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Policy Frameworks for Sustainable Growth and Development of Gum Arabic Value Chain in Nigeria's Sudano-Sahelian Region

Abstract. The gum arabic value chain in Nigeria's Sudano-Sahelian region holds substantial potential for economic transformation, yet this potential remains largely unrealised due to inequitable value distribution, weak institutional frameworks, and inadequate policy implementation. This study examined the performance and distribution system of the gum arabic value chain and identified policy frameworks necessary to promote its growth and development. Data were collected from 508 stakeholders across Borno and Yobe states using a structured questionnaire complemented with an interview schedule and analyzed using Structural Equation Modelling. Noteworthy, a multi-stage sampling technique was used to generate the representative sample size for the study, while an easy-cost route approach applied to the data collection lasted for the period of October-December 2025. The findings revealed that the export chain generated the highest final value of ₦18,000/kg, yet Nigerian producers captured only 13%, while international processors appropriated 66% of total value addition. The local industrial chain demonstrated improved equity with producers receiving 25% of final value, while the traditional market chain provided the highest proportional share at 33.96%. Institutional frameworks demonstrated the strongest influence on value chain growth ($\beta = 0.399$, $p < 0.001$), followed by resources ($\beta = 0.321$, $p < 0.001$) and power relations ($\beta = 0.366$, $p < 0.001$). The study concludes that strengthening institutional capacity, investing in local processing infrastructure, and reforming policy frameworks are essential for capturing value that currently accrues to international buyers. Recommendations include establishing functional cooperatives, enhancing stakeholder coordination, addressing security challenges in key producing states, and fostering public-private partnerships to generate over \$476 million as projected by the Raw Materials Research and Development Council. This study contributes empirical evidence for policy formulation and sustainable value chain development in fragile ecological zones.

Keywords: Gum arabic, Value chain, Governance, Equity, Nigeria

JEL Classification: O11, Q01, Q13

Introduction

The Sudano-Sahelian region of Nigeria, encompassing Borno, Yobe, Jigawa, Kano, Katsina, and Sokoto states, represents one of the most ecologically fragile and economically marginalised zones in West Africa, where gum arabic production serves as a critical livelihood activity for millions of smallholder farmers (Sagay & Mesike, 2026). Gum arabic,

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derived from *Acacia Senegal* and *Acacia seyal* trees, has been a cornerstone of the region's socio-economic fabric for centuries, providing sustainable income while contributing to environmental conservation through desertification control and soil fertility enhancement (Vehrs & Waziri, 2023). Nigeria stands as the largest gum arabic producer in West Africa, accounting for approximately 8% of global supplies with annual production ranging between 20,000 and 25,000 metric tons, yet the country captures minimal value from international trade despite this substantial production volume (Donatus, 2025; Muhammad et al., 2020). The global gum arabic market presents enormous opportunities, projected to grow from \$1.28 billion in 2025 to \$1.97 billion by 2030, driven by increasing demand for natural ingredients in food, pharmaceuticals, and cosmetics industries (Donatus, 2025; Muhammad et al., 2020). However, the paradox of high production volume coupled with low value capture characterises Nigeria's gum arabic sector, reflecting broader challenges faced by agricultural commodity chains in developing economies where raw materials are exported with minimal local processing (Dayoub, 2025).

Despite Nigeria's status as the largest gum arabic producer in West Africa and substantial global market growth projections, the gum arabic value chain in the Sudano-Sahelian region faces critical challenges constraining its potential for economic transformation and sustainable development (Dayoub, 2025). The fundamental problem lies in the highly inequitable distribution of value addition across the value chain, where international processors and exporters capture the majority of economic benefits while smallholder producers – predominantly women and youth comprising 85% of value chain participants – remain trapped in poverty with minimal returns for their labour (Vehrs & Waziri, 2023). The export chain demonstrates that while France imported \$97 million worth of raw gum in 2023, it exported \$205 million of processed gum, capturing a \$108 million value-added margin that benefits European economies rather than Nigerian producers (Dayoub, 2025). Additionally, the absence of quality grading systems, certification mechanisms, and adequate processing infrastructure forces the majority of gum arabic to enter the longer, less equitable export channel, while shorter local distribution systems that offer better producer margins lack the scale necessary to absorb national production volumes (Sagay & Mesike, 2026; Omokhaye, 2019). Policy frameworks governing the gum arabic sector have been fragmented, inconsistent, and insufficient to create enabling environments for value chain development, with weak institutional mechanisms, limited stakeholder coordination, and inadequate regulatory frameworks hindering sector growth (Sagay & Mesike, 2026). The ecological vulnerability of the Sudano-Sahelian region, characterised by desertification, erratic rainfall patterns, and land degradation, further compounds these challenges, threatening the sustainability of gum arabic production systems that serve both economic and environmental functions (Ostrom, 1990).

Previous studies have extensively documented value distribution inequities in the gum arabic sector (Dayoub, 2025) and production constraints in Nigeria's Sudano-Sahelian region (Vehrs & Waziri, 2023). However, these studies largely assess production and marketing, neglecting integrated analysis of how policy frameworks, institutions, power relations, advocacy coalitions, and governance mechanisms jointly shape gum arabic value chain outcomes. No known empirical study has employed Structural Equation Modelling to simultaneously examine how policy frameworks, institutional mechanisms, power relations, advocacy coalitions, and governance structures collectively influence gum arabic value chain growth in Nigeria. Furthermore, existing literature has not adequately addressed the

synergistic interactions among institutional, regulatory, and governance variables in fragile ecological zones characterised by insecurity and weak institutional capacity.

This study is justified by the critical need to understand the dynamics of the gum arabic value chain and identify effective policy frameworks that can promote its growth and development for sustainable economic transformation in the Sudano-Sahelian region. The region's significance extends beyond economic considerations, as gum arabic production contributes to environmental sustainability through combating desertification and preserving biodiversity, making it imperative to develop value chains that balance economic development with environmental conservation (Vehrs & Waziri, 2023). The potential for generating over \$476 million for Nigeria by 2025 through optimised local production and processing underscores the economic importance of developing the gum arabic sector as a strategic intervention for rural development and poverty reduction (The Raw Materials Research and Development Council (RMRDC), 2025). The high participation of women and youth in the value chain positions gum arabic development as a powerful vehicle for gender equity and youth employment in an area characterised by limited livelihood opportunities and high vulnerability to climate change impacts (Muhammad et al., 2020). Furthermore, previous studies have largely focused on production aspects while neglecting systemic analysis of value distribution, institutional frameworks, and governance mechanisms that determine value chain performance, necessitating empirical evidence for effective policy formulation (Dayoub, 2025). By applying robust theoretical frameworks – Political Economy Theory, Advocacy Coalition Framework, and Good Governance Theory – this study contributes to limited empirical literature on agricultural value chain development in fragile ecological zones, providing actionable insights for policymakers, development practitioners, and stakeholders seeking to unlock the potential of the gum arabic sector (World Bank, 2020). Ultimately, this research aims to inform strategies that can transform the gum arabic value chain from its current status as a raw material exporter to a dynamic sector that generates sustainable livelihoods and contributes to inclusive economic growth in Nigeria's Sudano-Sahelian region. Thus, the specific objectives of this research are to assess performance and distribution system of the gum arabic value chain; and, to develop the policy frameworks necessary for promoting the growth and development of the gum arabic value chain in the study area.

Literature Review

Theoretical Framework

This study is anchored on three complementary theoretical frameworks that collectively explain the dynamics of gum arabic value chain growth and development in Nigeria's Sudano-Sahelian region: Political Economy Theory, Advocacy Coalition Framework, and Good Governance Theory.

