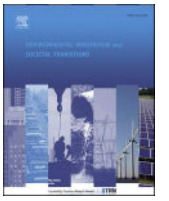
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Socio-technical lock-in as alignment process: tracing the joint development of pesticide dependency and vegetable production in Senegal (1900–2024)

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ABSTRACT

Lock-in mechanisms are common explanations for the persistence of undesirable system configurations in the present. However, studies often analyse lock-ins statically, without tracing and explaining underlying processes. In this article, we explore the development of lock-in over time, by analysing the case study of pesticide lock-in the Senegalese vegetable sector. To this end, we draw on extensive archival document analysis. We trace pesticide lock-in through four periods (from the 1900s to 2024) and explain it as the result of alignment processes across multiple heterogenous dimensions: agricultural policy, input supply, scientific and technical knowledge, on-farm production, and vegetable commercialisation & consumption. These dimensions have aligned in stages, fuelling a dynamic of growing dependence on chemical control. To date, this overall alignment has only been partially challenged, stimulating several adaptations, reinforcing the chemical intensification process, and marginalising attempts to reduce pesticide use. The paper ends with a discussion of conformities and deviations in a case study from the existing literature on lock-in within the agri-food sector in the Global South, before suggesting ways out of the current pesticide lock-in.

1. Introduction

The 2021 UN Food Systems Summit concluded that current global food systems are unsustainable (UNFSS, 2021). This most recent policy-focused event reiterated the international scientific consensus that addressing contemporary sustainability challenges calls for major transformations of production and consumption systems to overcome conventional intensification dynamics, that is, the growing dependence of food systems on fossil and chemical inputs (HLPE, 2017; IPBES, 2019; Köhler et al., 2019; IPCC, 2022). Given the urgency of addressing these challenges, why are such major transformations not unfolding at the required pace and scale across the globe? Lock-in has become a powerful and widespread explanation for this paradox (Liebowitz and Margolis, 1995; Unruh, 2000; Walker, 2000). Lock-ins have been observed in many socio-technical systems worldwide (David, 1985; Vanloqueren and Baret, 2008; Klitkou et al., 2015) and there is extensive knowledge about how lock-in mechanisms favour incremental changes preventing major

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transformations from happening (Koch, 2011). But how exactly do these system lock-ins establish themselves over time? How do they develop in different sectors and contexts? As many fields of research have explored processes analogous to lock-in the agri-food sector (Goldstein et al., 2023), we draw upon literature in rural sociology, evolutionary economics and political economy. We introduce a systemic and processual approach that offers a way to understand lock-in as trajectories of alignments across socio-technical dimensions. To illustrate this approach, we draw upon the case study of the Senegalese vegetable sector and seek to explain how and why a seemingly irreversible pattern of pesticide-dependence has established itself.

To date, transition studies[1] carry a bias in favour of European transport or energy production systems (Köhler et al., 2019). Yet there is a strong argument for challenging and enriching existing frameworks by exploring other sectors, especially in the Global South, as the sociotechnical configurations, post-colonial contexts and political processes open new questions to transition studies (Murphy, 2015; Ramos-Mejía et al., 2018; Wieczorek, 2018; Köhler et al., 2019). By focussing on a historical case of lock-in the vegetable sector in Senegal, this article contributes to broadening the scope of empirical observations, thus fostering reflection on the regularities or variation of patterns observed. In the next section we present the concept of lock-in transition studies and the conceptual framing that enables the interpretation of lock-in as a process of alignment of practices towards 'obligatory points of passage' across analytical dimensions. Following the explanation of our methods (Section 3), we deploy our historical narrative (Section 4). We then present a two-layered analysis of lock-in: first, as resulting from three main types of generic lock-in mechanisms (Section 5.1), and second, as a process of multi-dimensional alignments (Section 5.2). We conclude by looking at how our case study conforms to and differs from the existing literature on lock-in the agri-food sector, before suggesting ways out of the current pesticide lock-in.

2. Analysing socio-technical lock-ins

In this section we introduce a distinction between two complementary uses of the concept of lock-in found in the literature: i) generic reference to different types of lock-in and their diagnostic application; and ii) a processual view of lock-in as resulting from multi-dimensional alignments of heterogeneous entities. When reviewing these approaches, we pay particular attention to evidence from the agri-food sector. The concept of lock-in has been extensively used to explain the persistence of established socio-technical configurations (Unruh, 2000). It resonates with concerns within the social sciences about the prevalence of positive feedback or self-reinforcing mechanisms (e.g. confirmation, reproduction, institutionalisation), particularly when these are associated with negative or undesired consequences (Goldstein et al., 2023). In economics, lock-in refers to situations where the deployment of a given technology is impeded due to self-reinforcing mechanisms favouring a sub-optimal but priorly established technology (David, 1985; Arthur, 1989). In transition studies, lock-ins are broader and are seen as fostering not only sub-optimal configurations but also as impeding the radical socio-technical transformations required to address new problems, such as sustainability challenges (Klitkou et al., 2015; Köhler et al., 2019). Synthesising insights from different streams of literature, Geels (2019) suggests three broad types of lock-in mechanism: a) techno-economic; b) social and cognitive; and c) institutional and political. In practice, these broad types usually combine and reinforce one another but can be analytically distinguished. It is essential to consider these mechanisms as interactive and potentially complementary, rather than simply to rank their relative strength (Oliver et al., 2018). Building on this typology, we discuss agri-food perspectives on lock-ins in Section 2.1 below. Section 2.2, in turn, discusses a processual view of *lock-in as an alignment process*, with particular attention to its operationalisation.

2.1. Lock-in as diagnosis: techno-economic, socio-cognitive and politico-institutional mechanisms

Techno-economic lock-ins can derive from several factors ranging from technological complementarities, sunk investments, or economies of scale (Arthur, 1989; Geels, 2004, 2019). Within the literature on agri-food systems, specific techno-economic lock-ins include the phenomenon of the 'chemical treadmill' (Clunies-Ross and Ross, 1992), or the 'pesticide treadmill' (Hansen, 1988; Bakker et al., 2020). Both notions highlight the circular dependency created by the use of synthetic inputs, whereby the ecological processes involved in reproducing soil fertility or controlling crop pests are disrupted, requiring increased use of synthetic inputs to try to correct them. In particular, the pesticide treadmill can occur because weeds and pests often develop resistance to pesticides (Gould et al., 2018; Bakker et al., 2020). Moreover, political economists of agriculture have used the concept of the 'technological treadmill' (Cochrane, 1958, 1979) to explain how the adoption of new, more productive technologies compels all farmers in a sector to follow suit, while raising inequalities between farms. Successful new technologies can lead to increased sectoral production, lower agricultural commodity prices, and higher land prices as early adopters invest their profits into fixed assets like land. The result is 'a cannibalistic process in which the large aggressive, innovative farmers gobble up the productive assets of the smaller, less efficient, less aggressive [ones] (Cochrane, 1979, p. 405) – which is particularly salient in deregulated competitive environments.

