.477	1.404	85.567				
14	0.446	1.311	86.878				
15	0.415	1.221	88.100				
16	0.398	1.171	89.271				
17	0.345	1.016	90.287				
18	0.333	0.981	91.267				
19	0.315	0.927	92.194				
20	0.271	0.797	92.992				
21	0.262	0.769	93.761				
22	0.242	0.712	94.473				
23	0.226	0.664	95.137				

24	0.215	0.633	95.770
25	0.201	0.591	96.361
26	0.191	0.562	96.923
27	0.179	0.527	97.450
28	0.161	0.473	97.923
29	0.149	0.437	98.360
30	0.138	0.407	98.767
31	0.133	0.390	99.157
32	0.113	0.334	99.491
33	0.095	0.280	99.771
34	0.078	0.229	100.000

[a] When components are correlated, the sums of squared loadings cannot be added to obtain a total variance.
Extraction Method: Principal Component Analysis.

The scree plot (Figure 1) was further examined to assess the component structure. The plot shows a pronounced decline in eigenvalues across the initial components, followed by a progressive levelling of the curve after the fifth component. Visual inspection suggests that the elbow occurs at the fifth component, which is consistent with the Kaiser eigenvalue-greater-than-one criterion discussed in Section 3. Component 5's eigenvalue of 1.006 is only marginally above this cut-off, while Component 6's eigenvalue of 0.900 falls just below it, making the retention decision finely balanced.

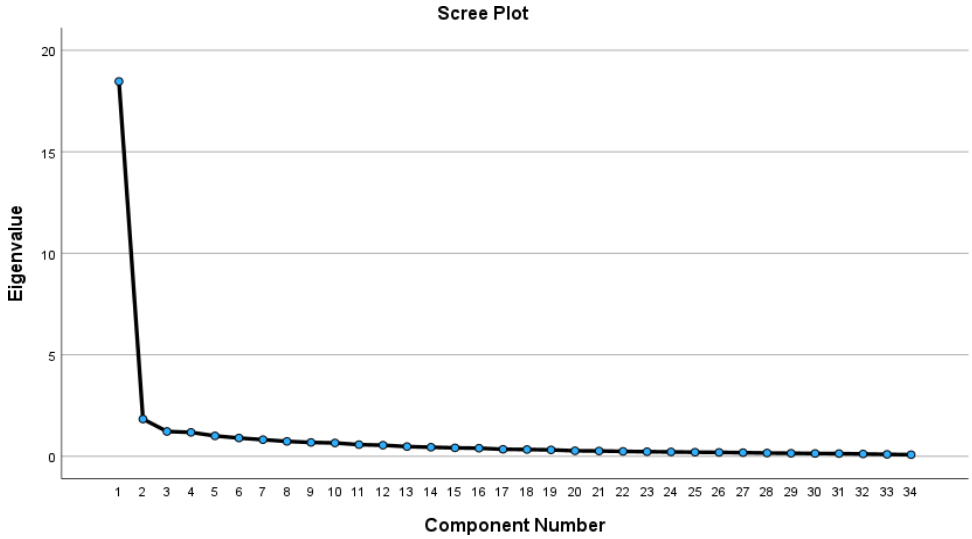


***Figure 1**: Scree plot for the barriers*

3.4 Component structure of construction learnership barriers

The Pattern Matrix (Table 4) was analysed to ascertain the composition of the extracted components. The 34 barrier variables were condensed into five components, with the variable loadings on each component interpreted in consideration of their conceptual relationships. A loading threshold of ≥ 0.30 was established to ascertain substantial contribution, in accordance with the suppression level applied in Table 4 and aligned with conventional guidelines for sample sizes of this magnitude (Hair et al., 2019). The extracted components were identified as: Training and Curriculum Challenges; Access and Support Limitations; Learner Mismatch with Industry Requirements; Employer Incentives and Recognition Challenges; and Operational and Administrative Barriers. No items cross-loaded above 0.30 on more than one component, which is consistent with, although not confirming, the discriminant clarity of the structure. Loadings between 0.30 and the reporting threshold were checked but were not found on a second component for any item. However, the

suppressed pattern matrix and item communalities were not reported in full and are recommended for a supplementary file in any future application of this instrument.

