INTEGRATED COST MANAGEMENT BEST PRACTICES (ICMBPS):

ROADMAP FOR SUSTAINABLE INFRASTRUCTURE PROJECT DELIVERY, DEVELOPMENT AND GROWTH OF NIGERIA'S ECONOMY

BY

PROFESSOR UCHE .O. AJATOR Ph.D

FNIQS, FNIOB, FIIA, FERC(NOM), PHF, MAACEI, RQS, R.BLDR.
PROFESSOR OF QUANTITY SURVEYING, COST ENGINEERING & PROJECT MANAGEMENT;

DEPT. OF QUANTITY SURVEYING,
NNAMDI AZIKIWE UNIV. NAU,AWKA
COORDINATOR UNIVERSITY-INDUSTRY RELATIONS NAU AWKA
08167005721, 07064298472, uo.ajator@unizik.edu.ng

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CONTENTS

INTEGRATED COST MANAGEMENT BEST PRACTICES' ROADMAP FOR SUSTAINABLE SUCCESS OF INFRASTRUCTURE PROJECT DELIVERY TO BOOST SOCIO-ECONOMIC GROWTH OF NIGERIA

ABSTRACT

This research surveyed integrated cost management best practices for sustainable success of infrastructure project delivery to boost socio-economic growth of Nigeria. It exposed the concepts of infrastructure sustainability, Integrated Cost Management (ICM), Integrated Cost Management Best Practices (ICMBPS) and Project Success Measures (or Key Performance Indicators KPIS) and showcased how they could be applied in infrastructure development to achieve net value-addition to the economy. It crafted guiding research questions linked to ICMBPS and configured a chart of the cost management best practices showing their required levels of integration. It further developed detail technical best practice action steps in integrated cost management and the order/ pathway or roadmap of their implementation that would lead to sustainable economic growth. While positing Quantity Surveyors(QSs), as the primary drivers of ICM, it recommends for governments MDAS' professionals and project consultants/stakeholders to exercise collective resolve to achieving sustainable success in infrastructure project delivery, rather than preconditioning projects to fail and turn around to institute abortive post-mortem failed project audit exercise that adds no value to the economy.

Keywords: Infrastructure, ICMBPS, Economic Growth, Sustainability, Quantity Surveyors, Stakeholders.

