



ABSTRACT

This paper presents an innovative model for integrating an E-Portfolio System into the assessment of construction trades trainees in Nigeria, focusing specifically on the N-Power Build programme. The paper appraises the training, assessment, and certification process of the programme and proposes the adoption of an E-Portfolio System to overcome financial and personnel resource constraints commonly associated with large-scale capacity-building initiatives involving dispersed trainees. The integration of an E-Portfolio System holds immense potential to elevate the quality of capacity-building programmes, particularly in the context of construction trades. By leveraging modern technology and utilizing electronic

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ODELING E-PORTFOLIO TO FIT FOR PURPOSE IN CONSTRUCTION SKILLS DEVELOPMENT: A Case Study of N-Power Build Programme in Nigeria

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Introduction

The construction industry is a critical component of any economy and plays a significant role in the infrastructural development of a country. In Nigeria, the industry faces a significant challenge of lack of skilled labor, which has resulted in the over-reliance on foreign construction artisans to execute various jobs. The N-Power Build programme was initiated by the Federal government to address this challenge by providing accelerated training and certification to non-graduates between the ages of 18-35. The programme aimed to develop skills and capacities in electrical installation, plumbing, pipe fitting, masonry, carpentry, joinery, welding, fabrication, and automobile technology (CORBON, 2019). However, delivery was not without some challenges, and the major one is prolonged assessment, which is a prerequisite for certification.

The certification and licensing of successful artisans under the programme is the final and crucial stage in the training model designed by the Council of Registered Builders of Nigeria (CORBON). This stage marks the transition of successful artisans into fully-fledged practitioners in the construction sector, where their services in various trades are in high demand due to short supply. The overarching philosophy of this training process is to bridge the significant gap between skills demand and supply in the Nigerian Construction Industry. The certification and licensing of these skilled artisans are critical steps in elevating the trainees' status and enabling them to contribute effectively to the construction industry in Nigeria. By validating their expertise and preparing them for the demands of the real-world construction environment, this program aims to significantly enhance the overall skill level in the sector and address the industry's current challenges. However, only Trainees that have undergone a comprehensive assessment, and validated as 'FULLY ASSESSED,' will be eligible for the certification and license. This assessment for the NPower trainees was assigned to the Nigerian Institute of Building (NIOB) as the Awarding Body under the Sector Skills Council.

The e-portfolio system has the potential to enhance learning and assessment in technical and vocational training. Some studies identified the benefits of e-portfolio, such as improving students' reflective practice, enhancing their digital literacy skills, and facilitating lifelong learning. However, there are



portfolios, the assessment process can become more dynamic, flexible, and personalized to meet individual trainees' needs. E-Portfolios offer a comprehensive and multi-dimensional representation of trainees' practical skills, enabling a more accurate and holistic evaluation of their capabilities. One of the significant advantages of implementing E-Portfolios is the ability to remotely assess and monitor trainees in diverse locations, effectively addressing logistical challenges often encountered with traditional assessment methods. This digital approach facilitates continuous feedback and skill improvement, empowering trainees to reach their full potential and become a competent and skilled workforce for the construction industry in Nigeria. In conclusion, this paper advocates for the integration of an E-Portfolio System in the assessment of construction trades trainees in the N-Power Build programme. Embracing technology-driven assessment will not only enhance the programme's impact on skills development but also contribute significantly to the nation's infrastructural transformation, while concurrently addressing the pressing challenges of youth unemployment and restiveness in Nigeria.

Keywords: E-Portfolio, NPower, Construction Trades, CORBON, TVET, NSQF

other studies that highlighted the challenges of implementing e-portfolio, such as the need for technical support and adequate training for both instructors and students.

Despite the objectives of the N-Power Build programme, there are gaps in skills acquisition and the assessment of trainees in the construction trades. The current assessment method does not adequately capture the trainees' practical skills and competencies, which are critical for the construction industry. There is a need for an assessment method that would enhance the quality of the training and enable the development of a competent and skilled workforce for the construction industry in Nigeria.

The assessment method used in the N-Power Build program for the construction trades was overwhelmed by logistical challenges and poor trainees and assessors ratio. Moreover, it fails to effectively capture trainees' practical skills and competencies, hindering their skills acquisition and overall assessment. The lack of compliance with standardised training delivery manuals and alignment to National Occupational Standards (NOS) poses challenges. Additionally, many training centers are not registered by the awarding body, and trainees' biodata is often not captured. Soft skills, such as health and safety, teamwork, and communication, which are integral to the training, are not adequately delivered by Trainers. Insufficient quality assurance, funding, and security concerns hinder the effectiveness of induction, initial assessment, and direct observations. Lack of standardization and availability of assessment materials for Trainers can lead to the possible exploitation of trainees. There was a lack of continuity and sustainability of programme delivery among training providers and centers.

The paper addresses the apparent misconception about the E-Portfolio System in Nigeria and its potential to enhance the quality of the training and enable the development of a competent and skilled workforce for the construction industry. It is proposing a model for the integration of an E-Portfolio System in the assessment of construction trades trainees in the N-Power Build programme in Nigeria. The objectives of this paper, therefore, are:

- i. To examine the N-Power Build programme's objectives and scope of training.
- ii. To identify the gaps in skills acquisition in the construction trades.
- iii. To propose a model for the integration of an E-Portfolio System in the assessment of trainees in the N-Power Build programme.
- iv. To evaluate the potential impact of the proposed E-Portfolio System on the quality of the training and the development of a competent and skilled workforce for the construction industry.



Contextual Framework

The Strategic Role of CORBON in the Delivery of NPower Build Programme

The Council of Registered Builders of Nigeria (CORBON) was established to regulate the Building Technology Profession and serves as the Sector Skills Council for vocational training and certification in construction trades through the Nigeria Skills Qualification Framework (NSQF). Collaborating with the National Social Investment Office (NSIO), CORBON implemented the NPower Build program to address unemployment and skills shortages among Nigerian youths in the construction sector. The program trained candidates in six construction trades, using a two-stage approach comprising Basic Theory and Practice followed by Apprenticeship/on-the-job training. Partnerships with vocational institutions and the Nigerian Institute of Building ensured standardized and comprehensive training, aligning with industry requirements. The program utilized well-structured instructional manuals based on National Occupation Standards (NOS) to enhance skill acquisition and capabilities for construction works.

Insights on the National Skills Qualifications Framework

The National Skills Qualifications Framework (NSQF) in Nigeria is a nationally validated assessment and certification system that acknowledges skills and competencies acquired through on-the-job experience or formal/informal training. It plays a vital role in establishing national standards for industry-based competence, offering a common basis for graduation, job entry, career progression, and remuneration assessments. The NSQF aligns learning outcomes and competencies for skilled manpower development, promoting strong linkages between the skills training sector and industries. Its objectives include expanding access to education and promoting lifelong learning, facilitating the recognition of prior experiential learning, and enabling up-skilling and re-skilling opportunities for youth and working adults (NBTE, 2021, Okwa, A. A. and Musa, J., 2015, Opoola, A. L., 2020, UNESCO, 2023).