***Table 4**: Pattern matrix for the barriers*

Barriers	**Component**				
	1	**2**	**3**	**4**	**5**
Ineffective assessment methods	0.905				
Lack of regulatory compliance	0.826				
Inadequate career guidance	0.794				
Lack of qualified facilitators and mentors	0.761				
Inadequate preparation of beneficiaries	0.739				
Lack of supporting standards and framework	0.733				
Outdated learnership curriculum	0.693				
Limited support services	0.677				
Possible gender bias	0.653				
Unrealistic workload on learners	0.635				
Inefficient feedback mechanism	0.581				
Limited access to training facilities	0.574				
Undue political interference	0.536				
Geographical constraints on beneficiaries	0.518				
Uncertainty on learner performance	0.506				
Limited government support	0.343				
Financial constraints on beneficiaries		0.787			
Limited access to information		0.747			
Ineffective monitoring and evaluation		0.629			
Limited collaboration among stakeholders		0.497			
Lack of prior qualification or experience		0.467			
Limited language proficiency of participants		0.369			
Lack of technological infrastructure		0.357			
Learner mismatch with industry requirements			0.945		
Lack of incentives				0.796	
Lack of incentives for employers				0.774	
Lack of recognition for employers				0.640	
Insufficient funding of learnership programmes				0.563	
Negative construction industry reputation				0.545	
Lack of organisational support				0.499	
Inflexible admission criteria				0.421	
Potential high costs of running learnership programmes					0.718
Potential high cost of implementation					0.653
Potential administrative burden on employers					0.525

Extraction Method: Principal Component Analysis.
Rotation Method: Oblimin with Kaiser Normalisation.
Rotation converged in 13 iterations. Loadings below 0.30 are suppressed for clarity.

4.4.1 Component 1: Training and curriculum challenges

Component 1 emerged as the most substantial construct in the rotated solution (rotation sum of squared loadings = 15.758). The unrotated extraction attributed 54.3% of the total variance to this component prior to rotation, although it is important to note that this figure is not representative of

a rotated, labelled component; it is included here for completeness. Sixteen variables loaded onto this component. The strongest loading was recorded for ineffective assessment methods (0.905), followed by lack of regulatory compliance (0.826), inadequate career guidance (0.794), lack of qualified facilitators and mentors (0.761), inadequate preparation of beneficiaries (0.739), and lack of supporting standards and frameworks (0.733). Other variables included outdated learnership curricula (0.693), limited support services (0.677), possible gender bias (0.653), unrealistic workload on learners (0.635), inefficient feedback mechanisms (0.581), limited access to training facilities (0.574), undue political interference (0.536), geographical constraints on beneficiaries (0.518), uncertainty regarding learner performance (0.506), and limited government support (0.343).

Collectively, these variables represent constraints associated with the training environment, curriculum delivery, assessment, learner preparation, institutional support, and regulatory conditions surrounding learnership implementation. The dominance of this component indicates that barriers relating to the organisation and delivery of training constitute a substantial share of the overall constraint structure. The breadth of this component, encompassing sixteen of the thirty-four items, combined with the instrument's overall alpha of 0.985, more plausibly reflects a degree of item redundancy or insufficient discrimination among items rather than a single, narrow construct. Furthermore, the component is conceptually heterogeneous, combining assessment methods, regulatory compliance, career guidance, gender bias, political interference, and geographical constraints. The label 'Training and Curriculum Challenges' is retained here, as items related to training delivery carry the strongest loadings; however, a broader label such as 'Training Delivery and Institutional Capacity Constraints' would also be defensible and is offered as an alternative for readers who may find the narrower label too restrictive concerning the item content.

4.4.2 Component 2: Access and support limitations

Component 2 (rotation sum of squared loadings = 9.007; 5.4% of the unrotated variance) comprised seven variables. The strongest loading was for financial constraints on beneficiaries (0.787), followed by limited access to information (0.747) and ineffective monitoring and evaluation (0.629). Limited collaboration among stakeholders (0.497), lack of prior qualifications or experience (0.467), limited language proficiency of participants (0.369), and lack of technological infrastructure (0.357) also contributed to this component. The grouping of these variables reflects barriers that may restrict learners' ability to access, participate in, and receive adequate support throughout learnership programmes. The construct therefore captures both material access constraints and weaknesses in the information, monitoring, stakeholder, and technological support systems surrounding programme participation.

