

**Agrifood Value Chains:
Concepts, Axes of Transformation,
illustrations**

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Overview of Talks: 20 Feb

- 1) Concept of the Value Chain (VC), “fish image”, as cluster of VCs with dendritic structure
- 2) Evolution of research approaches
- 3) Axes of VC transformation: structure, conduct/behavior, performance
... presented in structure of VC typology (traditional, transitional, modern)
- 4) Examples of transformation of VCs: fish (Asia/US), chicken (US) potatoes (India, US), dairy (Brazil), chicken (US)

21 Feb.

- 1) “homework” Nigeria poultry/eggs VC, group discussion case based on analysis approach
- 2) Research questions (for methods application)
... linking policy issues (testing conventional wisdom assumptions...) with research questions/hypotheses
- 3) Testing hypotheses & Myth busting... with cereals example (from stacked survey) as motivation for stacked survey approach

- 4) Rapid reconnaissance/meso study
- 5) Stacked surveys/ micro study
- 6) Conclusions and way forward

1. VC concept

Picture a fish in your mind.



- a) VC composed of principal “spine” of segments
 - b) Each segment of which supplied by input VCs (intermediate inputs & factor inputs)
 - c) And input segments supplied by (1) factor supply chains/markets; (2) intermediate inputs
 - d) Overall “dendritic structure”
 - e) Policy issues linked to both of the above
- ... example from Bangladesh

2. March of the literature

2.1. General march from “meso-economics” to “micro-economics” to “business strategy economics”

a) Meso analysis: “Structure-Conduct-Performance”

... structure: industrial organization like spatial layout and concentration of VC

... conduct: technology, institutions (contracts, standards), organization (procurement, marketing structures)

... performance (income distribution over segments and within segments, profitability, efficiency)

b) Micro analysis

... choice of technologies by actors

... choice of institutions by actors to coordinate marketing and procurement

... choice of organization

... “integrative analysis”: innovator choosing how to “implement” innovation to stay “middleman” (volume, make/buy, technology/institutions/organization)

2.2. (Evolution of) VC Analysis perspectives crossed with “issues”

2.2.1. Traditional: typology plus mapping cost and value added and costs across segments, space, actors; link to PAM

2.2.2. VC Management: Porter, commodity/“engineering” SC to VC (product cycle & standards/attributes evolution)

... example (is 2.2.1. but differentiation by “type” of given product)

2.2.3. NIE: choice of institutions & organizational forms as coordinating mechanisms; function of TCs

➔ Micro: choice of mechanisms by actors (e.g.)

➔ Meso evolution of A-system (spot), B-System (spot or VI/hierarchy) or C-system (VI/hierarchy or networks) (discussed next)

EXTENSION: Global VC – power relations – Lead Firm + standard/VA (rents) + choice of coordination mechanism (link to NIE) ➔ rent (profits) distribution along VC segments (and intra-segment strata)

2.2.4. Network/netchain analysis: clustering/de-clustering, networks/functional fragmentation and “flexible specialization”

... study of formation of clusters & inter-actor relations (conditioners)

2.2.5.a. Per segment (and over scales hence inter-actor differentiation) micro and meso determinants and evolution: analysis of micro

- a) technology choice,
- b) market channel choice,
- c) procurement system choice

2.2.5.b. Upgrading as Investment functions bundling technology + VA/attribute choices

i) (Micro)Investment function

ii. (Meso) investment function

iii. Links of upgrading in VCs with investment functions (and poverty traps, or kinks in investment functions)

... and links back to micro and meso constraints)

2.2.5a. And 2.2.5b (micro)_ aggregate to meso structure/conduct/performance

... study shocks of policy change, non policy change via those to test and explain change via micro foundations inter-actor inter-temporal

2.2.6. Integrative “innovator business strategy” micro analysis: in era of rapid innovation and competition

... example of fast food chain as innovation

... example of Tyson’s with cut chicken

3. Structure & Conduct/Behavior based typology of VCs with transformation

3.1. Columns as typology of VCs

- a) “A-System” (local/traditional and traditional rural-urban VC)
- b) B-system (transitional rural-urban VC)
- c) C-system (modern rural urban and international VC)
- d) SUB COLUMNS are segments of VC and “overall”