Political Economy Theory, as advanced by Acemoglu and Robinson (2019), posits that inclusive institutions promote economic transformation by creating enabling environments for productive activities. The theory emphasises how institutional frameworks, policy environments, power relations, and resource availability interact to determine value chain outcomes. For the gum arabic sector, this framework explains how institutional quality, policy coherence and equitable power distribution among stakeholders influence sectoral

growth and development (North et al., 2013; North et al., 2009). The theory is particularly relevant given the fragmented institutional landscape and weak coordination mechanisms characteristic of the Sudano-Sahelian region, where smallholder farmers often lack organisational capacity (Wanjala & Etemesi, 2026).

The Advocacy Coalition Framework, developed by Sabatier and Weible (2019), explains how stakeholder coalitions influence policy outcomes and sector development through shared beliefs and coordinated actions. This framework is essential for understanding how diverse actors –including producers, processors, exporters, and government agencies – interact to shape gum arabic policy and institutional arrangements (Jenkins-Smith et al., 2018). The framework highlights the importance of stakeholder participation, representation of marginalised groups, and inter-coalition collaboration in driving value chain expansion.

Good Governance Theory, as articulated by Kaufmann et al. (2011) and Fung (2006), emphasises the role of participatory engagement, institutional functioning, and responsive regulatory frameworks in achieving sustainable development outcomes. The theory posits that transparent, accountable, and inclusive governance mechanisms enhance service delivery, stakeholder trust, and institutional effectiveness (Rodrik, 2012). For the gum arabic sector, this framework explains how governance principles such as accountability, rule of law, and community participation can drive sustainable value chain development. These three frameworks collectively provide a comprehensive lens for analysing the complex policy, institutional, and governance dimensions of gum arabic value chain development in the Sudano-Sahelian region.

Conceptual Framework

The conceptual framework depicts the relationships among three theoretical perspectives – Political Economy Theory, Advocacy Coalition Framework, and Good Governance Theory – and gum arabic value chain growth. Policy frameworks, institutional frameworks, and resources serve as independent variables, while power relations, advocacy coalitions, and governance mechanisms act as intervening variables influencing value chain outcomes including production expansion, employment, income stability, market access, and socio-economic well-being in Nigeria's Sudano-Sahelian region.

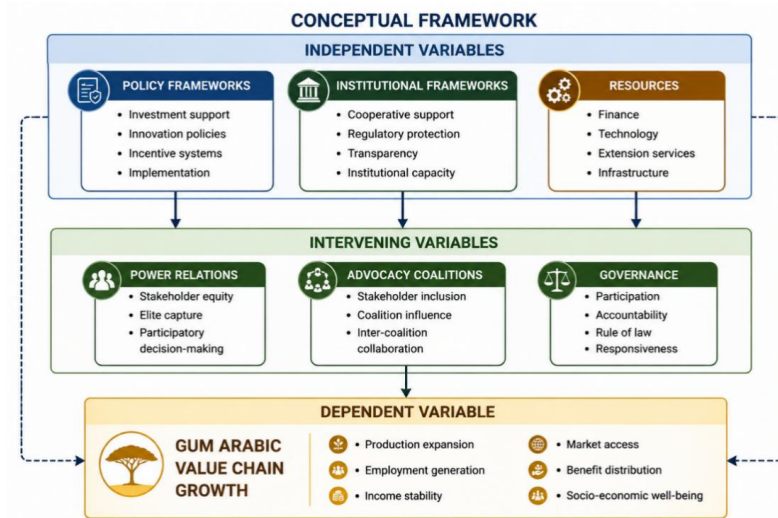


Fig. 1. Conceptual Framework

Source: Python, 2025.

Empirical Review

The empirical literature on gum arabic value chains reveals significant insights into production, value distribution, and policy challenges in producing countries. Dayoub (2025) demonstrates that while France imported raw gum arabic at approximately \$1.58/kg in 2023, it exported processed gum at \$4.63/kg, nearly tripling value through processing and branding, with a \$108 million value-added margin benefiting European economies. This finding highlights the structural inefficiency where producer countries capture minimal value from international trade despite substantial production volumes.

Vehrs and Waziri (2023) documented that modernisation of processing facilities in north-eastern Nigeria could substantially enhance local value retention and create employment opportunities for the 85% of value chain participants who are women and youth. Their research established that establishing local processing hubs in Yobe and Borno states reduced reliance on long-distance intermediaries and allowed producers to receive price premiums of 15–20% compared to export-destined gum. The Raw Materials Research and Development Council (RMRDC, 2025) projects that optimising local production and processing could generate over \$476 million for Nigeria by 2025, emphasising strategic investment in domestic processing infrastructure.

Donatus (2025) noted that persistent insecurity in key producing states – Borno, Yobe, and Jigawa accounting for 70% of national supply – disrupted supply chains and deterred investment in processing facilities. Djetoyom et al.(2024); Adindu et al. (2019) observed that traditional distribution systems achieve lower post-harvest losses (8–10%) compared to

export chains (15–20%) yet cannot absorb annual national production of 20,000–25,000 metric tons. Hamidu et al.(2025) identified limited access to finance and extension services as key constraints for smallholder gum arabic producers in the Sudano-Sahelian region.

Additionally, Sagay & Mesike (2026) examined the socio-economic contribution of gum arabic production to rural livelihoods in the Sudano-Sahelian zone, finding that it provides 40–60% of household income during dry seasons. Adindu et al.(2019) documented that limited organisational capacity among smallholder farmers constrained collective marketing and bargaining power. The Raw Materials Research and Development Council (RMRDC) (2025) reported that weak coordination among stakeholders and inadequate quality certification systems hindered Nigeria's competitiveness in international markets. Collectively, the literature underscores the need for policy interventions addressing institutional weaknesses, processing infrastructure deficits, and market coordination failures to unlock the sector's potential for economic transformation.

Empirical Gap

While existing literature extensively documents the inequitable value distribution and production constraints in the gum arabic sector, limited empirical research has systematically examined the interrelationships among policy frameworks, institutional mechanisms, power relations, advocacy coalitions, and governance structures in shaping value chain outcomes. Previous studies have largely focused on production and marketing aspects, neglecting comprehensive analysis of institutional and governance determinants. Furthermore, no known study has employed Structural Equation Modelling to test the combined influence of Political Economy Theory, Advocacy Coalition Framework, and Good Governance Theory on gum arabic value chain growth. This study addresses these gaps by providing empirical evidence for policy formulation.

Research Methodology

Study Area

The study was conducted in Nigeria's Sudano-Sahelian region, encompassing Borno, Yobe, Jigawa, Kano, Katsina, and Sokoto states (Sagay & Mesike, 2026). This region lies within the Sahelian ecological zone, characterised by semi-arid conditions, erratic rainfall, and fragile ecosystems prone to desertification (Vehrs & Waziri, 2023). The area experiences a pronounced dry season lasting 6–8 months annually, with annual rainfall ranging between 400–800mm, conditions favouring *Acacia Senegal* and *Acacia seyal* growth (Muhammad et al., 2020). Borno, Yobe, and Jigawa states account for approximately 70% of Nigeria's annual national gum arabic supply of 20,000–25,000 metric tons (Donatus, 2025). However, the region faces significant challenges including persistent insecurity, limited infrastructure, inadequate processing facilities, and weak institutional capacity, constraining value chain development (Sagay & Mesike, 2026). The region's ecological significance extends beyond economic considerations, as gum arabic production contributes to environmental conservation through combating desertification (Muhammad et al., 2020).