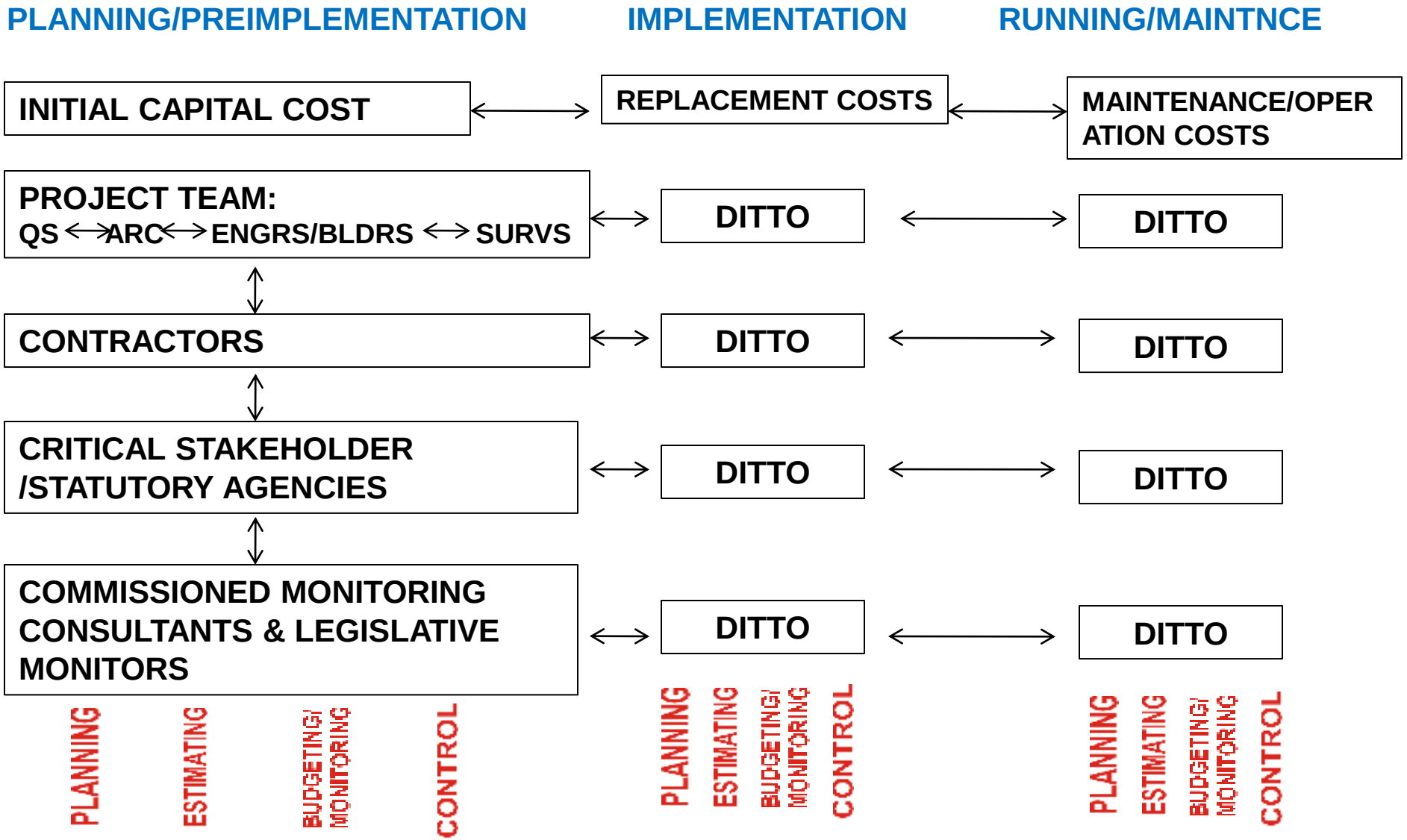
INTRODUCTION

1. CONCEPTS

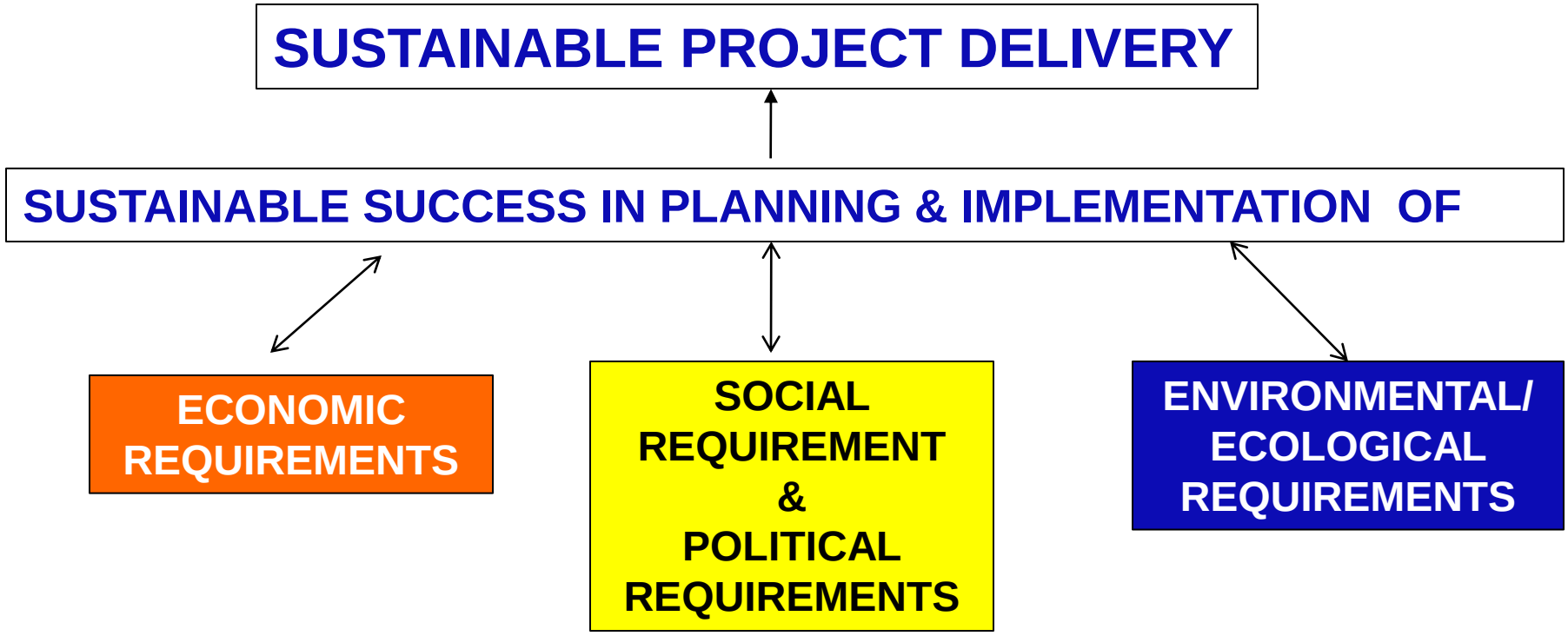
- **Infrastructure is the indispensable perquisites that drive the social, economic and political development of a nation. We need sustainable success in development of infrastructure to generate socio-economic activities/shore-up our currency and grow our economy.**
- **Infrastructure development is a multi-faceted programme and needs well-coordinated, integrated multi-disciplinary team-effort in cost management, with supreme project success objective, which must subsume all sectional individual, political and parochial interests (Ajator, 2012a, 2012b, 2012c).**
- **Infrastructure construction can be said to be successfully completed if it is executed within time, budget, acceptable quality performance, financial and risk levels, and sustainable with empathy to the environment health and safety etc. with all stakeholders realizing their planned/contracted interests in the projects which yield to the supreme projects' objectives that add value to the economy (Ajator & Onyeador, 2009,2008).**

