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The Importance of Resource Scheduling for Inclusive Development of the Construction Industry: A Case Study of Manpower Resource Development in Katsina State

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ABSTRACT
Resource scheduling, the systematic planning and sequencing of labour, materials, equipment, time, and cost, is a foundational project management function whose benefits extend well beyond individual project sites into the broader development of the construction workforce. This paper examines the importance of resource scheduling, and particularly manpower resource scheduling, for inclusive development of the construction industry, using Katsina State, Nigeria as a case study. Adopting a qualitative, document-based approach, the paper reviews peer-reviewed literature, government reports and recent programme documentation on construction resource planning and workforce development published between 2020 and 2026. Findings indicate that poor manpower scheduling, characterised by ad hoc labour engagement, weak forecasting of skill requirements, and heavy reliance on informal apprenticeship, continues to undermine both project performance and equitable access to construction employment in Nigeria generally and Katsina State specifically. Conversely, recent state-level interventions, notably the Family Homes Funds Limited Artisan Skills Training (FAST) programme delivered in partnership with the African Development Bank, illustrate how deliberate, planned investment in manpower development, structured training schedules, certification and welfare support, can convert an informally scheduled, low-skill labour pool into a certified, inclusive workforce spanning youth and women across multiple construction trades. The paper concludes that formal resource scheduling techniques, including Gantt charts, the Critical Path Method, resource levelling and Building Information Modelling-based scheduling, when extended deliberately to manpower planning, offer a practical and underused lever for inclusive development in Katsina State's construction industry, and recommends their wider adoption alongside continued investment in certified artisan training.

Keywords: resource scheduling, manpower development, inclusive development, construction industry, Katsina State, artisan training.

INTRODUCTION

The construction industry is one of the largest employers of labour in Nigeria, contributing consistently between roughly three and four percent of the country's real gross domestic product in recent quarters, alongside a much larger nominal contribution when combined with real estate services (Businessday NG, 2024a, 2024b; AirealEnt, 2024). Yet the industry's capacity to translate this economic weight into broad-based, inclusive employment and skills development depends heavily on how its core resources, manpower, materials, machinery, money and time, are planned and scheduled at project and industry level (An Assessment of Resource Planning Approaches, 2026). Resource scheduling, in this sense, is not merely a technical project-management exercise; it is also a determinant of who gains access to construction employment, what skills they acquire, and whether that access is distributed equitably across gender, age and geography (Adu et al., 2025).

In Katsina State, a predominantly semi-arid state in north-western Nigeria with a construction sector historically dominated by small and medium-sized contracting firms and an informal apprenticeship system, manpower resourcing has traditionally been reactive rather than planned (Iiste, n.d.; Zenodo, 2026). Craftsmen are typically engaged as projects arise, with limited forward scheduling of training, certification or deployment, a pattern documented broadly across Nigerian construction firms (International Journal of Environmental Research & Earth Science, n.d.). This paper argues that deliberate resource scheduling, extended beyond materials and equipment to manpower development itself, offers a practical pathway toward more inclusive development of Katsina State's construction industry, and examines this argument through the lens of a recent state-level artisan training initiative.

Statement of the Problem

Nigerian construction projects continue to be affected by cost overruns, schedule delays and quality shortfalls linked to poor resource planning, including inadequate forecasting of manpower requirements (Abani et al., 2025; Kaming et al., 2021, as cited in Abani et al., 2025). At the same time, the industry faces a persistent shortage of technically skilled craftsmen, even though it remains, after agriculture, the largest employer of Nigeria's workforce (Iiste, n.d.). In Katsina State specifically, this combination of poor project-level scheduling and weak systematic manpower development has constrained the extent to which the construction sector generates inclusive, broad-based employment, particularly for youths and women, despite substantial and growing demand for housing and infrastructure across the state (Katsina State Government, 2026a). This paper addresses the gap between the technical literature on construction resource scheduling and the empirical, state-specific evidence on manpower development in Katsina State.