Socio-cognitive lock-ins involve the homogenisation of practices through routines, heuristics and shared mindsets. Core capacities can turn into core rigidities, impeding radical innovations as actors encounter difficulties shifting away from established practices (Leonard-Barton, 1995, cited by Geels, 2004). Within the literature on agri-food systems, scholars have shown how farmer networks (Cowan and Gunby, 1996; Gaillard, 2022) and agricultural research and extension systems (Vanloqueren and Baret, 2008) can become trapped in problem-solving routines based on the intensive use of pesticides, where more sustainable and profitable alternatives do not even enter the calculations. The search for alternative solutions can therefore constitute a demanding process, especially in more

[1] *Transition studies* is a multi-disciplinary field of research that, in the face of contemporary sustainability challenges, explores how the stability or change of socio-technical systems is achieved over time, *e.g.,* housing, transport, food, and energy production (see: Köhler *et al.*, 2019).

knowledge-intensive models like organic production, the Integrated Pest Management (IPM) approach or agroecology (Cowan and Gunby, 1996; Goulet, 2013; Wolff and Recke, 2000). In addition, user practices organised around particular technologies reinforce lock-in effects (Geels, 2004). In rural areas, the intensive use of synthetic inputs is often associated with aspirations of modernisation (Luna, 2020), performances of masculinities (Saugeres, 2002; Bell, 2004; Bureau-Point, 2021) or conventional representations of the 'good farmer' (Laurent and Rémy, 2004; McGuire, Morton and Cast, 2013; Burton et al., 2021). Further downstream in the supply chain, the 1980s mass distribution boom coincided with the rise of food consumers' expectations of convenience and affordability (Burch and Lawrence, 2007). As consumers became accustomed to accessing uniform and low-cost products in one location year-round (Smith, 2007), stringent food safety standards were required, along with supply chains favouring high-input agriculture and economies of scale (Konefal *et* al., 2005). In the 2020s, 80 % of consumers in the Global North purchase their food in supermarkets and a similar trend seems to be underway in the Global South (Reardon, Timmer and Berdegue, 2004; Bahn and Abebe, 2020; Das Nair, 2020). In addition, formal and informal institutions often constitute a form of 'social capital' (Putnam, 1993, cited by Geels, 2004) providing mutual benefits through enhanced coordination and cooperation. Those advantages are lost when turning to less institutionalised, novel technologies such as alternatives to chemical control (Cowan and Gunby, 1996; Gaillard, 2022).

Politico-institutional lock-ins refer to existing regulations, standards, and policy networks that tend to favour incumbents and create an uneven playing field (Geels, 2019). These issues are particularly acute in the Global South, where external and internal inequalities reinforce the lock-in of socio-technical systems, as power asymmetries make it more difficult to challenge configurations that are unsustainable but profitable to incumbent elites (Murphy, 2015; Ramos-Mejía et al., 2018). Given the continued influence of (post-)colonial dynamics and structural inequalities over political economy, socio-technical regimes in the Global South are often marked by dysfunctionalities such as the provision of irregular or poor-quality services (Wieczorek, 2018; Feola, 2020; Arora and Stirling, 2023; Ghosh and Mguni, 2025). Besides North-South domination, weak national redistribution mechanisms, and even the appropriation of the state by private interests – in what is sometimes referred to as patrimonial or marketized states – tend to worsen inequalities within the socio-technical regimes of the Global South (Bevan, 2004; Wood and Gough, 2006; Ramos-Mejía et al., 2018). Within the literature on agri-food systems, scholars have shown how European subsidies contribute to maintaining high-input agriculture in spite of inferior performance compared to some forms of low-input farming (Vanloqueren and Baret, 2008). In the Global South, political objectives of increased agricultural production in the name of 'food security' (Bricas and Malézieux, 2021) often coincide with pro-pesticide regulations (Thrupp, 1988; Hu, 2020). For instance, agrochemical companies and state representatives in India have been working together to promote the replacement of mechanical weeding with chemical weeding in the Indian cotton sector (Stone and Flachs, 2018). Moreover, incumbent actors have asymmetrical access to policy networks to impede regulatory changes that would challenge their vested interests (Geels, 2014, 2019; Stirling, 2019; Turnheim, 2022). For instance, in 1976 a United Nations Environment Programme initiative to map the global trade of potentially toxic chemicals was discontinued, due to the USA's refusal to provide its data, in the name of protecting trade secrets (Hill, 1988; Sundén and Huismans, 1990). More generally, the pesticide industry is well known for continuing its efforts to capture regulators and hinder policies to reduce pesticide use (Watterson, 2001; Tostado and Bollmohr, 2023), and is involved in extensive discourse struggles aimed et (re)legitimising pesticide use (Kaiser, 2023; Mansfield et al., 2023).

2.2. *Lock-in as process: multi-dimensional alignments*

Although there are many examples of lock-in situations, the examples for the agri-food sector rarely trace the establishment and reproduction of techno-economic, socio-cognitive and politico-institutional lock-ins. Lock-ins are often investigated statically, to identify the factors impeding radical changes[2] (see: Meynard et al. 2018 or Clapp (2021) for good illustrations). Given the dual status of lock-in as a (self-reinforcing) process and a state resulting from such a process (Garud *et al.*, 2010; Goldstein et al., 2023), it is crucial to develop means to combine '*1) longitudinal approaches to how socio-technical configurations have stabilised along particular trajectories to take on specific forms and shapes, and 2) evaluative-descriptive approaches to how stable socio-technical configurations actually are (Klitkou* et al., *2015) and how socio-technical stability may change over time—notably as alternatives are developed or windows of opportunity for change open up'* (Turnheim, 2022 p 46–47). To do so, Geels (2004) proposed to explicitly focus on the coevolutionary interactions among multiple heterogenous entities during the development and establishment of socio-technical systems (i.e. policy, science, technology, users & market, and socio-cultural dimensions). As such processes are known to unfold over several decades (Geels and Turnheim, 2022), explicit attention to the multidimensionality *and* temporality of socio-technical change processes (Beck et al., 2021) is needed to understand the dynamics of lock-in (how) and the rationales from which they derive (why), as well as un-locking potentials.

To describe the positive (or negative) interactions between the dimensions of the socio-technical configurations at stake, transition studies have often made use of the notion of alignment (and more rarely to the opposite movement of de-alignment) (Geels, 2002; Geels and Schot, 2007). A core assumption is that socio-technical lock-in intensifies as the alignments of actors and activities across analytical dimensions increase in number (increasing ties) and quality (coherence) (Geels, 2002). According to Goulet (2021), such an understanding constitutes a legacy from actor-network theory (ANT). Returning to ANT is therefore a relevant way to refining our understanding of alignment, as the recurrent use of this notion in transition studies is accompanied by a certain vagueness in its

[2] A notable exception to the two trends described above is the work by Watson (2018), which seeks to describe developments in the pesticide industry since the pre-industrial period and the agricultural, social, political and demographic context in which these developments occur on a global scale. See also: Lamine et al. (2023).

application (Goulet, 2021). In ANT, the notion of alignment has a fairly precise meaning, referring to the state of agreement generated by a translation, that is, the process whereby a given socio-technical configuration is defined and stabilised around a particular practice that allows the functioning of the whole configuration. Callon suggests that such alignment processes may be observed through the emergence of 'obligatory passage points' (Callon, 1984) framing interactions between actors. He argues that lock-in processes refer to the reinforcement of such states of agreement due to two mechanisms (Callon, 1991): first, the enrolment of a growing number of heterogeneous entities within a given configuration, the accumulation of which increases, for all parties, the obligation to follow any 'passage point' around which this configuration has previously been established; and second, the growth in the degree of reciprocal dependence between the entities of a given sociotechnical configuration. To uncover the development of pesticide lock-in as a process of multi-dimensional alignment, we thus propose to: i) map and trace the diversity of actors aligning towards chemical control across empirical dimensions in each period of the proposed chronology (hereafter referred to as the 'scope of alignment'); and ii) to characterise the evolution of these alignments across periods in terms of 'intensity' (i.e. strengthening or attenuation of previous alignments). In both cases, we examine whether and how the activities performed by the actors engaged in each dimension contribute to either establishing chemical control as an 'obligatory passage point' – that is, a practice necessary for any actor to achieve their own goals – or, on the contrary, to formulating 'alternative passage points' and establishing pesticide use as a 'passage point to be avoided'.

2.3. Analytical operationalisation

To trace the establishment of multi-dimensional alignments over time (without forgetting the potential for de-alignments that may contribute to the weakening of lock-in), we adopted an operationalised representation of the analytical dimensions of agri-food systems. To do so, we followed Lamine & Marsden (2023) sectoral, agri-food adaptation of Geels (2004) presentation of a socio-technical system. Since vegetables in Senegal are usually not processed before cooking, we did not distinguish between consumers, intermediaries and processors, unlike Lamine & Marsden. Instead, we focused on a single dimension that we called 'commercialisation & consumption'. The result is a hexagonal analytical framework with the following analytical dimensions: i) Agricultural policy; ii) Scientific and technical knowledge; iii) Input supply; iv) Vegetable production; and v) Vegetable commercialisation & consumption. To capture lock-in as both a self-reinforcing process unfolding over decades, and a current result of such a process, we have sought to account for the alignments (and possible de-alignments) that have taken place within the five analytical dimensions delineated above, since the emergence of vegetable production in Senegal. As explained in the introduction to Section 4, this approach was made possible by the fact that (European-type) vegetable production in Senegal emerged quite recently, at the beginning of the twentieth century.