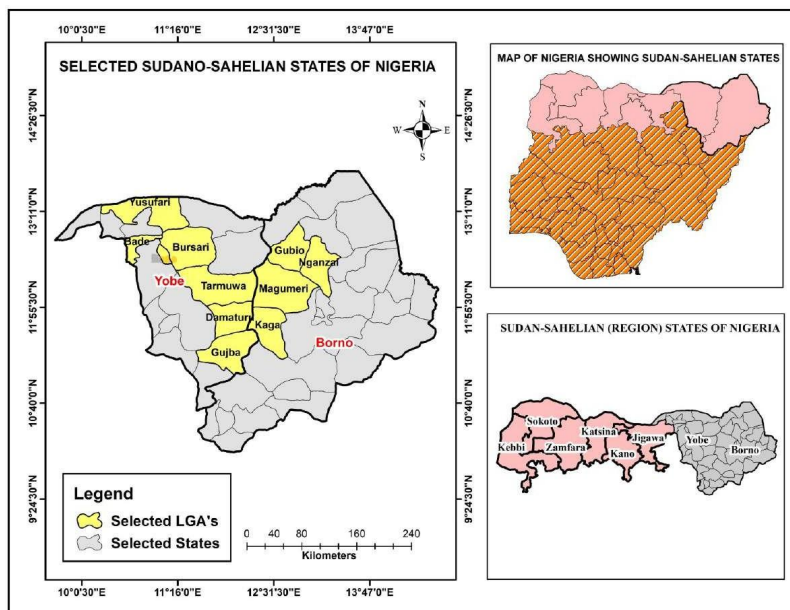


Fig. 2. Map of the Sudano-Sahelian Region Showing Study Area

Source: Authors' own design, 2025.

Sampling Technique and Sample Size

A multistage sampling technique was employed to select a representative sample size of 507 respondents from a sampling frame of 29,782 gum arabic value chain actors identified through a reconnaissance survey (Table 1). The first stage involved the purposive selection of Yobe and Borno States due to their ecological suitability and prominence in gum arabic production and trade. In the second stage, 10 Local Government Areas (LGAs) with high production activities were purposively selected: six from Yobe (Damaturu, Tarmuwa, Yusufari, Gujba, Bade, and Bursari) and four from Borno (Gubio, Magumeri, Kaga, and Nganzai). The third stage involved selecting 10 major gum arabic markets across these LGAs to represent key production and trading hubs; i.e. 1 market per LGA, thus, gives a total of 10 selected markets. Subsequently, the sampling frame sourced through reconnaissance survey was stratified into six stakeholder categories: producers, retailers, wholesalers, exporters, market agents, and processors. To address disproportionality caused by the dominance of producers and retailers, graduated proportional weights were assigned before applying Cochran's (1963) sample size formula, adapted by Nicholas & Adefunke (2025). Producers (20%), retailers (12%), and the remaining actors (8%) were sampled separately, while exporters were included through complete enumeration (21 respondents) because of their small population. The resulting sample comprised 244 producers, 143 retailers, 24

wholesalers, 33 market agents, 43 processors, and 21 exporters, with respondents in each stratum selected through simple random sampling to ensure representativeness and minimise sampling bias. Thus, a total of 508 actors across the value chain formed the final sample size for the study.

Cochran's sampling formula:

$$n = \frac{Z^2 \times p \times q}{e^2} \dots\dots\dots (1)$$

Where: Z = The Z-score of the desired confidence level (1.96 at 95%),

P = The estimated proportion of an attribute in the population (0.5),

q = 1-p,

e = The desired margin of error (0.04).

$$n_{adj} = \frac{n}{1 + \frac{n-1}{N}} \dots\dots\dots (2)$$

Where: n_{adj} = Adjusted sample size; n = Sample size; N = population.

Stratum Allocation

$$n_h = n \times \left(\frac{N_h}{N} \right) \dots\dots\dots (3)$$

Where:

n_h = sample size for stratum h,

N_h = Population size of the stratum.

Method of Data Collection

Primary data were collected using a structured questionnaire complemented with an interview schedule administered to 507 stakeholders along the gum arabic value chain in Nigeria's Sudano-Sahelian region, including producers, aggregators, market agents, wholesalers, processors, exporters, and retailers. The questionnaire employed a five-point Likert scale to measure constructs derived from Political Economy Theory, Advocacy Coalition Framework, and Good Governance Theory. The instrument underwent pilot testing and validity assessment, with indicator loadings exceeding 0.70 and significant t-statistics confirming construct reliability (Hair et al., 2019). Secondary data were obtained from published reports, including those from the Nigerian Export Promotion Council, Raw Materials Research and Development Council, and relevant academic literature.

Method of Data Analysis

The present study used value chain margin formula and inferential statistic to analyse the data collected. Objective 1 was achieved using value chain formula; and objective 2 was achieved using political economy theory, advocacy coalition theory, and good governance theory. Noteworthy, in operationalisation of these theories, they were mapped into the structural equation model of confirmatory factor analysis.

Empirical Model**1. Value chain margin**

$$VA = SP - CP \dots\dots\dots (4)$$

Where: VA = Value added; SP = Selling Price; CP = Cost Price.

2. Structural Equation Model (SEM)

Structural Equation Modelling (SEM) is a comprehensive statistical technique used to test complex relationships between observed and latent variables (Hair et al., 2019). SEM combines factor analysis and path analysis to examine both measurement and structural models simultaneously, allowing researchers to assess direct and indirect effects among multiple variables (Byrne, 2016). The technique is particularly valuable for testing theoretical frameworks in social science research, as it accounts for measurement error and provides robust estimates of model fit using indices such as CFI, RMSEA, and SRMR (Kline, 1998; Kline, 2005). SEM is widely applied in agricultural economics and value chain studies to evaluate institutional, policy, and governance determinants of sector performance.

a. Political Economy Theory

Measurement model

$$P_i = P_1 + P_2 + P_3 + P_4 + P_5 \dots\dots\dots (5)$$

$$IF_i = IF_1 + IF_2 + IF_3 + IF_4 + IF_5 \dots\dots\dots (6)$$

$$PR_i = PR_1 + PR_2 + PR_3 + PR_4 + PR_5 \dots\dots\dots (7)$$

$$R_i = R_1 + R_2 + R_3 + R_4 + R_5 \dots\dots\dots (8)$$

$$VCG_i = VCG_1 + VCG_2 + VCG_3 + VCG_4 + VCG_5 \dots\dots\dots (9)$$

Structural Model

$$VCG_i = \beta_1 P_i + \beta_2 IFP_i + \beta_3 PR_i + \beta_4 R_i + \varepsilon_i \dots\dots\dots (10)$$

(Source: Acemoglu and Robinson, 2019).

(Note: See the theoretical framework for detail of the theory).

b. Public Policy Theory/Advocacy Coalition Framework

Measurement model

$$PP_i = PP_1 + PP_2 + PP_3 + PP_4 + PP_5 \dots\dots\dots (11)$$

$$IIF_i = IIF_1 + IIF_2 + IIF_3 + IIF_4 + IIF_5 \dots\dots\dots (12)$$

$$AC_i = AC_1 + AC_2 + AC_3 + AC_4 + AC_5 \dots\dots\dots (13)$$

$$RR_i = RR_1 + RR_2 + RR_3 + RR_4 + RR_5 \dots\dots\dots (14)$$

$$VCG_i = VCG_1 + VCG_2 + VCG_3 + VCG_4 + VCG_5 \dots\dots\dots (15)$$

Structural Model

$$VCG_i = \beta_1 PP_i + \beta_2 IIF_i + \beta_3 AC_i + \beta_4 RR_i + \varepsilon_i \dots\dots\dots (16)$$

c. Good Governance Theory

Measurement model

$$PE_i = PE_1 + PE_2 + PE_3 + PE_4 + PE_5 \dots\dots\dots (17)$$

$$IFF_i = IFF_1 + IFF_2 + IFF_3 + IFF_4 + IFF_5 \dots\dots\dots (18)$$

$$RN_i = RN_1 + RN_2 + RN_3 + RN_4 + RN_5 \dots\dots\dots (19)$$

$$GO_i = GO_1 + GO_2 + GO_3 + GO_4 + GO_5, \dots (20)$$

Structural Model

$$GO_i = \beta_1 PE_i + \beta_2 IFF_i + \beta_3 RN_i + \varepsilon_i \dots (21)$$

(Source: Kaufmann et al., 2011; Fung, 2006).