Aim and Objectives

This paper aims to examine the importance of resource scheduling for the inclusive development of the construction industry, using manpower resource development in Katsina State as a case study. The specific objectives are to: (a) review resource scheduling techniques applicable to construction manpower planning; (b) clarify the conceptual relationship between resource scheduling, manpower development and inclusive development; (c) examine recent manpower development interventions in Katsina State's construction industry; (d) identify challenges limiting the translation of resource scheduling into inclusive workforce outcomes; and (e) recommend measures for strengthening manpower resource scheduling in the state.

Literature Review and Conceptual Framework

The Concept of Resource Scheduling

Resource scheduling refers to the process of allocating and sequencing the resources required for project execution, principally labour, materials, machinery and money, across the project timeline so as to minimise idle time, avoid resource conflicts and ensure steady workflow (An Assessment of Resource Planning Approaches, 2026). It is widely regarded as the foundation of effective construction project management, with tools ranging from simple bar (Gantt) charts to network-based techniques such as the

Critical Path Method (CPM), and increasingly to digital approaches such as Building Information Modelling (BIM)-enabled 4D scheduling, which link design models directly to construction sequencing and resource deployment (An Assessment of Resource Planning Approaches, 2026; Building Without Barriers, 2026). Table 1 summarises the principal techniques discussed in the recent literature.

Table 1

Summary of Common Construction Resource Scheduling Techniques

Technique	Description	Primary Resource Focus	Key Source
Gantt Chart	Bar-chart representation of activity start/finish dates against a timeline; widely used for simple sequencing of trades on site.	Time / labour sequencing	Building Without Barriers (2026)
Critical Path Method (CPM)	Network-based technique identifying the longest sequence of dependent activities that determines minimum project duration.	Time, labour, equipment	Optimising Project Cost Control Practices (Abani et al., 2025)
Resource Levelling/Smoothing	Adjusts activity start dates within available float to avoid peaks and troughs in demand for a given resource, especially manpower.	Manpower, equipment	An Assessment of Resource Planning Approaches (2026)
Building Information Modelling (BIM)-based scheduling (4D)	Links 3D design models to project schedules to simulate construction sequencing and resource deployment before work begins.	All resources (materials, labour, equipment, cost)	An Assessment of Resource Planning Approaches (2026); AfDB (2025)
Just-in-Time (JIT) resourcing	Coordinates procurement and mobilisation of materials and manpower to arrive only as needed, reducing idle time and storage costs.	Materials, labour	An Assessment of Resource Planning Approaches (2026)

A recurring finding in the Nigerian literature is that, although these techniques are well documented, construction managers frequently do not rely on formal schedules once construction is under way, managing resources, including manpower, on an ad hoc basis instead (International Journal of Environmental Research & Earth Science, n.d.). Görsch et al. (2024, as cited in An Assessment of Resource Planning Approaches, 2026) further argue that conventional top-down planning often overlooks workers' own bottom-up input, suggesting that hybrid approaches enabled by digital platforms may better support real-time coordination of labour on site.

Manpower Resource Development

Manpower resource development in construction encompasses the training, certification, mentoring and career progression of the workforce, from craftsmen and artisans through supervisory and professional cadres. In Nigeria, the dominant pathway for developing skilled manpower remains informal apprenticeship rather than structured, scheduled training, a pattern confirmed in a recent assessment of skilled manpower supply in the building construction sector, which found informal apprenticeship systems to be the leading contributor to skills development (Relative Importance Index = 0.796), ahead of artisan competency (0.775) and adequacy of supply relative to demand (0.759) (Zenodo, 2026).

Comparable evidence from Ghana's construction industry similarly finds that informal artisan training, while indispensable to the sector, suffers from significant deficiencies in technical skills, formal education and readiness for independent work, underscoring the case for more structured, scheduled training interventions across West Africa (Enhancing Informal Artisan Training in Ghana's Construction Industry, 2025).

Government-backed technical and vocational training institutions, including the federal Industrial Training Fund, established to promote and regulate skills acquisition in industry, provide one structured alternative to purely informal apprenticeship (Industrial Training Fund, n.d.). At state level, dedicated vocational training centres, such as the Katsina Vocational Training Center, have similarly sought to formalise skills acquisition through scheduled training cohorts, certification and starter packs for graduates entering self-employment (Katsina Vocational Training Center, n.d.).