3. Methods

To explore how the pesticide lock-in of the Senegalese vegetable sector unfolded over the past 125 years we used a narrative case study method (George and Bennett, 2005). We sought to construct a historical narrative organised around the aforementioned five-pillar framework and according to the four time periods that we identified. To build the historical narrative,[3] we conducted an extensive literature review of scientific publications as well as grey literature, policy documents and archives. To this end, we first constructed a corpus of documentary resources through keyword searches using Google Web and Scholar (see Appendix A for more details). The archives of the Senegalese Agricultural Research Institute (ISRA) and the French agricultural research agency for international cooperation and development (CIRAD) were also searched for scientific studies and policy publications. This process led to the identification of 287 documents, including books, scientific articles, newspaper articles, official reports, and grey literature from the development aid sector. We organised the documentary base by classifying the references according to the analytical dimension(s) addressed. After reading their abstracts and/or table of contents to identify the resources that were the most relevant to the question of pesticide lock-in, the first author purposively sampled 12 documents by analytical dimension (i.e., 57 references including three sampled documents referring to two different analytical dimensions). The list of the sampled documents is presented in Appendix C. Those documents were read, leading to the discovery of 91 new documents directly relevant to the analysis, thus raising the document base to 378 resources (presented in Appendix B) and the purposively sampled documents to 148. All 148 documents were read in full and their content was coded according to an iterative method of axial and theoretical coding performed by the first author, under the supervision of the other three (Maxwell, 2013) (i.e., relevant passages were extracted and classified according to the analytical dimension analysed).When these 148 documents are cited in the Results section, readers can find the full reference to the corresponding documents in Appendix B, instead of in the list of academic references. Comparison and cross-checking of the coded passages enabled us to achieve a causal reconstruction (Mayntz, 2004) of each analytical dimension's evolution. The historical narrative resulting from this process is organised systematically, around the five analytical dimensions for each period, in the following section. To organise the presentation of our results over almost 125 years, we have drawn up a four-stage chronology of the relationships

[3] One important point needs to be made about this approach: although it is based on diverse sources, it entails the risk of misrepresenting the subjective experience of people, particularly subalterns and lay people, whose voices have not been transcribed in books, articles or reports. This is a matter of some concern, as the deployment of pesticides, particularly in a colonial context, is known to have led to violence and sacrifice on the part of the communities concerned (Tousignant, 2018; Hardin, 2019). As those voices have subsequently been silenced in the name of the greater good of 'modernisation', this 'other side of the story' is difficult to access without historical or ethnographic fieldwork, using first-hand sources. The results of this article will therefore have to be interpreted in the light of other empirical research.

between vegetable production and pesticide use. These periods were selected by the identification of turning points (Abbott, 2009) for each analytical dimension, summarised in Table 1 below.

4. Longitudinal case study of pesticide lock-in the vegetable sector

In 2019, Senegal's vegetable sector produced a total of 1350,000 tonnes, primarily for the domestic market. Despite rapid growth since the early 2000s, vegetable exports to Europe reached only 90,000 tonnes in the same year (MAER, 2020). In Senegal, vegetable production and consumption mainly relates to 'European-type' vegetables (e.g., onion, potato, cabbage, tomato, eggplant, carrot, green bean, turnip, salad) as opposed to 'African-type' vegetables (e.g., gombo, bissap, jaxatu) (Coly et al., 2005; MAER, 2020). After having been introduced by French colonisers since the beginning of the 20th century, the production of 'European-type' vegetables has grown spectacularly, as represented in Fig. 1 that is based on the figures of vegetable production found in the documents cited in this literature review.[4]

Since colonial times, vegetable production has been concentrated in the Niayes region, which accounts for 80 % of the national output (PDS, 2003; PIESAN, 2021). The River Valley in the north of the country (Pagès, 1995; Ndiaye, 2003) and the outskirts of the cities of Ziguinchor and Bignona in the south are also significant production areas (CDH, 1983). The location of the Senegalese vegetable production basins is indicated below on Map 1 showing the geographic specialisation of agricultural production in Senegal.

4.1. 1900–1960: birth of the vegetable sector, the early start of pesticide use

4.1.1. Historical narrative

Compared to continental Senegal, the Niayes area has a cool microclimate and significant groundwater, making it ideal for vegetable production. However, due to large flooded areas exposing it to infectious diseases, no habitats or permanent agriculture were in place when French colonisation intensified at the end of the 19th century (Kane, 1973; Dia, 2018). After the occupation of Gorée and Saint-Louis, the French colonisers expanded their settlements to Dakar, Rufisque, Mboro, Lompoul, and Mécké by the end of the 19th century. This led to an increased demand for 'European-type' vegetables (Souillac, 1965a; Tourte, 2005a; Fare et al., 2017). While most of Senegal was under French protectorate, the colonial authorities directly administered a large part of the Niayes area (Bruschi, 2005). This institutional context enabled the settlers to support vegetable production by all possible means. Extensive development work was then undertaken to drain the waterways in order to combat the vectors of endemic diseases. In addition, vegetation measures were taken to stabilise the dunes, to protect the vegetable production basins (Dione, 1986). Settlers' determination to produce their needs locally was reinforced during the two World Wars, when supplies from France faced major difficulties (Amin, 1969; Fare et al., 2017). After World War I, vegetable farmers were given land tax exemptions and after 1937, the sector benefited from (forced) migration of workers planned by the colonial authorities to secure vegetable production (Kane, 1973; Sow, 1975; Dione, 1986).

In the early 1900s and 1930s, French settlers and the colonial administration established vegetable gardens and agronomic stations that played a central role in the acclimatisation and dissemination of European vegetable species (Fall & Fall, 2001; Tourte, 2005a; Fare et al., 2017). This led to the birth of vegetable production in the Niayes area. Whereas small-scale production (backyard gardens) of 'African-type' vegetables was common in continental Senegal (Boilat, 1853; CDH, 1986), it had until then been quite marginal in the sparsely populated Niayes region (Fare et al., 2017). Colonial agronomic stations also introduced 'modern' inputs like chemical fertilisers (Souillac, 1965b; Tourte, 2005a; Fare et al., 2017). During World War II, fuel shortages led to increased use of horse-drawn vehicles, boosting vegetable production by 40 % due to a steady supply of manure (Bouffil, 1950; Tourte, 2005a). Evidence of pesticide supply circuits in Senegal is limited to post-war advertisements for DDT and lindane-based products in colonial newspapers (Paris-Dakar, 1947, 1949).

In addition to introducing seeds and fertilisers from Europe, colonial agronomic stations played a crucial role in the development and dissemination of agricultural knowledge. Starting in 1936, the agents at the Mboro station, located in the centre of the Niayes area, conducted large-scale trials and extension activities aimed at training and supporting Senegalese vegetable producers (Fall & Fall, 2001; Tourte, 2005a; Fare, 2018). Furthermore, producer unions like the Union of the Gardeners and Vegetable Producers of the Cap Verde Region (SYNJARMAR), which brought together up to 2500 producers by the late 1960s (Amin, 1969), helped accelerate the adoption of vegetable crop production techniques among Senegalese peri-urban farmers. Since its creation in 1945, the union maintained close relations with colonial stations and used its own members' contributions to carry out trials to evaluate the best production techniques (varieties, inputs, cultivation operations, etc.) (Souillac, 1965a, 1965b; Tourte, 2005a; Fare, 2018).

