

Niche development and upgrading in the PV value chain:

The case of local assembly of PV panels in Senegal.

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Local assembly of PV panels - high priority in Africa

Political priority

- "Aligned with the African Union's Agenda 2063, *African governments need to develop an industrial strategy for scaling up renewables.*"
- "*Governments should give consideration to reducing import duties, while supporting the development of an African renewables sector through domestic and foreign investment.*"
- "African governments should actively engage with *potential investors in manufacturing solar panels, wind turbines, and other renewable technologies*"

Local PV assembly plants established

- Tunisia 2010, 2012, 2013, 2014
- Kenya 2011
- Senegal 2011
- South Africa 2011 - 2015
- Ethiopia, 2012
- Burkina Faso 2013
- Morocco 2014
- Nigeria 2014

A need to adapt innovation studies to a developing country context

Innovation studies in developing countries

- Burgeoning literature:
> 40 empirical papers published during 2010-2014
- Two special issues: TFSC (Berkhout et al., 2009) and ESP (Berkhout et al., 2010)
- Main conceptual (transition) frameworks: MLP, SNM, TIS
- Overweight of studies in Asia (India, Thailand, Malaysia,)
- Limited studies in Africa/LDCs (exemptions: Byrne, 2009; Tigabu et al. 2013; Aurora et al., 2013)

Specific conditions in developing countries

- Conditions for innovation is different in developing countries
 - Weaker institutions, political and economic instability, corruption, informal sector dominance
- Innovations systems in developing countries are highly influenced by international linkages
 - Interventions by international donors
 - Insertion into global value chains

Special Issue of Environmental Science and Policy on Sustainability transitions in developing countries

Objectives, approach and methodology

Research question

How and why local PV production has been established and re-established in Senegal

Conceptual framework

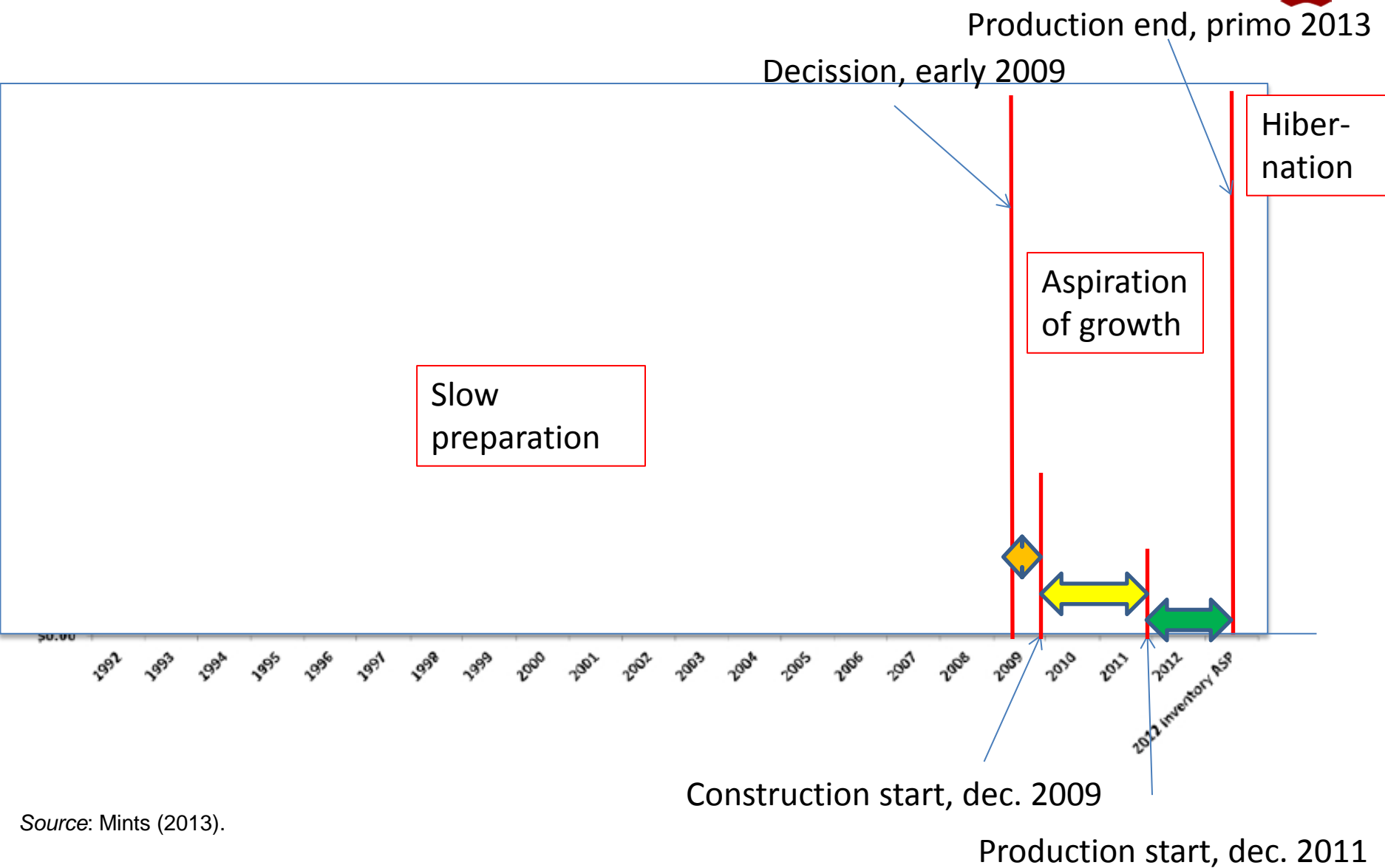
MLP framework (transition framework) for historical analysis of technology niche development