- **Fundamental to successful realization of infrastructure projects are their cost-effective planning, budgeting, monitoring and control, otherwise referred as infrastructure cost management for which the quantity surveyors play the pivotal role both at pre and post contract stages to ensure seamless implementation (Ajator, 2004, 2018, Olupitan etal 2021, Ajator & Onyechi, 2011) see fig 1a.**
- **The QS plans, estimates, budgets and documents cost, financial and production performance baselines which serve as standards for monitoring cost, finance and productivity at implementation to ensure effective control of projects' total success as planned to add value to the nation's economy. To achieve this, the Quantity Surveyors have to partner/ integrate with other built environment professionals and project critical stakeholders (Ajator, 2019, Ajator & Onyeador, 2008) see fig 1a.**

Fig 1a: INTEGRATED TOTAL COST MGT (OVERT COLLABORATION OF PROJECT ACTORS)



SUSTAINABLE PROJECT DELIVERY CONNOTES SUSTAINABLE SUCCESS OF THE DEVELOPMENT THAT MEETS ECONOMIC, SOCIAL AND ENVIRONMENTAL REQUIREMENTS IN ITS PLANNING AND IMPLEMENTATION (AJATOR, 2014).



SUCCESSFUL PROJECT IMPLEMENTATION DEPICTS THE EXTENT TO WHICH INTEGRATED COST MANAGEMENT OF THE PROJECTS CONTROLS SUCH FACTORS AS;

- **Insufficient capitals,**
- **Inadequate cash flows,**
- **Inflation,**
- **Poor planning,**
- **Political pressures/govt bureaucracy/opportunistic behaviour / transition cost**
- **Abuse of contract condition**
- **Low competence of contractor/proj. professionals' interdependencies**
- **Poor administration by MDAS organizations.**
- **Variation of project scope and design**
- **Change of consultants**
- **Changes in original concept, business, geography, sustainability/ environmental impact mitigation plans and project complexities and uncertainties (Ajator, 2014, Ajatoretal, 2017, Ajator, 2017).**

INTEGRATION/COLLABORATION, SUCCESS & GROWTH OF GDP/HDI IMPACT

- **Integrated cost management posits partnering openly and overtly in a coherent and seamless coordination of projects activities.**
- **It facilitates realization of projects on time, budget, quality at reduced risk and environmental damage.**
- **And ensures sustainable socio-economic development that would catalyze growth of GDP as well as address Nigeria's dwindling Human Development Index (HDI) by bridging the GAP between the poor and the rich, income inequality and adversarial policies in the economy (Ajator & Onyeador, 2008; Ajator, 2012a,2012c, 2017a; SERI, 2007).**

2. THE OVERRIDING RESEARCH QUESTIONS IN INTEGRATED COST MANAGEMENT OF INFRASTRUCTURE PROJECTS ARE:

- What are the ICM Best Practices to be applied for sustainable success of infrastructure projects' delivery?
- How efficient and effective are the planning, costing, budgeting, procuring, monitoring and controlling of the development projects?
- How comprehensive, effective, accurate and quality standard are the project documentations? Are environmental and sustainability considerations adequately documented?
- Are efficient, effective, comprehensive data warehousing, cost data market intelligence, sound benchmarking, skilled factoring, internal and external data networking and knowledge management adequately exercised?
- Are whole lifecycle costing and management, which considers the project total life phases, initial, operation and maintenance implications at project formulation, efficiently applied?