The expansion of the Senegalese vegetable sector coincided with a significant transformation in the economic logic and location of production units, as well as their use of synthetic inputs. Before the 20th century, many vegetables, such as the leafy greens commonly consumed in pre-colonial diets, were primarily gathered for family consumption rather than cultivated (Mathieu & Meissa, 2008). However, this changed with the emergence and rapid growth of commercial 'European-type' vegetable production (Souillac, 1965b, 1965a; Amin, 1969; Faye et al., 2007; Fare et al., 2017). Vegetable production became primarily driven by peri-urban entrepreneurs and family farms producing for the market, often utilising the labour of women (farmers' wives) for commercialisation (Amin, 1969; Kane, 1977; Fare et al. 2017). Vegetable cultivation then spread from the immediate outskirts of the military forts and towns invested by the settlers to the wider Niayes area (Tourte, 2005b). It initially emerged as a dry-season activity in fertile basins known as 'Niayes',

[4] As calculation methods are not always explicit and could have been different from one source to another, the figures presented should be considered less for their absolute value than for the general trend of increase they suggest.

Table 1
Events, turning points and periods of the pesticide lock-in trajectory.

	Policy	Input-supply	Scientific and technical knowledge	Vegetable production	Commercialisation and consumption
1900–1960	Dakar became the capital of French West Africa in 1902. The first colonial agronomic stations were set up in Dakar and its suburbs (1904). The affirmation of a proactive policy in favour of vegetable production was reflected in extensive development work in the Niayes area (from 1908) and tax incentives (from 1913).	Increasing efforts to acclimatise European-type vegetables (from 1910) and introduction of the first mineral fertilisers. Introduction of the first pesticides for agricultural use from 1945.	Expansion of knowledge relating to the production of European-type vegetables in colonial agronomic stations (from 1904).	European-type vegetable production gradually takes off.	Growing demand for European-type vegetables as French colonists gradually settled on the mainland (beyond Saint-Louis and Gorée Island).
1960–1984	Independence of Senegal (1960). Proclamation of a productivist agricultural policy based on the conventional intensification of agriculture, with little interest in the vegetable sector.	Introduction of a vast system of subsidies for fertilisers and pesticides from 1960 onwards.	Development of formal research and extension systems for conventional intensification of vegetable production (SODENIA from 1962, then CDH from 1972).	Drop in groundnut export prices (1968) and great drought decade (1970s). Vegetable production took on increasing economic importance and production tripled.	Designation of ceebu jën as the national dish, symbolising the integration of European-type vegetables into the eating habits of Senegalese households (from 1960).
1984–2000	Succession of Abdou Diouf to Leopold Sedar Senghor as President of the Republic (1984). Budgetary austerity policy following the announcement of structural adjustment reforms. Growing interest in developing vegetable production to improve the country's trade balance.	Dismantling of pesticide subsidies (from 1984) and liberalisation-privatisation of the pesticide market (from 1980). Expansion of pesticide donations from the Japanese Cooperation Agency (from 1986 to 2000).	Dismantling of the CDH research and extension system from 1986 onwards.	Vegetable production doubled over the period and pesticide use became widespread (almost 100 % of users by the end of the 1990s).	Increasing professionalisation of vegetable commercialisation. Declining trend in producers' income per unit of vegetable produced.
2000-	Succession of Abdoulaye Wade to Abdou Diouf as President of the Republic (2000). Designation of vegetable production as a strategic and priority sector, a catalyst for economic growth from 2006 onwards. A halving of customs duties on pesticides in 2000.	Japanese cooperation stopped donating pesticides (2001). Designation of the CSP as the body responsible for approving pesticides under the Environment Code Act (2002).	Academic research institutions increasingly investigate alternatives to pesticides (e.g., CIRAD from the 2000s, CDH from the 2010s).	Vegetable production multiplied by 6 over the period.	In 2020, standard LMR_NS 03–0171, reiterated the absence of a binding standard setting a maximum limit on pesticide residues in vegetables intended for Senegalese consumers.

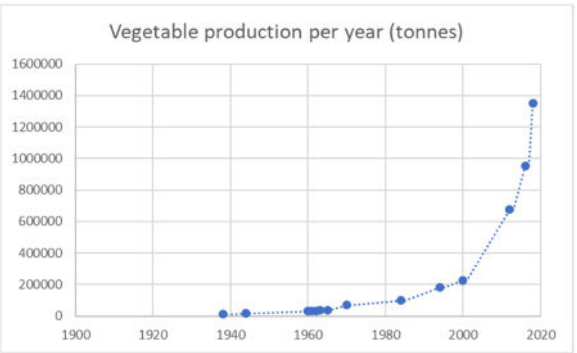


Fig. 1. Growth of annual vegetable production in Senegal (1900–2020).

which were flooded during the rainy season but were rich in clay and organic matter. As the demand for vegetables grew, producers transitioned to cultivating the less fertile sandy soils of the hillsides. This shift was made possible through the use of abundant irrigation, organic and mineral fertilisers, and rigorous chemical control of soil insects using substances such as lindane and DDT (Bouffil, 1950; Chevalier, 1950). In general, agri-entrepreneurs have been well disposed towards 'modern production techniques' such as the use of fertilisers and pesticides (Bouffil, 1950; Souillac, 1965a, 1965b; Amin, 1969; Faye et al., 2007). As a result of all these factors, domestic production reached 30,000 tonnes by 1960 (Souillac, 1965a, 1965b).

Between the early 20th century and Senegal's independence, households, particularly among the wealthier ones, increasingly adopted the consumption of 'European-type' vegetables (Dione, 1986). To satisfy the needs of a growing population, the volume of imported vegetables rose significantly, reaching 20,000 tons by 1960. This phenomenon concerned SYNJARMAR members and spurred efforts to cultivate visually appealing products that could compete with 'made in Europe' vegetables (Souillac, 1965a, 1965b). During the final decades of French colonisation, this objective also resulted from the quest for export opportunities in Europe, although the quantities exported remained limited to a few tonnes per year. To meet the uniformity requirements of importers, SYNJARMAR organised collective agricultural campaigns and actively sought better standardisation of products. In 1957 SYNJARMAR was awarded the gold medal at the Paris agricultural competition for its display of vegetable products (Souillac, 1965a, 1965b) – a seal of approval for its coordinated efforts.

4.1.2. Alignment trajectory

All the elements described above can be interpreted in terms of a process of alignment represented in Fig. 2 below. The processes corresponding to the arrows in the figure are explained with their corresponding number in the paragraph hereafter.

(1) From the early 20th century, the horticultural potential of the Niayes area was developed in line with the settlers' appetite for European-type vegetables, which stimulated the rapid expansion of commercial vegetable production in Senegal. (2) To feed the settlers, the colonial land change policy was driven by the objective to produce more vegetables and supported the emergence of commercial vegetable production through development work, tax incentives and population relocations. (3) The establishment of supply channels for seeds and mineral fertilisers, notably via colonial agronomic stations, became essential to vegetable production. (4) From 1945 onwards, chemical control and vegetable production became linked, with the appearance of the first synthetic pesticides and dedicated supply channels. (5) The use of pesticides combined with mineral and organic fertilisers critically enabled the spatial expansion and increase of vegetable production. 6) Finally, through sustained efforts to produce and disseminate knowledge relating to the use of synthetic input for increased productivity, colonial agronomic stations and vegetable producers' unions contributed to aligning knowledge production towards chemical control. In sum, the period 1900–1960 shows the initial stages of two alignment fronts: a) multi-alignment towards vegetable production, and b) partial alignment of three analytical dimensions around chemical control from 1945 onwards, as indicated in Fig. 2 above.

4.2. 1960-1984: rapid deployment of chemical control

4.2.1. Historical narrative

Senegal's early independence saw significant macroeconomic policy controversies. President of the Council, Mamadou Dia, wanted to dismantle the groundnut-based trading economy (*économie de traite*) inherited from colonisation and establish an agrarian socialism relying on a cooperative system. In contrast, President, Léopold Sedar Senghor, who embodied an assumed Francophilia, promoted the reliance on groundnut exports to ensure rapid economic development (Dramé & Niang, 2019). In 1962, Dia, whose revolutionary project was doubly opposed to French interests and to those of the religious brotherhoods (*confréries*) that derived their power from the groundnut trade, was arrested two days before the scheduled day of the Council's vote on the Dia-Senghor controversy and sentenced to life imprisonment (Colin, 2007; Dramé & Niang). In 1964, four years after Senegal's independence, the French government announced the imminent end of its preferential groundnut purchase tariffs, thus destabilising state income and precipitating the groundnut sector into crisis. In response, the Senegalese authorities aimed to increase productivity by implementing 'Green Revolution'[5] techniques (Fall & Fall, 2001; Faye et al., 2007; Toussignant, 2022). Additionally, the vegetable as well as cotton sectors began to receive specific attention from public authorities as diversification opportunities (Jager et al., 1970; CDH, 1986; Fall & Fall, 2001). To this end, SODENIA (Société pour le Développement des Niayes) was tasked with disseminating improved irrigation techniques, fertilisers, and pesticides (Souillac, 1965a, 1965b; CDH, 1974; Fare, 2018).