4.4.3 Component 3: Learner mismatch with industry requirements

Component 3 accounted for 3.596% of the total variance and was defined by a single variable, learner mismatch with industry requirements, which recorded a particularly high component loading of 0.945. It was characterised by a rotation sum of squared loadings of 1.359, far below every other component. A component defined by a single item does not meet the conventional minimum of three items (or two items with a loading above 0.70 and a high inter-item correlation) required for a stable, interpretable dimension. However, it is reported here with that caveat, as it cannot be treated as evidence of a genuine, distinct latent construct in the way the other four components can. What the result does support, more cautiously, is that this item is statistically isolated from the others. Its correlations with the remaining four components range from only 0.018 to 0.103 (Table 5), indicating that it does not covary appreciably with any of the broader constraint groupings. This isolation is a defensible and interesting finding in its own right, distinct from the stronger claim that it constitutes its own latent dimension. Additionally, it is possible that a four-component solution, with learner–industry mismatch discussed separately as a standalone item rather than as "Component 3", would provide a more parsimonious and defensible representation of these data. Both interpretations are

presented in the Discussion (Section 5.3), and the reader is cautioned against over-interpreting the single-item result as confirmation of a fifth systemic dimension.

4.4.4 Component 4: Employer incentives and recognition challenges

Component 4 (rotation sum of squared loadings = 12.752, the second most substantial dimension in the rotated solution, despite its smaller 3.5% share of the unrotated variance) consisted of seven variables. These were lack of incentives (0.796), lack of incentives for employers (0.774), lack of recognition for employers (0.640), insufficient funding of learnership programmes (0.563), negative construction industry reputation (0.545), lack of organisational support (0.499), and inflexible admission criteria (0.421). The clustering of these variables highlights the institutional and economic conditions influencing employer engagement in learnership implementation. This construct captures constraints related to the incentives, recognition, financial support, and organisational environment required to encourage and sustain participation in construction learnership programmes.

4.4.5 Component 5: Operational and administrative barriers

Component 5 (rotation sum of squared loadings = 7.178; 3.0% of the unrotated variance) comprised three variables: potential high costs of running learnership programmes (0.718), potential high cost of implementation (0.653), and potential administrative burden on employers (0.525). These variables collectively reflect the cost and administrative demands associated with programme implementation. Although this component's rotated sum of squared loadings is the second smallest among the five extracted components (excluding Component 3's single-item result), its emergence as a separate dimension indicates that operational costs and administrative requirements constitute a distinct barrier to the implementation of construction learnerships.

3.5 Relationships among the extracted components

As Direct Oblimin rotation was employed, the extracted components were allowed to correlate. The Component Correlation Matrix (Table 5) was subsequently examined to ascertain the extent of association among the five underlying components. The strongest correlation was observed between Component 1 (Training and Curriculum Challenges) and Component 4 (Employer Incentives and Recognition Challenges) (r = 0.639). Component 1 was also positively associated with Component 2 (Access and Support Limitations) (r = 0.462) and Component 5 (Operational and Administrative Barriers) (r = 0.440). Component 2 exhibited a correlation with Component 4 (r = 0.414), while Component 4 was additionally associated with Component 5 (r = 0.397). In contrast, Component 3 (Learner Mismatch with Industry Requirements) displayed weak correlations with the remaining components, ranging from 0.018 to 0.103. This indicates that learner mismatch represents a comparatively distinct dimension. By contrast, Training and Curriculum Challenges, Access and Support Limitations, Employer Incentives and Recognition Challenges, and Operational and Administrative Barriers exhibit greater interconnectedness. Overall, the correlations provide empirical support for understanding the constraints affecting the implementation of construction learnerships as systemic and interrelated rather than isolated.