- **Are value Engineering and management practices efficiently and effectively implemented, to gain benefit of synergy, utilize best project components/process alternatives, eliminate wastes, improve functions and utility and release best value at lowest lifecycle cost?**
- **Are effective Monitoring, Evaluation and Controlling implemented from the onset, using effective legislative oversighting National project monitors and project team cost/progress evaluation to provide regular progress report to avert project failure and engender success, instead of post-mortem failed project audit practice?**
- **Are there efficient/effective Partnering (or Cooperation) among project professionals, MDAS, Project consultants, Project beneficiaries, Desk officers on one hand and contractors, subcontractors/ suppliers and the consultants on the other?**
- **Are appropriate Financial Engineering implemented to provide appropriate funding, correct source, optimal interest and commitment charges, moratorium and amortization terms? Are there quality budgeting, cashflows and cost and performance baselines for control purposes?**

- **Are regular cost and performance measurements, physically and electronically reported to track key performance indicators and recommend prompt value-analyzed corrective actions?**
- **Are there regular Assessment of Total project Success (TPS) and Total Project Performance Index TPPI (which are aggregate success rate or net socio-economic value addition of the project to the economy)? How does the obtained value compare with the FVS' value, set as criterion merit for the approved project?**
- **Is the TPS or Aggregate Success Rate significantly high to achieve sustainable national socio-economic growth? If low, then go back to replanning, costing, budgeting, monitoring and control of proposed projects.**
- **The positive answers to these questions are the integrated ICM Best Practices which this research seek to discuss in a conceptual Framework or roadmap of their application that would enable Nigeria realize sustainable success in growth of her economy (see figure 1: integrated CM Best Practices' Roadmap to sustainable infrastructure development and growth of the national economy.**

3. TABLE 1: KEY INTEGRATED COST MANAGEMENT BEST PRACTICES (ICMBPS) AND LEVELS OF INTEGRATION. Source: Authors survey 2023

S/N	PROFESSIONAL INTEGRATED BEST PRACTICES	LEVEL OF INTEGRATION
A	**A). GENERAL BEST PRACTICES** Effective Planning, Procurement, Costing, Budgeting, Monitoring and controlling projects	Very High/Wide Integration (V.H.I)
B 1	**B). SPECIFIC BEST PRACTICES** ACCURATE AND QUALITY DOCUMENTATIONS	V.H.I
2	EFFECTIVE/ EFFICIENT DATA WAREHOUSING & BENCHMARKING	V.H.I Vertical & Horizontal
3	LIFECYCLE COSTING AND MANAGEMENT	High Integration (Vertical/Horizontal)
4	VALUE ENGINEERING & MANAGEMENT PRACTICES	V.H.I
5	MONITORING, EVALUATION & CONTROLLING PRACTICE	VERY WIDE INTEGRATION
6	EFFECTIVE PARTNERING & CO-OPERATION	Horizontal/Vertical Integration
7	FINANCIAL ENGINEERING (Funding, Source, Cost, Budgeting and Cash flows).	VERY WIDE INTEGRATION
8	REGULAR COST/PERFORMANCE MEASUREMENT & REPORTING (EARNED VALUE MANAGEMENT/ FORECASTING).	V.H.I HORIZONTAL/VERTICAL
9	TOTAL PROJECT SUCCESS (TPS) & PERFORMANCE MEASURES (TPPI) (COMPARE WITH PROJECT NET SOCIAL BENEFIT FROM FVS)	V.H.I
10	HIGH PROJECT SUCCESS AND HIGH NET SOCIAL BENEFIT CONTRIBUTION LEADS TO SUSTAINABLE SOCIO-ECONOMIC GROWTH AND HIGH HUMAN DEVELOPMENT INDEX (HDI) ATTENDANT TO IT. WHILE LOW PROJECT SUCCESS REQUIRES RETURN TO (A) EFFECTIVE PANNING, PROCUREMENT, COSTING, BUDGETING, MONITORING & CONTROLLING OF PROJECTS	