Global value chains perspective for analysing investment drivers, market strategies and international linkages

Methodology (data collection)

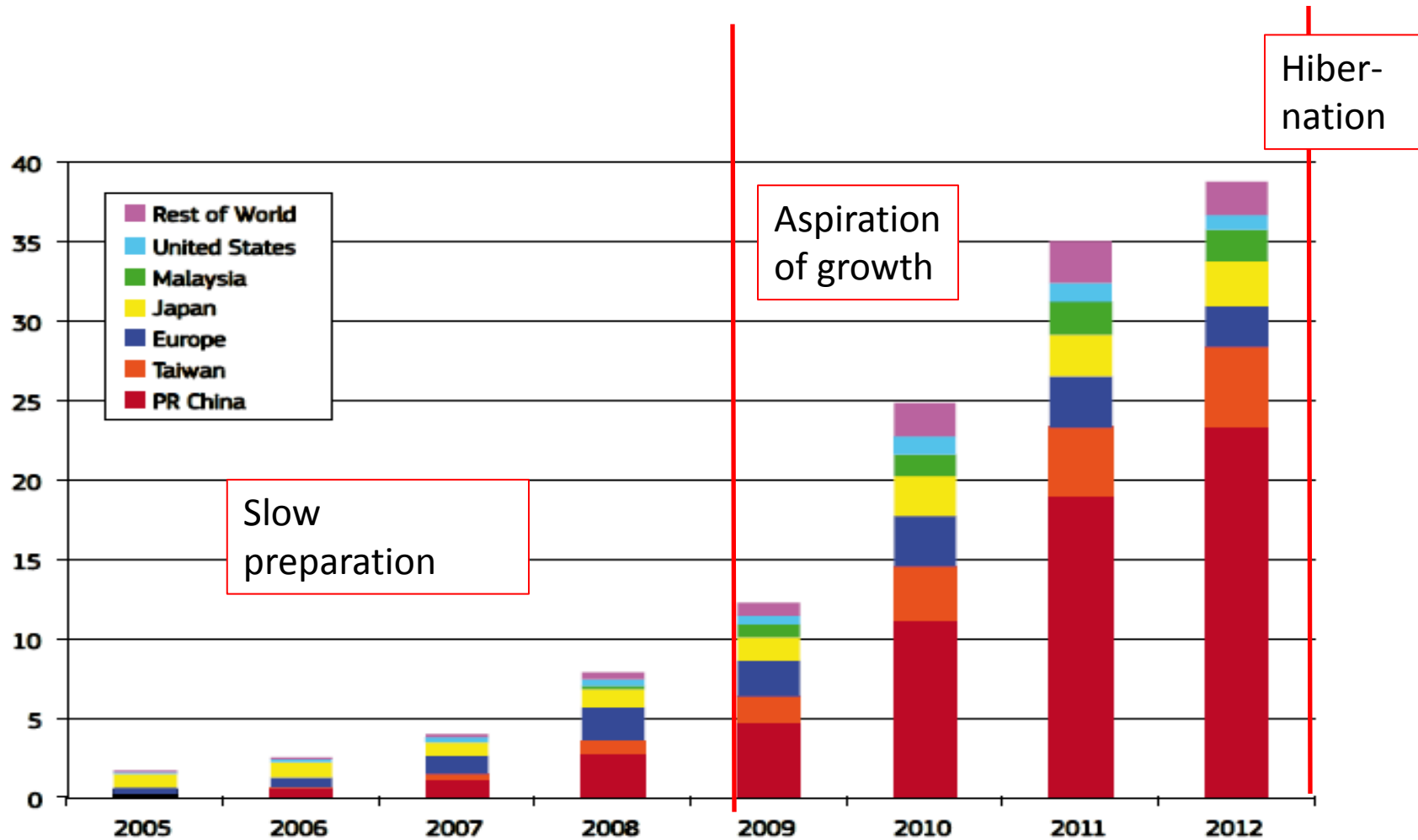
- Literature review, review of journal papers
- Interviews with stakeholders presenting different strategic interests: (Owner, CEO's, former project managers, former minister for renewable energy, energy commission (COMNAC), NGO)
- Insight from two energy policy oriented projects, TNA www.tech-action.org and FIRM www.lowcarbondev-support.org conducted in Senegal from 2010-2015
- Field visits to plant