Table 5: *Component correlation matrix*

Component	1	2	3	4	5
1	1.000	0.462	0.103	0.639	0.440
2	0.462	1.000	0.018	0.414	0.285
3	0.103	0.018	1.000	0.079	0.026
4	0.639	0.414	0.079	1.000	0.397
5	0.440	0.285	0.026	0.397	1.000

Extraction Method: Principal Component Analysis
Rotation Method: Oblimin with Kaiser Normalisation

4. Discussion of Results

The Principal Component Analysis demonstrates that the barriers affecting the effectiveness of construction learnership extend beyond isolated implementation challenges and can be understood through five underlying components: Training and Curriculum Challenges, Access and Support Limitations, Learner Mismatch with Industry Requirements, Employer Incentives and Recognition Challenges, and Operational and Administrative Barriers. The clustering of the observed barriers into these broader components provides a more integrated understanding of the conditions that constrain learnership implementation. Furthermore, the relationships identified among most of the extracted components indicate that weaknesses within one area of implementation may coexist with constraints in other areas of the system. The cross-sectional, correlational design employed in this study cannot establish whether one constraint causally amplifies another. This finding supports the interpretation of the policy–practice gap as a systemic implementation challenge rather than the consequence of a singular programme deficiency.

4.1 Training and curriculum challenges

Training and Curriculum Challenges have emerged as the predominant underlying component within this context. This component encompasses barriers related to assessment, regulatory compliance, career guidance, facilitator and mentor capacity, learner preparation, support for standards and frameworks, curriculum relevance, learner support, training facilities, and feedback mechanisms. The extensive range of variables included within this component indicates that the quality of learnership provision cannot be attributed solely to curriculum content. Rather, effective training relies on the interplay between programme design, delivery, assessment, institutional capacity, and the support available to learners throughout their educational journey.

Aigbavboa and Thwala (2014) contend that construction learnerships are more likely to be effective when the skills acquired through training align with those demanded by the industry. Similarly, Mummenthey and Du Preez (2010) identify outdated curricula and misalignment with industry requirements as significant challenges that affect the effectiveness of learnerships. This underscores the necessity of maintaining a direct relationship between the content and delivery of learnership programmes and the occupational realities of the construction sector. The findings also suggest that curriculum alignment is part of a broader training environment. Inadequate facilitators and mentors, ineffective assessment practices, limited training facilities, and insufficient learner preparation all compromise the effectiveness of training delivery. Consequently, curriculum responsiveness, assessment quality, facilitator competence, learner preparation, and institutional support should be regarded as interrelated components of training quality, rather than as discrete interventions. This pattern is not unique to South Africa; comparative research on international training systems similarly reveals that training quality is contingent upon the joint alignment of curriculum content, workplace mentoring capacity, and assessment practices, rather than being attributable to any single element in isolation (Fuller & Unwin, 2003; Steedman, 2012). This suggests that the breadth of Component 1 reflects a structural characteristic of work-based training systems more generally, rather than a peculiarity of this specific instrument.

4.2 Access and support limitations

The second component, Access and Support Limitations, combines financial constraints on beneficiaries, limited access to information, ineffective monitoring and evaluation, limited stakeholder collaboration, lack of prior qualifications or experience, language limitations, and inadequate technological infrastructure. The combination of these variables indicates that access to learnership opportunities involves more than admission into a programme. Effective participation also depends on whether learners can obtain the information, financial resources, and institutional support necessary to remain engaged throughout the programme.

Limited information on available learnership opportunities, inadequate financial support, shortages of training resources, and weak coordination between training institutions and construction firms have been identified as persistent barriers to programme effectiveness (Botha et al., 2023; Ozumba & Shakantu, 2018). Botha et al. (2023) similarly document how gaps in information and institutional support restrict access to skills development programmes for underserved groups. Ozumba and Shakantu (2018) attribute weak information flow on South African construction sites in part to under-utilised information and communication technology, consistent with the technological infrastructure item loading on this component. Stakeholder collaboration is particularly important because learnership implementation involves several interdependent actors whose roles influence learner placement, monitoring, information sharing, and workplace exposure. Coordination failures among these actors have been identified as a recurring constraint on skills development systems more broadly (Kruss et al., 2014).