The National Board for Technical Education (NBTE) serves as the current apex regulatory body for the NSQF (UNESCO/UNEVOC, 2019, Ezeahurukwe, J., 2020), and a proposal for the establishment of a National Commission for Skills Education and Training (NCOVET) is being considered.

However, challenges to skills development in Nigeria include a preference for university education over Technical and Vocational Skills and poor perception about construction trades (Awe, E. M. et. al, 2010 and Oseghale, B., 2021, Bello, O. and Muhammad, A. D. K., 2021).

CORBON, as a Sector Skills Council, strives to create awareness and promote TVET through NPower Build programme facilitation. Enhancing skills development requires involving educational institutions and the industry in the NSQF's development and application, ensuring alignment with the construction industry's manpower needs (Sara, H. A. and Dabban, I. M., 2020). Additionally, addressing skill gaps and improving curriculum planning necessitates stronger policy influence and data collection to enhance the effectiveness of skills development initiatives (ITF, 2016).

Skills Qualifications Assessment in Construction Trades

Assessment serves the dual role of showcasing acquired knowledge and creating deliberate occasions for learners to exhibit their established levels of proficiency, skills, and/or expertise. When considering assessment in the context of granting a certification or recognition, the act of awarding a qualification hinges upon forming informed decisions based on evidence garnered through authorized and quality-vetted assessment methods. The aim of assessment, leading to potential qualification, revolves around evaluating whether the attainment of learning, as defined by specific learning outcomes, has been successfully accomplished (UAE Ministry of Education, 2023).

The literature review for this study reveals different theoretical frameworks for skills qualification assessment in technical education. Assessment is an integral part of quality assurance framework (Wafudu, S. J., and Kamin, B. Y., 2021). It promotes learning (Curtis, D. D., 2010). Notable frameworks include Competency-Based



Education and Training (CBET), Authentic Assessment, Situated Learning Theory, Multi-dimensional Assessment, and Work-Based Models.

Competency-Based Education and Training (CBET) emphasizes assessing learners' practical skills against industry standards, promoting skill development (Kalu, U. O, et. al., 2023, Ayonmike, C. S., et. al., 2014, Baraki, A. H, et. al, 2016, and Preston, J., 2017). Authentic Assessment engages learners in real-life scenarios, leading to more accurate assessments and increased job satisfaction (Rusalam, N. R., et. al. 2018). Situated Learning Theory emphasizes contextual learning through active participation, positively impacting skill development (Ling, L. S. and Choo, T. B., 2005). Multi-dimensional Assessment applies to blended learning, it integrates various methods, reducing biases and providing a comprehensive picture of candidates' capabilities (Calderon, O., et. al, 2012)). Work-Based Models combine on-the-job training and classroom learning, contributing to skill development, retention, and career progression (Haruna, R. and Kamin, Y., 2019).

E-portfolio Use in Technical and Vocational Education and Training (TVET)

E-portfolio is a digital tool used to collect, organize, and present evidence of learning, skills, and experiences in the context of Technical and Vocational Education and Training (TVET), an e-portfolio system can enhance learning and assessment by improving students' learning outcomes, engagement, reflective practice, and digital literacy skills (Buzetto-More, N., 2010 and Sweat-Guy, R. & Buzetto-More, N., 2007). In the same context, Matsom, H. et. Al. (2015), describes “e-portfolio as a collection of digital artifacts or work products, including the evidence of learning, demonstrations, resources, groups, communities, organisations, or institutions.”

The benefits of using an e-portfolio in TVET, includes enhancing learning, improving assessment, and facilitating lifelong learning. The authors also discussed the challenges of implementing an e-portfolio in TVET, advocating the need for technical support and adequate training for both instructors and students (Matar, N., 2015, Ebil, S. H. & Salleh, S. M., 2020).

Specific studies on the use of E-Portfolios

Several studies have examined the use of e-portfolios in different vocational and technical education contexts, highlighting their benefits and implications. Harper, W. (2005) and McCowan, C., et. al. (2005), conducted a study in Australia and found that e-portfolios provided learners with a personalized and engaging learning experience. They allowed for the integration of various learning materials and supported reflective practice.

Cyril, M. N. and Andrew, E. (2014), adduced that e portfolios are pedagogical agents and that could be harnessed and utilised in teaching and learning of technical and vocational education in Nigeria. In the United Kingdom, Denmark, Romania and TuTurhan, M. and Demirli, C. (2010), explored the use of e-portfolios in a TVET context. They discovered that e-portfolios facilitated the acquisition of competencies and served as a means for learners to demonstrate their achievements and progress. However, the study also noted that the effective implementation of e-portfolios required substantial technical and pedagogical support from instructors. In Malaysia, Ruhizan M.Y, et. al. (2017), conducted a study to ascertain the country's readiness for e-portfolio for TVET, and concluded that ICT knowledge and resources are sufficient for the e-portfolio system. Song, B. K. (2021), established that e-portfolios supported the development of reflective practice and self-assessment among learners. Additionally, they facilitated collaboration and communication between learners and instructors. Jimoyiannis, A. (2012). Outlined a pedagogical framework for designing and implementing e-portfolios in educational practice. The focus lies on students' engagement, learning, and personal development within e-portfolio. Oradini, F. and Saunders, G. (2007), submits that e-portfolio can be shared for feedback and eventually submitted for summative assessment. Furthermore, they established that students believed that making an e-portfolio can help them think more about what they learned. Hornblow, D. J. (2007), advocated for E-portfolio that is consistent with a concept of learner-worker employability and



an approach to learning that is reflective, contextually relevant, framed appropriately, and deep rather than surface. Based on their study findings, Poortinga, J. and Meede, S. (2007), concludes that e-portfolios are better for professional goals than for academic functioning or study career management. In a pilot study, Firssova, O. and Brinke, D. J. (2007), tested the feasibility of the APL concept in the context of a university curriculum at the Masters' level, and conclude that there is a general usefulness of portfolio as an APL instrument and provided validation of general portfolio design principles and heuristics in the context of APL. Given certain perception of difficulties associated with the use of e-portfolio, Rossi, P. G., Magnoler, P., and Giannandrea, L. (2007). modeled the structure and the use of ePortfolios to fulfil the users needs and to be perceived as an extremely usable and motivating tool.

These studies collectively demonstrate the positive impact of e-portfolios in vocational and technical education, through support to the development of learners' professional competencies, providing a platform for sharing and collaboration, and enhancing learners' motivation and engagement. Furthermore, it provides a means for reflection on learning experiences and promoted collaboration and communication. In summary, e-portfolios enhances engagement, reflective practice, acquisition of competencies, collaboration, and communication. However, successful implementation requires careful consideration of technical and pedagogical support.

