

# **The influence of institutional logics on vaccine development, production, and distribution in Africa**

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## **Abstract**

**Purpose** – Africa has the most deaths from infections yet lacks adequate capacity to engage in vaccine development, production, and distribution, the cornerstone of efficiently managing and eliminating several infectious diseases. Research has scarcely explored the role of institutional logics in vaccine development, production, and distribution, collectively known as end-to-end vaccine manufacturing. We sought to explore how institutional logics influence firms to engage in the vaccine manufacturing value chain in Africa.

**Design/methodology/approach** – We conducted multiple case study research using five vaccine manufacturing firms from four African countries in three regions. Qualitative interviews were conducted among 18 executives in five vaccine manufacturing firms.

**Findings** – We identified that the state, corporate, and market institutional logics disparately influence the different parts of the vaccine manufacturing value chain. These institutional logics co-exist in a constellation that also shapes the organizational forms. Their constellation has dominant logics that guide behavior, while subdominant and subordinate logics influence behavior to a limited extent. The findings show that institutional logics are a function of contextual factors, such as historical events, technological changes, and pandemics.

**Originality** – The study developed a typology that identifies vaccine manufacturing firm archetypes, institutional logics and their constellations underpinned by contextual factors. The findings have implications for firms and policymakers, as they may guide the end-to-end vaccine manufacturing interventions adapted for their regions.

**Keywords** – Institutional theory, Institutional logics, Vaccine development, Vaccine production, Vaccine distribution, Africa

## 1. Introduction

Africa has the world's largest burden of infectious diseases, making vaccine manufacturing central to healthcare provision (GBD 2016 Mortality Collaborators, 2017). Before the COVID-19 pandemic, Africa faced increased vaccine demand due to a growing population, which is set to double by 2050 (Cilliers *et al.*, 2015). Asian vaccine manufacturing organizations supply most vaccines used in Africa, with African firms supplying less than 1% (Ekström *et al.*, 2021; Pagliusi *et al.*, 2020). Such a low percentage demonstrates that African vaccine manufacturing firms are yet to reach their full potential in vaccine development, production, and distribution, collectively referred to as end-to-end vaccine manufacturing (African Vaccine Manufacturing Initiative [AVMI], 2017; Ekström *et al.*, 2021). A few African countries have firms with limited capabilities to leverage the end-to-end vaccine manufacturing. In these countries, most firms only fill vials with vaccines and package them for distribution (Kana *et al.*, 2023; Thompson *et al.*, 2023).

Failure to engage the whole vaccine manufacturing value chain by African firms has been attributed to a lack of technology transfer partners, financial incentives, manufacturing capabilities (Dhai, 2023; Thompson *et al.*, 2023), underdeveloped intellectual property laws, regulatory insufficiencies (Dhai, 2023; Hayman *et al.*, 2021; Makenga *et al.*, 2019) and competition from vaccine manufacturing multinational companies (MNCs) (Kana *et al.*, 2023). Several of these reasons appear to be part of constructs constraining the means and ends of firms and shaping their behavior, suggesting that institutional logics play a role in the failure of African vaccine manufacturing firms to engage the entire value chain (Ekström *et al.*, 2021). These logics are organizing principles that guide societal behaviour (Friedland and Alford, 1991). The role of institutional logics is recognized in some of the initiatives undertaken to improve vaccine manufacturing in Africa (Dhai, 2023; Kana *et al.*, 2023; Sambala *et al.*, 2019). However, there is a dearth of literature on how these logics influence firms to engage in the value chain activities, how the logics have changed over time, and whether the changes have influenced decisions to leverage the full vaccine manufacturing value chain.

Since end-to-end vaccine manufacturing is predominantly studied in health sciences, we deviate from the norm by positioning it in supply chain management, which focuses on business processes (e.g., data analytics), managerial components (e.g., leadership), and supply chain structures (e.g., production management) (Cooper *et al.*, 1997; Holgado *et al.*, 2024). While research in this area has appreciated the role of institutional logics in the effectiveness of supply chain activities, we need to understand the dominant institutional logics and the constellations that impact supply chain activities (Annala *et al.*, 2019; Carmagnac *et al.*, 2023).

Furthermore, there is a call to explore the various constellations of these logics as influenced by contextual factors, such as historical events (Hesse *et al.*, 2019; Paiva *et al.*, 2024). We argue that the contextual nuances in Africa, as influenced by the colonial history, are a laboratory to explore the interlink between institutional logics, end-to-end vaccine manufacturing, and the context.

Our research question is: how do institutional logics influence end-to-end vaccine manufacturing in Africa? The question is premised on institutional logics as central to constraining or enabling means and ends of individual behavior and organizational actions (Friedland and Alford, 1991). We focus on two logics most relevant to this study: the state and market. Our first submission is that the state highly regulates the pharmaceutical industry. Therefore, the regulations determine the feasibility of leveraging the full vaccine manufacturing value chain (Makenga *et al.*, 2019). Second, the African vaccine market is dominated by a small number of large firms (Kana *et al.*, 2023; Thompson *et al.*, 2023; World Trade Organization [WTO], 2020). This may discourage innovation, engagement of the entire vaccine value chain, and industry growth.

To examine the influence of institutional logics, we used a multiple case study design in four African countries from three regions. These countries were selected based on the respective state of the vaccine manufacturing value chain. We engaged 18 executives from five firms who shared their experiences of institutional logics and how their firms were involved in vaccine manufacturing.

First, this study contributes to vaccine manufacturing research by introducing the scarcely researched institutional logics' role in providing rationales for firms to engage in the end-to-end vaccine manufacturing process beyond the well-known technical factors. Second, the findings contribute to supply chain management and vaccine manufacturing literature by identifying the institutional logics influencing the various stages of end-to-end vaccine manufacturing. These logics, identified as bureaucratic state, capitalist corporate, market, and welfare, vary based on their dominance, and their constellation influences organizational forms. Lastly, the study contributes to institutional logics and institutional theory research, demonstrating that logics are dynamic, co-exist in constellations, and play different roles based on regional contextual and historical nuances.

## 2. Literature review

### 2.1. Institutional logics

Derived from institutional theory, institutional logics define the beliefs and standards that govern what is meaningful and acceptable in a society (Friedland and Alford, 1991). They form identity, provide purpose, and guide actions (Friedland and Alford, 1991; Suddaby, 2010). Our study focuses on logics as “organizing principles” of institutional orders, which are discrete institutional systems units (Thornton *et al.*, 2012). Institutional orders include the state, communities, religions, corporations, markets, families, and professions (Thornton *et al.*, 2012). Each order reflects unique societal norms, guidelines, and individual and firm behavior (Friedland and Alford, 1991). One or two of these orders may become dominant in society but may change over time. While there are many institutional orders, this study focuses on the state and market.

State logics regard the government in power as a redistribution system to maximize the common good by developing and implementing governing regulations to guide actions (Wikberg, 2021). Improvements in state logics (e.g., tax systems and investment environment) are positively associated with increased entrepreneurship and firm growth in emerging economies (Eijdenberg *et al.*, 2019). However, complicated and complex state regulations and bureaucracy incentivize firms to evade or sidestep regulations, resulting in corruption. Although corruption encourages anti-competitive behavior (Lajqi and Krasniqi, 2017), in some emerging economies, firms have high performances and growth rates, despite the prevalence of negative state logics (Wilkins and Emik, 2021; Xheneti and Bartlett, 2012).

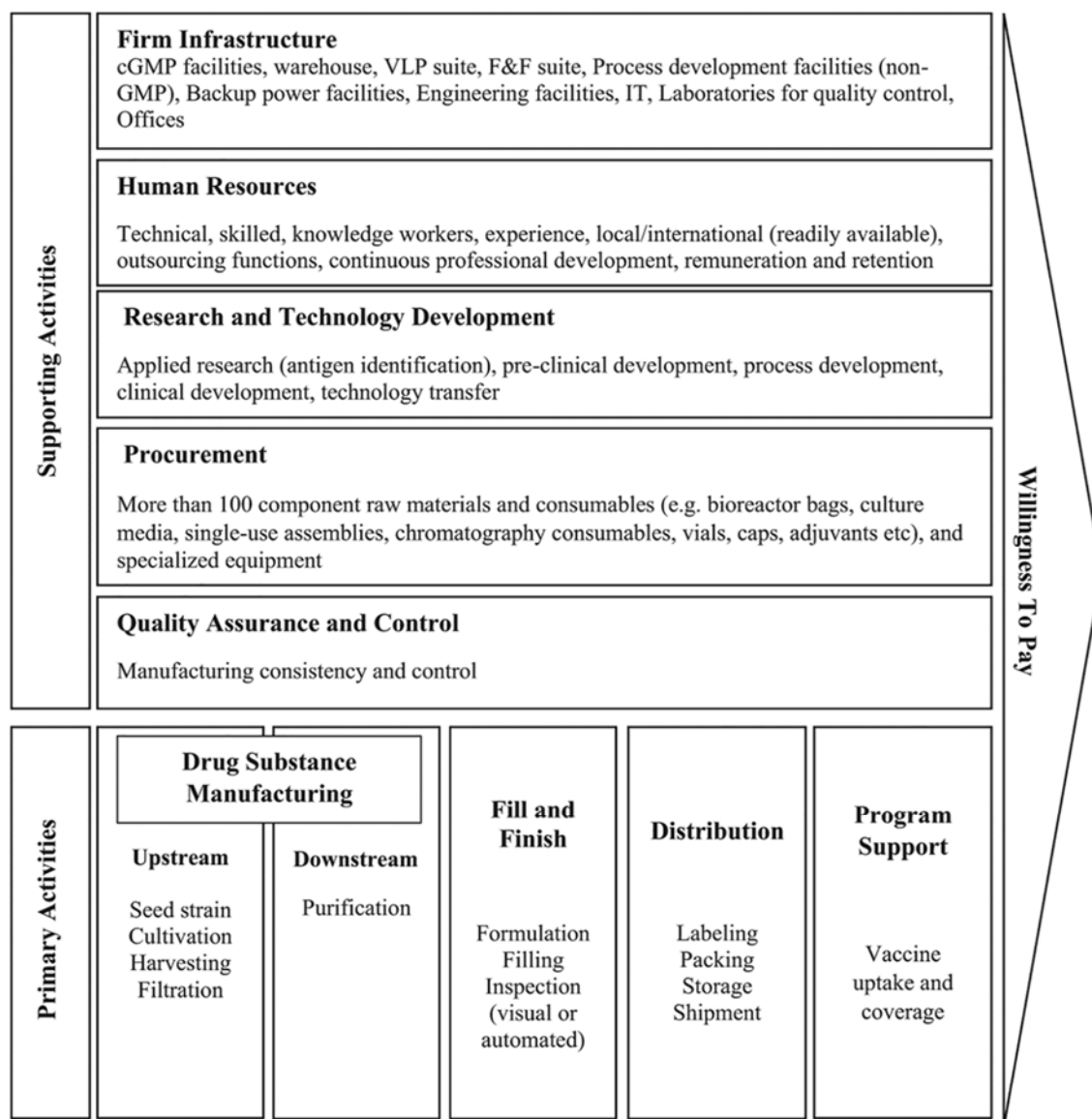
Market logics center on the market as an exchange system (transaction) or a collection of several actors who aggregate over common beliefs on an “issue” (Mountford and Geiger, 2021). The constraining and enabling constructs of market logics have been evaluated considering mostly the capital, labor, and product. In developing countries, access to skilled labor contributes to firms’ performance and growth (Mertzanis and Said, 2019). Regarding capital market logics, financial institutions have been identified to have facilitated the rise of innovative biotechnology and the generation of high-growth firms (Audretsch and Elston, 2006). Lastly, the product market, intense competition, and product liability laws are associated with reduced firm performance persistence. In conclusion, these logics influence how firms are run and respond to environmental challenges.