The clustering of financial, informational, technological, and stakeholder-related barriers within the same component therefore broadens the meaning of access. Effective access should include not only entry into a programme but also the conditions necessary to participate effectively and progress through it. Increasing learner enrolment without strengthening support systems may therefore have a limited impact on programme effectiveness.

4.3 Learner mismatch with industry requirements

Learner mismatch with industry requirements emerged as a distinct component and displayed comparatively weak relationships with the remaining components. As outlined in Section 4.4.3, learner mismatch with industry requirements is a single-item result that should be interpreted primarily as evidence that this item is statistically isolated from the other barriers (correlations ranging from 0.018 to 0.103 with the remaining components). Rather than being interpreted as confirmation of a distinct fifth dimension, it is important to note that a component consisting of one item, labelled after that same item, cannot independently support the assertion that the item constitutes its own construct. With that caveat in mind, the isolation of this item remains substantively interesting. It suggests that the alignment between learner capabilities and industry expectations is a challenge that training administration, funding, and employer incentives alone may not adequately address. This observation is consistent with the broader literature. Aigbavboa and Thwala (2014) find that learnership effectiveness is enhanced when developed skills align with industry requirements, and similar curriculum-alignment concerns are documented internationally in apprenticeship systems where training providers and employers negotiate content jointly (Fuller & Unwin, 2003). Collectively, these findings emphasise the necessity for learnership programmes to remain responsive to evolving industry practices and occupational demands. Therefore, the single-item basis of this result implies that a definitive claim of a distinct 'mismatch' dimension should be deferred until confirmation is obtained with a broader item set.

The distinct position of learner mismatch within the component structure is significant for the policy–practice debate. Learnership performance should not be evaluated solely through enrolment, completion, or certification figures. Attention must also be directed towards the relevance and transferability of the competencies acquired to actual construction employment. Increased industry involvement in programme design, workplace training, and competency assessment may therefore be essential to strengthen the connection between training outcomes and labour market requirements.

4.4 Employer incentives and recognition challenges

Employer Incentives and Recognition Challenges have emerged as a distinct dimension, encompassing a lack of incentives, inadequate employer recognition, insufficient programme funding, negative perceptions of the construction industry, limited organisational support, and

inflexible admission criteria. The clustering of these variables demonstrates that employer participation in learnerships is influenced by the institutional and economic environment within which organisations are expected to provide workplace training. Jackson et al. (2017) identify challenges related to project placement, learner selection, and employers' mentoring capacity, while Chankseliani and Anuar (2019) note that perceptions of cost, risk, and administrative complexity may impact participation in workplace training.

These challenges are particularly pertinent in the construction sector, where project-based work and fluctuating workloads can affect firms' capacity to provide sustained workplace exposure. Employer participation should therefore not be assumed merely because workplace training is mandated within the learnership system. Employers require an enabling environment that acknowledges the resources necessary to accommodate, supervise, and develop learners. Insufficient funding, weak organisational support, and limited incentives may diminish employers' willingness or capacity to participate, thereby restricting workplace learning opportunities.

4.5 Operational and administrative barriers

Operational and administrative barriers include the costs associated with running learnership programmes, implementation costs, and the administrative burden placed on employers. Although this component accounts for a smaller proportion of the total variance, its emergence as an independent dimension indicates that administrative and operational requirements remain important for learnership implementation. Akinshipe et al. (2022) identify operational and administrative barriers as significant constraints in the implementation of skills development. Administrative requirements may become particularly challenging when participating organisations must simultaneously manage training obligations, reporting requirements, workplace supervision, and ongoing construction project demands. These operational barriers should therefore not be viewed independently of employer participation. Costs and administrative requirements may influence employers' willingness and capacity to participate, while reduced employer participation can, in turn, affect workplace exposure and training delivery. This illustrates how operational constraints can extend beyond administrative processes and influence the broader functioning of the learnership system.