4 FIG. 1: ICM BEST PRACTICES' ROADMAP TO SUSTAINABLE INFRASTRUCTURE DEVELOPMENT AND GROWTH OF THE NATIONAL ECONOMY (Ajator 2023)

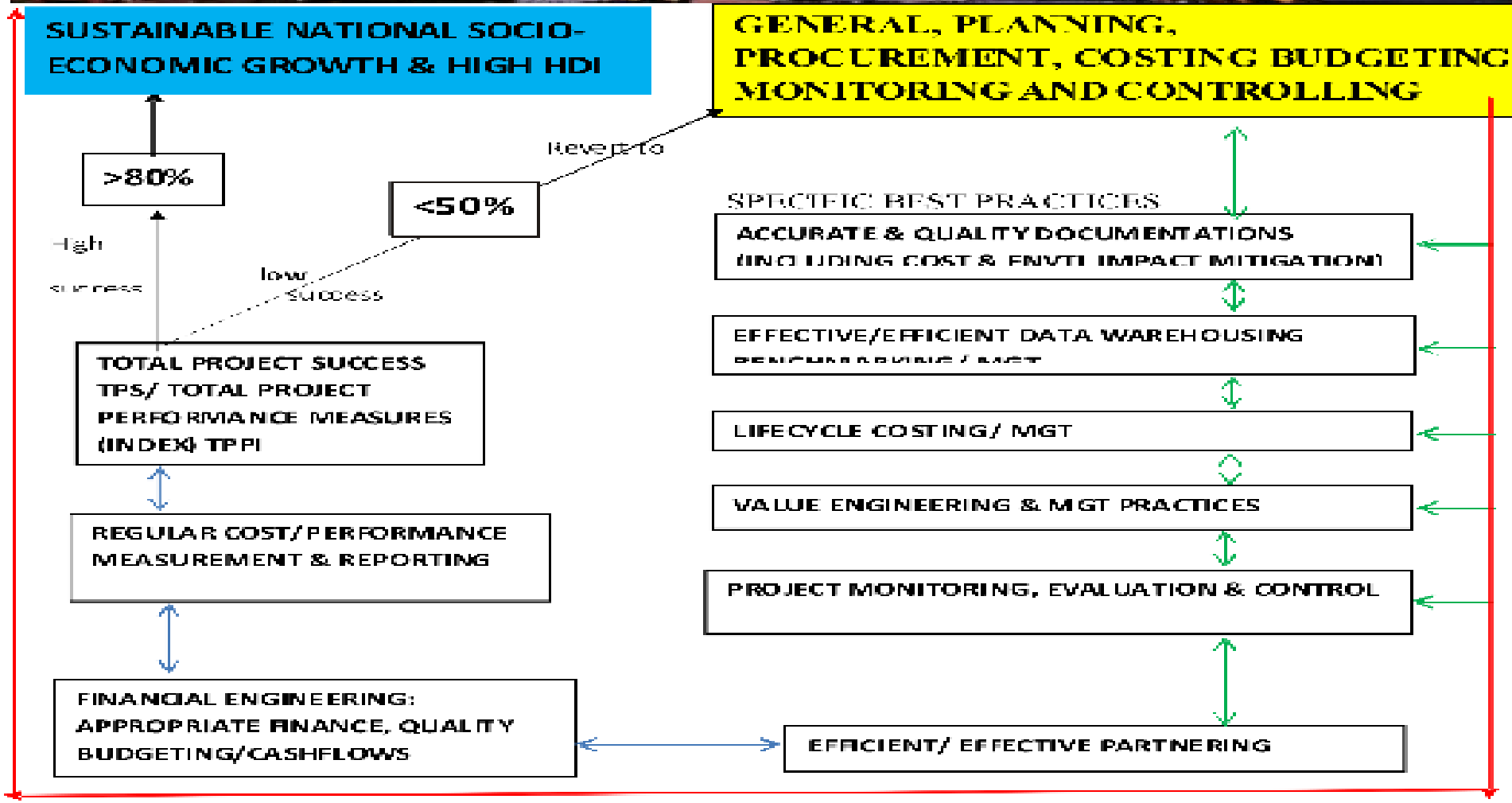


Figure 1: Integrated Cost Mgt Best Practices Roadmap to Sustainable Infrastructure Development and Growth of National Economy. Sources: Authors Survey (2023)