Defining three specific periods



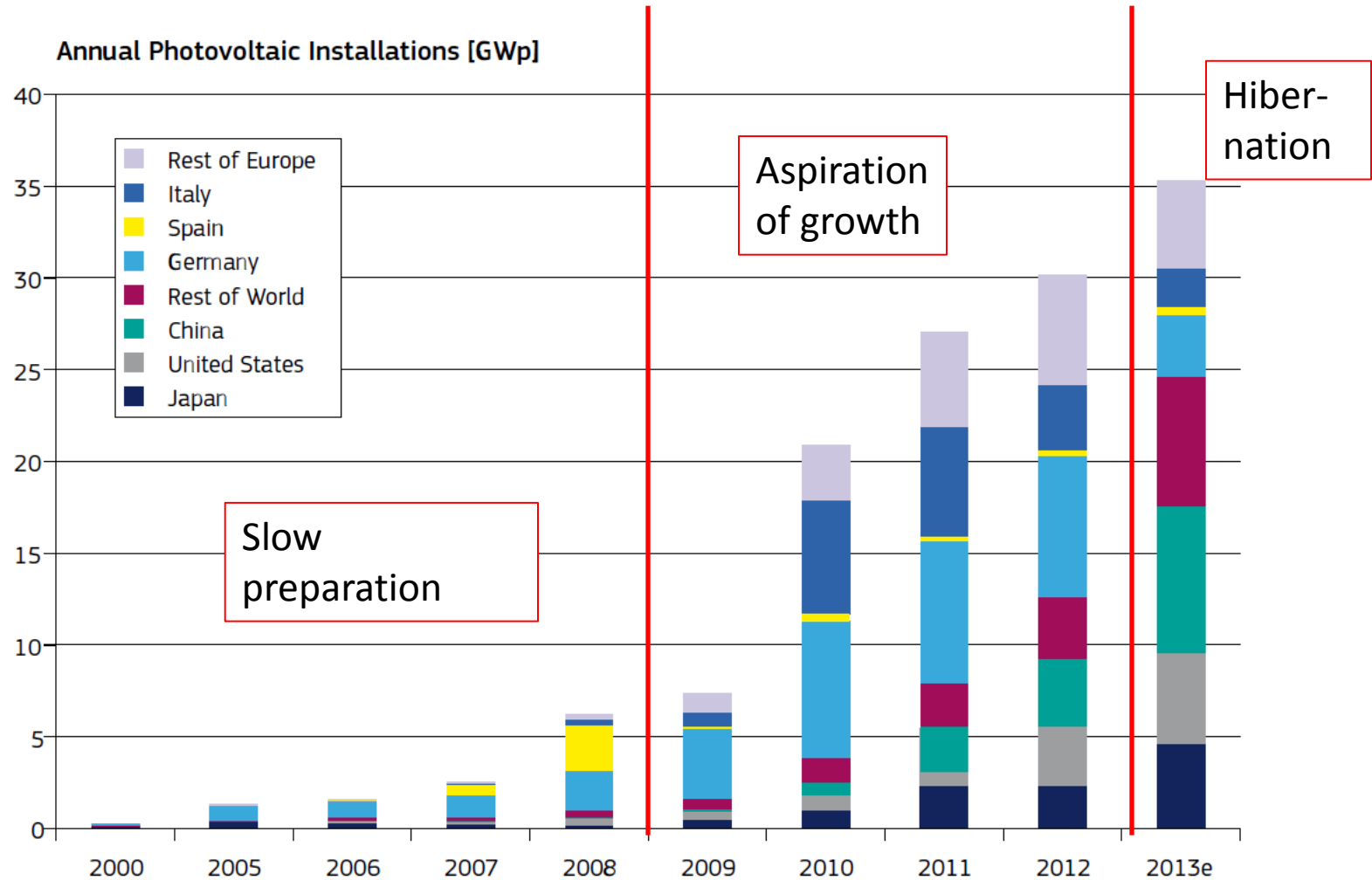
Source: Mints (2013).