## **2.2. Institutional logics in supply chain management**

Several logics such as professional (Bobbin *et al.*, 2021), economic and sustainability (Carmagnac *et al.*, 2023), and socio-economic logics (Pullman *et al.*, 2018; Schumm and Niehm, 2023; Vanpoucke and Klassen, 2023) were reported to influence the various aspects of supply chain processes. These institutional logics co-exist and are not in isolation (Annals *et al.*, 2019). It is argued that logics co-exist as a constellation of logics, where there are primary (dominant) and secondary (subdominant) logics (Goodrick and Reay, 2011). Primary logics significantly influences behaviour, while secondary logics do not cause any significant change. These behavioral changes brought by institutional logics can compete, leading to coping strategies to address unmet expectations (Saldanha *et al.*, 2015). A more recent study (Nath and Eweje, 2021) found a co-existence of conflicting and complementing institutional logics that impact supply chain management activities. However, when there are economic and social logics, the dominance of the economic logics creates risks to their co-existence (McLoughlin and Meehan, 2021). Therefore, this study will contribute to knowledge by examining how the dominance and co-existence of institutional logics influence the end-to-end vaccine manufacturing activities.

## **2.3. End-to-end vaccine manufacturing**

The end-to-end vaccine manufacturing value chain encompasses separate activities of vaccine development and production with different optimization potential and cost implications. These activities include technology development (basic and applied research [antigen identification and isolation], R&D [process development and preclinical evaluation], clinical development [clinical evaluation], and licensure), the manufacturing process (upstream and downstream drug substance manufacture, formulation, fill-and-finish), vaccine distribution, and program support (Hatchet *et al.*, 2021). The activities can be streamlined into primary and support (see Figure I).



**Note(s):** Key activities of the end-to-end vaccine manufacturing constructed using the Porter value chain template (Ghemawat and Rivkin, 2014). The key activities used in the construction of the value chain were drawn from Cunningham *et al.* (2016), Stern (2020) and Hatchet *et al.* (2021). Abbreviations: cGMP: current Good Manufacturing Practices; VLP: Visualisation, Labelling & Packaging; IT: information technology

**Source(s):** Authors own creation

**Figure I.** End-to-end vaccine manufacturing

Primary activities concern processes directly involved in the production, marketing, and distribution of the vaccine product, while support activities concern all processes that increase efficiencies of the primary activities through optimized technological processes, efficient infrastructure design, and skilled human resources (Ghemawat and Rivkin, 2014; Plotkin *et al.*, 2017). Vaccine manufacturers engage in different parts of the value chain’s key activities.

Large MNCs engage the entire value chain, while smaller companies undertake technology development (biotechnology companies) and some fill-and-finish (contract manufacturers). Those undertaking the primary activities receive technology transfer from biotechnology companies or MNCs as a licensing agreement, joint venture, or partnership, with some conditions and restrictions attached (Wellcome Trust, 2023; World Health Organization [WHO], 2011).

Cognizant that several players exploit parts of the value chain, with few engaging in the entire value chain, the ability to exploit the entire chain is crucial for the realization of the objectives of security of supply and pandemic preparedness. Most of the manufacturers in Africa are engaged in fill-and-finish, where the active pharmaceutical ingredient is mixed with excipients during formulation, filled into vials or syringes, and then packaged and labeled for distribution (see Table I) (AVMI, 2017; Ekström *et al.*, 2021; Kana *et al.*, 2023). Undertaking only fill-and-finish may be inadequate to address the security of supply concerns, as these players are reliant on technology owners for the drug substance.

In Africa, only the Institut Pasteur firms of Algeria, Senegal, and Tunisia are involved in drug substance manufacturing, involving rabies, yellow fever, and tuberculosis, respectively (Wellcome *et al.*, 2023). Limited technology development has been undertaken by African vaccine manufacturers, with Biovac and Innovative Biotech having some R&D activities, albeit without patents yet. Only one (8%) of the 12 African vaccine manufacturing firms manufacture vaccines with WHO prequalification status, essential for supplying international bodies, such as the United Nations International Children's Emergency Fund (UNICEF). Furthermore, four (33%) of these firms have facilities compliant with the WHO's good manufacturing practices (GMP), namely those involved in formulation and filling. Consequently, African vaccine manufacturers are not taking advantage of the potential costs and lead-time synergies afforded by the integrated engagement of the entire vaccine manufacturing value chain (Mynhardt and Ndembu, 2023). Reasons cited for failing to engage the entire value chain include a lack of local scientific capacity, regulatory immaturity, and inadequate financing mechanisms – elements reflecting the influence of institutional logics on vaccine manufacturing (Ekström *et al.*, 2021).

**Table I.** African vaccine manufacturing companies and value chain

**Source:** Compiled using data from Wellcome, Biovac and Boston Consulting Group (2023).

Country	Firm	Year founded	Vaccine Products	Capacity (# of doses)	R&D	DS	F&F	P&L	Import		
South Africa	Firm A	2014	Covid-19	N/A	•	•	•				
			Hepatitis B		•						
	Firm B	1997	Rift Valley Fever	300M	•						
			TB		•						
			Covid-19				•	•			
Firm C	2003	BCG	30M					•			
		Covid-19					•				
		GBS			•						
		Hepatitis B							•		
Ethiopia	Firm D	1995	Hexavalent	<50K			•				
			OCV			•					
			OPV						•		
			Pneumococcus					•			
			Measles							•	
Nigeria	Firm E	2005	Rabies	N/A		•	•	•			
			Covid-19			•					
			Ebola			•					
			HIV			•					
Algeria	Firm F	2005	HPV	N/A							
			Yellow Fever			•					
			N/A								
Senegal	Firm G	1894	Rabies	N/A		•	•				
			Covid-19				•	•			
Morocco	Firm H	1982	Yellow Fever	200M		•	•				
			BCG							•	
			Influenza							•	
			Rabies							•	
			Tetanus							•	
			Typhoid							•	
Tunisia	Firm I	1923	Yellow Fever	60K			•	•			
			BCG							•	
			Cholera					•	•		
			Covid-19					•	•		
			DT					•	•		
			DTP						•	•	
			Hib								•
			Hepatitis A/B/A+B								•
			HPV								•
			Influenza								•
Egypt	Firm J	1897	IPV	200M					•		
			Meningitis							•	
			MMR							•	
			OPV							•	
			Pentavalent							•	
			Pneumococcal							•	
			Rabies							•	
			Rotavirus							•	
			Tetanus						•	•	
			Typhoid						•	•	
			Varicella								•
			Yellow Fever								•

Acronyms: BCG: Bacille Calmette-Guérin; DT: Diphtheria & Tetanus; DTP: Diphtheria, Tetanus, and Pertussis; DS: Drug Substance; F&F: Fill-and-Finish; GBS: Group B Streptococcus; Hib: *Haemophilus influenzae* type b; HIV: Human Immunodeficiency Virus; HPV: Human Papilloma Virus; IPV: Inactivated Polio Vaccine; MMR: Measles, Mumps, OCV: Oral Cholera Vaccine; OPV: Oral Polio Vaccine; P&L: Packaging and Labelling; TB: tuberculosis.



## ***2.4. Institutional logics and end-to-end vaccine manufacturing***

### *2.4.1. State logics and end-to-end vaccine manufacturing*

Regulations are essential in vaccine manufacturing, given the potential health risks associated with the end products. These regulations determine the vaccine manufacturing's technical feasibility through specific clinical development and quality technical requirements. There is a requirement for constant approval of the product development by the national regulatory authorities (NRAs) at each stage of clinical development, regular certification of the manufacturing facilities, and testing of the batches before the final release (Gruber and Marshall, 2018). The NRAs' experience and regulatory guidelines influence the scientific and technical feasibility of developing vaccines, especially for poorly characterized diseases. In Africa, many NRAs are not equipped to deal with the technical requirements prevalent in the engagement of the value chain (AVMI, 2017). Consequently, some African organizations make programmatic and strategic choices focusing on fill-and-finish (Makenga *et al.*, 2019; Mynhardt and Ndembu, 2023).

Other institutional state logics constraining or enabling vaccine manufacturing firms include the WHO recommendations. WHO publishes the target product profile for vaccines and provides recommendations for countries concerning immunizations, which are implemented by most governments (Plotkin *et al.*, 2017). Such recommendations reduce uncertainties for vaccine manufacturing firms and enable them to seek product development strategies to engage the vaccine manufacturing value chain.

State logics evolve with time (Wikberg, 2021). Some African vaccine manufacturing firms were founded during the colonial period, where logics like the regulations and enforcement bodies were aligned with the Western states through the colonial government. Colonization may be considered part of institutional logics that transformed and restructured cultures, socio-political systems, administrative systems, and market and financial systems in Africa (Abdulai, 2019). Changing governments, such as in decolonization, have the potential to change regulations and their enforcement and subsequently influence actors' strategic decisions on leveraging the vaccine manufacturing value chain (Abdulai, 2019). Consequently, longitudinal evaluation of institutional logics may reflect the transformative influence of colonization and decolonization on institutional logics, influencing firms to engage the entire vaccine manufacturing value chain.

#### 2.4.2. *Market logics and end-to-end vaccine manufacturing*

Capital, labor, and product market logics contribute to positive firm performance and growth, depending on the size of an organization, industry, and region (Mertzanis and Said, 2019). In vaccine manufacturing, the process is long, expensive, and often requires external financial support (Malvolti and Malhame, 2020). In the African regions, existing financial institutions (guided by investment return) have limited capacity to fund such long-term programs, making companies rely on philanthropic organizations (guided by service) that provide partial support on specific programs aligned to their strategic goals and over a limited time (Abiodun *et al.*, 2021; Malvolti and Malhame, 2020). Resultantly, many vaccine manufacturing organizations opt to engage the low-risk fill-and-finish capabilities, compared to risk-laden technology development or cost-intensive drug substance production (Mynhardt and Ndembu, 2023; Path, 2023).

A lack of skilled human resources is the commonly cited constraint to growth by African vaccine manufacturing organizations (Makenga *et al.*, 2019). African manufacturers struggle to attract, retain, and upskill talent (Wellcome *et al.*, 2023). The talent deficit mainly affects the technically challenging technology, process, and antigen development (Path, 2023). Inadvertently, vaccine manufacturing in Africa is skewed toward fill-and-finish.

In Africa, the vaccine product market is limited; it is not a free and open market, and it is characterized by oligopsony (WTO, 2020). The largest buyers of vaccines are governments and international bodies, such as UNICEF and the Global Alliance for Vaccines and Immunisation (GAVI). Manufacturers supplying vaccines, especially to international bodies like UNICEF and GAVI, rely on economies of scale to increase their profit margin (Makenga *et al.*, 2019). Consequently, older vaccines fetch the highest margin compared to new vaccines within the same disease portfolio. This influences firms to seek scale to maximize profits at the expense of innovation that could increase scope. Therefore, for African firms, the current market (capital/financial, labor, and product) may constrain leveraging the whole vaccine manufacturing value chain.