3.2. VC typology based on structure,

ROWS

a) Commercial orientation, distribution of VA & leadership

- **spatially:** short to long
- **Product Cycle/VA:** niche to commodity to differentiated (commercial) product
- **Product composition:** types of product linked to product cycle

- **“Lead Firm” (a la Gereffi):** upstream or midstream or downstream “led”
- **Distribution of VA over segments and over sub-strata in segment:** upstream to downstream, **socioeconomic;**
- **... also structural: Share of post-farmgate –** small to large
- **Capital ownership:** domestic to regional to global; investment dynamics

b) Structural

- **Geographic length:** short to long
- **Intermediational length:** monotonic: many hands to few hands/direct sale/direct buy (**or U or J curve**); Tanzania maize vs hortic.
- **Share of post farmgate in total VA**
- **Per segment consolidation:** fragmented to consolidated
- **Netchain/network/clustering:** no cluster, clustered, de-clustered, networked clusters

c) Conduct: Technological

- **Scale of firm:** from small to big
- **Capital/labor ratio of firms:** from low to high
(and vintage & type change: hammer to roller mill)
- **Asset specificity:** from low to high
- **Labor skill:** from low to high
- **Productive capital attributes** (transferred vs indigenous etc.)

d) Institutional & Organizational

- **Market organization:** spot to coordinated to VI
- **Vertical integration (or “functional fragmentation”):** fragmented to linked
- **Horizontal integration:** individual to horizontal linkage (coops, clusters)
- **d) Procurement system change by buying firms:** distribution centers/centralized, & specialized/dedicated wholesalers/agents

- **Inter-firm institution/contracts:** spot to contracts (verbal to written)
- **inter-segment VC finance (tied, not tied)**
- **Inter-segment institution/standards existence, setter, and type (e.g. public standards; vs Globalgap horticulture product standards)**
- **Diffusion of brands (plus packaging)**

3.3. Axes of VC transformation: performance (changes)

- a) Value added distribution over segments
(example of quality rice in Bangladesh)**
- b) Distribution of participation: Exclusion and
inclusion by asset or zone**
- c) Variability/risk of supply and prices**
- d) Vulnerability/climate/food safety**
- e) Income and employment impact on
“producers” (upstream and midstream)**
- f) Price/access and nutrition impacts on
consumers**

4. Illustrations of rapid change

4.1. Fish VC transformation: historical view US, Europe

... and growing demand “shock” to Asia fish supply

a) Local fish capture US & Europe, 1400s-1700s

b) 1400s-1600's: emergence of extremely valuable niche into Western Europe (dried/salted, "bacalao")

c) 1700s/1800s: "Cape Cod": US emerges to compete with Iceland with Atlantic coast cod (dried/salted, sold in Europe & US/Americas)

... commoditization phase 1: main fish consumed in US 1800s-mid 1900s

d) Commoditization phase 2: “Industrialization” of cod

... 1929 in UK with “plate froster” (first quick freezer); food frozen in slim rectangle slabs

... rise of processed “fish sticks/fingers”

1950s/1960s UK, US (cocktail sauce/ketchup/tartar sauce)

... CHEAP; children liked; no bones; just heat (convenience food)

... incomes, women entering workforce, eat at school

**... Important channel of food innovation is via
“food service” sector (fast food fish)
(incomes, women entering workforce)**

e) 2 phases of commodization → Extreme over-fishing/near disappearance of Atlantic cod:
1970s-present

f) 1970s-present, sudden huge shift in US fish/seafood consumption source:

f.1) rise of fish-farming: 50% from aquaculture, 50% from capture

f.2) 91% of US consumption of fish/seafood is imported by 2011

f.3) Emergence of “differentiated products”

... **first safety of commodity** (HACCP certified)

... **quality** (“sushi grade”) (consumers wanting to move beyond commodity breaded products)

... **sustainability label** (consumer reaction against over-fishing)