Inclusive Development

Inclusive development is a development paradigm that goes beyond aggregate economic growth to emphasize participation, empowerment and equitable access to opportunity across social, economic and environmental dimensions, with particular attention to groups that might otherwise be marginalized from growth processes (Beyond Buzzwords, n.d.; Spur Economics, 2024). Applied to infrastructure and construction specifically, inclusive development has been described as an approach in which infrastructure delivery is deliberately linked to economic growth and poverty reduction, rather than treated as a purely technical or financial exercise (Lawinsider, n.d.). Within the construction industry, inclusive workforce development is understood to include deliberate efforts to broaden access to training and employment across gender, age and socio-economic background, an approach increasingly recognised as both a social good and a source of improved firm performance through wider talent pools (Adu et al., 2025; Boomandbucket, 2023).

Read together, these three concepts, resource scheduling, manpower development and inclusive development, suggest a logical pathway in which deliberate planning of manpower resources (not only materials and equipment) creates the structured training and deployment opportunities through which inclusive workforce outcomes become possible. Figure 1 illustrates this conceptual framework as applied to Katsina State's construction industry.

The Nigerian and Katsina State Construction Industry Context

Nigeria's construction sector remains a significant, if fluctuating, contributor to national output. National Bureau of Statistics data show the sector contributing 3.23 percent of real GDP in the second quarter of 2023, rising to 3.36 percent in the third quarter of 2023, before easing to 3.17 percent in the second quarter of 2024 and recovering to 3.35 percent in the third quarter of 2024 (Businessday NG, 2024a, 2024b). Figure 2 illustrates this quarter-on-quarter trend.

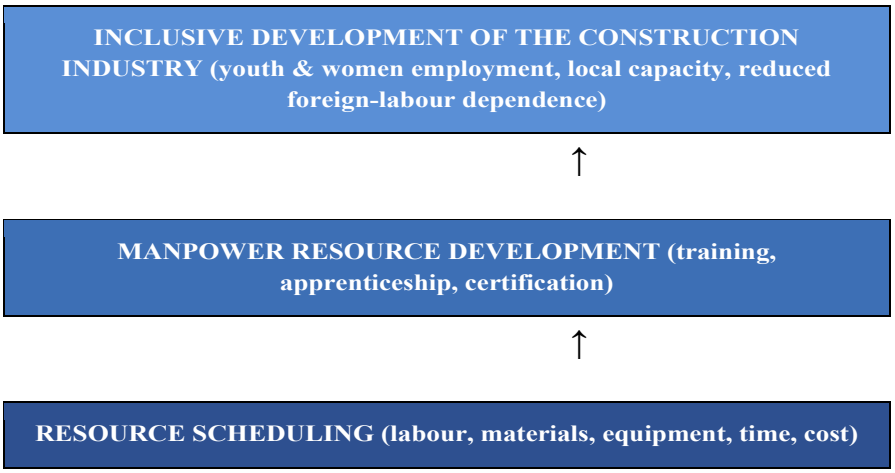

Figure 1. Conceptual framework linking resource scheduling, manpower resource development and inclusive development of the construction industry (read bottom to top).

Quarter	Visual (share of real GDP)	Value
Q2 2023		3.23%
Q3 2023		3.36%
Q2 2024		3.17%
Q3 2024		3.35%

Figure 2. *Nigeria's construction sector contribution to real GDP, Q2 2023 - Q3 2024. Data source: National Bureau of Statistics, as reported in Businessday NG (2024a, 2024b).*

This national picture masks considerable sub-national variation. In Katsina State, the construction sector has historically been dominated by small and medium-sized contracting firms dependent on informally trained artisans (Iiste, n.d.), with limited access to the kind of structured skills pipeline available in more industrialised southern states. Nigeria's broader labour market context compounds this challenge: informal employment accounted for an estimated 92.8 percent of total employment nationally in 2024, with unemployment estimated at 4.9 percent in 2025, reflecting an economy in which formal, scheduled skills development remains the exception rather than the rule (Economy of Nigeria, n.d.).

Against this backdrop, the Katsina State Government has, since 2026, pursued a more deliberately scheduled approach to manpower development in the construction trades, through the Family Homes Funds Limited (FHFL) Artisan Skills Training (FAST) programme, delivered in partnership with the African Development Bank (AfDB) (MSME Africa, 2026; Katsina State Government, 2026b). This programme is examined in detail as the paper's case study in the following section.