### **3. Research methodology and design**

#### **3.1. *Multiple case study design***

This study used a multiple case study design to explore the role of institutions in firms' decisions to engage the whole vaccine manufacturing value chain, mainly from the organizations' perspective (Yin, 2018). We conducted a multiple case study design of vaccine manufacturing firms selected from Southern, Western, and Northern African regions. This

approach allowed across-case comparisons and provided robust findings for theoretical replicability (Yin, 2018). Five vaccine manufacturing firms from different areas were selected as cases.

### ***3.2. Motivation for the study's setting***

The study was conducted using firms from four different African countries of three geographical regions that had some level of vaccine manufacturing in the past 20 years. We focused on Africa because it has the highest burden of vaccine-preventable infections and low vaccine manufacturing capacity (Makenga *et al.*, 2019). Several plans and initiatives were developed and implemented to promote end-to-end vaccine manufacturing in Africa. These include the Pharmaceutical Manufacturing Plan for Africa (PMPA) in 2007, the AVMI in 2010, and Vaccine Manufacturing and Procurement in Africa in 2015. The initiatives targeted dimensions subtended by institutional logics constraining the organizations from engaging in the full vaccine manufacturing value chain.

However, these initiatives did not translate into increased manufacturing capacity (Makenga *et al.*, 2019). For example, the PMPA proposed public funding of US\$54 million, subtended by development, growth, and service logics. The proposal failed to materialize over the targeted five-year period (Mynhardt and Ndembi, 2023). While service and investment return logics relate to capital/finance market challenges in Africa, the service logics could not enable increased manufacturing capacity. Hence, the African setting will explain how institutional logics influence organizations to engage the end-to-end vaccine manufacturing value chain.

### ***3.3. Motivation for the selection of study cases***

Africa has 54 countries grouped into five geographical regions – Northern, Southern, Eastern, Western, and Central – that share a legacy of colonization, which has created diverse countries and cultures. To capture the influence of colonization and changes in the institutional logics post-colonization, we selected four countries from the three regions with vaccine manufacturing as cases. The countries were chosen based on the presence of vaccine manufacturing firms in the country. Of the four countries, two are francophone (Morocco and Senegal), and two are anglophone (Nigeria and South Africa) – refer to Table II.

The selection of francophone and anglophone countries was premised on the bulk of African nations having been colonized by France or Britain (Lee and Schultz, 2012). France and Britain have had unique colonial institutions and policies that seem to have a legacy in

these nations (Lee and Schultz, 2012). Post-colonial institutional stability and economic growth of former British colonies is attributed to the colonial government self-reliance policies. In contrast, the instability of former French colonies is thought to be linked to France’s centralized administration and subsidies (Ocheni & Nwankwo, 2012).

**Table II.** Selected countries

	<b>South Africa</b>	<b>Nigeria</b>	<b>Morocco</b>	<b>Senegal</b>
Region	South	West	North	West
Anglo/Francophone	Anglophone	Anglophone	Francophone	Francophone
Total country population (million)	60.0	211.4	37.3	17.2
Total country births (p.a.)	1 172 000	8 109 136	668 000	562 482
GDP/capita	US\$6 994	US\$2 085	US\$3 497	US\$950
Vaccines budget (government)	US\$150 000 000	US\$148 100 000	US\$38 000 000	US\$1 950 902
Vaccine suppliers	Local importers, local vaccine manufacturers, MNCs	UNICEF	Local importers (IPM), UNICEF	UNICEF
Vaccine pricing	Competitive pricing for MICs	GAVI pricing*	GAVI+UNICEF**	GAVI pricing*
GAVI vaccine financing support % of vaccines supplied locally	0%	38%†	25%	70%
manufactured***	Approx. 70%	0%	0%	0%

**Source:** UNCTAD (2021); GAVI (2021); United Nations Department of Economic and Social Affairs Population Division (2022); Clinton Health Access Initiative Nigeria (2023).

**Notes:** p.a. = per annum; IPM = Individual Pharmacotherapy Management; MICs = Middle Income Countries.

\*GAVI pricing is negotiated through advanced market commitment, which lowers prices of vaccines procured for low-income countries, and pooled procurement, which gives them buyer’s power for negotiating prices and increases competition between suppliers.

\*\*The Ministry of Health consults with UNICEF on the fair vaccine pricing.

\*\*\*Calculated as a percentage of the ratio of the value of the vaccines supplied to the total vaccines financing budget of the country.

Similar to the selection of the countries, we purposively selected established vaccine manufacturing firms. We excluded vaccine manufacturing MNCs operating in these countries. The elimination of MNCs was ascribed to their stable home-country institutions’ ability to engage the value chain, when compared to the sole influence of the host-country institutions. Details of the cases are shown in Table III – Firm 2 and 3 are from the same country.

**Table III.** Selected firms and cases

Characteristics	Firm 1	Firm 2	Firm 3	Firm 4	Firm 5
Region of origin	South (Case 1)	West (Case 2)	West (Case 2)	North (Case 3)	West (Case 4)
Colonial firm year established	1811	1940	N/A	1920	1896
Colonial period vaccine manufactured	Smallpox, rabies, BCG, DTP	Smallpox, rabies, yellow fever	N/A	Typhoid	Yellow fever, BCG
Year of independence	1911 (1994)*	1960	1960	1956	1960
Post-colonial firm year re-established	2003**	2005**	2005	1967**	n/a
Post-colonial period vaccine manufactured	Hexavalent, PCV	None	None (R&D)	None	Yellow fever
State/Private	PPP	PPP	Private	State/PPP	NPO
Core business	Vaccines only	Vaccines only	Vaccines + pharma and lab services	Vaccines + PHI	Vaccines, PHI, and diagnostics
Number of patents	None	None	2	None	None
Current strategy	Reverse integration	Reverse integration	Forward integration	Reverse integration	Reverse integration

**Source:** Compiled using data from Wellcome, Biovac and Boston Consulting Group (2023).

**Notes:** BCG = Bacille Calmette-Guérin; DTP = diphtheria, tetanus, and pertussis; NPO = not-for-profit organization; PCV = pneumococcal conjugate vaccine; PHI = public health institute; PPP = public-private partnership; R&D = research and development.

\*The two years indicate the years of independence from colonization and apartheid.

\*\*Firms were re-established on the backbone of the colonial period entities and facilities as PPPs.

### 3.4. Units of analysis and data collection

We used institutional logics emerging from the data as the embedded units of analysis, which are sub-units of interest within the identified cases (Yin, 2018). We sought to explain how these logics, namely, the state, market, and corporate, influence the engagement with the vaccine manufacturing value chain. The state logics explained the bureaucratic nature of government and political changes contributing to vaccine manufacturing stagnation. The market logics address the capital, labor, and product challenges faced by vaccine manufacturers across the different parts of the vaccine manufacturing value chain. Lastly, the corporate logics are driven by firms that pursue profitability as one of the key enablers of end-to-end vaccine manufacturing. These institutional logics themes are explained in detail as part of the data analysis.

We identified 18 executives from five organizations in four countries: South Africa (Case 1), Nigeria (Case 2), Morocco (Case 3) and Senegal (Case 4) (refer to Table IV). The sample included two board chairs, three chief executive officers (CEOs)/executive directors,

two advisors, one chief operating officer (COO), one country coordinator, four directors/heads of R&D, two regulatory managers, two business development directors/managers, and one communication strategist. The study sample was well experienced, with several participants participating in the different eras of vaccine manufacturing in the selected countries. Participant Case 4\_Firm 5\_RAM had worked for the company for six months but had been the company’s consultant for more than five years. Participant Case 4\_Firm 5\_BD had been with the company for three months but had international vaccine manufacturing experience and was selected for the study because of the essential role played in COVID-19 vaccine manufacturing. The sample was diverse in areas of specialization, covering areas pertinent to the value chain (R&D and operations) and institutional logics (legal and regulations, strategy, and business development).

**Table IV.** List of participants

Case	Part ID	Designation	Work experience (years)	Interview length (minutes)
Case 1 (South Africa)	Firm_1_BC	Board Chairperson	19	67
	Firm_1_CEO	Chief Executive Officer	18	76
	Firm_1_S&I	Head of Science and Innovation	19	54
	Firm_1_RM	Regulatory Manager	16	62
Case 2 (Nigeria)	Firm_2_BC	Board Chairperson	17	60
	Firm_2_COO	Chief Operations Officer	17	43
	Firm_2_Adv	Advisor (former director)	35	41
	Firm_3_CEO	Founder, Chief Executive Officer	17	56
	Firm_3_CC	Country Coordinator	12	57
	Firm_3_BD	Business Development Manager	10	45
	Firm_3_ComS	Communication Strategist	4	56
Case 3 (Morocco)	Firm_4_ED	Executive Director	5	43
	Firm_4_RD	Head of Research Departments	29	48
	Firm_4_TVR	Head of Toxins and Venom Research	14	53
Case 4 (Senegal)	Firm_5_Strat	Senior Advisor for Biotechnology	5	54
	Firm_5_BMR	Director of Biomedical Research	5	38
	Firm_5_BD	Director of Business Development	0.25	59
	Firm_5_RAM	Regulatory Affairs Manager	0.5	18

### 3.5. Data collection

Since the study required managers to participate on behalf of their firms, we requested a letter of permission from the company to collect data, followed by the university ethical clearance application. We prepared one semi-structured interview guide for all participants to ensure data was collected consistently. The interview questions in Appendix A Table A.1, were developed from the literature review. These questions covered vaccine manufacturing activities, institutional factors, and changes in the institutional factors. Colleagues’ feedback helped us to

minimize the participant's background information and focus more on the institutional logics and vaccine manufacturing activities.

Since the participants were geographically sparse, the semi-structured interviews were conducted online via Microsoft Teams, which allowed us to record the conversations with the interviewees' permission. We requested that each participant be interviewed separately to maximize freedom of expression and the ability to answer the questions without being influenced by others. At the start of the online interviews, the participants gave verbal consent to proceed. The consent stated that participation was confidential and voluntary, and the participants had the right to withdraw from the study at any point.

The interview started with the company's history, how institutional factors impact the different parts of the vaccine manufacturing value chain, and how the institutional factors changed over time. During the interviews, the participants used memory anchors to ensure accurate recollections of events. These are signposts of significant events within the firm and the country. Examples of memory anchors included the election of new governments, changes in political parties, and disease outbreaks. Each interview lasted approximately 45 minutes and yielded good insights on the topic. Data collection happened in 2022 during the pandemic, which was a busy period for vaccine manufacturing firms, but the participants were cooperative despite their time constraints.

At the end of each interview, we requested additional information in the form of reports (from regulatory inspections or due diligence assessments) to assist in triangulating the information gathered during the interviews and field notes from the interviews. We also gathered publicly available media interviews of ten executives. These interviews helped to triangulate the data.