(Note: See the theoretical framework for detail of the theory).

Where, β_{1-n} = Regression coefficients; ε_i = Error term

Note: See Appendix (1) for definition of variables.

Table 1a. Sampling Frame of Gum Arabic Value Chain in Borno and Yobe State

State	LGAs	Markets	Producers	Agents	Wholesalers	Retailers	Exporters	Processors	Total
Borno	Magumeri	Magumeri	3 052	31	17	133	1	67	3 301
	Nganzai	Nganzai	3 880	29	28	224	4	44	4 209
	Kaga	Gamdu	2 850	40	36	287	7	53	3 273
	Gubio	Gubio	5 001	24	40	301	6	38	5 410
Yobe	Damaturu	Damaturu	1 500	25	11	30	1	30	1 597
	Busari	Busari	2 000	20	10	38	0	26	2 094
	Gujba	YadinBoni	1 800	23	13	47	0	20	1 903
	Yusufari	Yusufari	3 000	30	12	50	1	30	3 123
	Tarmuwa	Tarmuwa	2 750	21	15	41	0	22	2 849
	Bade	Gashua	1 920	27	14	33	1	28	2 023
Total	10	10	27,753	270	196	1184	21	358	29,782

Source: Reconnaissance Survey, 2025.

Table 1b. Sampling Size of Gum Arabic Value Chain of Borno and Yobe State

State	LGAs	Markets	Producers	Agents	Wholesalers	Retailers	Exporters	Processors	Total
Borno	Magumeri	Magumeri	27	4	2	16	1	8	58
	Nganzai	Nganzai	34	3	3	27	4	6	77
	Kaga	Gamdu	25	5	4	35	7	7	83
	Gubio	Gubio	44	3	5	36	6	4	98
Yobe	Damaturu	Damaturu	13	3	1	4	1	4	26
	Busari	Busari	18	2	1	5	0	4	30
	Gujba	YadinBoni	16	3	2	5	0	2	28
	Yusufari	Yusufari	26	4	2	6	1	3	42
	Tarmuwa	Tarmuwa	24	3	2	5	0	2	36
	Bade	Gashua	17	3	2	4	1	3	30
Total	10	10	244	33	24	143	21	43	508

Source: Reconnaissance Survey, 2025.

Results and discussion

Performance and Distribution System of the Gum Arabic Value Chain

The performance of the gum arabic value chain in the Sudano-Sahelian region of Nigeria revealed a highly inequitable distribution of value addition across the three market channels. As shown in Table 2a, the export chain generates the highest final value of ₦18,000/kg, yet Nigerian producers capture only 13% of this value, with a meagre 10% share of cumulative value addition at the farm gate. The international processor appropriates 66% (₦6,000/kg) of total value addition – more than the combined share of all Nigerian actors in the chain. This finding aligns with Dayoub (2025), who demonstrates that while France imported raw gum arabic at approximately \$1.58/kg in 2023, it exported processed gum at \$4.63/kg, nearly tripling value through processing and branding. Similarly, the study documents that France imported 97 million worth of raw gum in 2023 but exported 205 million of processed gum, capturing a \$108 million value-added margin that benefits European economies rather than African producers.

Table 2a. Export (Nigeria-Based) Market Value Chain (₦/kg)

Stage	Selling Price (₦)	Cost (₦)	Value Added (₦)	Cumulative Value Added	% Share of Value Addition
Producer	2,250	1,350	900	900	10
Aggregator	3,300	600	450	1,350	5
Market Agent	3,900	300	300	1,650	3
Wholesaler	5,400	900	600	2,250	7
Exporter	7,500	1,200	900	3,150	10
International Processor*	18,000	4,500	6,000	9,150	66
Total	-	-	9,150	-	100

Note: International Processor data was sourced from Dayoub (2025).

Source: Field survey, 2025.

The local industrial value chain (Table 2b) demonstrates significantly improved equity in value distribution. The final value stands at ₦15,000/kg, with local processors capturing 41.56% of total value addition (₦1,600/kg) – the single largest share among domestic actors. More importantly, producers receive 25% of the final value compared to only 13% in the export chain. This finding supports Vehrs and Waziri (2023), who argued that modernisation of processing facilities in north-eastern Nigeria could substantially enhance local value retention and create employment opportunities for the 85% of value chain participants who are women and youth. The Raw Materials Research and Development Council (RMRDC) projects that optimising local production and processing could generate over \$476 million for Nigeria by 2025, emphasising that strategic investment in domestic processing

infrastructure is the most direct pathway to capturing value that currently accrues to international buyers (RMRDC, 2025).

Table 2b. Local Industrial Value Chain (₦/kg)

Stage	Selling Price (₦)	Cost (₦)	Value Added (₦)	Cumulative Value Added	% Share of Value Addition
Producer	2,250	1,350	900	900	23.38
Aggregator	3,300	600	450	1,350	11.69
Market Agent	3,900	300	300	1,650	7.79
Wholesaler	5,400	900	600	2,250	15.58
Local Processor	9,000	2,000	1,600	3,850	41.56
Industrial Consumer	15,000	-	-	-	-
Total	-	-	3,850	-	100.00

*Embedded value in final products.

Source: Field survey, 2025.

The local traditional market chain (Table 2c) presents a contrasting pattern: although the final value is lowest at ₦6,000/kg, producers capture the highest proportional share at 33.96% of total value addition. This inverse relationship between final value and producer share confirms the value chain literature's finding that shorter chains with fewer intermediaries tend to distribute value more equitably. However, stakeholders at the Nigerian Export Promotion Council's 2026 workshop noted that while traditional markets offer better producer margins, they limit overall sector growth potential due to the absence of quality grading, certification, and value-added processing (Nigerian Export Promotion Council (NEPC), 2026). As the global gum arabic market is projected to grow from 1.28 billion in 2025 to 1.97 billion by 2030 at a CAGR of 9.01%, driven by increasing demand for natural ingredients in food, pharmaceuticals, and cosmetics, Nigeria risks remaining a raw material exporter unless substantial investments in local processing infrastructure are prioritised (Donatus, 2025).

Table 2c. Local Market Value Chain (₦/kg)

Stage	Selling Price (₦)	Cost (₦)	Value Added (₦)	Cumulative Value Added	% Share of Value Addition
Producer	2,250	1,350	900	900	33.96
Aggregator	3,300	600	450	1,350	16.98
Market Agent	3,900	300	300	1,650	11.32
Wholesaler	5,400	900	600	2,250	22.64
Local Retailer	6,000	200	400	2,650	15.10
Consumer (Traditional)	6,000	-	-	-	-
Total	-	-	9,150	-	100.00

Source: Field survey, 2025.

The comparative insights in Table 2d revealed that despite Nigeria being the largest producer in West Africa and accounting for approximately 8% of global supplies (20,000–25,000 metric tons annually), the country captures minimal value from international trade (Donatus, 2025). This paradox – high production volume but low value capture – is characteristic of agricultural commodity chains in developing economies. Dayoub (2025) identifies limited local value addition as the primary constraint, noting that producer countries could raise farm gate prices by 30–50% through implementing collective action, international standards compliance, and direct trade linkages. The persistent insecurity in key producing states – Borno, Yobe, and Jigawa account for 70% of national supply – further compounds these structural challenges, disrupting supply chains and deterring investment in processing facilities (Donatus, 2025). Consequently, the gum arabic value chain in Nigeria's Sudano-Sahelian region exhibits paradoxical development: modest local value addition coexists with substantial untapped potential for economic transformation if strategic interventions prioritise domestic processing capacity alongside improved market coordination and security enhancements.