Benefits of E-Portfolio Systems for TVET

E-portfolio systems have gained significant attention in TVET due to their potential to improve student learning outcomes and enhance employability (Kiffer, S., et. Al., 2021, and Lygo-Baker, S. & Hatzipanagos, S., 2012). These systems facilitate assessment and evaluation in TVET, allowing instructors to assess student learning outcomes and provide timely feedback, which can save time and reduce workload. According to Rahim, M. B., (2015), they provide an efficient method for students' competence evaluation, descriptions of students' development process, storage of artefacts, assessment, and online learning. Furthermore, Wassenmiller, A. and Lazarevic, B. (2010) established that e-portfolio systems enable students to showcase their skills, competencies, and achievements to potential employers, thereby increasing their chances of securing employment and enhancing their career prospects. Lamont, M. (2007) affirmed in her paper that e-portfolio are used as assessment tools to ensure programme coverage, meet national standards, and determine whether a student meet the requirements for certification or graduation.

Methodology

This paper adopted a qualitative research approach, using a case study of the N-Power Build programme in Nigeria. Textual and numerical data were collected through document analysis of reports and programme documents from Federal government institutions. In addition, oral interview of Assessors was conducted for vital information on the assessment process that aligns with the requirements of National Occupational Standards.

The documents were studied to identify the programme's objectives, the scope of training, and the challenges encountered. A review of the literature on the E-Portfolio System was conducted to identify its potential to enhance the quality of training and assessment of practical skills and competencies. Pandas, a Python library was used to develop the E-Portfolio Assessment Model Code. The choice of Python is on the premise of simplicity and readability even for non-coders.

Data Distribution of Training Centers Trainees based on Geo-politicalzones.

The reports provided the following information/data:

1. The domain skills (building trades) and soft skills areas
2. Statistics on the training Centres and their trainees
3. Distribution of the centres across States and the Federal Capital Territory

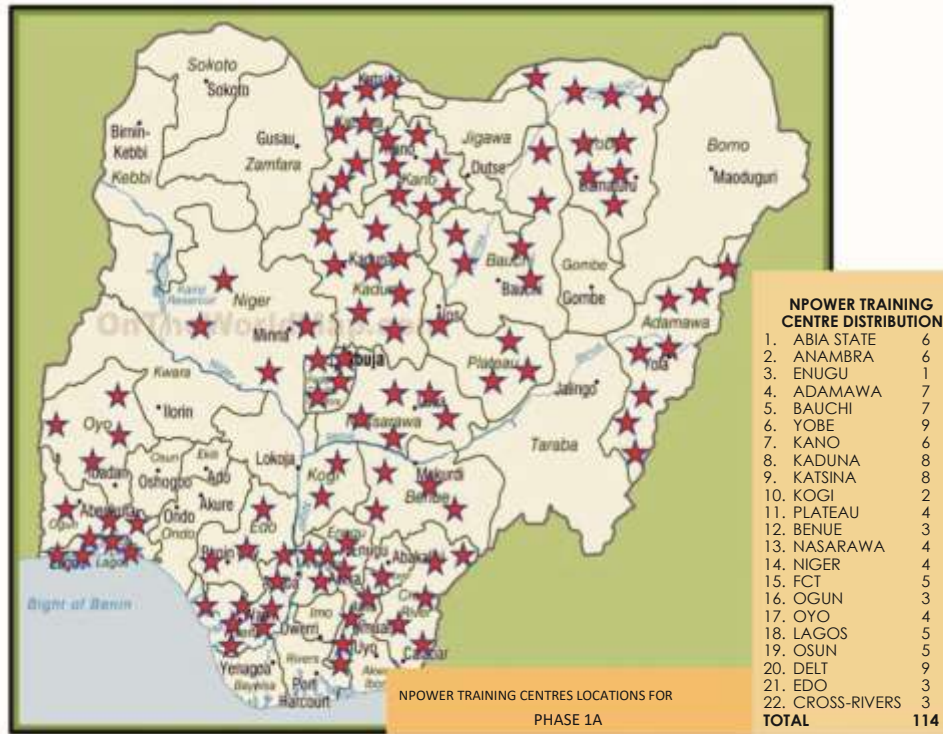


Fig. 1a: Distribution of Centres for Batch 1A (Note: Stars represent the location of centres)
 (Source: Report on National Capacity Building in Construction Trades Batch 1, FGN, 2019)

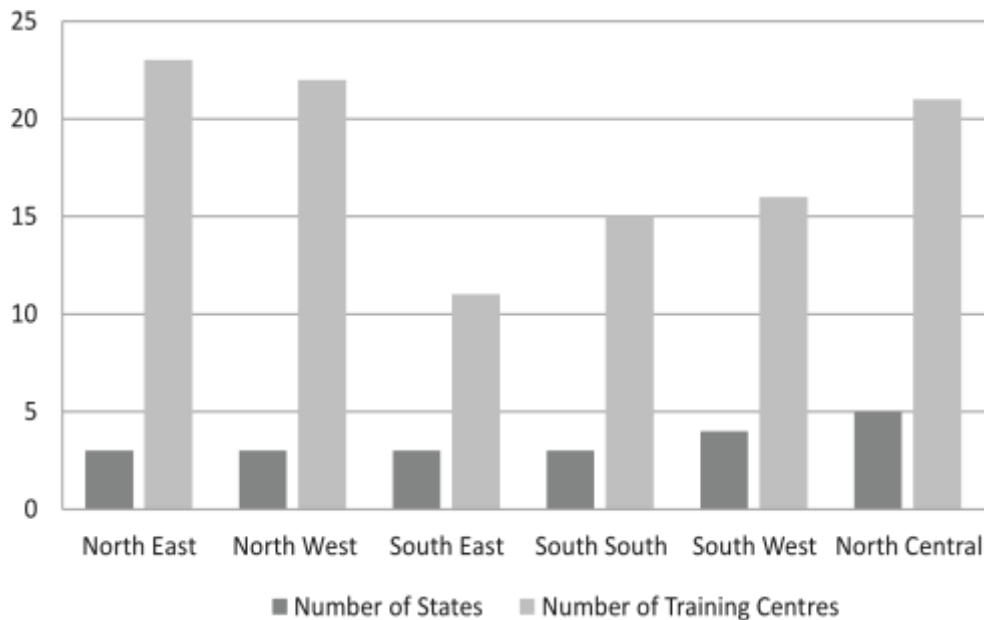


Fig. 1b. Number of training centers in Batch1A
 (Source: Report on National Capacity Building in Construction Trades Batch 1, FGN, 2019)