Landscape level



Global PV production (GWp) by country and region 2005-2012. Source: Jäger-Waldau (2013).

Landscape level



2009-2012: Aspiration of growth

Landscape level

- Financial crisis 2008 and oil price drop
- FIT dropped in Spain and reduced in Germany
- Module price drop from 2.2-0.8 USD/Wp
- Big international PV companies goes bankrupt
- Election Jan-April 2012, (riots). Wade loses office
- Regional unrest in 2012, Mali, Burkina Faso

Regime level

- Lettre d'Énergie in 2008
- Wade is focussing on infrastructure, positioning his son in the strong ministries for infrastructure, and from 2010 also for Energy
- Louis Seck minister of renewable energy (mid 2010-april 2012)

- COMNAC very active 2009 -2012
- Renewable Energy law approved in 2011, including FIT

Niche level

Prod.

- SPEC investment decided in 2009.
- Factory starts in dec 2011, CEO let off in Nov 2012, closes in Jan. 2013
- Production --less than 1 MWp

Demand

- Street lighting project paid by AGEROUTE (2 million USD)
- Preparation of roof top program, (un toit un panneau) including FIT
- Program for low cost financing of SHS designed
- Strong focus on establishing regional projects in Chad, Mali, Burkina Faso, Togo

2013-2016: Hibernation

Landscape level

- Oil prizes stabilise and fall
- Difficult access to risk capital
- CDM not extended, Low value of CO2 credits

Regime level

- FIT not implemented
- RE concessions in place and starts moving
- Decision on coal fired plant