... **“labor standards”** (consumer reaction against fish boat slavery for example in Thailand) (**social audits**)

... **“local catch”** (in some areas)

... **issue of scaling up**

g) Rise to preponderance of Asian aquaculture in US consumption:

... **shrimp ranked #1**, most of it **from Asian aquaculture** (shrimp was tiny NICHE, now cheap commodity)

... imported Asian shrimp pushes out US oysters ---
to make “shrimp cocktails” (appetizer/dish
introduced by chefs in US and UK, 1960s-1980s)
... now US per capita in 2010 of shrimp = US per
capita of oysters in 1910

... **canned tuna (Thailand) & salmon (aquaculture Chile (introduced from Norway; after over-fishing..)** #2, #3 (used to be Atlantic cod)

... **Pacific Pollock/Alaskan Walleye** (processed into fillet o' fish) (used to be Atlantic cod)

... **Asian (aquaculture) tilapia & catfish (pangasius)**

#4, #5 (used to be Atlantic cod)

... **takes us to Asian aquaculture supply chain
development next**

4.2. Asian Supply and Demand evolution

a) Two drivers of extremely fast growth of Asian aquaculture (and shift from capture)

- **Huge US market growing fast → export market → spurring initial transformation from traditional supply chain**
- **Then huge Asian domestic urban market (extremely fast urbanization (3/4 of fish in domestic market go to urban), income) → second phase of transformation**

b) Links: export base then domestic market explosion (niche to commodity to differentiated)

... Guangdong China case (to US, then to Beijing)

... **with freezing & fast food steps**, local innovations (as in US)

... **food habits are CHANGEABLE!**

c) Product cycle innovation: Shift from local niche carp & tiger shrimp to the “big three” commodity species

→ ... Asian Tilapia (African fish introduced to Asia); super fast grower

→ Replaced also with Asian Pangasius-catfish
(fast grower & breathes air so can grow
densely)

Pacific White Shrimp: grows densely
(volumetrically not on bottom)

c) Asian aquaculture technology change

- fish/shrimp open-water (and rice fields) capture...
- to vast spread of aquaculture (ponds)
... from traditional/extensive (no feed)
... to semi-intensive (feed)
... to capital-intensive (feed, aerators/pumps, hatcheries)
... plus medicines for growing need for disease control

Semi-traditional Shrimp farm Vietnam

Modernizing traditional shrimp farm

Java

Introduction of feed

Aerators for intensification

Fertilizer for ponds (for phytoplankton
then zooplankton growth)

Larvae hatchery development

Vannamei for volumetric production

Intensive huge shrimp farm Indonesia
(CP has largest in world there)

Netting stock on Java

Grading shrimp for market, Java

Investment in ice plants

Holding area shrimp on ice

Loading iced-shrimp in trucks Indonesia

River iced-transport of shrimp/fish to
packers Vietnam

Shrimp and Canned Tuna Industries – packing Thailand

Fish wholesale in southern China 60 years ago

Today: Largest shrimp
wholesale market in world south
China

Local supermarket sale Java

d) Rapid rise of fish feed industry in Asia

- Shift from local feed SME
- **to clusters of large-scale mills** (often extension of chicken feed mills)

(Nigeria case, 600%!)

- **To FDI in fish feed** (New Hope (China) to Bangladesh), regional multinational
- **Rise of value chain financing from feed mills to farmers as “new technology”**
- **Big demand for maize, soy, peanut cake, fish meal** → accelerates ingredient market development (US exports to)

e) Vertical integration (ponds (own or outgrowers), feed, marketing)

- **For production and supply chain control given the US/Europe/Japan attribute demand (private standards, certification**