Table 2d. Comparative Insight (All 3 Chains)

Indicator	Export (Nigeria-Based) Chain	Local Industrial	Local Traditional
Final value	₦18,000	₦15,000	₦6,000
Producer value added share	10%	23.38%	33.96%
Producer share	13%	25%	37.50%
Value addition location	Abroad	Nigeria	Nigeria
Processing level	High (foreign)	Medium (local)	Low

Source: Field survey, 2025.

Further, based on the data presented in Figure 3, the distribution system of the gum arabic value chain in the Sudano-Sahelian region of Nigeria operates through three parallel yet distinct channels: the export chain, the local industrial chain, and the local traditional market chain. In the export distribution system, gum arabic moves from producers to aggregators, then to market agents, wholesalers, and finally to exporters before reaching international processors. Each intermediary adds transport, storage, and bulking services, with cumulative value addition rising steadily from ₦900/kg at producer level to ₦9,150/kg at the international processing stage. Notably, the international processor captures 66% of total value addition (₦6,000/kg) more than the combined share of all Nigerian actors. This distribution pattern reflects what Dayoub (2025) describes as a “vertical, buyer-driven chain” where multinational processing firms in Europe and Asia exercise significant pricing power, leaving producing countries with minimal margins. The system effectively exports raw value and re-imports processed value, a structural inefficiency that limits local economic transformation.

In contrast, the local industrial distribution system shortens the chain by replacing the exporter and international processor with a local processor who sells directly to industrial consumers (e.g., food, pharmaceutical, and cosmetics manufacturers). Here, the distribution sequence is producer → aggregator → market agent → wholesaler → local processor → industrial consumer. The local processor adds ₦1,600/kg (41.56% of total value addition),

which is substantially higher than the 10% captured by Nigerian exporters in the international chain. This finding aligns with Vehrs and Waziri (2023), who observed that establishing local processing hubs in Yobe and Borno states reduced reliance on long-distance intermediaries and allowed producers to receive price premiums of 15–20% compared to export-destined gum. However, the authors also note that the local industrial distribution system remains constrained by inadequate storage facilities, irregular power supply, and limited access to quality certification, which forces some processors to rely on aggregators who still extract an 11.7% share of value. The Raw Materials Research and Development Council (RMRDC, 2025) further argued that distribution efficiency in this chain could be improved through producer cooperatives that bypass multiple intermediaries, potentially increasing producer share from 25% to over 40% of final value.

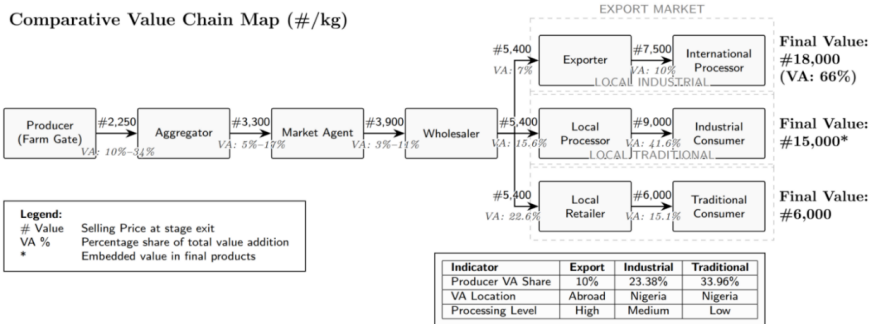


Fig. 3. The Distribution System of the Gum Arabic Value Chain

Note: ₦ = Naira (Nigerian currency value).

Source: Python, 2025.

The local traditional distribution system represents the shortest and most equitable channel: producer → aggregator → market agent → wholesaler → local retailer → traditional consumer (e.g., households using gum arabic as a thickener or adhesive). With only five intermediaries and a final consumer price of ₦6,000/kg, this system gives producers the highest relative share (33.96% of cumulative value addition). The distribution logic here is primarily based on proximity and trust, as transactions occur within local markets with minimal transport and quality grading costs. A study by the Nigerian Export Promotion Council (NEPC, 2026) supports the observation that traditional distribution systems in the Sudano-Sahelian region achieve lower post-harvest losses (estimated at 8–10%) compared to export chains (15–20%), because traders handle smaller volumes and move products quickly

to nearby consumers. However, the same report cautions that this system cannot absorb the 20,000–25,000 metric tons of annual national production, leaving the majority of gum arabic to enter the longer, less equitable export channel. The key insight from comparing all three distribution systems is that while shorter chains improve producer margins, they lack the scale to drive sector-wide growth. Dayoub (2025) concludes that an optimal distribution model would combine primary collection by cooperatives (to reduce aggregator margins), targeted investment in shared local processing infrastructure (to capture value that currently goes to international processors), and direct linkage to industrial consumers (to bypass unnecessary wholesalers). Without such restructuring, Nigeria's gum arabic distribution system will continue to favour foreign value capture despite being the largest West African producer.

The Policy Frameworks Necessary for Promoting the Growth and Development of the Gum Arabic Value Chain

The Structural Equation Modelling (SEM) analysis examined three theoretical frameworks for promoting policy frameworks necessary for the growth and development of the gum arabic value chain in Nigeria's Sudano-Sahelian region. The measurement models demonstrated robust psychometric properties across all constructs, with indicator loadings exceeding 0.70 and highly significant t-statistics (all $p < 0.001$), confirming convergent validity and reliability of the latent variables (Hair et al., 2019). Nevertheless, the diagnostic test statistics showed the fitness of the model for the specified equations (theories) as evident by the respective test statistics that are within the recommended thresholds (See Appendix 2). The structural model results for each theoretical framework are presented below, with discussions grounded in the measurement model outcomes and supported by relevant literature focusing specifically on gum arabic value chain development in the Sudano-Sahelian region.

Political Economy Theory

The structural model revealed significant direct effects on gum arabic value chain growth (VCG). Institutional frameworks (IF) demonstrated a positive and significant influence on VCG ($\beta = 0.200$, $t = 4.227$, $p < 0.001$), suggesting that strengthening local institutions such as gum arabic cooperatives and producer associations directly enhances value chain development in the Sudano-Sahelian region (Table 3a & Figure 4a). This finding aligns with Acemoglu and Robinson's (2019) institutional theory, which posits that inclusive institutions promote economic transformation by creating enabling environments for productive activities. The measurement model confirmed that all institutional framework indicators (IF1–IF5) had loadings above 0.749 with t-statistics exceeding 35.57, indicating that cooperative support, inter-agency coordination, regulatory protection, transparency, and institutional capacity are reliable indicators for gum arabic sector development in this ecologically fragile region.

Policy frameworks (P) strongly influenced institutional frameworks ($\beta = 0.725$, $t = 30.636$, $p < 0.001$) and significantly affected power relations (PR) ($\beta = 0.702$, $t = 27.175$, $p < 0.001$). These results indicate that coherent and stable government policies shape institutional effectiveness and stakeholder power dynamics within the gum arabic sector of the Sudano-Sahelian region. The measurement model for policy variables showed strong loadings (P1–P4: 0.786–0.840), confirming that policies supporting investment, innovation, accessible incentives, and effective implementation are critical determinants for gum arabic

development. Power relations significantly predicted value chain growth ($\beta = 0.366$, $t = 7.088$, $p < 0.001$), supporting North et al. (2009), who argued that equitable power distribution enhances value chain performance by preventing elite capture and ensuring broad-based participation of smallholder gum arabic producers who are predominantly found in the Sudano-Sahelian zone.