### **3.6. Data analysis**

Before data analysis could begin, the recorded interviews were transcribed and quality controlled. We analyzed the interview data using both within- and across-case analysis (Yin, 2018). During within-case analysis, we evaluated the key insights relating to institutional logics, changes in the organizational activities associated with the changes in the logics, and how these participants interpreted these logics. For each case, a timeline of the organization's key historical events was constructed (Yin, 2018).

The across-case analysis, shown in Figure II, was done deductively and inductively using Atlas.ti software, a computer-assisted qualitative data analysis software. The software's primary advantage is that it provided systematic data analysis, showed emerging relationships,

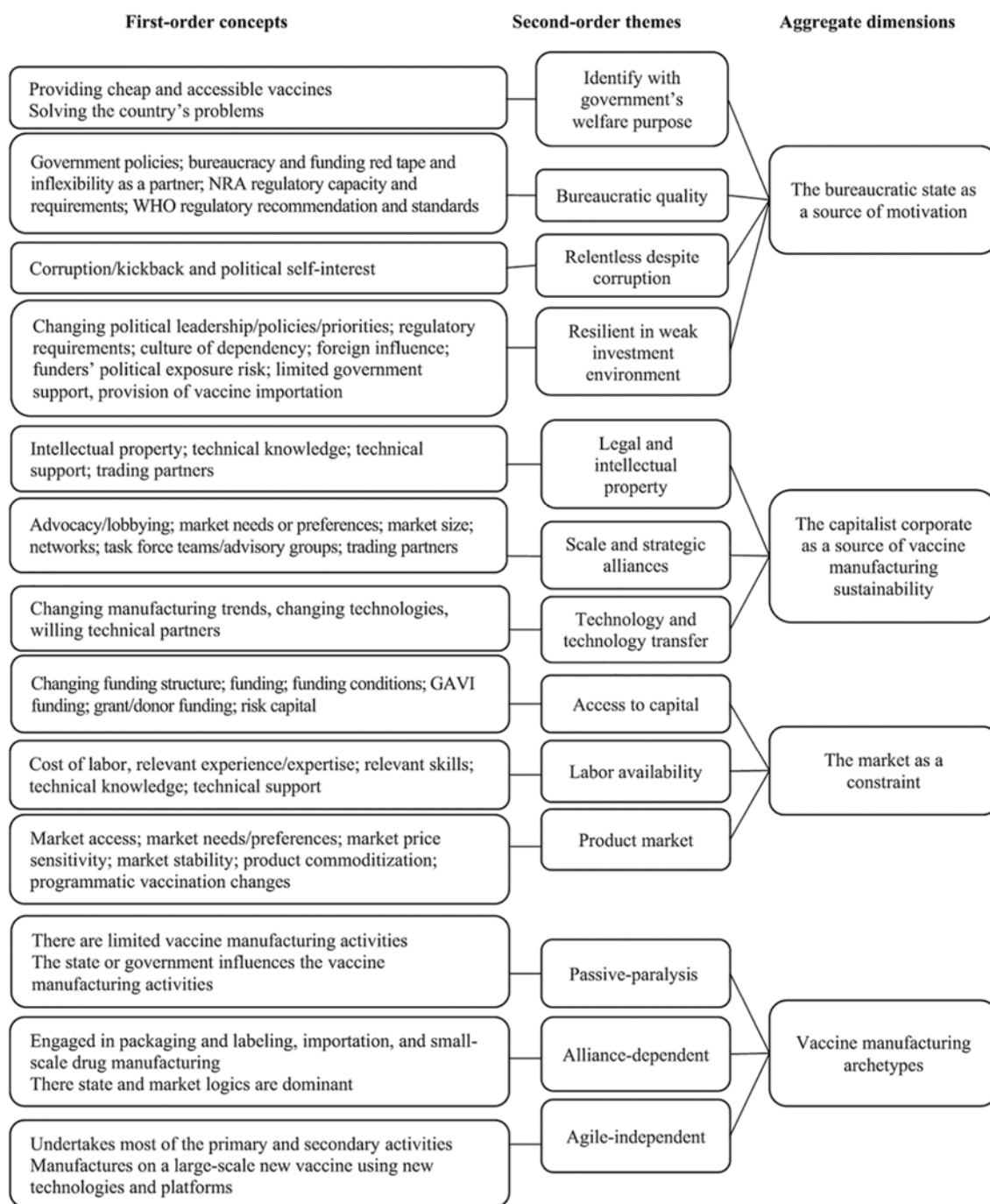
and gave a transparent analytical process that enhanced the findings' credibility. The deductive process started with the broad themes of vaccine manufacturing activities previously described by Cunningham *et al.* (2016), Stern (2020), and (Hatchett *et al.*, 2021). These included research and development, fill-and-finish, and distribution. Once these broad themes were loaded onto Atlas Ti, we started coding inductively.

We analyzed the data inductively in three steps (Gioia *et al.*, 2013). First, we developed first-order concepts by assigning labels to the participants' responses to the interview questions. There were 61 first-order concepts, including phrases like relevant skills, technical support, trading partners, and funding conditions. Second, the related first-order concepts belonging to the same logics were grouped to form second-order themes. Third, similar themes were grouped into higher-order aggregate dimensions associated with the main institutional logics and organizational archetypes. For example, second-order themes like bureaucratic quality, corruption, and investment environment were aggregated into the "bureaucratic state" aggregate dimension. We observed two divergences during the analysis. First was the tension between doing good for society and maintaining the firm's profitability. These findings were regarded as significant and reported in the findings. Second, there were divergent responses regarding past events that impacted vaccine manufacturing. We relied on secondary data to deal with the divergent views. In addition to the data structure, we analyzed responses to the interview questions per case (see Appendix A, Table A.2).

Since we used two coders, we checked the intercoder reliability. We used the percentage agreement (pairwise agreement between coders) to determine the intercoder agreement (McHugh, 2022). There was 92% agreement, meaning 8% misrepresented the data (McHugh, 2022). We checked the erroneous percentage and found that one of the researchers was more specific in coding the technical names of vaccines and the manufacturing processes. We refined the code list to ensure alignment.

We conducted a multiple case study design to increase the findings' robustness. The data analysis noted similarities and differences between the themes from one case to another. For example, the cases demonstrated that state or corporate logics mainly influenced the organizations' critical decisions, and market logics co-dominated with either. The replication of our findings from one case in one country to another in a different country increased the validity of our findings (Yin, 2018). The country and participant triangulation increased the trustworthiness and validity of our findings.





Source(s): Authors own creation

Figure II. Data structure

## 4. Results

### 4.1. *Within-case analysis*

#### 4.1.1. *Case 1: firm 1 in South Africa*

Firm 1 in South Africa engaged in most vaccine manufacturing value chain activities. Market and corporate logics were often mentioned as guiding the executives' strategies and decision-making on the activities of the value chain to engage. Thus, access to capital, labor, product market, and intellectual property played a crucial role in their decisions. The cessation of manufacturing by the state-owned enterprise and the WHO's recommendation for privatizing the entity signaled the shift from the dominant state logics to corporate logics. The corporate logics enhanced the firm's focus on profitability. Despite the change, the state emerged as motivating through limited incentives.

#### 4.1.2. *Case 2: firms 2 and 3 in Nigeria*

Firms 2 and 3 used different strategies to establish vaccine manufacturing capacity in their country. State logics emerged as the principal logics guiding the executives of Firm 2 in their decision to undertake some of the activities of the vaccine manufacturing value chain. The frequent change in political leadership was cited as the reason for the failure to reopen the post-colonial vaccine manufacturing facilities following the closure of facilities for an upgrade at the recommendation of the WHO. Government bureaucracy, prevalent corruption, and a dependency culture were interpreted as demotivating the adoption of corporate logics values and principles. There has been relatively little progress in vaccine manufacturing by Firm 2.

Founded in 2005, Firm 3, a privately owned entity, had no association with the colonial-era vaccine manufacturing entities. The executives referred to the market and corporate logics as guiding their strategy (forward integration strategy) on the vaccine manufacturing value chain. The firm focused on R&D for new and innovative vaccines, which will see them owning these vaccines' intellectual property. Firm 3 agreed on an inbound technology transfer for fill-and-finish but has yet to develop the infrastructure to undertake these activities. Executives saw access to grant funding as facilitating their engagement in manufacturing and the weak infrastructure and government bureaucracy as motivating the adoption of corporate values for sustainability. Its funding is derived from grant funders that finance R&D, while commercial funding provides loans for infrastructure development.

#### *4.1.3. Case 3: firm 4 in Morocco*

Morocco is a francophone country with a political system that differs from the other three countries. It follows a constitutional monarchy, where the powers are vested in the King. Vaccine manufacturing in the country is undertaken by a state-owned entity in partnership with a multinational philanthropic organization. Expectedly, for a state-owned entity receiving government funding, state logics emerged as principal to the executives' decision-making on parts of the vaccine manufacturing value chain to engage. We noticed references made to the collective using phrases such as "our country" and "our people" reflecting the firm's role in increasing societal well-being. In addition, we noticed references to the King and political will as encouraging the executives in their recent decisions to engage in formulation and filling and to upgrade the facilities. In one of the interviews, participant Firm 4\_RD used the phrases, "This is the King's decision" and "This is designed by the first minister or by the King", concerning the influences providing motivation. Grant or donor funding enabled the firm to engage in the research activities of the value chain. As a result, access to capital co-emerged with state logics.

#### *4.1.4. Case 4: firm 5 in Senegal*

Firm 5 was the oldest among the researched firms and the only one exploring drug substance manufacturing. The firm also produced the COVID-19 vaccine. The incentives provided by international bodies and government support were interpreted as motivating factors for pursuing strategies ensuring access to vaccines by producing low-cost products. Access to donor funding for infrastructure development and upgrade in line with WHO regulatory requirements, philanthropic partnerships, and supply of vaccines to UNICEF reflected the executives' adoption of welfare values and the interpretation that their purpose was to increase collective well-being. This interpretation was further noted by the firm registering as a non-profit organization. Therefore, the emerging dominant logics were state and market logics, especially the product market, where the executives interpreted the socio-economic circumstances and price sensitivities as barriers to vaccine access and the society valuing logics, which increased overall societal access and well-being.

### ***4.2. Across-case analysis***

The aggregate dimensions shown in Figure II show that bureaucratic state, capitalist corporate, and market logics guide executives' decisions to engage in end-to-end vaccine manufacturing.

The figure also shows the archetypes influenced by the identified institutional logics. Appendix A, Table A.2 provides responses to the interview questions per case.

#### *4.2.1. The bureaucratic state as a source of motivation for engaging in the vaccine value chain*

The influence of state logics on the strategies employed by the firms' executives was evident across all firms. However, changing intellectual property laws, manufacturing standards, and technologies faded their influence. In the immediate post-colonial period, vaccine manufacturing firms were state-owned or part of a state-owned institution and thus had an alignment of purpose. They manufactured vaccines for infections, such as polio, yellow fever, and rabies, for the local populations, except for Firm 5 (Senegal), which partnered with a multinational company to manufacture vaccines for UNICEF. The executives interpreted the functional institutional environment with government incentives, funding, and political will as a motivation to improve the welfare of the local population instead of making a profit by selling to other countries that lacked the capacity. Their role was altruistic, and they manufactured vaccines with no intellectual property protection while they maximized the societal good of health:

“But the vaccine that we were producing was strictly for government campaigns, so what was the equivalent of the UNICEF and so forth to ensure that we can inoculate” (Firm 5\_BD, Senegal).