5. DETAILED ACTION STEPS / REQUIREMENTS OF ICMBPS

(A) GENERAL ICM BEST PRACTICE ACTIONS REQUIRED

Effective planning, Procurement, Costing, Budgeting and Controlling

- Use Critical Path Method CPM/ Programme
- Evaluation and Review Technique PERT,
- Earned Value Management (EVM),
- Project Crashing Practices,
- Efficient use of slack/floats,
- Computer system/softwares,
- Cost data banks mgt, Networking of cost of projects locally and internationally,
- Knowledge management,
- Sound procurement,
- Contractor's ratio analysis and Zeta model analysis in contractor selection for proper placement of contracts to competent firms that implement financial planning and cash budgeting.
- Cost segregation analysis and reporting
- Improper procurement predisposes project to ultimate failure.

FOR OIL /GAS PROJECTS, SEEK TO CONTROL NIGERIA'S COST PREMIUM FACTORS (NCPF) THAT NEGATIVELY IMPACT PROJECT SUCCESS.

Plate 1: Detailed Key Preliminaries' Cost Drivers (NCPF) for Oil and Gas Industry
Source: Adapted from Awoyomi (2019).

B). SPECIFIC ICM BEST PRACTICES ACTIONS REQUIRED

1. ACCURATE & QUALITY DOCUMENTATIONS

- Involve all relevant project parties for quality documentation.
- Document prevailing Macro and Micro economic conditions.
- Document project briefs/requirements, detail scope etc. detail project design, Technical specifications, contract condition, type of tender, type of contract, general items/preliminaries, preambles, appendix, insurance and bonds, payment bond, retention bond, advanced repayment bond, performance bond etc, special and particular conditions, site survey, site data, site datum, soil test, CBR, traffic counts (ADT), pavement design curve for highway projects, date of site possession and photographs. (Ajator, Onwuka & Ikekpeazu, 2016)'
- **Document Cost Estimate and BOQS:**

Rate analysis records; direct costs/ indirect costs, their percentages of ETC, profit and risk percentage allowances etc. Plant, machinery, equipment and types. Basic cost and operations' plans, labor types and rates. Materials' schedule of basic rates (prices), submission date and unit rate build ups/ assumptions.

- **Document Construction Plan/Programme;** early warning charts, quality performance charts, implementation sequence, outline security and safety plan.
- **Document Earned Value Indices Forecasting and Management Records Regularly.**

  Document labor, plant, equipment utilization statements, front-end payments, currency denominations arrangements, percentage payment terms in US$ and ₦ naira. Fully priced document of preliminaries.
- **Document Contract Administration Reports and Systems:**
  - Project inspections site meetings and minutes.
  - Valuations and certificates (paid and unpaid)
  - Change orders (variations and other instruction records).
  - Price fluctuations and notices' record.

- Dayworks and percentage charges, claims/issues' notifications, agreed and paid claims, agreed unpaid claims and unresolved claims to date.
- Document environmental baselines/impact mitigation plans,accidents/force majure/weather change notifications, resolved and unresolved disputes.
- Document records of notification of all contingent issues that can cause contract price and cost changes:
- Records of issued design queries/date of response, value-analyzed quotations, statistical treatment of inflations, factored exchange rate movement on project cost, location and subsoil difficulties. Emergent local regulations, labour problems and sudden scarcity and agitations, periods of youth restiveness. Allowed factors for contractors, sub-contractors and suppliers' delays. Allowed factors for oversea projects' complexity etc. Record these and more as critical conditions governing the contract for effective cost management (Ajator, 2021;Ajatoretal, 2016).

2. EFFICIENT/EFFECTIVE DATABASE WAREHOUSING AND MANAGEMENT

- Implement comprehensive data warehousing:

- **Set up cost estimating data base (local, national / international)**
- **Obtain data from cost sources survey.**
- **Suppliers detail quotations/budget quotations.**
- **Company records.**
- **Trade literature/ trade manuals and cost brochures.**
- **Unit pricing literature.**
- **Technical literature and textbooks.**
- **Personal cost books and Government departments' cost data.**
- **Computer/ internet data (eg. Jumia etc).**
- **Apply data information intelligence and project data knowledge management.**
- **Implement cost data benchmarking, historical, vertical and horizontal data integration. Skilled and professional data factoring (and record the basis and underlying assumptions).**