Case Study: The FAST Programme and Manpower Scheduling in Katsina State

Training under the FAST programme formally commenced in Katsina State in early 2026, with the state becoming the first of twelve participating states nationally to roll out the Nigerian Skills Qualification (NSQ)-certified initiative (MSME Africa, 2026). The programme, funded in part through a one million United States dollar technical assistance grant from the Youth Entrepreneurship and Innovation Multi-Donor Trust Fund, was designed to professionalize Nigeria's housing value chain by equipping young artisans with practical, industry-relevant skills across high-demand trades (MSME Africa, 2026). Although originally allocated 150 beneficiary slots, Katsina State expanded participation to 500 trainees, reflecting what Governor Dikko Umaru Radda described as the administration's determination to maximize opportunities for its citizens (Katsina State Government, 2026b). Table 2 summarizes the key features of the programme as documented in government and programme reporting.

Table 2. *Key Features of the FHFL Artisan Skills Training (FAST) Programme in Katsina State, 2026*

Programme feature	Detail (Katsina State, 2026)
Implementing partners	Katsina State Government, Family Homes Funds Limited (FHFL), African Development Bank (AfDB)
Programme name	FHFL Artisan Skills Training (FAST) Project
Number of trainees graduated	500 (expanded from an original state allocation of 150)
Trades covered	Masonry, carpentry, plumbing, electrical installation, tiling, painting, POP (plaster of Paris) design
Certification	National Skills Qualification (NSQ) Framework
Financial support to trainees	Monthly stipend of ₦60,000 during training; starter toolkits on graduation

State ranking among participating states	First of 12 states to commence the AfDB-backed programme
Funding instrument	US$1 million technical assistance grant from the Youth Entrepreneurship and Innovation Multi-Donor Trust Fund
Government in-kind support	Accommodation, feeding, welfare and security for trainees throughout training
Recognition incentive	₦5 million reward package for outstanding graduates (best male and female artisans per trade)

Several features of the FAST programme illustrate the practical value of scheduled, rather than ad hoc, manpower development. First, the programme combined classroom instruction with practical site training on a defined schedule, rather than relying solely on informal, employer-led apprenticeship (Katsina State Government, 2026b). Second, trainees received a monthly stipend of sixty thousand naira throughout the training period, a form of resourcing that reduced the opportunity cost of participating in structured training rather than immediately seeking informal paid work, addressing a barrier to inclusive participation identified more broadly in the informal-apprenticeship literature (Zenodo, 2026; Katsina State Government, 2026b). Third, graduates received starter packs and were enrolled in the FHFL database for deployment to housing projects nationwide, effectively scheduling their transition from training into paid deployment, rather than leaving graduates to independently seek work (MSME Africa, 2026). Finally, the explicit inclusion of a reward package for the best-performing male and female artisans across trades reflects a deliberate, if modest, gender-inclusion mechanism within the scheduling of training incentives (Katsina State Government, 2026b).

Officials associated with the programme framed it explicitly in inclusive-development terms. The state's Training Centre Coordinator noted strong participant interest since the programme's commencement, while the then Honourable Minister of Housing and Urban Development described the initiative as a landmark intervention addressing the skills gap in Nigeria's construction sector, combining classroom instruction, practical site training, starter toolkits, NSQ certification and business mentorship (Katsina State Government, 2026b). Programme organizers further noted that building local artisan capacity was intended to reduce reliance on foreign artisans for specialized construction services, directly linking manpower resource scheduling to the inclusive, locally-owned development of the state's construction sector (MSME Africa, 2026).

Discussion: Resource Scheduling as a Lever for Inclusive Development

The FAST programme illustrates, at state scale, the conceptual pathway set out in Figure 1: deliberate scheduling of manpower resources, defined training cohorts, structured curricula, stipends and certification timelines, produced a certified, deployable, and comparatively gender-conscious construction workforce, in contrast to the ad hoc, informally scheduled apprenticeship system that continues to dominate elsewhere in Nigeria's construction sector (Zenodo, 2026; Iiste, n.d.). This is consistent with findings from the broader Nigerian resource-planning literature, which associates the absence of forward-looking manpower schedules with idling time, uneven workflow and reduced project performance (An Assessment of Resource Planning Approaches, 2026; International Journal of Environmental Research & Earth Science, n.d.), and suggests that the benefits of scheduling manpower resources extend beyond individual project efficiency to shape the inclusiveness of the sector's workforce development pathways more broadly.