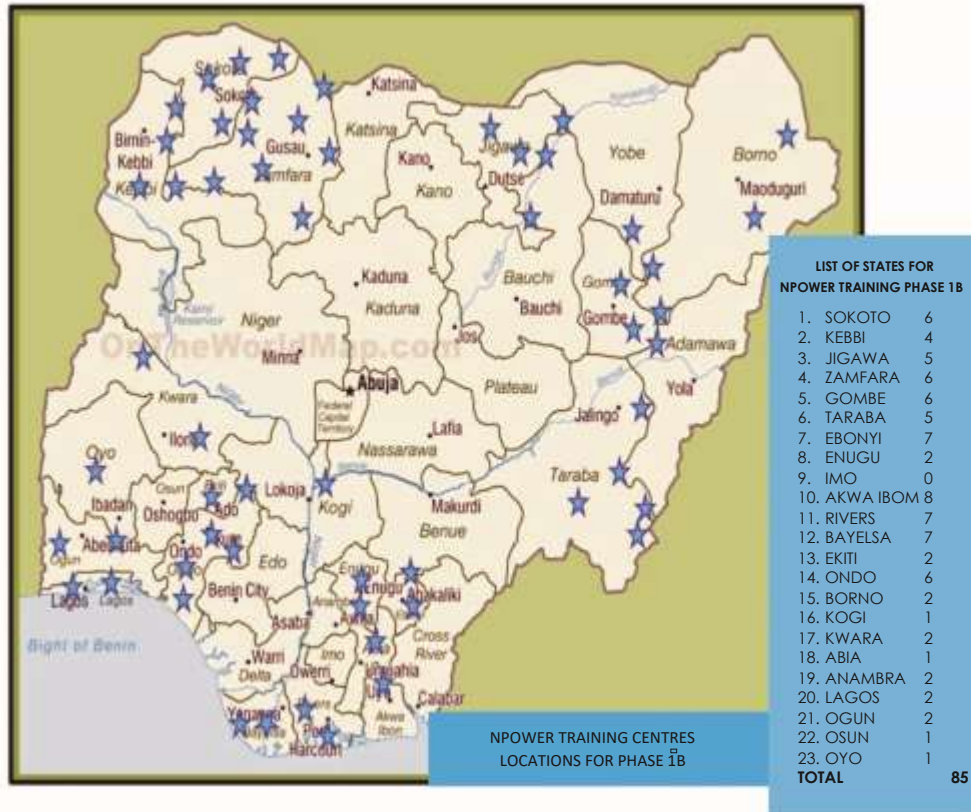


Fig. 2a: Distribution of Centres for Batch 1B (Note: Stars represent the location of centres)

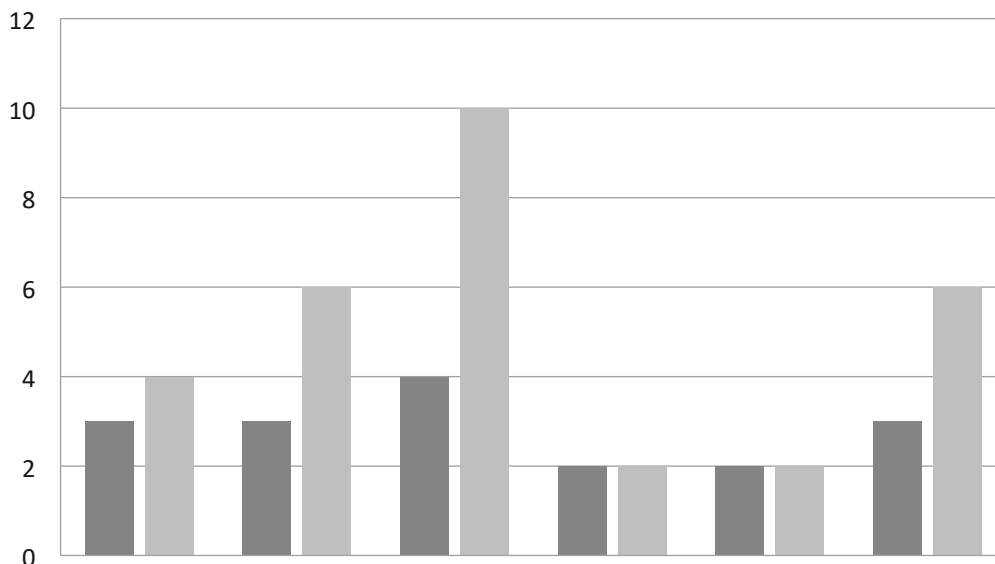


Fig. 2b. Number of training centers in Batch 1B
 (Source: Report on National Capacity Building in Construction Trades Batch 1, FGN, 2019)

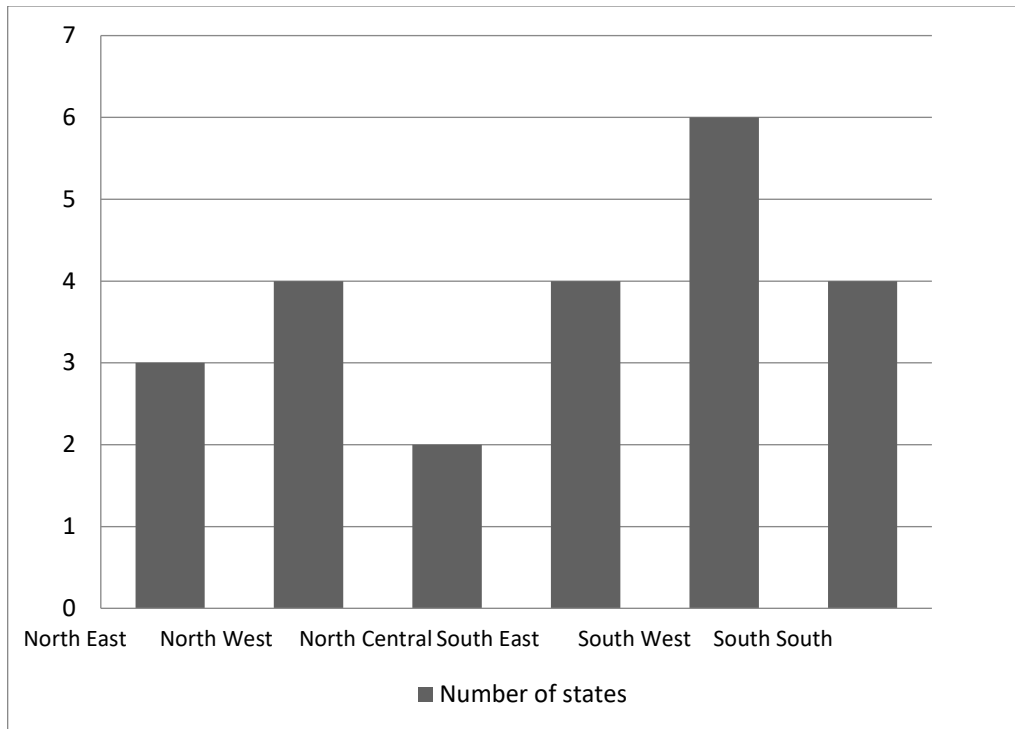


Figure 2b: Number of training Centers in Batch1B
 (Source: Report on National Capacity Building in Construction Trades Batch 1, FGN, 2019)