The collective identity of the firm with the state's welfare logics is pronounced when there are dysfunctions in the organizational field. We noted that the welfare purpose of state logics continued to influence some executives despite practices undermining the basis of the logics. For example, one firm identified corruption influencing how executives invest in certain parts of the value chain. In this case, we learned that the provision for the importation of vaccines creates an opportunity for individuals working in government-owned entities to ask for kickbacks from suppliers and logistics organizations. A board chairperson of one of the firms explained the connection between corruption and the importation of vaccines: “Contracts for importation mean they can make money from whoever the contractor is” (Firm 2\_BC, Nigeria). Although corruption can be a deterrent, some executives interpret corruption as the actions of isolated individuals, not as part of the state's collective identity.

The limited regulatory capacity and its influence on the firms emerged from the findings. Despite the limited regulatory oversight, all entities continued manufacturing

vaccines for local purposes in the immediate post-colonial period. This indicates that profits did not drive the firms at the time, but by the need to serve the local populations because they could not manufacture vaccines for export without a functional NRA.

But they [NRA] have become more engaging with manufacturers. So, the environment is improving, but ... and how it was established in all of that was not enabled by the regulatory system. In actual fact, I think it was a big stumbling block historically. (Firm 1\_CEO, South Africa)

Following WHO's inspections and recommendations for upgrading several manufacturers' facilities and/or technologies, we noted that most countries-initiated efforts to capacitate their national regulatory authorities. The improvement in the regulatory capacity was a motivation as it affects firms' abilities to attract funding, construct appropriate facilities, and utilize the economies of scale through manufacturing WHO-prequalified vaccines for export.

#### *4.2.2. Corporate logics as a source of vaccine manufacturing sustainability*

WHO inspections in Nigeria, Senegal, and South Africa indicated the need to modernize the facilities and technologies to align with international standards. The firms read these recommendations differently, which resulted in different strategies and growth trajectories. At the time, executives from firms in Senegal and Nigeria looked to philanthropic organizations and their governments to finance facility upgrades, as evidenced by this participant: "I think the success has been through ensuring extremely high-quality standards aligned with [the] WHO. And then, of course, we have also had philanthropic support to finance very expensive refurbishments and maintain that regulatory certification" (Firm 5\_Strat, Senegal).

Contrary to Senegal and Nigeria, the WHO recommendations for facility upgrades in South Africa were taken to mean the need for profitable and sustainable vaccine manufacturing like the international counterparts. Therefore, the South African organization was partially privatized to access capital from commercial lenders, build a globally competitive firm, and ensure the sustainability of vaccine manufacturing. This privatization move strengthened the dominance of corporate logics in South Africa.

In addition to the WHO recommendations, the dawn of new technology created new classes of vaccine manufacturers. Technologies were said to have changed from easily replicable artisan-level technologies in the early years of vaccine manufacturing to the current sophisticated technologies leveraging better science and production at economies of scale. Nearly all executives viewed the technological changes as a trigger to adopt values and

practices consistent with corporate logics. We noted that Firms 1 (South Africa) and 3 (Nigeria) from anglophone countries were guided by the corporate logics more than the other firms, as their strategies were designed to develop intellectual property for innovative vaccines, with Firm 3 (Nigeria) having two registered patents. These two firms – from the two largest economies in Africa – focused on increasing profitability and internationalization, as evidenced by the following quote:

So, what we do need to ensure is two-pronged. Number one, that you continuously get high-value products that are more profitable. Or that you internationalize.... I think the important [thing to] bear in mind in our strategy is that those products are high value. (Firm 1\_CEO, South Africa)

Executives from Firm 3 (Nigeria) made decisions guided mostly by co-dominating corporate and market logics, with the state also playing some role. In contrast, those from Firm 2 (Nigeria) made decisions guided predominantly by state logics. Conversely, executives of Nigerian Firms operated from the same country, yet were guided by different dominant logics. Francophone-based Firms 4 (Morocco) and 5 (Senegal), whose countries' economies are less advanced, appeared to be less concerned about profit. Expectedly, the state logics help the conviction toward adopting technology transfers for the public good. These technology transfers were noted to be cheaper and affordable commodity vaccines.

#### *4.2.3. Market logics as an encumbrance in end-to-end vaccine manufacturing*

We identified access to financial capital as one of the market logics facing the executives. While access to capital has a significant bearing on a firm's ability to engage the value chain, we observed that the executives considered its effect as encumbering the engagement, but not being the primary motivation for the strategic decision taken by the firm. For example, the strategic purpose of Firm 5 (Senegal) is to maximize access through the manufacture of low-cost vaccines, resonating with the welfare of state logics. Therefore, they access funders that do not seek interest in the capital, but enforce conditions, such as limiting sales and distribution of the vaccines to specific markets or the maximum price of the vaccine. This was evidenced by Firm 5\_BD (Senegal), who said: "The conditions of the grants and loans limit again, like [the] yellow fever back in 1920 or 37, limit our marketability. So, we can't produce it and then sell it to private buyers."

Similarly, the welfare principles gravitate Firm 4 (Morocco) toward grants, donations, and government funding. Conversely, firms guided by corporate logics expressed access to

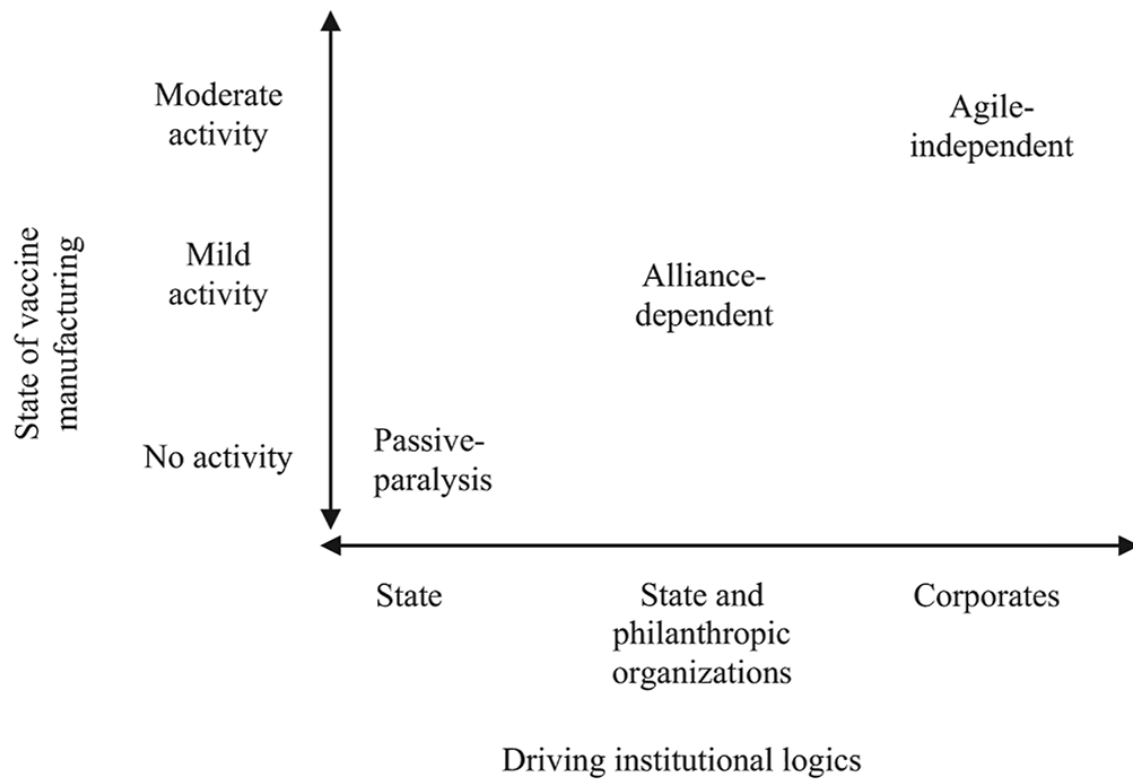
capital as a significant challenge in their environment. Pressure to increase revenue meant they must develop innovative vaccines, thus requiring access to risk capital. Where such access was limited, the executives adopted strategies that enabled technology transfers for high-value products with high profitability (Firm 1, South Africa) or developed technologies they could license outwards and generate high profits (Firm 1, South Africa and Firm 3, Nigeria). In this case, risk capital and the capital market are hurdles to adopting corporate values and principles.

The executives appeared to apply similar interpretations on the availability or non-availability of relevant skills and experienced human resources. The lack of access to experienced human resources did not seem to shift the strategic decision taken by the executives guided by the state or corporate logics. Often, firms recruited from developed countries or trained the local population through the technology transfer processes: “About the facts, vaccines production, we need the training [in] from outside. Because I think there is new technology about the new vaccines, we need the training” (Firm 4\_TV, Morocco).

Most of all, the executives mentioned the importance of the product market characteristics, such as market size, stability, and price sensitivity. The product market guided the executives on the type of product to manufacture and the scale and the parts of the value chain to engage. However, this was within the values and principles set by state or corporate logics. For example, though Firm 1 (South Africa) focuses on manufacturing high-value products with a high return, it also considers manufacturing commodity vaccines, such as cholera, from end to end because the scale makes this undertaking profitable. Firm 1\_CEO said: “So low volume but higher value, which essentially means that you can make more profit per dose out of formulation fill-finish than you would typically.”

#### *4.2.4. Institutional logics influencing vaccine manufacturing firm archetypes*

Figure III shows that the influence of institutional logics on vaccine manufacturing results in the three archetypes that we labeled passive-paralysis, alliance-dependent, and agile-independent firms. These archetypes were mapped according to the state of manufacturing in the selected countries classified as “no, mild, and moderate” activity. No activity means a firm is not engaged in the vaccine manufacturing value chain. Mild activity means that a firm is involved in packaging, labeling, and/or importation for distribution or small-scale drug substance or fill-and-finish of simple old technology vaccine (e.g., attenuated or inactivated vaccines). Lastly, moderate activity is when a firm undertakes most of the primary and secondary activities of the value chain or manufactures large-scale new vaccines, including multivalent vaccines, using new technologies and platforms (e.g., vectored vaccines).



**Source(s):** Authors own creation

**Figure III.** Vaccine manufacturing archetypes

The first archetype is a passive-paralysis firm, which has experienced no activity in vaccine manufacturing because of political and governmental instability and reliance on the state to make critical decisions. In other words, state logics are the key driver of the vaccine manufacturing decisions and actions. Firm 2 (Nigeria) is an example of passive paralysis, dependent on the government. The executives in this firm reported that they could not start manufacturing vaccines due to the constant leadership changes, which compromised the continuity of the projects: “Each time a new military government came, they abandoned everything the others had done. That is what happened to the vaccine production” (Firm 2\_BC, Nigeria).