At the same time, the case study points to important limits. A single, donor-supported cohort of 500 trainees, while significant for Katsina State, represents a small fraction of the state's total construction workforce, and the programme's reliance on external technical assistance funding raises questions about

the sustainability of scheduled manpower development once donor support concludes, a concern paralleled in the broader Nigerian literature on donor-dependent human-resource development strategies in construction (Restructuring Education, Training and Human-Resource Development, n.d.). Moreover, gender inclusiveness in Nigerian construction manpower more broadly continues to face structural barriers, including workplace culture and stereotypes, that scheduling interventions alone cannot resolve without complementary policies on work-life balance and mentorship (Adu et al., 2025).

Challenges to Effective Manpower Resource Scheduling in Katsina State

Drawing on the literature and case-study evidence reviewed above, several challenges constrain the translation of resource scheduling into inclusive manpower development in Katsina State's construction industry. First, informal apprenticeship remains the dominant, largely unscheduled pathway into the trades, limiting the reach of structured, certified training relative to overall workforce size (Zenodo, 2026). Second, construction managers on individual project sites frequently do not consistently apply formal scheduling tools, including for manpower, once construction is under way, reducing the practical, day-to-day benefit of scheduling techniques documented in the literature (International Journal of Environmental Research & Earth Science, n.d.). Third, structured manpower development interventions such as FAST remain dependent on donor and federal government funding rather than being embedded within a recurrent state training budget, raising sustainability concerns (MSME Africa, 2026). Fourth, gender barriers, including workplace bias and limited work-life balance support, continue to constrain full inclusiveness even where scheduled training programmes exist (Adu et al., 2025). Finally, adoption of digital scheduling tools such as BIM-enabled 4D scheduling remains limited among Nigerian construction managers generally, restricting the precision with which manpower needs can be forecast and matched to available skilled labour (An Assessment of Resource Planning Approaches, 2026).

RECOMMENDATIONS

Based on the foregoing analysis, this paper recommends that: (a) the Katsina State Government institutionalise the FAST training model within a recurrent, state-funded vocational training budget, so that structured manpower scheduling does not depend solely on donor project cycles; (b) construction professional bodies and contractors operating in the state adopt formal scheduling tools, including Gantt charts, the Critical Path Method and, where feasible, BIM-enabled 4D scheduling, for both materials and manpower planning, rather than relying on informal, reactive labour engagement; (c) future training cohorts explicitly schedule gender-inclusion targets and complementary support such as childcare or flexible training hours, building on the reward-based gender incentives already present in the FAST programme; (d) the Katsina State Ministry of Environment, Ministry of Works and relevant professional bodies collaborate to establish a state-level construction manpower database, linking certified graduates to project deployment on an ongoing, scheduled basis, extending the FHFL deployment-database model beyond a single donor programme; and (e) further empirical research, including firm-level surveys of resource-scheduling practice among Katsina-based contractors, be undertaken to validate and extend the documentary findings of this paper.

CONCLUSION

This paper has examined the importance of resource scheduling for inclusive development of the construction industry in Katsina State, using the state's recent artisan skills training programme as a case study. The evidence reviewed indicates that deliberate scheduling of manpower resources, structured training cohorts, certification pathways, stipend support and planned deployment, can convert an informally organised, low-skill labour pool into a certified, more inclusive construction workforce, complementing the more familiar application of scheduling techniques to materials, equipment and project time. At the same time, the sustainability of such gains depends on embedding scheduled manpower development within recurrent state institutions rather than one-off donor-funded programmes, and on complementary measures to address gender and other structural barriers to inclusion. Extending

established construction resource-scheduling techniques deliberately to manpower planning offers Katsina State a practical, evidence-based pathway toward a more inclusive and resilient construction industry.

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