4.6 Relationships among the extracted components

The relationships among the extracted components further substantiate the understanding of construction learnership barriers as systemic rather than isolated. Training and Curriculum Challenges, Access and Support Limitations, Employer Incentives and Recognition Challenges, and Operational and Administrative Barriers were found to be interrelated. In contrast, Learner Mismatch with Industry Requirements exhibited comparatively weak relationships with the other dimensions. These interrelations suggest that deficiencies in one aspect of the implementation system may coexist with challenges in other areas. However, the cross-sectional correlational data cannot establish the direction or mechanism of any such relationship. As a theoretically informed conjecture rather than a tested finding, one plausible mechanism posits that limited employer incentives diminish industry participation. This reduced industry participation, in turn, restricts workplace training and mentorship, while inadequate workplace exposure undermines the practical relevance of training. A comparable conjecture may associate limited stakeholder collaboration with constrained access to information, monitoring, and learner support. Testing whether such a causal chain exists would necessitate a structural equation model or a longitudinal design capable of establishing temporal precedence, which is identified as a priority for future research (Section 8).

Consequently, the gap between policy intent and implementation practice cannot be effectively addressed through isolated interventions. Curriculum reform without sufficient facilitator and mentor capacity may have limited impact; increasing learner access without addressing financial and

informational support may not ensure meaningful participation; employer incentives without streamlined administrative processes may fail to encourage sustained industry involvement; and successful programme completion may still possess limited labour-market value where learner competencies remain misaligned with industry requirements. The findings, therefore, advance the construction learnership discourse beyond merely identifying existing barriers to explicating how those barriers are structured within the implementation system. This provides a more robust empirical foundation for understanding persistent underperformance in learnership as a policy–practice problem requiring coordinated alignment among government institutions, training providers, employers, and learners.

Although this study does not adopt a formal theoretical framework, given its applied, problem-driven orientation, the pattern of correlated components is also consistent with policy implementation theory. Matland's (1995) ambiguity-conflict model characterises implementation as highly variable and primarily dependent on the strength of local coalitions, particularly where policy goals are ambiguous and local discretion is substantial. These conditions plausibly prevail within a devolved, multi-actor system such as construction learnerships, in which government institutions, SETAs, training providers, and employers each interpret and enact policy with considerable latitude. Relatedly, the accounts of Bureaucracy (1980) and Lipsky (2010) regarding street-level bureaucracy suggest that the frontline implementers surveyed in this study (Section 4.1) shape policy outcomes through the discretion they exercise in daily practice, which may elucidate why the observed barriers cluster around operational and administrative conditions rather than the formal policy architecture itself. Readers who prefer an applied, non-theoretical reading of the findings may set this paragraph aside without detracting from the paper's substantive argument.

5. Conclusion

This study investigated the systemic constraints undermining the implementation and effectiveness of construction learnership programmes in the Eastern Cape Province of South Africa, with particular attention to the gap between policy intent and implementation practice. Principal Component Analysis revealed that the barriers affecting learnership effectiveness are structured around five underlying dimensions: Training and Curriculum Challenges, Access and Support Limitations, Learner Mismatch with Industry Requirements, Employer Incentives and Recognition Challenges, and Operational and Administrative Barriers. The relationships observed among most of these components further demonstrate that learnership underperformance cannot be attributed to isolated challenges but reflects weaknesses across interconnected components of the skills-development system.

The findings indicate that the existence of a robust policy and institutional framework does not, in itself, guarantee effective implementation. Training quality and curriculum responsiveness are interlinked with learner access and support, employer participation, and the operational conditions under which learnerships are executed. Learner mismatch with industry requirements emerges as a comparatively distinct dimension, further underscoring the importance of ensuring that programme outcomes correspond with the actual skills requirements of the construction sector. Collectively, the findings suggest that bridging the policy–practice gap in this province necessitates interventions that address both the individual dimensions and their interrelations. Extending these conclusions to South Africa's national learnership system would require replication beyond the Eastern Cape.