The second archetype is alliance-dependent firms with mild manufacturing activity, relying on partnerships to engage in different vaccine manufacturing activities. These firms are driven by co-dominance of state and market logics. Moreover, this archetype had the welfare logics predominantly driven by philanthropic organizations and the state. In this study, Firm 4 and 5 are alliance-dependent firms motivated to focus on social or welfare impact by reinvesting profits into the firm. Being part of the alliance of a multinational firm provided



multiple opportunities to focus on the fill-and-finish part of the end-to-end vaccine and drug substance manufacturing (Firm 5, Senegal) and importation for distribution (Firm 4, Morocco): “We are not interested in making benefits. We just want to be break even. Of course, with benefits happened, it will be welcome. But in any case, it will be reinjected into the foundation” (Firm 5\_BMR, Senegal).

Lastly, agile-independent firms are engaged in moderate vaccine manufacturing despite the challenging institutional environment. Firms 1 (South Africa) and 3 (Nigeria) fell under this category. Although Firm 1 is a partnership between private and public institutions, the firm has been agile in adapting to the changing vaccine environment. Despite the delays from the government, the management demonstrated agility in advancing the vaccine manufacturing activities: “Despite the challenges and some discouraging events over the last 20 years, we have been like a dog with a bone concerning keeping focus and pushing ahead...” (Firm 1\_S&I, South Africa).

On the contrary, Firm 3 (Nigeria) is a privately owned enterprise with no government connection. Corporate and market logics dominance enabled Firm 3 to establish a subsidiary abroad and engage in R&D. The findings demonstrate that institutional logics shape vaccine engagement activities within the firms and their organizational forms.

## **5. Discussion**

We contribute to supply chain management research in several aspects, focusing on 1) identification of logics, 2) archetypes of vaccine manufacturing firms, 3) constellation of institutional logics, 4) contextual factors shaping the logics, and 5) a typology for end-to-end vaccine manufacturing.

### ***5.1. Institutional logics and end-to-end vaccine manufacturing***

Our study’s first contribution to the existing literature is revealing the logics influencing vaccine manufacturing in Africa. We also show how the different logics influence the different aspects of the vaccine value chain (see Table V). Our study found that the bureaucratic state, capitalist corporate, and market logics influence end-to-end vaccine manufacturing. The bureaucratic state manifests as slow, standardized, and inflexible business processes, practices, and policies. These logics result in slow progress in advancing R&D, drug substance manufacturing, and fill-and-finish. These findings align with those of Hesse *et al.* (2019) that bureaucracy, defined by a clear hierarchy of offices subject to strict discipline and control, is at the core of state-related logics.

**Table V.** Institutional logics and vaccine manufacturing value chain

Institutional logics and firms	Vaccine manufacturing process				
	R&D	Drug substance manufacturing	Fill-and-finish	Packing and labeling	Importation for distribution
State	The African regulators tend to adopt positions of external mature regulatory agencies, such as the Food and Drug Administration. The state has a weak impact on this stage.	The state has a moderate influence on this stage. Governments focus on equal access; the costly drug substance manufacturing may drive strategies towards the latter stages.	The regulatory authorities license the facilities where fill-and-finish are conducted for a specific product. The logics have a moderate influence on strategies to exploit this stage.	The state logics moderately influence this stage as local regulatory authorities usually have specific labeling requirements.	The government's welfare attitude and purpose of providing affordable vaccines to the population (social needs) dominate organizations exploring this value chain stage (supply chain).
Market	The ability to attract and retain expertise and collaboration with other entities is critical. The cost of R&D development may be derided by public funders making decisions on growth and development. This has a moderate impact on R&D.	The stage is technically challenging, requiring specialized expertise. Attracting and retaining skills is essential to exploit this stage successfully. The logics moderately influence firms to exploit this stage of the value chain.	The stage requires adherence to specific protocols but is less intense than the preceding two stages. Firms need efficient infrastructure and equipment to meet market needs. The logics have a moderate influence on this stage.	The stage is the least technical and does not require specialized skills, nor is it capital-intensive. Furthermore, this stage is often automated. As a result, labor, capital, and product market logics weakly influence this stage.	The stage is non-technical, does not require specialized skills, and requires less capital investment than the preceding stages. As a result, labor, capital, and product market logics weakly influence this stage.
Corporate	These logics have a dominant impact on R&D. The pursuit of innovative and patented products is due to possible higher returns on investment over an extended period (duration of the patent).	The logics have a moderate influence on this stage, as the exploitation of the stage is associated with increased revenues. The influence of the logics is seen in innovations, such as new bioreactors, which accommodate larger cell densities and reduce fixed costs.	Changing technologies, such as disposable blow-fill-seal, are increasing the utilization of facilities, reducing fixed costs, and increasing revenue. The corporate logic has a moderate impact on this stage, encouraging new technologies to increase revenue.	This stage is often the starting phase for firms undertaking reverse integration to build capacity. The logics moderately impact this stage and encourage automation to increase revenues.	Corporate logics have a weak influence on exploiting this stage, as the importation and distribution of vaccines are associated with low margins, especially for commodity vaccines.
Firms	Firms 1 and 3	Firm 5	Firms 1 and 5	Firms 1 and 5	Firms 1 and 4

**Note:** Firm 2 is in the process of re-engaging in vaccine manufacturing.

Capitalist corporate logics focus on the need to drive profitability by engaging in business-related practices, such as technology transfers, scale and strategic alliances, intellectual property, product formulation, and fill-and-finish parts of the vaccine manufacturing value chain. Drawing from the sustainability of supply chain management, which focuses on commercial and sustainability logics (Carmagnac *et al.*, 2023), corporate logics are responsible for a firm's profitability. The study demonstrates that profitability is one of the main challenges in African vaccine manufacturing. Consequently, the basis of these

profit strategies is anchored on expanding the scale and scope of products and diversification of organizations (Teixeira, 2017).

We found that market logics are associated with changing technologies and regulations, an increasing need to upgrade facilities, and decreasing government funding; the executives' decisions were increasingly guided by the need to increase an efficient product market and resource (labor and capital) acquisition, logics constituting the market order. Changing from state to corporate logics meant a shift in the market logics. In our case, it meant issues about accessing capital (the capital market), availability of labor (labor market), and competition in the product (product market). These issues were also identified in previous studies on the healthcare and financial industries (Thornton *et al.*, 2012).

We go beyond identifying the logics by demonstrating how they are interrelated or co-exist, work that still requires attention in supply chain management research (Annala *et al.*, 2019; Nath and Eweje, 2021). Welfare logics are the underlying driver of engagement in vaccine manufacturing. In the planning of the study, we did not anticipate that welfare logics would play a significant role in motivating firms to engage in vaccine manufacturing and executives to be hopeful under challenging circumstances. Welfare logics focus on engaging in humane activities for the well-being of society, as demonstrated by the firms' collective identity with the government's intention to introduce national vaccine programs. In guiding organizations' decision-making, our results suggest that the collective identity of welfare logics play a significant role in firms guided by the state and philanthropic organizations (Firms 2\_Nigeria, 4\_Morocco and 5\_Senegal) and a minor role where corporate logics are dominant (Firms 1\_South Africa and Firm 3\_Nigeria).

The explanation could be that in Firm 1 (South African) and 3 (Nigerian), the changing logics (welfarism to capitalism) shifted the main "issue" in market logics from product access (product market) to financial risk and sustainability (capital market). The shift is associated with changes in strategies toward the development of high-value products and investing in technology development. In contrast, the persistence of state logics in Senegal and Morocco implies that the firms are still concerned about access and less about financial risk. Their pursuit of philanthropic and government funding indicates that the capital market and corporate logics have less influence on their decisions to engage in end-to-end vaccine manufacturing.

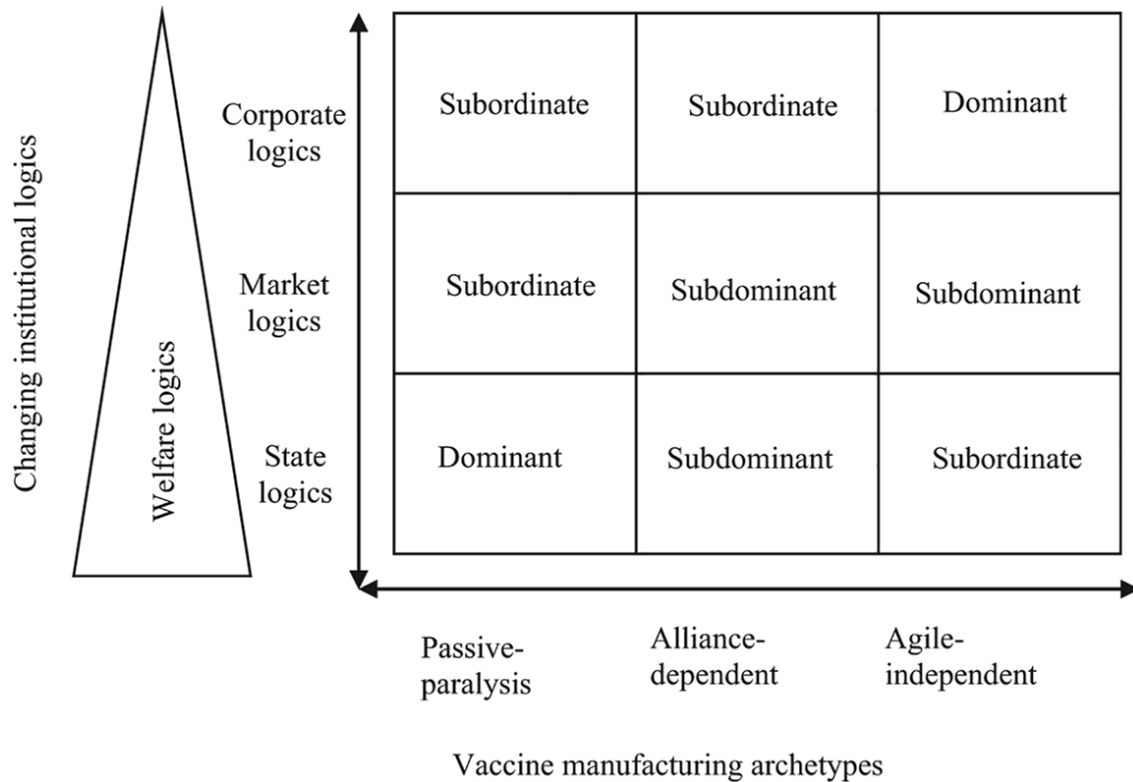
Like our findings, the collective identity was influential in state logics replacing medical professionalism in the U.S., as the employers and medical insurance organizations were all health buyers (Scott *et al.*, 2000). Collectively, they identified with the state, concerned about resources (reduced by the cost escalations) and social welfare (compromised by the

varied quality of service). Our findings show that welfare logics were so significant that even in cases where other actors participated in corrupt activities, they were not regarded as part of the collective. The findings reveal that the shunning of corruption by executives reflected that the greater good was more valuable than individual gain. We add to supply chain and management research the significance of welfare logics as integrating logics that ensure firms' missions are pursued despite the corrupt environments (Wilkins and Emik, 2021; Xheneti and Bartlett, 2012).

### ***5.2. Institutional logics and archetypes of vaccine manufacturing firms***

Our second contribution to supply chain literature demonstrates the dominance of the institutional logics and how they shape the archetypes of vaccine manufacturing firms. We distinguish the relevance of the logics as dominant (strong), subdominant (moderate), and subordinate (weak) in guiding behavior (Goodrick and Reay, 2011). Dominant logics guides behavior, while subdominant guides to a certain extent/moderately, and subordinate has the weakest influence (See Figure IV).