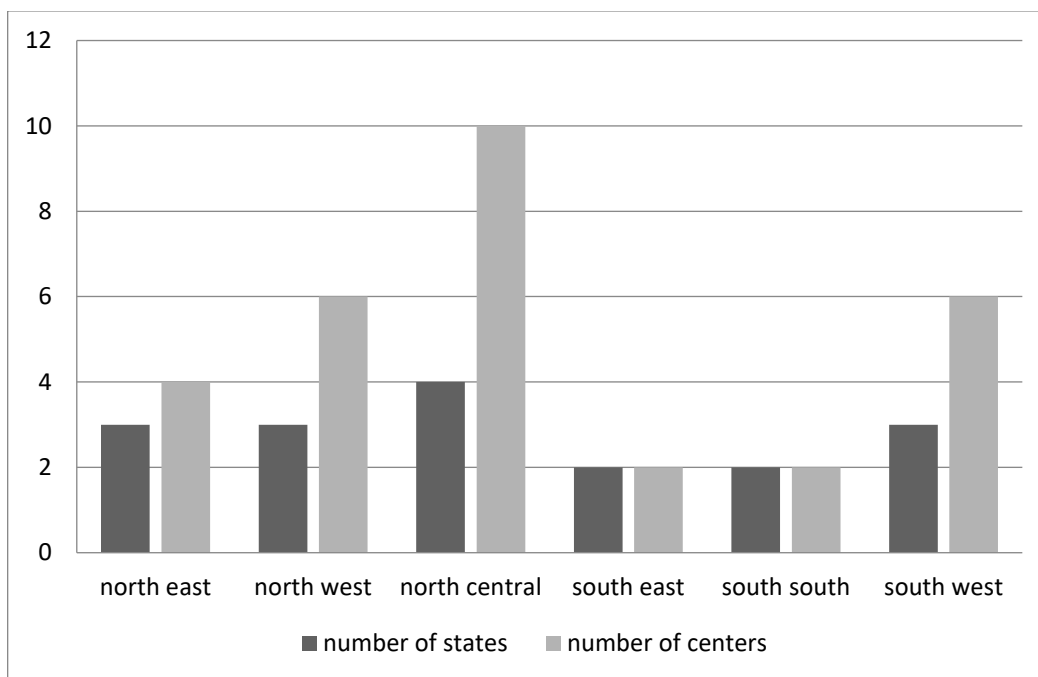


Fig 3: Number of training Centers in Phase1C
 (Source: Report on National Capacity Building in Construction Trades Batch 1, FGN, 2019)

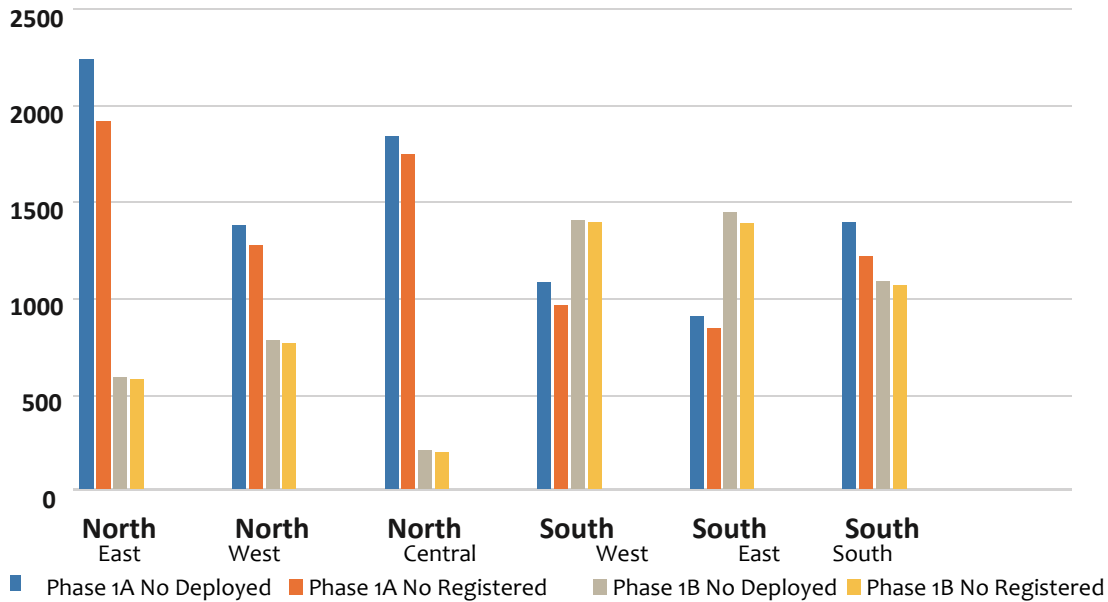


Figure 4 – Number of Trainees Deployed vs. Actual Registered
 (Source: Report on National Capacity Building in Construction Trades Batch 1, FGN, 2019)

Information on standardised NSQ assessment process

Table 1. Information on standardised NSQ assessment process

S/ N	Phase	Assessment Activity	Expectation/Required documentation	Person responsible	Estimated Duration	Possible Constraints and Factors
			Familiarisation meeting between learner,			
1	Induction and Documentation	Initial meeting with candidate	Center head and QAA and agreeing commencement date for assessment	Center head/QAA	1hour	Assessment risks
2		Orientation and Induction	A detailed guide on the assessment processes, requirements, NOS, duration, appeals, documentation, etc given to the learner by the QAA	QAA	1 day	Assessment risks
3		Complete documentation and folder arrangement	QAA supports the learner in filing required	QAA/Learner	1 day	Assessment risks



			documents in an assessment folder				
4	Assessment/Evidence Generation/QAA Decisions	Questions and Answers	Answers to questions in relation to the NOS	Learner and QAA	1 week	Number of Knowledge based Performance Criteria (PCs) in the NOS	
5		Planning	Documented Agreement for each assessment activity	Learner and QAA	1 day per assessment activity		
6		Direct Observation (several visits to the work place by the QAA)	Direct Observation Report	QAA	2 months	Availability of work related to Performance being assessed and other assessment risks	
7		Personal statements	Personal statements	Learner	1 day		
8		Witness statements	Witness statements	Professional/ Workbased supervisor/	1 day		
9		Report of Examination of work product (s)	Report of Examination of work product (s)	QAA	1 day		
10		Internal Verification	Internal verification	Feedback and actions to the QAA, and final report to the Awarding body.	IQAM	1 week	Level of support required to the QAA

Challenges Encountered in the Delivery of N-Power Programme

1. **Logistics Challenge:** Short lead times for preparation and execution of preliminary activities, such as the assessment of instructors and training of trainers in various locations at short notice, posed logistical challenges during program implementation.
2. **Late Response to Information:** Government-owned institutions experienced delays in responding to information due to red-tape policies or lack of proficiency with information technology, which was the main tool used for communication and dissemination of important information.