5.1 Limitations of the study

Several limitations should be considered when interpreting these findings. First, the sample was drawn using non-probability purposive and snowball sampling rather than a probability design, rendering statistical generalisation beyond the sampled stakeholders unwarranted. The findings support analytical generalisation to comparable implementation contexts. Second, the study is

confined to the Eastern Cape Province, and the barrier structure identified herein may not be applicable in provinces with different institutional capacities, industry compositions, or SETA administrations. Third, with 34 barrier items and n = 149 (a subject-to-variable ratio of approximately 4.4:1), the Principal Component Analysis operated below the conservative 10:1 guideline established in the factor-analytic literature. Consequently, the resulting structure, particularly the single-item Component 3, should be regarded as provisional, pending replication with a larger sample. Fourth, all data were collected through self-report from a single respondent group at a single point in time, which raises the possibility of common-method bias and precludes any causal or longitudinal inferences. The cross-sectional design cannot ascertain whether the correlations among components reflect a genuinely systemic structure or shared method variance. Finally, the sample exhibited a skew towards early-career respondents in frontline implementation roles, which enhances the study's insight into operational-level barriers. This may, however, under-represent constraints that are more apparent from a strategic or policy-making perspective.

5.2 Recommendations and future research

Accordingly, training providers should enhance curriculum responsiveness, assessment practices, facilitator capacity, and mentorship arrangements to ensure that training aligns with contemporary construction-industry requirements. This addresses Component 1, Training and Curriculum Challenges, with primary responsibility resting on training providers in collaboration with CETA for curriculum registration. Greater and more continuous industry involvement in curriculum review and workplace learning should be promoted to strengthen the alignment between competencies developed through learnerships and those required in practice.

Stakeholder coordination should also be improved through clearer mechanisms for collaboration among government institutions, SETAs, training providers, and employers. This pertains to Component 2, Access and Support Limitations, with primary responsibility attributed to SETAs and government institutions, as the entities best positioned to coordinate information-sharing and monitoring across training providers and employers. Enhanced coordination should facilitate information sharing, learner placement, monitoring and evaluation, and the provision of appropriate learner support. Particular attention must be paid to financial and informational barriers that may restrict meaningful participation, even after learners have gained access to programmes.

The findings further indicate a need to create a more enabling environment for employer participation. This addresses Component 4, Employer Incentives and Recognition Challenges, with primary responsibility assigned to government and SETAs for funding and incentive design, and to employers for workplace supervisory capacity. Funding and incentive mechanisms should acknowledge the financial, supervisory, and organisational resources that employers require to provide meaningful workplace training. Concurrently, administrative and reporting processes should be reviewed and streamlined where feasible to reduce unnecessary burdens that may discourage employer participation, particularly among smaller construction firms.

Finally, mechanisms for improving learner–industry alignment should be strengthened through sustained engagement with the construction sector to identify evolving occupational and technological skills requirements. This corresponds to the learner mismatch item identified in Component 3, treated with the caution noted in Sections 4.4.3 and 5.3 due to its single-item basis, with primary responsibility resting on training providers and employers jointly, through structured curriculum review engagement. Learner selection, training content, workplace exposure, and competency assessment should collectively contribute to producing skills that are relevant and transferable to employment. Rather than measuring learnership success predominantly through enrolment and completion rates, greater emphasis should therefore be placed on the quality of competencies developed, workplace readiness, and progression into meaningful employment.

Beyond these practical recommendations, the findings indicate several priorities for future research. A structural equation model, applied to a larger sample, would facilitate the formal testing of the hypothesised interdependencies among components rather than relying on inferences derived from correlations. Qualitative investigations involving learners and employers would elucidate the mechanisms underlying the identified barriers, particularly the proposed causal chain discussed in Section 5.6. Comparative research across other provinces, or cross-nationally with other developing-economy apprenticeship systems, would determine whether the five-component structure identified in this study generalises beyond the Eastern Cape province of South Africa. Finally, longitudinal tracking of learnership completers into employment would clarify whether the barriers identified in this study result in weaker labour-market outcomes, which the present cross-sectional design cannot ascertain.

Enhancing the effectiveness of construction learnerships necessitates a shift from fragmented interventions to a coordinated, system-wide approach. Addressing training, access, employer participation, industry alignment, and administrative conditions collectively presents a greater potential to translate the province's learnership policy ambitions into effective practice; this coordinated approach also offers a plausible model for South Africa's broader learnership system, pending validation beyond the Eastern Cape province. Such an approach can strengthen the contribution of construction learnership programmes to sustainable skills development, employment creation, and the development of a resilient construction workforce.

6. Declarations

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