We have found that in conditions of constant change in government, firms dependent on government have passive paralysis that slows the progress of vaccine manufacturing. Firm 2 in Nigeria had passive-paralysis, demonstrated by slow growth in developing vaccine manufacturing facilities followed by complete stoppage. Our data demonstrates that managers reported "politics" as one of the contributing factors. As noted by Hesse *et al.* (2019), politics is seen as "verbal, symbolic, or substantive action of political actors on the individual or organizational levels (parties)" and is part of state logics (p. 690). This means state logics dominate passive-paralysis firms, while corporate and market logics are subordinate.



**Source(s):** Authors own creation

**Figure IV.** Institutional logics dominance and vaccine manufacturing archetypes

Since it is known that the institutional environment in Africa is weak (Nachum *et al.*, 2023), our findings show that some thriving firms are alliance-dependent between a philanthropic MNC and the state. The MNC’s resources, networks, and support help local firms deal with local challenges. In alliance-dependent, the state and market logics are subdominant, thus having equal significance. Additionally, the welfare logics drives the partnership between the state and multinational philanthropic firms. Firms’ welfare logics build on the emerging sustainability supply chain discourse on the socio-economic logics co-located in economic and social mechanisms (McLoughlin and Meehan, 2021). As seen with Firm 5, profits are reinvested into the firm to enhance welfare logics (e.g., Annala *et al.*, 2019). These findings suggest that the integratory role of welfare logics in state, market, and corporate logics could enhance our understanding of sustainable vaccine manufacturing in Africa.

Still on alliance-dependent firms, the study demonstrates how partnerships with MNCs from developed countries can influence institutional logics within the host countries. Drawing insights from international business studies, stable institutions in developed countries and parent firms contribute to the stability of their subsidiaries in less-developed contexts (Kim *et*

*al.*, 2018; Kostova *et al.*, 2008). This concept is known as institutional duality, where the practices of a subsidiary are shaped by the parent firm and MNCs, and the institutional environment in the host country (Hillman and Wan, 2005). While this study did not focus on the international business aspect of supply chain management, the findings demonstrate an opportunity to explore the role of vaccine manufacturing MNCs in shaping the institutional logics of their host countries.

While other firms depend on partnerships for survival, the study shows that institutional logics influence agile-independent firms, represented by Firms 1 and 3. The findings demonstrate that corporate logics, followed by market logics, are the drivers of firms' agility despite the challenging institutional environment. For example, collective identity with MNCs supplying innovative high-value vaccines was influential for Firm 1's technology transfer agreement with these MNCs, and Firm 1 and 3 strategies for internationalization. These findings show that these firms' priorities are not state logics, but corporate and market logics. In other words, state logics are subordinate.

By exploring institutional logics and their influence on manufacturing firm archetypes, we can see that these logics co-exist or are in constellations. Our study contributes by demonstrating three prominent constellations of institutional logics. The first is when there is one dominant logic and two non-dominant logics. In this study, passive-paralysis firms are influenced by state logics, while corporate and market logics are subordinate. In agile-independent firms, corporate logics are dominant, market logics are subdominant, and state logics are subordinate. The second constellation is where the two main logics are subdominant, and the last is subordinate. An example of this constellation is with alliance-dependent firms, where state and market logics are subdominant, and corporate logics are subordinate.

The last constellation is about the role of integratory logics – in this study identified as welfare logics – in creating collective identity among vaccine manufacturing firms. Welfare logics dominate firms with state logics and those supported by multinational philanthropic organizations. Where corporate logics dominate, there is a limited appreciation of welfare logics. Therefore, our findings provide insights that not only identify the logics but also reveal the kind of constellations that differ based on the region and type of firm. Although these logics have varying levels of dominance, they are not mutually exclusive; there are different combinations of institutional logics in the regions of vaccine manufacturing (Annala *et al.*, 2019; Carmagnac *et al.*, 2023; Scott *et al.*, 2000).

### ***5.3. Contextual factors shaping institutional logics***

Our next contribution to supply chain management literature focuses on the call to explore the role of context in shaping institutional logics (Hesse *et al.*, 2019). In this study, the context elements that influenced the institutional logics and the firms' engagement in vaccine manufacturing included historical events, technological changes, and the COVID-19 pandemic. Our findings on colonization address the call by Paiva *et al.* (2024) to use historical accounts, such as colonial history, to understand supply chain management better. We used the African context to demonstrate how the historical legacies of colonization shaped vaccine manufacturing activities. The persistent role of institutions from the colonial era impacted vaccine manufacturers' ability to engage in the value chain. We found that state logics guided decision-making in the vaccine manufacturing pre- and immediate post-colonial period and continues to co-dominate presently.

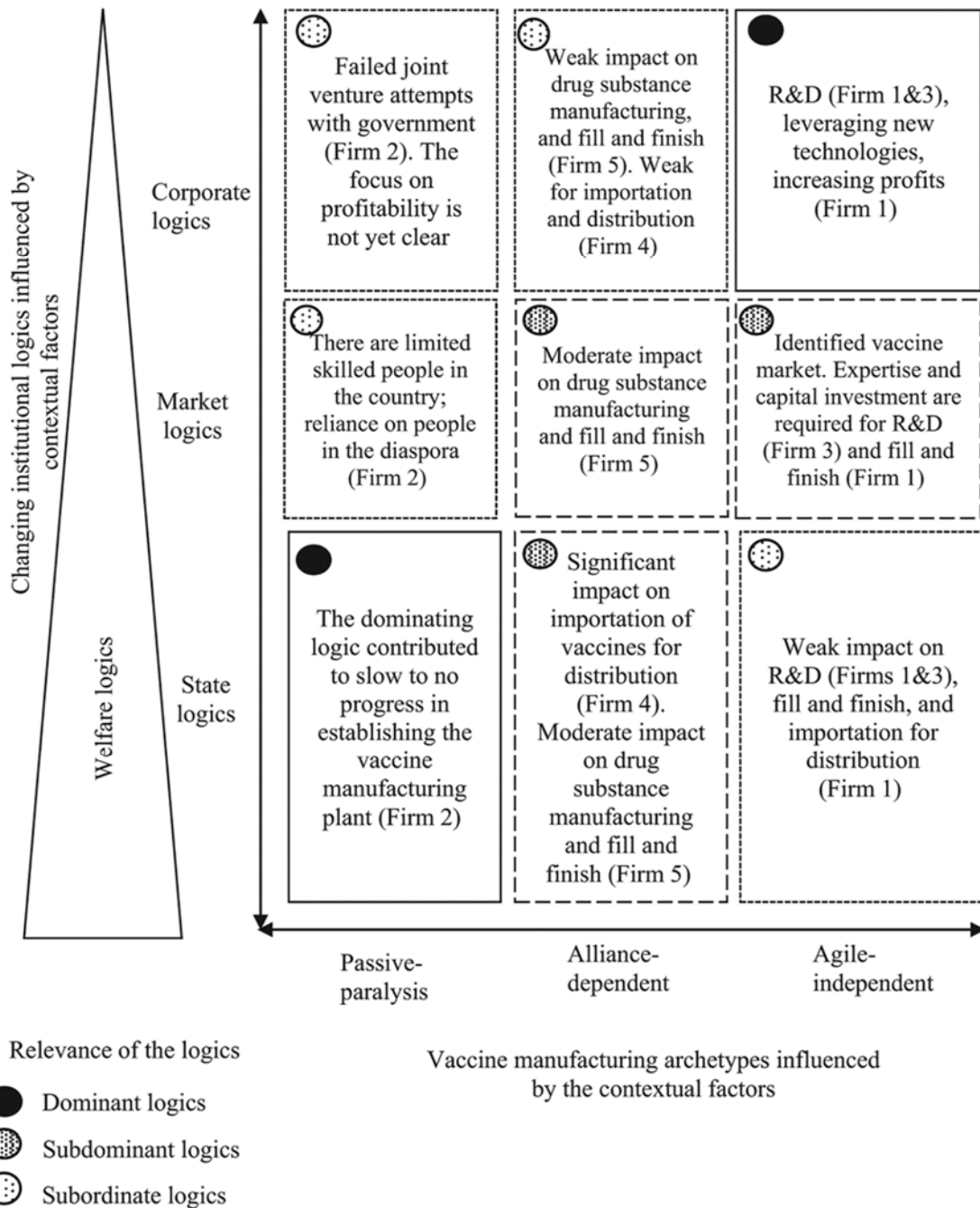
Regarding technological changes, our findings suggest that changing technologies and the dawn of GMP, which increased the cost of manufacturing while reducing returns, resulted in the institutional change from state to the combined "domination" of corporate, market, and state logics. Our observations are consistent with those previously reported in healthcare in Canada, where increasing costs of care and declining quality of service resulted in the emergence of corporate ("business-like") and market as co-dominant logics (Reay and Hinings, 2005).

Lastly, the findings demonstrate that the COVID-19 pandemic revived the interest to manufacture vaccines in Africa. Senegal had already started manufacturing COVID-19 vaccines. Executives emphasized that the pandemic ignited the desire for made-in-Africa vaccines. A recent study conducted in Ghana demonstrated a strong preference for vaccines made in Ghana by Ghanaian scientists (Adongo *et al.*, 2023). While the made-in-Africa narrative is on the rise, the executives cautioned that localized manufacturing would require the integration of multiple actors within and beyond their countries and regions.

### ***5.4. Institutional logics and end-to-end vaccine manufacturing typology***

Using the executives' interpretations of institutional logics, we developed a typology (see Figure V) that contributes to supply chain management research, especially vaccine manufacturing. The typology demonstrates that the dynamic context changes the institutional logics: state, market, and corporate. These logics are underpinned by welfare logics, which promote social good. Our study shows that the three logics are not in isolation, but can form constellations of logics depending on the various aspects of vaccine manufacturing firms and

their value chains. We demonstrate that dominance of stage logics led to passive-paralysis firms, while dominant corporate logics were seen in agile-independent firms. Firms that relied on partnerships were regarded as alliance-dependent. As expressed by the executives, dominant logics co-exist with other logics, such as labeled subdominant and subordinate logics. For example, corporate logics in agile-independent firms co-exist with subdominant market and subordinate state logics.



Source(s): Authors own creation

Figure V. Institutional logics and end-to-end vaccine manufacturing typology



Regarding the value chain, the findings demonstrate that institutional logics influence the value chain processes, R&D, drug substance manufacturing, fill-and-finish, and importation for distribution differently. The impact thereof can be classified as weak, moderate, and strong. We demonstrate how state logics contribute to the slow progress of vaccine manufacturing in passive-paralysis firms and how corporate and market logics were considered weak. In alliance-dependent firms, state and market logics have a moderate but positive impact on drug substance manufacturing, fill-and-finish, and importation of vaccines. Firms considered agile-independent have dominant corporate logics influencing profitability by engaging R&D, drug substance manufacturing, and fill-and-finish. These changes are influenced by contextual factors, such as historical events, technology, and the pandemic. In sum, the study demonstrates the varying dimensions and constellations of institutional logics in end-to-end vaccine manufacturing.