3. **Limited Technology Adoption:** Some centers were not accustomed to using emails and other application tools like Microsoft Excel, which was crucial for data collation. This necessitated special measures and additional support to effectively track and report activities related to the program's conduct, monitoring, and apprenticeship placement.
4. **Delayed Payment of Stipends:** The transmission of trainees' information in the required format by the Center heads was responsible for delays in the payment of some beneficiaries' monthly stipends, with some payments almost reaching the end of their apprenticeship period.
5. **The intervention of Payment:** The Council Project Management team had to spend about a month making personal phone contacts with affected trainees between December 24th, 2018, and January 23rd, 2019, to obtain the necessary information for collation. This effort led to the settlement of outstanding payments by the end of January 2019.
6. **Inadequate Provision of Tools and Protective Equipment:** Some trades lacked appropriate tools and consumables, and there was a shortage of Personal Protective Equipment (PPE) like hard hats. Despite commendable efforts by the NSIO to provide some materials, distribution logistics and protracted warehouse storage led to the spoilage of items like cement and timber with limited stock timelines.
7. **Lack of Understanding of Training Model and Guidelines:** There was a lack of adequate understanding of the training model, Occupational standards, and inattention to the detailed guidelines issued by the job creation team of the NSIO.
8. **Lack of Prior Arrangement for Apprenticeship:** Insufficient prior arrangements for the apprenticeship component necessitated the council's active canvassing of REDAN members and other contractors to make special arrangements for candidate placement and the sensitization of master artisans to ensure effective support.
9. **Shortage of Qualified Assessors:** There was an inadequate number and distribution of qualified assessors to handle the onsite assessment in line with the National Skills Qualifications (NSQ) certification requirements of the National Board for Technical Education (NBTE) and the awarding body. As a result, the assessment and certification process is still ongoing but expected to conclude before the end of the year.

Discussions on Results

Scope of the programme and Insights on challenges

The programme reports and interviews with Assessors serve as the primary sources of data and relevant information for this study. The sources offer valuable insights into the scope of the programme and the challenges encountered during its delivery. Addressing these issues is crucial for improving the program's effectiveness and ensuring the successful development of a skilled and competent construction workforce in Nigeria.

The programme follows a structured training approach, comprising a three-month in-centre training phase, where theoretical knowledge and domain skills are imparted, complemented with soft skills training. Instructors oversee this training phase, providing essential guidance to the trainees. The subsequent nine-month industry training, referred to as the Apprentice Stage, involves trainees being attached to Master-craftsmen who provide practical on-site skills instruction and introduce them to industry practices. This hands-on experience is vital for their skill development.

The reports provided information on the domain skills (building trades) and soft skills areas covered in the training, statistics on the training Centres, and the distribution of these Centres across various States and the Federal Capital Territory. The programme focused on six building trades (see Fig. 5), 256 training Centres distributed across 36 States and the Federal Capital Territory.



Fig. 5: NPower Build Focal Construction Trades

The process of deploying and registering beneficiaries for batches 1A and 1B involved various training centres. Batch 1A consisted of 8,079 trainees deployed across 113 training centres in 22 participating States and the FCT. Batch 1B had 5,524 trainees deployed to 88 training centres, with a focus on the remaining 17 States not covered in batch 1A. Some Batch 1B trainees were deployed to 5 States that already had trainees from Batch 1A. Subsequently, Batch 1C was formed, comprising 4,349 trainees distributed across 30 training centres in 18 states of the Federation. In total, there are 231 training centres with 13,554 beneficiaries enrolled for the three months of in-centre training before proceeding to the nine months of apprenticeship at various centres. Analyzing this information collected from the programme report and Assessors' interviews shed light on the programme's reach, distribution, and implementation challenges. By addressing these issues and leveraging the valuable insights gained from the data, the N-Power programme can be strengthened to achieve its goal of fostering a skilled and competent workforce to contribute to the development of the construction industry in Nigeria.

Assessors Approach to Assessment

The interactions with Qualified Assessors revealed an assessment process that is centered around ten critical activities aimed at enhancing the evaluation of trainees' skills and capabilities. These activities according to the Assessors are designed to ensure a thorough and effective assessment process while addressing potential challenges.

The initial meeting between the learner and the Center head/Quality Assurance Assessor (QAA) serves as a crucial starting point for the assessment process. During this one-hour familiarization meeting, both parties agree on the assessment commencement date and discuss potential assessment risks. This ensures a clear understanding and alignment before proceeding with the assessment.

Documentation induction and orientation provided by the QAA play a vital role in acquainting learners with assessment processes, requirements, National Occupational Standards (NOS), and other essential information. This comprehensive induction, lasting one day, is a valuable step in guiding learners through the assessment journey.

The proper organization of documentation is facilitated by the QAA, who assists learners in compiling their assessment materials into an assessment folder within one day. This arrangement ensures that all necessary paperwork is in order, minimizing documentation-related issues during the assessment.



The process of addressing queries related to the NOS Performance Criteria (PCs) is another significant activity. Over the course of one week, learners and the QAA engage in a questions-and-answers session, providing clarification and understanding on the knowledge-based PCs.

The planning of assessment and evidence generation is given careful attention, with one day dedicated to documenting agreements between learners and the QAA. This step considers the availability of work related to the assessed performance and other potential assessment risks, ensuring a well-prepared and organized assessment process.

Direct Observations are conducted by the QAA through multiple workplace visits, with Direct Observation Reports generated within two months. This activity takes into account the availability of work related to the assessed performance and other assessment risks, leading to comprehensive and accurate assessment outcomes.

Personal statements prepared by learners offer valuable insights into their experiences and achievements related to the assessed performance, providing a more holistic view of their capabilities.

Witness statements provided by professional or work-based supervisors further corroborate the learner's performance, adding credibility and reinforcing the assessment process.

The QAA's report on the examination of work products is prepared within one day, providing an objective evaluation of the learner's work and contributing to the overall assessment outcome.

Internal verification, conducted by Internal Quality Assurance Managers (IQAM), ensures the robustness of the assessment process. Feedback and actions are provided to the QAA, with the final report submitted to the Awarding body within one week, considering the level of support required by the QAA during verification. Overall, these critical activities, when integrated into the assessment process, create a comprehensive and effective framework. The process allows for a dynamic evaluation of trainees' skills and capabilities while addressing potential challenges, thereby enhancing the development of a competent and skilled construction workforce in Nigeria.