... to meet contracts with consolidated demand side (large supermarkets and food service firms, e.g. Sysco)

f) “Translation” to our VC analysis framework of Asian (note: Nigeria as transitional stage..) fish VC

f.1) Traditional transformation

- Structure: short + fragmented + backyard
- Technology: capture then pond + no feed
- Product orientation, product cycle: niche, local
- Market orientation: local, backyard, subsistence
- Performance: seasonal, expensive

f.2) transitional

- Structure: longer, town, fragmented + backyard plus commercial
- Feed industry emerging, fragmented
- Technology: pond & simple assembled feed, sinking
- Product orientation: commodity, exotic (tilapia, catfish)
- Market orientation: city, semi-subsistence to commercial
- Performance: cheap, low seasonal

f.3) modernizing

- Structure: long, country integrated, many backyard but dominant commercial
- Feed industry consolidating, FDI
- Technology: pond & concentrated/differentiated feed, floating
- Product orientation: commodity plus new wave capture introduction pond
- Market orientation: city, inter-regional, commercial, food safety
- Performance: cheap, low seasonal

4.3 Potatoes in Agra India: The Cold-Stored Potato Revolution in Western Uttar Pradesh, India

CONFLUENCE

... urban demand

... diet change

... Road

... electricity

... cold storage

... farm product and technology change

a) First wave of public investment & first wave of potato farming development in late 1980s-early 1990s

- Farmers shift from wheat to potato
- Public investment: NARS research & extension of new potato variety (higher yield, longer storage life, more resistant to transport)
- Public investment: water pump subsidies
- Encouraged by initial growth in Delhi economy

b) Rapid Urbanization as “demand pull”

- **Rapid growth in Delhi’s** population and incomes in the 1990s/2000s (linked to economic liberalization and public investment in city infrastructure)
- **“diffusion” of urbanization effect** in rural space: large public investment in **rural roads**
- **Diet diversification** into horticultural products in urban areas

c) Rise of the Rural nonfarm sector

- **Rural nonfarm sector development** especially fast and intense in the “market-shed” of Delhi
- **Drives up farm and nonfarm wages**
- **Fuels private investment** in all segments of the supply chain

d) Second wave of public investments in rural areas

- Public investment in **energy grid**
- Public investment in **limited subsidies for modern cold storages**

e) Modern Cold Storage Boom in 2000s

- Massive private investment in cold storages starting in mid/late 1990s
- ... crescendo over the 2000s
- b) Shifting potato from seasonal consumption in Delhi to nearly-year round (2/3 from cold store)

f) Second wave of potato farm
development: capital-led
intensification in second half 2000s

- capital-led intensification
- Land concentration (rental and purchase)

g) US case

- Same as above... and
- 1920s/30s Individual Quick Frozen technology for small
- “atlantic” potato variety
- 1950s/60s deep pressure fryer (KFC too)
- From baked potato home, night
- now to french fries via fast food
- Same happened fish sticks, chicken nuggets
- Totally changed consumption habits

4.4. Fast-tracking technology change: services VC evolution

“outsourced” mobile services for rice and mango farmers

a) mobile combine harvest/threshing services (US, China, Burma)

b) mobile “sprayer-trader” teams in Indonesia (“one stop shop” for mango farmers); seedling VC too

c) Chi Farms & Farm Support (poultry Ibadan)

4.5. US chicken (mirrors Nigeria traditional & transitional & emerging modern)

a) Traditional

- Structure: short + fragmented + backyard
- Technology: capture then backyard + no feed
- Product orientation, product cycle: niche, local
- Market orientation: local, backyard, subsistence
- Performance: seasonal, expensive

b) transitional

- Structure: longer, town, fragmented + backyard plus commercial, PERI-URBAN
- Feed industry emerging, fragmented
- Technology: small farm & simple assembled feed, no medicines
- Product orientation: commodity
- Market orientation: city, semi-subsistence to commercial
- Performance: cheap, low seasonal

b) modern

- Structure: long, country integrated, dominant commercial, NOT PERI-URBAN
- Feed industry consolidated
- Technology: outgrower and large, concentrated/differentiated feed

- Logistics change: train, water-logged
- New breed, contracts
- Market orientation: city, inter-regional, commercial, food safety,
- supermarket super cheap mass purchases and sale
- IQF, deep fry, disassembled, frozen (non traditional)
- Performance: cheap, fast food

→ CONFLUENCE, FAST JUMP

... super-modularity example from US chicken