## **6. Conclusion**

This study sought to determine how institutions influence end-to-end vaccine manufacturing in selected African firms. Notably, the cases used in this study provided an understanding of the types of institutional logics and how they impact the different aspects of the manufacturing value chain. Additionally, the logics influenced the archetypes of the manufacturing firms. Lastly, the findings demonstrated the role of context in shaping institutional logics.

### ***6.1. Implications for business practice, policy, and society***

*Practice implications.* Several industry initiatives to facilitate the expansion of vaccine manufacturing capacities in Africa were developed and implemented with little success. Some of these initiatives compounded the public health focus and the manufacturing focus. This reflected the ancient approach when vaccine manufacturing and philanthropy co-existed, activities guided by the state logics (or can use the word welfarism). Our study demonstrated that combining other logics could help advance vaccine manufacturing. However, the findings demonstrate that dominant corporate logics, supported by market and, to some extent, state logics, contribute significantly to vaccine manufacturing and its sustainability. Decision-makers in state entities and corporates should consider the combinations of logics that influence the vaccine value chain.

*Policy implications.* Our findings revealed that the dominance of the institutional logics is not the same across the different countries. Since other countries are performing well in other institutional logics, there should be a mechanism enabling knowledge transfer and sharing good

practices across the African continent. In this manner, policymakers could leverage the regional intellectual capital when designing their local policies.

In addition, the government policy initiatives, such as the incentives designed to facilitate local vaccine manufacturing, must be aligned with the dominating institutions. For instance, in countries where corporate and market logics are dominant, incentives like tax breaks and rebates for local manufacturing should be aligned with policies encouraging the procurement of innovative products on the market instead of the cheapest option available.

*Societal implications:* The findings revealed that the dominance of institutional logics has implications on the welfare logics, which is about access to vaccines and promoting the well-being of individuals. Therefore, firms and government organizations should work together to enhance the welfare logic to benefit society and its citizens.

### ***6.2. Limitations and suggestions for future research***

First, the study focuses on key individuals in selected firms and countries. There is a need to conduct comprehensive research on vaccine manufacturing involving other external stakeholders, such as the government, foreign MNCs, and international bodies. It would be interesting to discover how the institutional duality of MNCs serves as an advantage in vaccine manufacturing and how MNCs use the advantage to change the institutional logics in the host country. Such studies could be longitudinal, aiming to document how institutional logics change over time. Second, this study attempted to limit the institutions to country-level institutions. However, the world has become a global village, especially in healthcare, where institutions in another country may influence organizations in yet another country. Consequently, it is essential to understand the mechanisms involved, if any, in one country's institutions causing a change in another country's institutions.

Third, we observed blurred lines between the direct or indirect influence of international bodies on vaccine manufacturing firms through governments. Further research may explain the comparative roles of the government and international entities in vaccine manufacturing. Fourth, the type of dominant logics in the biopharmaceutical industry was also related to the size of the economy, with corporate logics being dominant in the two largest economies in Africa. Further research is needed to explore how a country's economic status influences executives' interpretation of logics. Finally, future research could focus on the non-dominant (subdominant and subordinate) logics' influence on institutional changes. The study did not detail the conditions that influence the conflicting and complementary logics in end-to-end vaccine manufacturing. Therefore, future research should explore those conditions. Moreover, the research could focus on how firms cope or respond to the different institutional logics.

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## APPENDIX A

**Table A.1.** Interview guide

<b>Interview Theme</b>	<b>Interview Questions</b>	<b>Supporting Literature</b>
Vaccine manufacturing value chain	<ul style="list-style-type: none"> <li>• Why does the firm engage in vaccine manufacturing activities?</li> <li>• Which part of the vaccine manufacturing value chain is the firm engaging?</li> </ul>	Ekström et al. (2021); Hatchet et al. (2021); Usman and Ovadia (2021)
Institutional factors and vaccine manufacturing	<ul style="list-style-type: none"> <li>• What constraining institutional factors influenced the progression through the vaccine manufacturing value chain?</li> <li>• What enabling institutional factors influenced the progression through the vaccine manufacturing value chain?</li> </ul>	Annals et al. (2019); Hesse et al. (2019); Pullman et al. (2018)
Changes in institutional factors and vaccine manufacturing	<ul style="list-style-type: none"> <li>• What and how have the institutional factors influencing the engagement of the value chain changed?</li> <li>• How has that change in the institutional factors influenced the engagement in the vaccine manufacturing value chain?</li> </ul>	Goodrick and Reay (2011); Hesse et al. (2019); Saldanha et al. (2015)

**Table A.2.** Interview data on vaccine manufacturing activities

Firm and Case	Why does the firm engage in vaccine development activities?	Which part of the vaccine development value chain is the firm exploiting?	Exemplary quotations
Firm 1_South Africa	Firm is engaged in low-volume products with high value to increase profitability. The motive is to internationalize for profitability.	The firm is engaged in R&D, formulation, packaging, filling, quality control, distribution, and technology transfers.	“Despite the challenges and some discouraging events over the last 20 years, we have been like a dog with a bone concerning keeping focus and pushing ahead” (Firm 1_S&I).
Firm 2_Nigeria	The growing population is the main reason for the intention to manufacturer vaccines.	The firm is not engaged in any vaccine manufacturing processes. Vaccine manufacturing was stopped for facility upgrades.	“Nigeria currently has 7 million babies annually and our mandate is to ensure that you know we’re going to make those expanded program on immunization (EPI) vaccines locally” (Firm 2_COO).
Firm 3_Nigeria	The company is driven by a need to be profitable. The company seeks to find solutions that are specific to the African diseases.	The firm is in the process of establishing forward integration. R&D for vaccine development are the core business activities.	“So now we have couple of IPs [intellectual property] and then we are also licensed.” (Firm 3_CEO).
Firm 4_Morocco	The increasing population and childbirths drive vaccine development.	The firm is engaged in training, technology transfers, and manufacturing until the final product and quality control. Fill-and-finish are completed by a subcontractor.	“Until now, we start just manufacturing of COVID-19 vaccine. But for other vaccines, all other vaccines they are imported” (Firm 4_ED).
Firm 5_Senegal	The company’s decision is driven by the social impact of saving and protecting lives more than the need to generate profits. Generated profits are reinvested into the business.	The firm manufactures vaccines, but they are sold to international organizations and governments. More recently, the firm is producing the COVID-19 vaccine.	“We are not interested in making benefits. We just want to be break even. Of course, with benefits happened, it will be welcome. But in any case, it will be reinjected into the foundation” (Firm 5_BMR).

**Table A.2 cont.** Interview data on institutions and vaccine manufacturing

Firm and Case	What constraining factors influenced the progression through the vaccine development value chain or lack thereof?	What enabling factors influenced the progression through the vaccine development value chain?	Exemplary quotations
Firm 1_South Africa	Changing the organizational structure to PPP, the cost of upgrading the facilities, lack of funding/risk capital, funders pulling out, challenges finding experts, regulations, and the bureaucratic nature of government.	Privately raised funds, access to intellectual capital, reliance on technology transfer partners, using the latest technologies and facilities, passed quality assessments, clearly defined operational strategies, and positioning in the African vaccine market.	“It became a challenge in that the government was very slow in making decisions, very slow in signing documents off...” (Firm 1_BC).
Firm 2_Nigeria	Changing the organizational structure to PPP, infrastructural challenges, pressures from the international regulatory organizations, political leadership challenges, lack of latest technologies, and self-interest.	There is talent in the diaspora to help develop local manufacturing activities, making do with the limited equipment and seeking technology transfer partners.	“It’s not because we don’t have; the people can produce it. That is like the money is going out of their pocket and would rather you jeopardize it so that we continue importing” (Firm 2_BC).
Firm 3_Nigeria	Access to funding is a challenge, competition with international vaccine manufacturers, limited commercial funding, regulatory problems, government taking time to implement, and logistics issues.	Good relationships with the regulators, technical expertise, international partnerships, personal funding, research grants, own intellectual property for two vaccines, local and international reputation, and resilience.	“Getting things done is very difficult in this part of the country or the world where you must do everything with your personal funding. So, it has been tough. And if you have the right calling, you come back again and continue” (Firm 3_CC).
Firm 4_Morocco	Expensive manufacturing costs, the government set the priority areas for the firm compromising autonomy, need to leverage the new technologies, and need funding to expand manufacturing activities.	Collaboration with other international partners through the alliance firm, the Government’s/King’s support, fraud control, and joint funding for projects.	“In Morocco, this is the King’s decision. If this is something designed by the first minister or by the King, the minister must follow them. This is strategic” (Firm 4_RD).
Firm 5_Senegal	Human resource required establishing the market is inadequate, selling vaccines to one customer, and not well integrated with other firms in regions.	The structure of non-profit orientation is an advantage for support from international philanthropic associations and the local government.	“We want [to] get it [manufacturing] going and then we want to share or cut and paste and support all the other regions” (Firm 5_BD).

**Table A.2 cont.** Interview data on changing institutions and vaccine manufacturing

Firm and Case	What and how have factors influencing the exploitation of the value chain changed?	How has that change in the factors influenced the exploitation of the value development value chain?	Exemplary quotations
Firm 1_South Africa	WHO's recommendations resulted in facility upgrades and privatization. Decline in manufacturing was influenced by apartheid government not investing in state-owned enterprises when the country was nearing the democratic era, and COVID-19 driving the need to manufacture.	Stronger regulations, although a bit stringent, improvement of facilities, formation of PPPs for vaccine manufacturing, and introduction of preferential procurement to empower previously disadvantaged individuals and companies.	"South Africa stopped because the apartheid government, let me say, they stopped investing, South Africa had state-owned enterprise. I think that's first and foremost means that a lot of funding was coming from the state" (Firm 1_CEO).
Firm 2_Nigeria	Changing (new) government appointments contributed to the change in the organizational form, failing joint venture activities, political challenges, and government losing interest in vaccine manufacturing.	Changes in governments caused the cessation of vaccine manufacturing activities, delayed funding and facility development, and a lack of continuity of the existing projects.	"Each time a new military government came, they abandoned everything the other one has done. That is what happened to the vaccine production" (Firm 2_COO).
Firm 3_Nigeria	COVID-19 and the new government's focus on local manufacturing.	In the process of executing the fill-and-finish manufacturing. The company has secured international and local partnerships.	"COVID-19 catalyzed the whole thing because it's a pandemic... and then we capitalize on that to make sure that we build the vaccine manufacturing facility of the 21st century in Nigeria" (Firm 3_CEO).
Firm 4_Morocco	Limited to no government changes that could have had a significant impact on vaccine manufacturing. Changing the business model to PPP. COVID-19 influenced the institutional changes to produce the COVID-19 vaccine.	No significant change in the institutional logics that had a negative impact on manufacturing vaccines. COVID-19 reignited the goal to manufacture own vaccines. The partnership with international organizations helps to buffer the local challenges.	"As you see, the COVID-19 has increased this idea to manufacture or develop a vaccine" (Firm 4_RD).
Firm 5_Senegal	WHO regulations influenced the change in manufacturing practices. Government changing priorities because of the COVID-19 pandemic. Changed the organizational structure to NPO.	Improved processes, quality management systems, technologies, and collaborations. Better access to funding is due to the firm's social orientation.	"I think there's always a need to improve the process, and right now we're moving again, we're going from manual low-volume processes to automated large manufacturing lines in the new facility" (Firm 5_Strat).