Resources (R) emerged as a strong predictor of VCG ($\beta = 0.321$, $t = 7.820$, $p < 0.001$), consistent with the resource-based view emphasising that adequate financial and technical resources drive agribusiness development (Barney, 2021). For the gum arabic sector specifically, this implies that public-private partnerships, simplified regulations, decentralisation, long-term research funding, and clear institutional mandates are essential for value chain growth in the Sudano-Sahelian region where gum arabic production is a critical livelihood activity (Sagay & Mesike, 2026). The measurement model for resources showed all indicators (R1–R5) had loadings between 0.712 and 0.769 with t-statistics exceeding 29.40, providing strong empirical support. However, the interaction between institutional frameworks and power relations on VCG was non-significant ($\beta = 0.010$, $t = 0.305$, $p = 0.761$), suggesting that these factors operate independently rather than synergistically in the Nigerian gum arabic context. This contrasts with some institutional theorists who posit complementary effects (Rodrik, 2012), potentially reflecting the fragmented institutional landscape and weak coordination mechanisms characteristic of the Sudano-Sahelian region, where gum arabic production is often undertaken by scattered smallholder farmers with limited organisational capacity (Wanjala & Etemesi, 2026). The measurement model for VCG demonstrated strong loadings (0.716–0.763), confirming the construct validity of gum arabic value chain growth measurement across production expansion, employment generation, income stability, market access, benefit distribution, and socio-economic well-being in the Sudano-Sahelian communities.

Table 3a. Policy Frameworks Necessary to Promote the Growth and Development of the Gum Arabic Value Chain Based on a Political Economy Theory

Variables	Original sample (O)	T statistics	P values	VIF
IF → VCG	0.200351	4.227061	2.41E-05	2.065707
P → IF	0.725411	30.63605	5.68E-14	1
P → PR	0.701657	27.17507	5.68E-14	1
PR → VCG	0.365771	7.088019	1.53E-12	2.117474
R → VCG	0.321274	7.820064	5.68E-14	1.420164
IF x PR → VCG	0.009556	0.304627	0.760663	1.107132

Source: Field survey, 2025.

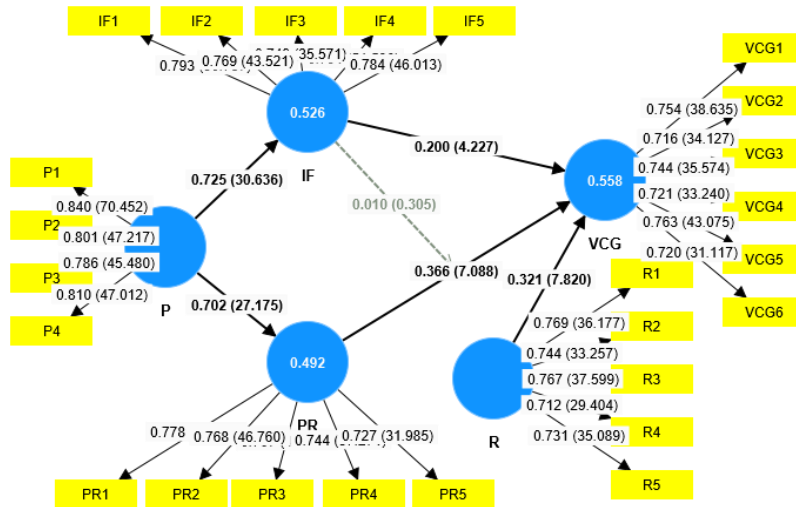


Fig. 4a. The Policy Frameworks Necessary to Promote the Growth and Development of VC Based on Political Economy Theory

Source: Authors' calculation.

Advocacy Coalition Framework

The ACF-based model demonstrated significant pathways influencing gum arabic value chain growth in the Sudano-Sahelian region (Table 3b & Figure 4b). Advocacy coalitions (AC) positively predicted VCG ($\beta = 0.185$, $t = 4.210$, $p < 0.001$), confirming that stakeholder coalitions effectively influence policy outcomes and sector development in the gum arabic industry (Sabatier & Weible, 2019). The measurement model for advocacy coalitions showed strong loadings (AC1–AC5: 0.742–0.811), indicating that stakeholder participation, representation of women and youth groups, diverse perspectives in policy debates, coalition influence on government decisions, and inter-coalition collaboration are reliable indicators of advocacy coalition strength in the gum arabic sector of the Sudano-Sahelian region. This suggests that diverse stakeholder engagement in policy processes contributes meaningfully to gum arabic value chain expansion, particularly important given the multiple actors involved from production to processing and marketing across the Sudano-Sahelian states.

Institutional frameworks (IIF) showed the strongest effect on VCG ($\beta = 0.399$, $t = 8.117$, $p < 0.001$), emphasising that well-functioning institutions are critical drivers of gum arabic value chain expansion in the Sudano-Sahelian region. This finding resonates with Ostrom (1990) work on collective action and common-pool resource management in agricultural systems, which demonstrates that effective local institutions facilitate sustainable resource use and economic development. For gum arabic, this implies that cooperatives and associations that support producers, coordinate between government and private actors, protect smallholder interests, ensure transparency, and possess adequate implementation

capacity are fundamental to sector growth in the Sudano-Sahelian region where gum arabic trees (*Acacia senegal*) are naturally abundant. The measurement model confirmed that IIF indicators (IIF1–IIF5) had loadings above 0.747 with t-statistics exceeding 33.76, validating the operationalisation of institutional frameworks for the gum arabic context.

Public policy (PP) significantly influenced both advocacy coalitions ($\beta = 0.714$, $t = 30.113$, $p < 0.001$) and institutional frameworks ($\beta = 0.744$, $t = 30.912$, $p < 0.001$), highlighting the importance of enabling policy environments for fostering coalition activity and institutional capacity in the gum arabic sector of the Sudano-Sahelian region. The measurement model for public policy showed strong loadings (PP1–PP5: 0.763–0.793), confirming that policy support, clear objectives, adequate incentives, effective implementation, and evaluation mechanisms are essential for creating supportive policy environments for gum arabic development. Resources (RR) demonstrated significant effects on VCG ($\beta = 0.307$, $t = 7.451$, $p < 0.001$), consistent with World Bank (2020) findings that resource availability determines value chain competitiveness in developing countries, including the gum arabic sector where access to finance and extension services remains constrained in the Sudano-Sahelian region (Muhammad et al., 2020).

The interaction between institutional frameworks and advocacy coalitions was non-significant ($\beta = 0.032$, $t = 1.111$, $p = 0.267$), suggesting that these mechanisms function through distinct pathways rather than through complementary effects in the Nigerian gum arabic context. This finding diverges from some ACF literature that posits institutional arrangements and coalitions interact to shape policy outcomes (Jenkins-Smith et al., 2018), possibly reflecting the relatively weak institutional capacity and fragmented coalition structures prevalent in the Nigerian agricultural sector, where gum arabic stakeholders often lack coordinated advocacy platforms (Foraminifera Market Research, 2026). The measurement model for VCG in this framework again demonstrated strong psychometric properties, with all loadings exceeding 0.71 and significant t-statistics, providing a solid empirical basis for the structural estimates.

Table 3b. Results of Policy Frameworks Necessary to Promote the Growth and Development of the Gum Arabic Value Chain Based on a Public Policy Theory/ Advocacy Coalition Framework (ACF)

Variables	Original sample (O)	T statistics	P values	VIF
AC → VCG	0.185303	4.209862	2.60E-05	2.05596
IIF → VCG	0.398601	8.116851	5.68E-14	2.22261
PP → AC	0.713893	30.11254	5.68E-14	1
PP → IIF	0.744044	30.91151	5.68E-14	1
RR → VCG	0.306955	7.451252	5.68E-14	1.371698
IIF x AC → VCG	0.032435	1.110789	0.266712	1.043426

Source: Field survey, 2025.