During that time, agricultural inputs in Senegal were mainly supplied by state-run organisations like SODENIA, which offered subsidies of up to 80 % for pesticides (Repetto, 1985; Faye et al., 2007; Sow et al., 2008). To this end, the Senegalese government received significant support from Official Development Assistance (ODA) from France (mainly) and the European Union, in the form of loans, rural credit funding, technical aid and pesticide donations (Bottrell, 1984; MDR, 1984; Repetto, 1985; Hill, 1988; Fall, 1991; Williamson, 2005). Globally, northern agrochemical companies began targeting markets in Africa, where health and environmental regulations were weak, following stricter regulations in Europe and North America (Bottrell, 1984; Hill, 1988). These companies took advantage of the fact that, despite several international initiatives that were hindered by U.S. pressure in the name of commercial freedom, pesticide trade was poorly regulated both internationally (Hill, 1988; Sundén and Huismans, 1990) and in Senegal (Deuse,

[5] The Green Revolution is a policy of transformation of agriculture in developing countries through dissemination of high-yielding varieties and synthetic inputs (fertilisers, pesticides, fossil fuels, etc.). This policy was largely promoted by the Rockefeller Foundation and inspired the agricultural policies of many countries in the Global South (Farmer, 1977; Smith, 2009; Galt, 2014).

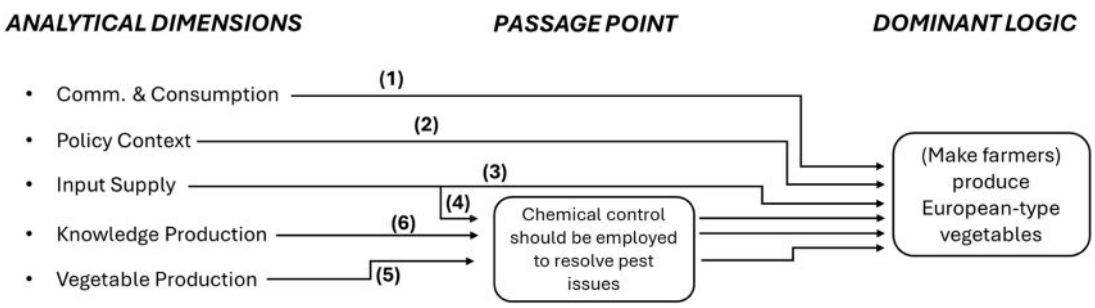


Fig. 2. During the 1900–1960 period, especially after 1945, input supply, knowledge production, and vegetable production began to align towards chemical control.

1975; FAO-WHO, 1977, as cited by Fall & Fall, 2001; Sow et al., 2008). Under these favourable regulatory conditions, the pesticide supply sector grew rapidly. By the early 1970s, 165 active ingredients had already been approved for agricultural use (Diallo & Deuse, 1974). However, aside from this broad overview, no specific data has been found concerning the pesticide supply channels used by Senegalese vegetable producers during this period.

In line with the productivist logic pursued by the Senegalese government, several research and extension institutions supported high-input vegetable production from 1960 to 1984. The SODENIA initiated this programme, which was later taken over by the Société des Terres Neuves (STN) until 1984 (MDR, 1984; Fall & Fall, 2001; Faye et al., 2007). To train workers and technicians in modern vegetable production, the Horticulture School of Cambérène was established in 1960 (Fare, 2018; SenePlus, 2020). In the early 1960s, agents from the Agronomic Research Centre of Bambey—the historical centre of colonial agronomic research in French West Africa—conducted trials to identify the most effective pesticides for vegetable cultivation (Appert, 1957; Bouhot & Mallamaire, 1965). Their efforts led to the identification of 24 active ingredients to combat 66 previously identified vegetable crop pests. The creation of the Centre for Horticulture Development (CDH) in 1972 intensified the production of scientific and technical knowledge related to high-input horticulture (CDH, 1980; MAEH, 2004). International experts detached to the CDH, along with Senegalese researchers and extension agents, conducted systematic agronomic trials and launched large-scale extension programmes, promoting chemical control, mineral fertilisers, and high-yield varieties (CDH, 1980, 1986; Collingwood et al., 1981; Beniest et al., 1987).

Chemical control progressed rapidly among vegetable producers, with 32 % using pesticides by the early 1970s, primarily in the form of hand-applied powder products (Navez, 1983; CDH, 1986). From the early 1970s to the mid-1980s, the Great Drought severely impacted rainfed agriculture (groundnut, millet, niébé, sorgho, etc.) and the economy of rural areas. Irrigated vegetable production in the Niayes area then emerged as a refuge activity for many Senegalese farmers (Beniest et al., 1987; Fare et al., 2017). The sector's growth attracted migrant workers from the groundnut basin and foreign countries, and led to an expansion, both in the vegetable production areas, and in the annual number of crop cycles (Fare et al., 2017). Irrigation techniques and access to water improved rapidly, directly impacting field sizes and farm incomes (Fare et al., 2017). As a result, vegetable production tripled over the period, increasing from 30,000 tonnes in 1960 to 100,000 tonnes in 1984 (Souillac, 1965a; MDR, 1984).

The growth of vegetable production in Senegal was driven by population increase and changes in dietary habits, particularly the incorporation of European-type vegetables that were historically consumed by French settlers. The establishment of ceebu jën as the national dish, featuring ingredients like cabbage, turnip, potato, carrot, eggplant and tomato, and traditional African vegetables such as okra, bissap and jaxatu, illustrates this shift. By the end of the 1970s, ceebu jën had become a daily staple across the country (Sankale et al., 1980; Ka & Leport, 2023). As vegetable production expanded in the Niayes region, commercialisation was professionalised, with merchants known as 'bana' replacing family labour in the collection, transport, and sale of produce (Souillac, 1965a, 1965b; Seck, 1985b cited by Coly et al., 2005; Fare, 2018). In response to rising fees from these intermediaries, SODENIA tried to implement a centralized distribution model similar to other state-run companies (Bouthier, 1965; CDH, 1974). These efforts faced challenges, however, due to the highly perishable nature of vegetable products, the SODENIA staff's lack of experience, and high operating costs. As a result, SODENIA went bankrupt, leading to the rise of informal traders, or 'bana' (CDH, 1974).

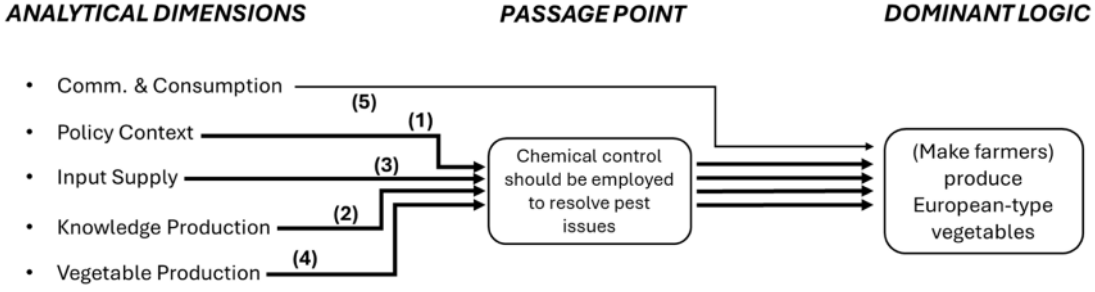


Fig. 3. From 1960–1984, the overall alignment towards chemical control progressed with the new alignment of the Policy dimension.