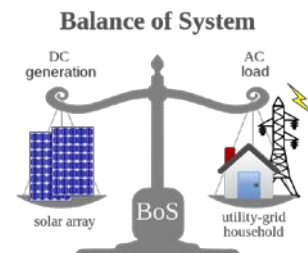
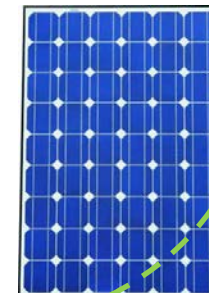
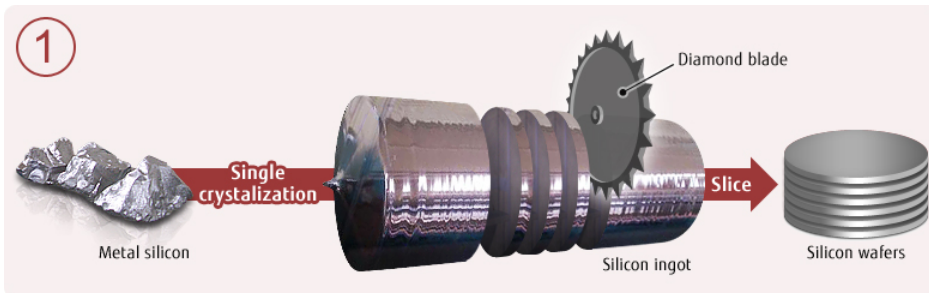
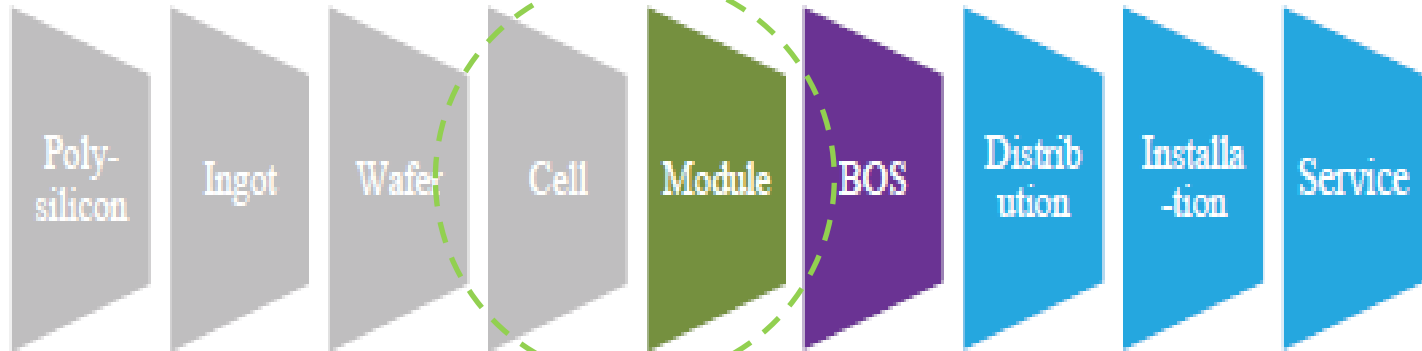
Niche level

- Factory hibernating (mothballs) and revitalized in March 2016
- Continued demand for
 - health centres
 - water pumping
- Roof top programme never materialized
- 2 MW plant on roof top of congress centre (Djamnadi)
- Large scale grid connected project (50 MW) in 2016
- Large regional demand,
 - Burkina 80 MW -- 2014-15
 - Mali 80 MW - agreed 2015

Global value chain for photovoltaic (PV)

Macro context: enablers – policies, strategies, plans, regulations

Meso context: supports – capacity building, market development



Position in global PV value chain

Assembly plant

Factory data

- 16 MWp -- optional 25 MWp
- Turnkey - Swizz (3S)
- Semi-automatic
- On site training of personnel
- 41 staff to produce 16 MW
(including 4 engineers + management)