Challenges Encountered During Implementation

The implementation of the N-Power Programme in Nigeria aimed to address the challenges of unemployment and restiveness among Nigerian youths. However, during the delivery of the program, several challenges were encountered, which impacted its effectiveness and efficiency.

One of the prominent challenges identified was the logistics challenge. The program faced short lead times for the preparation and execution of preliminary activities, such as assessing instructors and training trainers in various locations at short notice. This logistical constraint posed significant hurdles during the program's execution and required careful planning and coordination to overcome.

Another challenge arose from late responses to information by government-owned institutions. Delays were attributed to red-tape policies and a lack of proficiency with information technology, which hindered effective communication and dissemination of crucial program-related information. To improve the program's communication flow, addressing these bureaucratic obstacles and promoting technological literacy among stakeholders is crucial.

Limited technology adoption by some centers also presented a notable challenge. A lack of familiarity with tools like emails and Microsoft Excel impeded data collation and reporting processes. Addressing this issue requires providing additional support and training to enhance the technological capabilities of the centers involved.

Delays in the payment of stipends to beneficiaries were also observed. Issues in transmitting trainees' information in the required format led to delayed payments, impacting the trainees' financial stability during their apprenticeship period. To ensure timely stipend disbursements, streamlining data submission processes and enhancing data management practices are necessary.



An intervention to resolve payment delays required extensive efforts. The Council Project Management team had to make personal phone contacts with affected trainees, which highlights the importance of efficient and accurate data collection systems to avoid such interventions in the future.

Inadequate provision of tools and protective equipment posed challenges to the successful execution of the program. Some trades lacked necessary tools and consumables, and there was a shortage of Personal Protective Equipment (PPE) like hard hats. This hindered trainees' productivity and safety, emphasizing the need for better logistical planning and material distribution.

Lack of understanding of the training model and guidelines was identified as a barrier to the program's effectiveness. This deficiency calls for improved dissemination and clear communication of guidelines to all stakeholders involved in program implementation.

Insufficient prior arrangements for apprenticeship placements also surfaced as a challenge. Active canvassing of industry members was required to secure suitable placements for candidates, emphasizing the importance of robust partnerships and pre-planning with employers.

The shortage of qualified assessors impacted the assessment and certification process. The insufficient number and distribution of assessors raised concerns about meeting certification requirements and highlighted the need for adequate assessor training and recruitment.

Addressing these challenges is essential to enhance the delivery and impact of the N-Power Programme.

The adoption of an E-portfolio system can significantly contribute to enhancing the delivery and impact of the program. By leveraging modern technology and electronic portfolios, the E-portfolio system offers practical solutions to tackle these challenges effectively.

The Proposed E-portfolio model

The NPower Build programme in Nigeria aims to address youth unemployment and poverty by providing vocational training in various construction trades. An e-portfolio system can be a useful tool to assess and certify the trainees' progress and achievements in the programme. The design and implementation of an e-portfolio system for the NPower Build programme is proposed to have the following elements:

1. *Platform:* The e-portfolio system can be developed as a web-based platform accessible to both trainees and instructors. It should be user-friendly and easy to navigate.
2. *Content:* The e-portfolio system should allow trainees to document and showcase their learning progress, skills development, and achievements throughout the programme. The system should also allow instructors to provide feedback and assessment of trainees' performance.
3. *Assessment criteria:* The e-portfolio system should be aligned with the assessment criteria and learning outcomes of the NPower Build programme. The system should enable instructors to evaluate trainees' competencies and certify their achievements based on the set criteria.
4. *Integration with existing systems:* The e-portfolio system should integrate with other existing systems used in the NPower Build programme, such as the learning management system and the certification system. This will enable seamless data transfer and reduce duplication of effort.
5. *Technical support:* The successful implementation of an e-portfolio system requires technical support for both trainees and instructors. Technical support can be provided through training sessions, online resources, and helpdesk services.
6. *Privacy and security:* The e-portfolio system should ensure the privacy and security of trainees' data. The system should have measures in place to protect against data breaches and unauthorized access.
7. *User feedback:* The e-portfolio system should allow trainees and instructors to provide feedback on the system's usability, functionality, and effectiveness. This feedback can inform improvements and enhancements to the system.



The proposed e-portfolio model includes the submission of tasks, review of the submissions, and methods of certifying trainees. The submit task method allows trainees to submit their work for assessment while the review submission method allows assessors to review and provide feedback on trainee submissions. The certification of trainee method checks whether a trainee has completed all tasks and met all the assessment criteria. The model will return True if the trainee is certified and False if they are not.

Table 2. Key elements of the e-portfolio system for assessment and certification of Trainees

Feature	Description
User-friendly interface	The e-portfolio system should have an easy-to-use interface that can be accessed by trainees, instructors, and assessors.
Personalized profile	Each trainee should have a personalized profile where they can upload their personal information, resume, and educational background.
Learning modules	The e-portfolio system should have learning modules for each of the construction trades offered under the NPower Build programme. The modules can include videos, documents, quizzes, and assessments.
Skills tracking	The system should allow trainees to track their skills development over time. This can include recording their practical skills, such as measuring and cutting materials, and their soft skills, such as communication and teamwork.
Certification	Once a trainee completes the required training and assessment, the system should generate a certificate of completion that can be shared with potential employers.
Feedback and communication	The e-portfolio system should provide a platform for instructors and assessors to give feedback to trainees on their work and progress. It should also allow trainees to communicate with each other and with their instructors
Compatibility	The e-portfolio system should be compatible with mobile devices because many Trainees may not have access to desk computers or laptops.

The above table outlines the key features of the proposed e-portfolio system, including a user-friendly interface, personalized profiles, learning modules, skills tracking, certification, feedback and communication, and mobile compatibility. These features can help trainees document and showcase their learning progress, skills development, and achievements while providing instructors and assessors with a platform to evaluate their competencies.

Given the information in Table 2, Python 3.0 provided the basis for generating a model code in Table 3.