- Regularly update cost data in line with changing circumstances. Apply with caution cost data index updating above 5 years period, (as accuracy may be undermined by such factors as changes in legislation, productivity and technology).
- Apply excel and other software systems for regular data update.
- Use International Cost Measurement Standards ICMS data formatting, depending on project type, as currently cost management solutons are gravitating towards universal best practices (Ajator, 2015, 2019, Ajator etal, 2016, Ajator 2020, Ajator and Agusiobu, 2007). Align BESMM4® to ICMS Activity Costing Method for Civil works (applying appropriate factors).
- Do not lift preliminaries costs of previous project because they may be priced at breakeven level by desperate firms.
- In using these index costs, adjust for site location, clearance, contractor's overheads and profit and client's costs which are not always included in the indices because their cost trends may differ.
- Regularly train staff on data warehousing/ networking, intelligence management, and charge training costs to preliminaries.

(3) LIFECYCLE COSTING AND MANAGEMENT

- Implement total lifecycle costing in project evaluation.
- Recommend project(s) with overall best lifecycle cost in “resource-constrained” budgeting.
- Apply projects’ lifecycle cost management plan using cyclic maintenance schedule (plan).
- Zone project phases and lots for dry and wet seasons to avert delays due to wet conditions and colossal claim costs/disputes.
- Articulate maintenance implications/ considerations at project formulation stage and be compliant to the new legislations on planned or systematic infrastructure project maintenance.

- **Use components' life expectancies and costs to guide design and cyclic maintenance plan (do not apply expensive long life ornamentations on building of short life expectancy etc).**
- **Use lifecycle cost plan to guide plant capacity utilization plans, whether to move from initial low capacity to high capacity utilization or early maximum capacity utilization plant and assess impact on business profit.**
- **Use lifecycle costing to guide component parts' needs and requisition date plan as well as maintenance cost plan (eg Advance payment plan to beat scarcity, high inflation cost/obsolescence and meet expanded project needs) etc.**
- **For refineries, forecast the failure cohorts of their main plant items/ equipments and their assessed installation bulk items and components into a consolidated lifecycle operation and maintenance budget and spiritedly manage this to ensure sustainability of the plant/project (eg stockpiling enough crude/ refined PMS to avert shortages during periods of turnaround maintenance).**

(4). VALUE PLANNING, ENGINEERING & ANALYSIS PRACTICES (VM)

- **Blend together other disciplinary experts in authoritative review of project documents, functions, components, processes and funding etc (in a 5 day or 2 day workshop) to gain benefit of synergy; eliminate wastes, improve functions/utility, quality and provide best value at reduced overall lifecycle costs. Use value review periods suitable to the size and complexity of project.**
- **Going by US experience, cost of VM is 1% of Estimated Total Cost ETC while VM cost saving is 30% of ETC, so VM exercise is self-financing (Ajator, 2004,2012, 2015,2017).**
- **Make VM team independent of design team and ditto project monitoring team independent of design team. Eliminate bureaucracy and unethical practices/ supplanting in implementation of VM.**
- **Use VM and Project Monitoring as best practices in cost management. They are better alternatives to instituting failed contract tribunal as done by past Governments, which is postmortem and adds no economic values.**
- **Appoint only proven competent professionals into VM team. And National Assembly should pass a bill making VM compulsory on all projects of significance.**

(5). MONITORING, EVALUATION AND CONTROLLING PRACTICES

- a. use effective legislative oversight functions by legislators.
- b. use appointed project monitoring consultants (project monitors)
- c. monitoring by project consultant must shift from monthly progress/ financial statement and final account control to weekly, daily, hourly & real-time progress and cost control.
- Ensure regular and maximum integrative oversighting of activities by project monitors for all project consultants, contractors/ subcontractors and suppliers, clients and critical project stakeholders from project formulation stage to project handover/ commission and submission of monitors' report on performance of all stakeholders.
- Even with best prepared costing, without monitoring and control, the project budget will surely overrun.
- National monitors should present project success and net value-addition to the economy for cross-match to that submitted in project success/ economic review by project management team.

(6). EFFECTIVE PARTNERING AND CO-OPERATION

- Implement project partnering practices in project development and implementation cycle.
- Project team and stakeholders and project monitors where appointed early at inception must partner collaboratively.
- In association with other project consultants and contractors, package each project into appropriate time scale/phases.
- Partner overtly in the development of documentations for cost management at both pre and post contract administration and project monitoring documentation and over sighting exercise (Ajator, 2004, 2012, Ajator & Onyeador, 2008).
- Seek to equitably share or allocate project risks, provide free flow of information and unhindered access to stakeholders' project and personal files' data.
- Co-operate in the creation of accurate costs/ progress baselines for project performance measurements.
- Uphold honest, truthful win-win project success disposition.
- Equitably share project losses and cost savings and seek to internalize the benefits of serial contracting or project alliancing.