Ownership

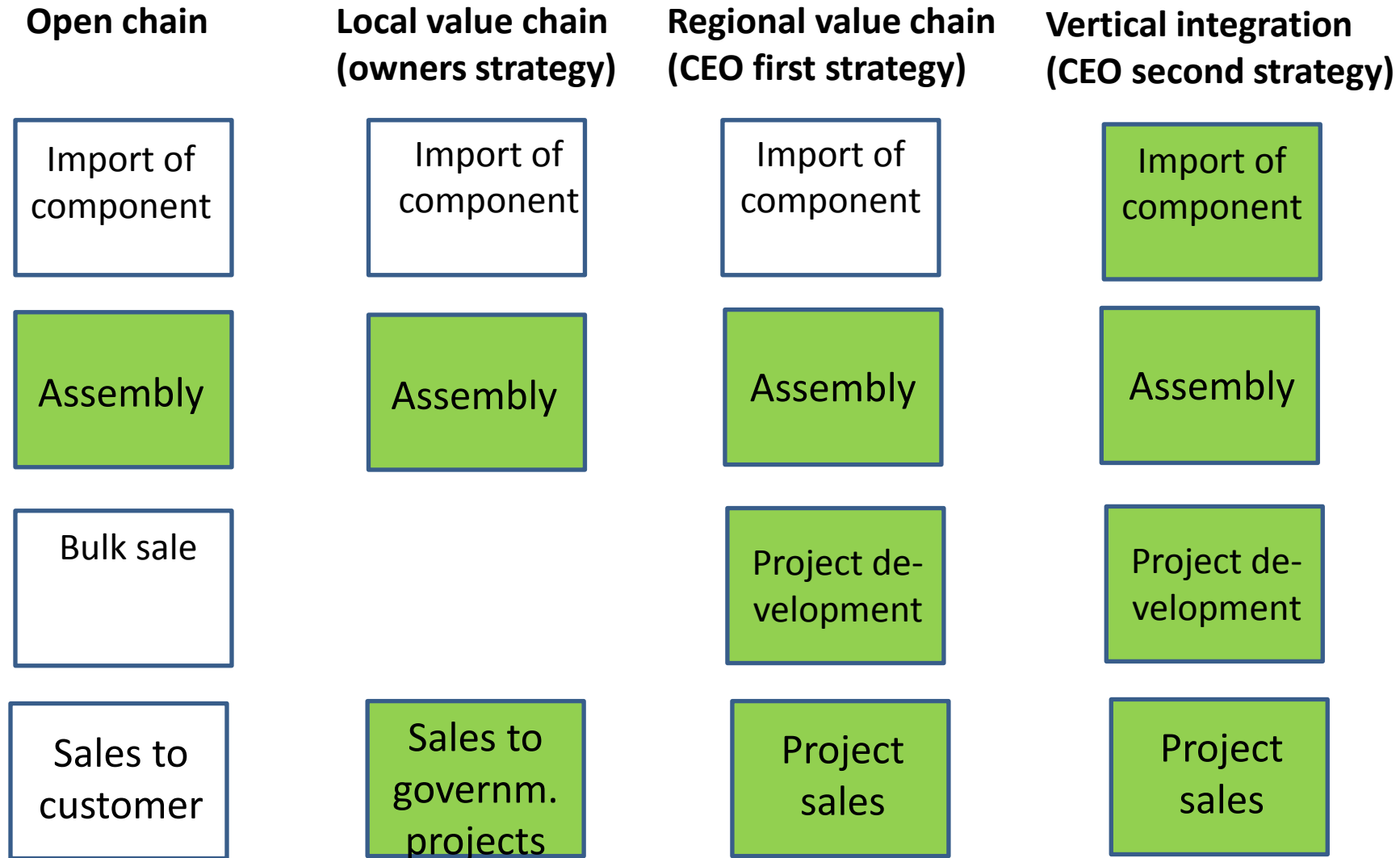
- | | |
|--------------------|------|
| • Ndiègne FALL | 65 % |
| • Saliou Sow (CEO) | 20 % |
| • ? | 10 % |
| • Senegalese ing. | 05 % |

Finance:

Local banks: BOA, BIGIS



Value chain governance



Value chain dynamics

Advantages/disadvantages of national ownership

- Advantages
 - Proud of national capital,
 - good for political connections,
 - preferential market nationally
 - Preferential market regionally
- Disadvantages
 - High cost of wafers, frames, glass
 - High cost of capital ??
 - Difficult access to overseas markets ??

Reconstruction strategy

- Vertical integration through capital injections from strategic groups:
 - Overseas producers (China)
 - Access to inputs
 - Access to technology
 - Regional Bank (BAOD)
 - Access to UEMOA market
 - Institutional investors
 - Access to cheap finance
 - Government (2-5 %)
 - Access to local market , preferential regulation

Empirical findings

- **Wanted to be first mover, but unlucky timing on the market side**
 - Protected niche disappeared**
 - Initiated in the spirit of good connection to a president who supported solar
 - Wade lost the election, his son was sentenced 6 years of prison for corruption
 - National framework was prepared but not decided upon
 - Regional market disappeared**
 - Regional unrest destroyed or delayed the regional markets
 - Extreme price reduction due to changes in FIT in Europe
- **Disagreement among the two main shareholders on strategy**
 - Strategy to involve more strategic shareholders vs. strategy to influence national policy
- **National capital investment in PV assembly had an impact of policy development**
 - due to direct political connections and influence at high level
 - due to enthusiasm among local PV value chain actors
- **Comparative advantages of national assembly is questionable**
 - In this regard it is important to include strategic investors, who are already well established at different levels of the value-chain in order to control the whole value chain