4.2.2. Alignment trajectory

All the elements described above can be interpreted in terms of a process of alignment represented in Fig. 3 below. The processes corresponding to the arrows in the figure are explained with their corresponding number in the paragraph hereafter.

(1) After independence in 1960, government policy remained aligned with the former colonial aim to increase European-type vegetable production, seen as a diversification opportunity in a context of rising instability of groundnut exports. Improving producer access to synthetic fertilisers and pesticides through dedicated subsidy programmes became a policy priority. (2) With the involvement of the Centre de Recherche Agronomique de Bambey from the early 1960s, followed by the CDH after 1972, the alignment of knowledge production and dissemination apparatuses with chemical control intensified. Chemical control became the main paradigm of vegetable crop protection studied and promoted by research and extension institutions. (3) Input supply also thrived under the paradigm of chemical control, introducing a wide range of pesticides to Senegal. (4) As vegetable production gained economic importance for farmers and more of them began to use pesticides, the alignment between vegetable production and chemical control initiated during the previous sequence was reinforced. (5) Consumption of European-type vegetables became widespread among the Senegalese population, marking a reinforcement of prior alignment between consumption and production patterns after independence. In sum, the 1960–1984 period was marked by: a) the strengthening of all pre-existing alignments; and b) new alignment of public policy towards chemical control with the rise of pesticide subsidies, as indicated Fig. 3 above.

4.3. 1984–2000: generalisation of pesticide use among vegetable producers

4.3.1. Historical narrative

After two decades of subsidies for chemical inputs, low international groundnut prices, and a 15-year drought, the Senegalese state faced a major budgetary crisis in the early 1980s (Faye et al., 2007). Bretton Woods institutions pressured it to implement structural adjustment reforms, making loans to the state subject to compliance, with a goal to achieving economic liberalisation and short-term budgetary balance (Kassé, 1990; Faye et al., 2007). Senegal was the first Sub-Saharan African country to adopt these reforms (Seck, 1998) which were part of the 1984 New Agricultural Policy (NPA) and which initiated a rapid withdrawal of the state from supporting the agricultural sector. In this context of fiscal restraint, public authorities' attention to the vegetable sector changed significantly. What was once considered a secondary, diversification crop became a priority commodity. The government aimed to achieve two main objectives: increase domestic production to reduce imports, and promote vegetable exports to Europe (MDR, 1984; Coly et al., 2005; Fall & Fall, 2001). To boost yields, Senegalese authorities identified the limited use of synthetic inputs as a significant barrier (MDR, 1984). From 1992, the pesticide trade went unregulated and grew exponentially in a decade-long legal vacuum. This resulted from Senegal joining a sub-regional pesticide regulation agreement, transferring the authority to approve pesticides to the Sahelian Pesticide Committee, which was not incorporated into national law until 2001 (CSP) (Sow et al., 2008; Diarra & Diallo, 2017).

The Senegalese pesticide and fertiliser subsidy system was gradually dismantled, giving rise to a privatised input sector (MDR, 1984; Fall, 1991; Williamson, 2003; Sow et al., 2008). Two main importers, SENCHIM and SPIA, came to dominate the market, while numerous petty retailers began distributing pesticides to farmers (Ouedraogo, 1991; Sow et al., 2008; Fall & Fall, 2001; Diarra & Diallo, 2017). As subsidies were phased out, pesticide prices tended to rise; however, this increase was mitigated by falling interest rates implemented by the main agricultural credit institution (Sow et al., 2008). Additionally, massive pesticide donations organised by the Japanese International Cooperation Agency (JICA) provided approximately 40 % of all pesticides used in Senegal from 1986 to 2000 for free (Repetto, 1985; Tobin, 1996a, 1996b; Sow et al., 2008; MAH, 2012). This initiative was intended as a compensatory measure following multilateral free trade agreements discussed as part of the negotiations conducted by the forerunner of the World Trade Organisation (WTO) – then known as GATT (Tobin, 1996a, 1996b). Pesticide donations led to market distortions and encouraged contraband, especially in lucrative sectors like vegetable production (Sow et al., 2008). Aside from pesticides, several development projects funded by foreign aid supported the growth of irrigated vegetable production through improved access to fertilisers and irrigation equipment (MAEH, 2004; Ndjekouneyom, 2007; Fare, 2018).

Due to structural adjustment reforms, agricultural research and extension systems faced significant reductions in resources (Coly et al., 2005; Ba et al., 2018). This change was part of a policy aimed at 'diminishing support to farmers' and encouraged their so-called 'responsibilisation' (MDR, 1984). From 1985 onwards, CDH underwent major staff cuts, leading to the abandonment of its large-scale extension system (MDR, 1984; CDH, 1986). In this void, private input resellers gradually emerged as the primary external advisors to farmers regarding crop protection, resulting in a systematic bias toward chemical control (Ouedraogo, 1991; Sow et al., 2008). In 1982, some scientists and foreign activists voiced concerns about the risks of increasing pesticide use in Senegal (Germain & Thiam, 1983; ENDA-PRONAT, 2010). Despite this shift in perspective among a few researchers, the residual and poorly funded Senegalese research and extension system was unable to develop alternatives to pesticides (Tobin, 1996b; RADHORT, 2012).

In the meantime, vegetable production continued to develop into a significant income-generating activity in rural and peri-urban areas, attracting an increasing number of seasonal and permanent workers. Land productivity progressed (de Bon et al., 1997), as did the number of crop cycles per year (Fare et al., 2017) and the cultivated surface areas, estimated to have doubled between 1984 and 1994 (passing from 6500 to 12,000 hectares) (Coly et al., 2005). High-input production techniques, including mechanised water pumping (Fare et al., 2017), fertilisers, high-yielding varieties and synthetic pesticides, became more prevalent, with reported pesticide use tripling during this period (Sow et al., 2008). A study conducted in 2000 in Mboro, located in the centre of the Niayes region, found that 100 % of vegetable producers were using pesticides, with weekly treatment frequency (Seck, 2001). Throughout the 1990s, the frequency of treatments grew due to an overall rise in pest pressure (Williamson, 2003; Williamson et al., 2008). As a result, vegetable production more than doubled, with output increasing from 100,000 tonnes in 1984 to 228,000 tonnes in 2000 (MDR, 1984; MA & DH, 2003).

Meanwhile, vegetable consumption rose due to urbanisation and demographic growth. Producers nevertheless struggled with limited bargaining power against local traders (i.e., bana) (Fall & Fall, 2001; Wade, 2004) and faced competition from European farms exporting surpluses to Senegal (David-Benz & Ba, 2000; Touré & Seck, 2005). Even though retail prices of vegetables increased, mainly due to inflation, growers did not benefit from a rise in added value (Wade, 2004; David-Benz, 2010). To cope, they focused on conventional intensification to boost productivity and lower production costs, as consumers primarily sought cheaper produce. It was only after the 1994 CFA franc devaluation, and the subsequent enhanced competitivity of domestically produced vegetables, that local demand for these goods increased sharply despite the offensive strategies of some European vegetable exporters (David-Benz & Ba, 2000; Fare et al., 2017).

4.3.2. Alignment trajectory

All the elements described above can be interpreted in terms of a process of alignment represented in Fig. 4 below. The processes corresponding to the arrows in the figure are explained with their corresponding number in the paragraph hereafter.

(1) During the structural economic adjustment reforms, vegetable production became a priority agricultural sector for public authorities. Despite the end of state subsidies for pesticides, the alignment of public action towards chemical control intensified *de facto* during the period 1984–2000, given the government's appeal for foreign pesticide donations and the 1990s legal vacuum concerning pesticide regulations. (2) Accordingly, the Senegalese pesticide market developed rapidly, intensifying the previous alignment of input supply and chemical control. (3) Despite the dismantling of public research and extension services, technical knowledge production remained strongly aligned with chemical control as private input dealers replaced researchers and public agents in advising vegetable producers on crop protection. (4) Meanwhile, the organisation of the vegetable market, by encouraging farmers to produce more and at a lower cost, increasingly made pesticide use an 'obligatory passage point'. (5) Vegetable producers engaged in a race towards conventional intensification, further strengthening ties between vegetable production and chemical control. In sum, the 1984–2000 sequence, which corresponds to the generalisation of chemical control among vegetable producers, saw: a) further strengthening of previously established alignments; and b) new alignment between vegetable commercialisation and chemical control through stronger productivity concerns in an increasingly competitive context, as indicated in Fig. 4 above.