(7). FINANCIAL ENGINEERING

- Provide adequate funding, right capital structure appropriate for particular projects (balanced equity and debt/ debenture funds).
- Use appropriate financing sources, at right cost and time, right armotization term and liberal moratorium suitable for the particular projects. Where possible, use debt to equity swap or early syndicated debt redemption option, possible virement of project fund or consociate financing where funding regulation and guideline allow.
- Apply prudent grant-agreement negotiations with sound financial/project reporting and auditing.
- Respect funding agreement signed (Ajator, 204a).
- Provide quality budgets, cashflows, cost and schedule performance baselines and project performance measures (Ajator, 2014a, Ajator, Onwuka & Ikekpeazu, 2016).

(8). IMPLEMENT REGULAR COST/SCHEDULE PERFORMANCE MEASUREMENT AND REPORTING (EVM)

- Establish at least 8 project performance measuring metrics (earned value mgt) which combines measurement of scope, cost & schedule in a single integration using established cost/schedule performance baselines.: Cost Variance (CV), Schedule Variance (SV), Cost Performance Index (CPI),Schedule Performance Index (SPI), To Complete Performance Index (TCPI), Billing Performance Index (BPI) (showing impact of cash flows on project success and need for correct and timely invoicing to improve contractor's cash flows and make project self- financing).
- Measure Profitability Performance Index (PPI).
- Measure Environmental Health and Safety Performance Index (HPI).
- Measure Quality Performance Index (QPI).
- Measure Team Satisfaction Index (TSI).
- Measure Client Satisfaction Index (CSI).
- Efficient implementation of Earned Value Management help provide accurate forecast and management of risk impact, scope changes, price escalations, schedule impacts, claims and loss of productivity, for corrective Management action early enough to avert project failure.

(9). IMPLENENT TOTAL PROJECT SUCCESS (TPS) PERFORMANCE MEASURES (TPPI).

- Deduce a weighted aggregate of the 8 performance indices (KPIS) indicative of the Net socio-economic Value-addition of the infrastructure project(s).
- Total Project Performance Index (TPPI):
- $\sum (W_1 \text{ X CPI}) + (W_2\text{XSPI}) + (W_3\text{XBPI}) + (W_4\text{XPPI}) + (W_5\text{XHPI}) + (W_6\text{XQPI}) + (W_7\text{XTSI}) + (W_8\text{XCSI}) \geq 80\%$=National Economic Growth

  ≥80%=National Economic Growth

  ≤50%= Low Addition to the Economy.

  Key: $\sum W_1$ TO W_8=weights of the KPIs.
- For high percentage success/ value of 80% and above, the project contributes significantly to national economic growth and development.
- For low percentage (or negative) success value of < 50% the projects contributes sparsely to the national economy and thus should revert to further planning, estimating, budgeting and controlling processes.

CONCLUSION AND RECOMMENDATIONS

- **Infrastructure construction is an integrated and collaborative process in which all commissioned professionals, Governments and their MDAS have imputs to make that would synergistically enhance economic growth.**
- **Key to achieving sustainable success in infrastructure projects and growth of the economy is the implementation of Integrated Cost management Best Practices, for which the QS plays a fundamental role, in synergy with project team members and stakeholders.**
- **National economic growth must stem from the collective commitment of Government and project actors to give Nigeria's development success a priority focus, over and above sectional and personal gains.**
- **There should be a visible will to enforce implementation of cost management best practices. Collaboration is key, sound documentation, data sharing and historical / current project database benchmarking and management are imperative.**
- **Stiff punishment should be metted to erring project actors and administering Ministry Personnels who engage in corrupt practices.**
- **Liberalize the judicial approach to Locus-standi, to grant every taxpayer right of action and enforcement of public duties against fraudulent project participants.**
- **Economic and Financial Crime Commission (EFCC), Independent Corrupt Practices & Allied Offences Commission (ICPC),etc, should see Quantity Surveyors as veritable partners in stemming corruption in Capital projects' delivery to ensure sustainable development success and socio-economic growth of Nigeria.**

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THANK YOU!