Table 3. E-portfolio assessment model code

Line number(s)	Code
1-2	import pandas as pd
4-17	class EPortfolio:
6-12	def init(self, platform, learning_objectives):
13-17	def add_task(self, task_id, task_description):



19-26	def add_submission(self, trainee_id, task_id, submission):
28-34	def add_rubric(self, task_id, criteria):
36-47	def review_submission(self, trainee_id, task_id, feedback):
49-58	def certify_trainee(self, trainee_id):
60-77	def generate_report(self, trainee_id):
80-92	eportfolio = EPortfolio('NPower Build', 'Construction trades trainees assessment and certification')
95-97	eportfolio.add_task(1, 'Build a brick wall')
98-100	eportfolio.add_task(2, 'Install electrical wiring')
101-103	eportfolio.add_task(3, 'Install plumbing')
106-108	eportfolio.add_rubric(1, {'Quality of work': 5, 'Completion time': 3, 'Safety': 2})
109-111	eportfolio.add_rubric(2, {'Accuracy of wiring': 5, 'Neatness of wiring': 3, 'Safety': 2})
112-114	eportfolio.add_rubric(3, {'Accuracy of plumbing': 5, 'Neatness of plumbing': 3, 'Safety': 2})
117-129	class EPortfolioModel:
131-137	def init(self, tasks, assessment_rubrics):
138-143	def submit_task(self, trainee_id, task_id, submission):
145-151	def review_submission(self, trainee_id, task_id, feedback):
153-166	def certify_trainee(self, trainee_id):

The Relevance of E-Portfolio in Addressing the Challenges

The integration of an E-Portfolio System can play a pivotal role in addressing the challenges encountered in the delivery of the N-Power Programme. E-Portfolios offer a dynamic and technology-driven approach that can effectively mitigate the identified issues. Here's how E-Portfolios can address the challenges:

- 1. Enhanced Communication and Preparation:** The E-Portfolio system can provide a centralized platform for communication and dissemination of important information. Trainees and stakeholders can access real-time updates, training schedules, and assessment requirements, thus reducing logistics challenges arising from short lead times. Through E-Portfolios, trainees can be adequately prepared for assessments and training activities, ensuring smoother program implementation.
- 2. Streamlined Data Collation Process:** E-Portfolios simplify the data collation process by offering predefined templates and user-friendly interfaces. Trainees can easily input their progress, achievements, and practical skills demonstrations. This automated system allows for efficient and timely data collation, eliminating delays in stipend payments and enhancing overall record-keeping.
- 3. Efficient Distribution and Inventory Management:** The E-Portfolio system can facilitate the distribution of training materials and Personal Protective Equipment (PPE) through digital records. Centers can maintain up-to-date inventories, reducing spoilage and ensuring that trainees have access to the necessary tools and consumables. The digital platform can also enable the timely provision of materials to remote training locations.
- 4. Comprehensive Understanding of Guidelines:** The E-Portfolio can serve as a repository for comprehensive guidelines and training materials. Trainees and instructors can access clear explanations of the training model, occupational standards, and program guidelines. The multimedia capabilities of E-Portfolios allow for interactive learning, ensuring a better understanding of the program's objectives and requirements.
- 5. Facilitating Apprenticeship Arrangements:** The E-Portfolio can be leveraged to establish partnerships with potential employers and master artisans. Trainees' digital records can showcase their progress, competencies, and achievements, making it easier for employers to assess their suitability for apprenticeship placements. This proactive approach streamlines the apprenticeship component and enhances job placement prospects.
- 6. Improved Assessment Process:** The E-Portfolio enable a comprehensive assessment of trainees' skills through multimedia evidence, such as videos, images, and written reflections. Assessors can remotely review



trainees' performance and provide timely feedback. This addresses the shortage of qualified assessors and ensures a smooth certification process in line with NSQ requirements.

7. Remote Monitoring and Evaluation: The E-Portfolio system can facilitate remote monitoring and evaluation, reducing the need for physical visits and paperwork. Quality Assurance Managers can track trainees' progress, provide support, and ensure compliance with program guidelines without being constrained by geographical limitations.

8. Continuous Program Evaluation and Improvement: The E-Portfolio system can enable continuous program evaluation through real-time data and feedback. Program administrators can identify emerging challenges, analyze trainees' performance trends, and make data-driven decisions for program improvement. This iterative approach enhances the program's effectiveness and adaptability.

Conclusion

The e-portfolio system can be a valuable tool for assessing and certifying the progress and achievements of trainees in the NPower Build programme. It can support reflective practice, self-assessment, and collaboration among trainees and instructors, as well as facilitate the certification process. The integration of the system offers a transformative solution to the challenges encountered in the N-Power Programme's delivery. By harnessing the power of technology and adopting E-Portfolios, the program can streamline communication, data collation, assessment processes, and apprenticeship arrangements. The comprehensive and dynamic nature of E-Portfolios fosters a more efficient and effective skills development program, contributing to the creation of a competent and skilled workforce for the construction industry in Nigeria.

The findings from this study shed light on critical gaps and challenges in the N-Power Build programme's assessment process. To improve skills acquisition and the overall effectiveness of the training, the following recommendations are put forward:

1. Enhancement of Assessment Methodology: To ensure accurate skills capture, the N-Power Build programme should explore the incorporation of more practical assessments and performance-based evaluations. By introducing on-the-job observations and real-life scenarios, the programme can better gauge trainees' competencies, providing a more comprehensive and authentic evaluation of their skills.

2. Investing in Quality Assurance: To enhance the overall assessment process's effectiveness and reliability, the programme must allocate adequate resources and ensure competitive remuneration for Quality Assurance Managers. By doing so, Quality Assurance Managers can better monitor, provide feedback, and offer essential support to trainees, leading to a more robust and well-organized assessment system.

3. Standardization of Assessment: The development of standardized assessment materials, rubrics, and guidelines is crucial for ensuring consistent evaluations across different training locations. By promoting fairness and reliability in the assessment process, standardization can contribute significantly to achieving accurate and equitable skill evaluations.

4. Early Engagement of Quality Assurance Managers: Ensuring the early engagement of Quality Assurance Managers is imperative for facilitating the collection of evidence from the outset of the training programme. Timely engagement allows for comprehensive evaluation throughout the duration of the programme, leading to more reliable and comprehensive assessment outcomes.

Addressing the identified gaps and challenges in the N-Power Build programme's assessment process is fundamental for improving skills acquisition and overall training effectiveness. The implementation of the suggested improvements, including a comprehensive e-portfolio assessment method, is essential to develop a competent and skilled workforce for the construction industry in Nigeria. Considering the limitations of the current assessment method, the integration of an E-Portfolio System is highly recommended for the N-Power Build programme.

The system offers a dynamic and flexible platform to capture trainees' practical skills and competencies effectively. Through the use of multimedia evidence, including videos, images, and written reflections, the



system can provide a comprehensive and holistic representation of trainees' capabilities. E-Portfolio assessment allows for remote monitoring and feedback, overcoming resource constraints and logistical challenges associated with traditional assessment practices. Moreover, it promotes self-directed learning and continuous improvement by encouraging trainees to reflect on their progress and achievements. By implementing an E-Portfolio System alongside the suggested improvements, the N-Power Build programme can establish a more reliable and efficient assessment framework, ultimately producing a skilled and qualified workforce equipped to drive Nigeria's infrastructural development.

Recommendations for further research direction on E-Portfolio Systems

The implementation of e-portfolio systems in TVET is not without challenges. Technical issues, such as system compatibility, data security, and reliability, can hinder adoption and implementation. Additionally, resistance to change from instructors and students, who may prefer traditional assessment methods, can pose challenges. Integration with existing systems, particularly learning management systems, can also be challenging and require significant effort and resources. Thus, more work is recommended.

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