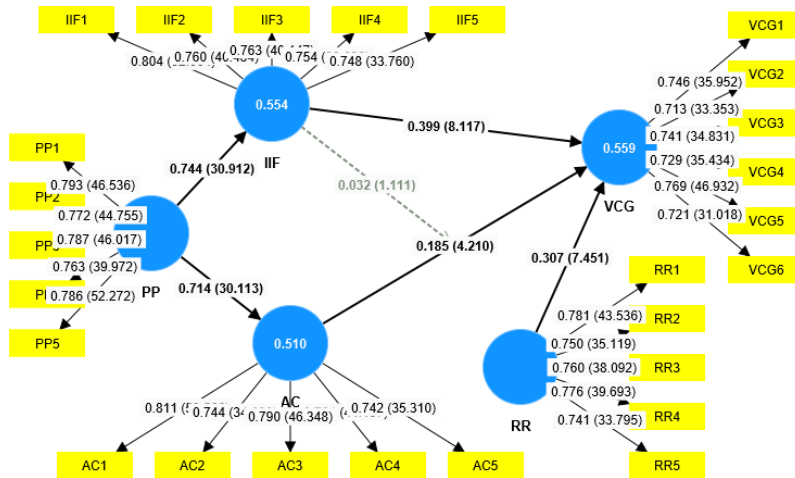


Fig. 4b. The Policy Frameworks Necessary to Promote the Growth and Development of VC Based on a Public Policy Theory/ Advocacy Coalition Framework (ACF)

Source: Authors' calculation.

Good Governance Theory

The governance-based model revealed several significant relationships relevant to gum arabic value chain growth and development in the Sudano-Sahelian region (Table 3c & Figure 4c). Participatory engagement (PE) strongly influenced institutional functioning (IFF) ($\beta = 0.685$, $t = 28.250$, $p < 0.001$) and significantly affected regulatory needs (RN) ($\beta = 0.240$, $t = 4.427$, $p < 0.001$). These findings support Fung's (2018) argument that stakeholder participation enhances institutional effectiveness by improving decision-making quality and legitimacy. For the gum arabic sector in the Sudano-Sahelian region, this implies that participatory and inclusive policies, transparent policy objectives, accountability in implementation, compliance with rule of law, and responsiveness to community needs are essential governance principles that can drive sustainable development. The measurement model for participatory engagement showed strong loadings (PE1–PE5: 0.755–0.810), confirming these indicators are reliable measures of participatory governance in the gum arabic context.

Institutional functioning significantly predicted governance outcomes (GO) ($\beta = 0.495$, $t = 13.875$, $p < 0.001$), indicating that transparent and accountable institutions drive gum arabic value chain development through improved service delivery and stakeholder trust (Kaufmann et al., 2020). The measurement model for institutional functioning confirmed all indicators (IFF1–IFF5) had loadings above 0.732, supporting the operationalisation of transparency, accountability, fair rule enforcement, equitable participation, and institutional effectiveness in gum arabic governance. This suggests that institutions operating with good

governance principles enhance gum arabic actor productivity, market access, sustainability, trust, and investment in the Sudano-Sahelian region (Abdulmalik & Abbas, 2025).

Table 3c. Results of the Policy Frameworks Necessary to Promote the Growth and Development of the Gum Arabic Value Chain Based on a Good Governance Theory

Variables	Original sample (O)	T statistics	P values	VIF
IFF $\rightarrow$ GO	0.495230	13.87519	5.68E-14	1.451150
IFF $\rightarrow$ RN	0.393064	7.071840	1.76E-12	1.884682
PE $\rightarrow$ IFF	0.685132	28.24988	5.68E-14	1
PE $\rightarrow$ RN	0.239515	4.427158	9.75E-06	1.884682
RN $\rightarrow$ GO	0.365652	9.035675	5.68E-14	1.627385
RN x IFF $\rightarrow$ GO	0.117721	4.501622	6.90E-06	1.192773

Source: Field survey, 2025.

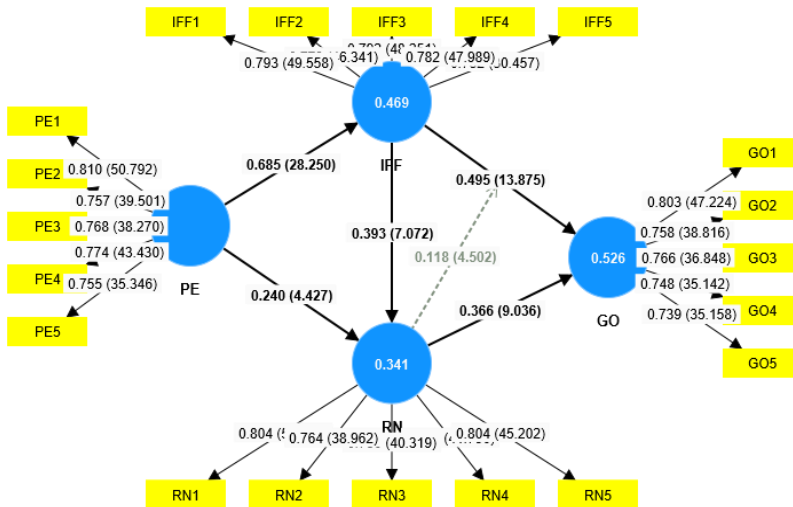


Fig. 4c. The Policy Frameworks Necessary to Promote the Growth and Development of VC Based on a Public Policy Theory/ Advocacy Coalition Framework (ACF)

Source: Authors' calculation.

Regulatory needs strongly influenced governance outcomes ($\beta = 0.366$, $t = 9.036$, $p < 0.001$), confirming that responsive regulatory frameworks addressing transparency, accountability, participation, representation, and efficiency are essential for gum arabic value chain growth in the Sudano-Sahelian region. The measurement model for regulatory needs showed strong loadings (RN1–RN5: 0.764–0.804), confirming that strengthening

transparency in policymaking, establishing accountability mechanisms, increasing community participation, ensuring equitable representation, and enhancing institutional efficiency are perceived as critical regulatory needs for gum arabic development in this ecologically sensitive region where sustainable resource management is paramount.

The interaction between regulatory needs and institutional functioning was significant ($\beta = 0.118$, $t = 4.502$, $p < 0.001$), suggesting synergistic effects where well-functioning institutions combined with responsive regulatory frameworks produce enhanced governance outcomes for the gum arabic value chain in the Sudano-Sahelian region. This interaction effect supports the complementary institutional perspective advocated by Rodrik (2012) who argues that institutional quality and regulatory responsiveness together determine development outcomes. For gum arabic specifically, this implies that effective institutions and appropriate regulations work together to create enabling environments for value chain growth, as evidenced by successful gum arabic development programs in other African countries with similar ecological conditions (World Bank, 2020). The measurement model for governance outcomes showed strong loadings (GO1–GO5: 0.739–0.803), confirming that productivity improvements, market access, sustainability, trust, and innovation are reliable indicators of governance-driven value chain development in the Sudano-Sahelian region.

Conclusions and Recommendations

Based on the empirical findings, this study concludes that the gum arabic value chain in Nigeria's Sudano-Sahelian region holds substantial untapped potential for economic transformation, yet this potential remains constrained by inequitable value distribution, weak institutional frameworks, fragmented policy implementation, and persistent security challenges. Additionally, this study provides a novel integrated framework that advances theoretical understanding of value chain development in fragile ecological zones. The findings offer actionable insights for policymakers, development partners, and stakeholders seeking to transform the gum arabic sector. By addressing identified gaps, the study contributes to empirical literature on agricultural value chains and sustainable development in Nigeria's Sudano-Sahelian region. Ultimately, strategic interventions prioritising institutional strengthening, local processing, and governance reforms can unlock the sector's potential to generate sustainable livelihoods and inclusive economic growth. The following recommendations are proposed to promote sustainable growth and development:

- The federal and state governments should prioritise significant investment in local processing infrastructure across the Sudano-Sahelian states, as this would enable Nigeria to capture value that currently accrues to international buyers and generate over \$476 million as projected by the Raw Materials Research and Development Council.
- Institutional capacity should be strengthened through establishing functional gum arabic cooperatives and producer associations that enhance smallholder bargaining power, facilitate collective marketing, and improve access to finance and extension services for producers.
- Policy frameworks must be reformed to promote participatory engagement, transparency, and accountability in governance mechanisms, ensuring that the voices of women and youth who constitute 85% of value chain participants are adequately represented in decision-making processes.