4.4. 2000–2024: intensification of the generalised chemical control

4.4.1. Historical narrative

Since the early 2000s, vegetable production has become the most dynamic agricultural sector in terms of economic growth, and therefore increasingly a focus of the public authorities' attention (MAEH, 2004; MA, 2008; MAER, 2014; Diouf, 2021). Public policies have sought to boost domestic production, notably by extending cultivated areas throughout the country (Senghor, 2006; MA, 2008; IPAR, 2011; MAER, 2020; Diouf, 2021). To this end, successive governments have been encouraging large-scale, industrial vegetable cultivation through tax exemptions, often at the expense of family farming (Faye et al., 2007; MA, 2008; Pemba Makosso, 2014; ENDAPRONAT, 2017). In addition, political leaders have encouraged further conventional intensification of horticulture (MAER, 2020; MEDD, 2021). Although the CSP was legally recognised as responsible for pesticide registration in 2001, ending a decade-long legal vacuum, regulation remains loosely enforced. This is evident in the widespread sale of non-registered pesticides, which are particularly cheap (Diop, 2013; Diarra & Diallo, 2017; UEMOA, 2019; Gaillard, 2022). Since 2000, pesticide imports have been encouraged by a reduction in customs and fiscal taxes, a result of the adoption of the Common External Tariff (CET) among the member countries of the West African Economic and Monetary Union (WAEMU) (Sow et al., 2008). The Union creates a favourable institutional context for the use of pesticides, as the necessity for chemical control is explicitly outlined in its regulatory texts (UEMOA, 2009, p. 2). Meanwhile, the development aid sector has been increasingly promoting agroecology, framed as a strategy to combat allegedly excessive immigration to Europe (Marfurt et al., 2023; 2024) and is supporting initiatives focused on pesticide reduction or phase-out through training delivered to farmers (PADEN, 2014a; ENDA-PRONAT, 2010, 2022; DyTAES, 2020; FAO, 2021; COLEACP, 2021; ECHOS, 2021; DPV, 2022; Bottazzi et al., 2023). The development aid sector, which provides the majority of public support to agriculture (MAER, 2014; Gabas et al., 2017; Baborska, 2021), has been criticised as occasioning a 'projectorate', that is, a situation where public policy is implemented and formulated within the framework of short-term, externally funded projects, to the detriment of local sovereignty (Bottazzi & Boillat, 2021; Boillat et al., 2022).

Since the early 2000s, the Senegalese government has resumed subsidising chemical fertilisers, high-yielding crop varieties, and certain pesticides, particularly after the 2008 global economic crisis (MA, 2008; IPAR, 2015a, 2015b; Fall, 2016; Commodafrica, 2020; Diouf, 2021). However, pesticide supply is mainly handled by an expanding private sector involving hundreds of petty retailers supplied by eight main importers whose number has doubled since 2000 (Fall & Fall, 2001; Sow et al., 2008; Williamson et al., 2008; Diop, 2013; Diarra & Diallo, 2017). Pesticides have become quite affordable compared to other agricultural inputs (Fare, 2018), largely due to the rise of Asian generic pesticide production aimed at the Global South since the early 2000s (Zhang et al., 2011; Wan, 2014; Shattuck, 2021). As a result, vegetable producers mainly use made-in-China, broad-spectrum, and older-generation pesticides (Cissé et al., 2006; Diop, 2014; Diarra & Diallo, 2017). In parallel, many pesticide importers in Senegal are introducing botanical or micro-organism-based biopesticides, although they face challenges in selling these products due to their lower agronomic efficacy and higher costs (Albisia, 2024; Agropharm, 2024). Since 2000, pesticide imports into Senegal (all sectors combined) have almost tripled, from around 2635 tonnes to 7335 tonnes in 2023 (MAH, 2012; Port of Dakar, 2024).

After two decades of reduced capacity, public agricultural advice and research have received increased funding since 2000 (Ba et al., 2018). However, most activities have depended on foreign donors funding short-term projects (CDH, 2011, 2015, 2022), which has limited the establishment of a coherent agricultural research policy (Coly et al., 2005; Faye et al., 2007; Gaye & Sène, 2014).

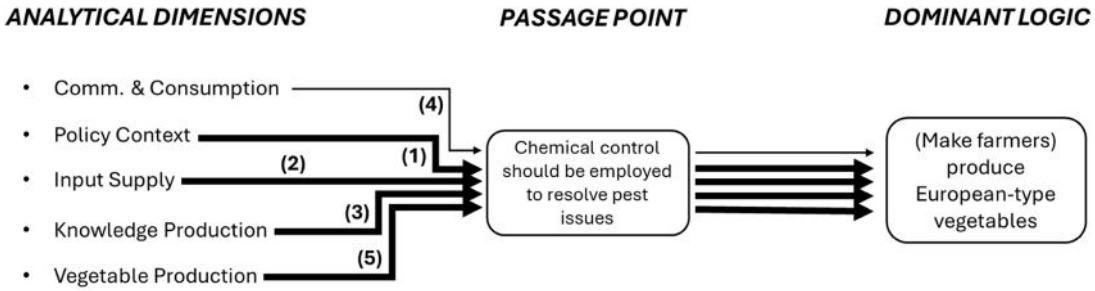


Fig. 4. From 1984–2000, the overall alignment towards chemical control progressed with the new alignment of the commercialisation & consumption dimension.

Interestingly, research projects are increasingly aimed at contributing to an 'agroecological transition' (Malézieux et al., 2009; Brévault et al., 2014; CDH, 2015). Agricultural advice activities have however been focusing on input substitution, such as replacing pesticides with botanical biopesticides, thus neglecting broader understandings of crop health that emphasise the need to transform landscapes and crop systems (Dugué et al., 2016, 2017; Bottazzi & Boillat, 2021; Gaillard, 2022). In any case, NGO staff and public advisers remain far outnumbered by pesticide resellers and contribute very marginally to the evolution of crop protection practices. To date, producers' main advisors on crop protection remain their peers and local pesticide resellers (Williamson, 2005; Muniappan et al., 2008; Gaillard, 2022).

Since 2000, vegetable production has surged from 228,000 tonnes to 1350,000 tonnes in 2018 (MA & DH, 2003; MAER, 2020; Diouf, 2021). Exports to Europe also rose from 10,000 tonnes in 2000 to 90,000 tonnes in 2020, primarily involving industrial, foreign-owned farms (MAEH, 2004; Makosso Pemba, 2014; IPAR, 2015; MAER, 2020). Vegetable producers have become even increasingly reliant on synthetic inputs, high-yielding seeds, water, and fossil fuels for water pumping (Williamson et al., 2008; Giunta et al., 2015; Fare et al., 2017). In the Niayes area, vegetable producers have been confronted with growing pest pressure, resulting from several factors: i) excessive use of fertilisers (Sall & Vanclooster, 2009; Fernandes et al., 2019); ii) the spread of high-yielding varieties that are more pest-susceptible (Williamson, 2005); iii) the destruction of beneficial organisms involved in pest control, due to pesticide sprayings (Bommarco et al., 2011; Labou et al., 2016, 2017); iv) the spread of several exotic pests since the 2000s (PIP, 2013; Maodo & Dasylva, 2017; Thiao, 2017; Heve et al., 2021); and v) the development of insecticide resistance (Sene et al., 2020). Confronted with growing pest pressure, vegetable producers have developed their own innovative practices, such as pesticide mixings (Cissé et al., 2006; Gaillard, 2022) and increased treatment frequency, spraying every week or even twice a week during the peak growing season (Seck, 2001; Williamson et al., 2008; Gaillard, 2022). As a result, pesticide use in the vegetable sector has likely increased in tandem with vegetable production, that is, at least a sixfold growth, but no quantitative estimates exist (Touré & Seck, 2005; Williamson et al., 2008; RADHORT, 2012; Tendeng et al., 2018).