- Security challenges in Borno and Yobe states must be addressed through comprehensive interventions that protect supply chains and create enabling environments for investment in processing facilities.
- Stakeholder coordination should be enhanced through strengthening the Nigerian Gum Arabic Council and establishing effective monitoring and evaluation mechanisms to ensure policy coherence and implementation effectiveness.
- Finally, public-private partnerships should be fostered to mobilise resources for research, technology transfer, and capacity building, thereby transforming the gum arabic sector into a dynamic driver of inclusive economic growth and sustainable development in the Sudano-Sahelian region.

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Appendix

Appendix 1. Variable Definition

1. A Political Economy Theory (PET)	
Existing government policies support the growth of the gum arabic value chain	P1
Current policies encourage investment and innovation in gum arabic production and processing	P2
Policy incentives (tax breaks, grants, subsidies) for gum arabic businesses are accessible to local actors	P3
Policies are effectively implemented at the local level	P4
There is consistency and stability in government policies affecting the gum arabic value chain	P5

Local institutions (cooperatives, associations) effectively support producers and traders	IF1
Coordination among government agencies and private actors is strong	IF2
Regulatory frameworks protect the interests of small-scale actors in the value chain	IF3
Transparency and accountability exist in institutional practices related to gum arabic	IF4
Local institutions have adequate capacity and resources to implement policies	IF5
Policy-making processes include inputs from local stakeholders (farmers, traders, processors).	PR1
Women and youth have an equal voice in institutions governing the gum arabic value chain	PR2
Powerful actors do not dominate decision-making at the expense of smallholders	PR3
Conflict-resolution mechanisms exist for disputes in the gum arabic sector	PR4
The distribution of benefits from gum arabic activities is fair across different groups	PR5
Stronger public-private partnerships are needed to develop the gum arabic value chain	R1
Simplified regulations would enhance participation by smallholders and traders	R2
Greater decentralisation of decision-making would improve responsiveness to local needs	R3
Long-term funding for extension and research on gum arabic should be increased	R4
Institutions need clearer mandates to avoid overlap and inefficiency	R5
The gum arabic value chain in my area has expanded its production and processing capacity in recent years	VCG1
The gum arabic value chain has generated more employment opportunities for local people	VCG2
Incomes of smallholders and traders from gum arabic have increased and become more stable	VCG3
Local market access and linkages for gum arabic products have improved	VCG4
Benefits from gum arabic activities are distributed more fairly across different groups in the community	VCG5
The gum arabic value chain has enhanced the overall socio-economic well-being of the community	VCG6
2. Public Policy Theory/ Advocacy Coalition Framework (ACF)	
Existing public policies support the growth of the gum arabic value chain	PP1
Policy objectives for gum arabic are clearly stated and communicated	PP2
Government provides adequate incentives (tax breaks, grants, subsidies) for gum arabic actors	PP3
Policy implementation at the local level is effective and consistent	PP4
Policy evaluation and feedback mechanisms exist to improve performance	PP5
Local institutions (cooperatives, associations) support producers and traders	IIF1
Coordination between government agencies and private actors is strong	IIF2
Regulations protect the interests of smallholders in the value chain	IIF3
Transparency and accountability exist in institutions dealing with gum arabic	IIF4
Institutions have adequate resources and capacity to implement policies	IIF5
Stakeholders (farmers, processors, traders, NGOs) actively participate in policy processes	AC1
Women and youth groups are well represented in advocacy coalitions	AC2

Policy debates involve diverse perspectives from multiple coalitions	AC3
Coalitions influence government decisions on gum arabic policies effectively	AC4
Collaboration between coalitions has improved policy outcomes for gum arabic	AC5
Stronger public-private partnerships are needed to develop the gum arabic value chain	RR1
Simplified regulations would enhance participation by smallholders and traders	RR2
Decentralising decision-making would improve responsiveness to local needs	RR3
Long-term funding for extension and research on gum arabic should be increased	RR4
Stakeholder coalitions should be strengthened to improve policy influence	RR5
3. A Good Governance Theory (GG)	
Government policies for gum arabic are participatory and inclusive of all stakeholders	PE1
Policy objectives for gum arabic are transparent and publicly available	PE2
There is accountability in the implementation of gum arabic policies	PE3
Policies for gum arabic comply with the rule of law and established regulations	PE4
Policies are responsive to the needs of local communities involved in the value chain	PE5
Local institutions (cooperatives, associations) operate transparently	IFF1
Institutions show accountability to their members and communities	IFF2
Institutions enforce rules and regulations fairly without bias	IFF3
Institutions ensure equitable participation of marginalised groups (women, youth).	IFF4
Institutions are effective and efficient in delivering support and services	IFF5
Good governance practices have improved the productivity of gum arabic actors	GO1
Transparency and accountability have led to better pricing and market access	GO2
Participation of local communities in decision-making has enhanced sustainability of the value chain	GO3
Equitable treatment of all stakeholders has increased trust and cooperation	GO4
Effective institutions have promoted innovation and investment in the gum arabic sector	GO5
Strengthening transparency in policymaking would improve the gum arabic value chain	RN1
Establishing clear accountability mechanisms would enhance institutional performance	RN2
Increasing community participation in policy formulation would strengthen sustainability	RN3
Ensuring equitable representation of marginalised groups would boost development outcomes	RN4
Enhancing institutional efficiency would accelerate growth of the gum arabic value chain	RN5

Appendix 2a. Model Fit

Diagnostic tests	Saturated model	Estimated model	Thresholds
Political Economy Theory			
SRMR	0.053696	0.087235	0.08
d_ ULS	0.937054	2.473211	<0.95
d_ G	0.261477	0.321883	<0.95
Chi-square	1039.749	1182.552	0.05
NFI	0.867322	0.8491	0.90
Public Policy Theory/Advocacy Coalition Framework			
SRMR	0.050283	0.068527	0.08
d_ ULS	0.887467	1.6483	<0.95
d_ G	0.269977	0.318274	<0.95
Chi-square	1071.879	1185.371	0.05
NFI	0.872545	0.85905	0.90
Good Governance Theory			
SRMR	0.055096	0.070605	0.08
d_ ULS	0.637467	1.046862	<0.95
d_ G	0.197012	0.24979	<0.95
Chi-square	799.6993	963.2975	0.05
NFI	0.876303	0.850998	0.90

Appendix 2b. Construct Reliability and Validity

Variables	Cronbach's alpha	Composite reliability (rho a)	Composite reliability (rho c)	Average variance extracted (AVE)
Political Economy Theory				
IF	0.836348	0.837524	0.884235	0.604481
P	0.824467	0.826207	0.883703	0.655264
PR	0.813869	0.814561	0.870455	0.573502
R	0.800656	0.805209	0.861678	0.554954
VCG	0.831336	0.832743	0.876708	0.542512
Public Policy Theory/Advocacy Coalition Framework				
AC	0.828939	0.832123	0.879645	0.594073
IIF	0.823762	0.826161	0.876386	0.586586
PP	0.83951	0.841218	0.886095	0.608789
RR	0.819195	0.820853	0.873549	0.580217
VCG	0.831336	0.832384	0.876784	0.542693
Good Governance Theory				
GO	0.820592	0.823111	0.874439	0.582292
IFF	0.833428	0.834554	0.88245	0.600426
PE	0.831423	0.832201	0.881205	0.597517
RN	0.845553	0.84678	0.890029	0.61822

Source: Authors' calculations.

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