Urban and demographic growth have kept boosting vegetable production in Senegal, which now exceeds national demand for key crops like onions (Fare et al., 2017; MAER, 2020). Senegalese producers continue to face the challenges posed by European vegetable surpluses (Wade, 2009; Fare et al., 2017; ENDA, 2020), but they are also increasingly facing competition from agro-industrial farms setting up in the Niayes area (Lequotien, 2021a, 2021b; MCCPME, 2022). While still producing most vegetables in Senegal, family-run farms lack negotiating power over prices (Wade, 2009; ENDA, 2020). They often experience post-harvest losses of 30–60 % due to selling difficulties aggravated by insufficient storage infrastructure (David-Benz & Seck, 2018; MAER, 2018; Dakaractu, 2019; ANSD, 2020; Baborska, 2021). Meanwhile, the organic vegetable market is growing slowly, with most organic vegetables being sold at the same prices as conventional ones due to limited outlets (Binta Ba & Barbier, 2015; de Bon et al., 2019). The overall dynamics of the vegetable market continue to promote the use of chemical control, except in the European export market where compliance with pesticide residue standards is necessary (Blondeau, 2007). Whereas Senegal did establish maximum residue limits for vegetables for the first time in 2020, compliance with this standard is strictly voluntary and covers only a maximum of 12 active ingredients (ASN, 2019). In comparison, the number of active ingredients that are authorized and sold in the sub-region exceeds one hundred (CSP,

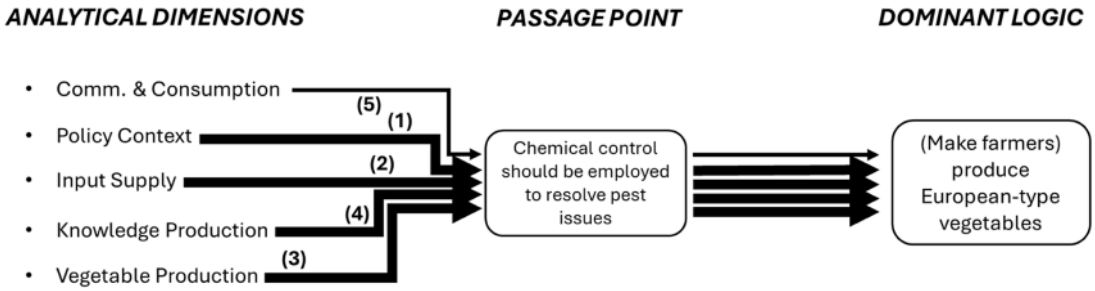


Fig. 5. Since 2000, overall alignment toward chemical control has been intensifying in each dimension.

2023).

4.4.2. Alignment trajectory

All the elements described above can be interpreted in terms of a process of alignment represented in the Fig. 5 below. The processes corresponding to the arrows in the Figure are explained with their corresponding number in the paragraph hereafter.

(1) With the advent of vegetable production as the leading agricultural sector, policy support for production growth reached an unprecedented level. This coincided with a stronger alignment toward chemical control, evidenced by a generalised circumvention of the legislation supposed to regulate the pesticide trade, the halving of customs taxes in force, and the designation of pesticide use as the central strategy for crop protection in West Africa. (2) This context, bolstered by the 'generic turn' in low-cost pesticide supply, enabled a boom in the Senegalese pesticide market (increased volumes and multiplication of distribution actors involved), intensifying the former alignment of input supply toward chemical control. (3) The arrival of cheap, generic pesticides and the intensification of pesticide use among vegetable producers are markers of a considerable strengthening of the alignment between chemical control and vegetable production. (4) The multiplication of pesticide importers and retailers, filling the de facto role of agricultural advisors, further reinforced the alignment between chemical control and technical knowledge production. (5) Competition between industrial and family vegetable producers is pushing family growers to improve their output, leading to a greater reliance on chemical control. This trend has been exacerbated by the absence of regulations on pesticide residue limits, reiterated in 2020. In sum, the period 2000–2025, which corresponds to the intensification of the generalised use of chemical control among vegetable producers, is characterised by a systematic reinforcement of the 5 alignments previously established, as indicated in Fig. 5 above.

5. Discussion: examining pesticide lock-in

We have organised our historical narrative by presenting the changes that have occurred along five analytical dimensions. This allows us to establish the prevalence of generic lock-in mechanisms *within* particular dimensions (in Section 5.1) and to analyse the development of alignments *across* dimensions over time (in Section 5.2), as well as eventual de-alignments.

5.1. Lock-in through techno-economic, socio-cognitive and politico-institutional mechanisms

We find evidence of conformity with the literature on typical lock-in mechanisms, as well as significant deviations. The case displays evidence of what the literature establishes as typical lock-in mechanisms: i) At the political-institutional level, it is striking how regulations, standards and policy networks have pursued a productivist rationale since colonisation, and this through different means (e.g., chemical input subsidies, priority support to agro-industrial farms, absence of pesticide residue standards, etc.). In addition, the structural circumvention of the regulations supposed to control the pesticide trade suggests a situation of regulators captured by vested interests. ii) From a socio-cognitive point of view, the merits of conventional intensification had until recently installed themselves as routinised and shared understanding among political leaders, vegetable growers, agronomists and rural advisers. From the point of view of vegetable farmers, advice networks where information is exchanged among peers and pesticide retailers undoubtedly constitute a form of social capital, insofar as they enable the rapid identification of treatments capable of protecting their crops at a lower cost. The uneven development of crop protection knowledge in favour of chemical control strongly fuels iii) a techno-economic lock-in that is reflected in the higher performance/cost ratio enjoyed by pesticide use. This advantageous ratio also stems from the consumption habits of Senegalese households and the organisation of the vegetable market, where informal quality standards for these products add no value to vegetables grown without pesticides. Still, on the techno-economic front, the generalisation of pesticide use among vegetable producers in the last decades of the twentieth century occurred in a context of growing competition and a broader race towards conventional intensification, illustrating a situation of a technological treadmill. This narrow co-evolution between the increased use of fertilisers, pesticides and high-yielding seeds suggests a situation of lock-in through technological complementarities, which equates to situations of chemical and/or pesticide treadmills. However, in the Senegalese sociotechnical system, the lock-in regarding pesticide use in vegetable production also differs substantially from situations of lock-in described in the Global North, in two significant respects: i) lower industrial sunk investments; and ii) the relatively minor role of supermarkets and mass distribution in Senegal.

Firstly, pesticide importers and retailers are motivated to sell as many inputs as possible, but their situation is quite different from that of the (European and North American) multinational companies focused on proprietary, under-patent products. The latter incur significant costs related to R&D, patenting, and registration, involving massive sunk investments that need to be recovered through large sales volumes. In contrast, importers and retailers in Senegal treat generic, off-patent pesticides as just another commodity and do not have equivalent sunk costs – especially since many importers avoid registration costs through fraud, allowing them greater portfolio flexibility. These companies are open to promoting alternative crop protection solutions if they prove financially beneficial, as evidenced by their efforts to introduce botanical or micro-organism-based biopesticides, despite challenges to sell these inputs due to their lower agronomic efficacy and higher costs.

Secondly, supermarkets and mass distribution, which are often cited as a central component of agri-food system lock-ins, are largely

absent from our case study. Although vegetable commercialisation has undergone significant professionalisation, the collection and distribution of the produce are still operated mainly by self-employed actors of the informal sector.[6] Paradoxically, the absence of mass distribution seems to contribute to the pesticide lock-in by preventing the designation of actors responsible for food safety and traceability, thus contributing to the invisibilisation of pesticide residues. Even if public regulations regarding pesticide residues were in place, the diversity of independent actors involved in vegetable commercialisation – which contrasts with the oligopolistic situations of mass distribution in the Global North – would probably render it more difficult to implement controls. In any event, the identification of typical lock-in mechanisms does not explain the lock-in trajectory of the sociotechnical system under consideration. To do so, we need to consider how analytical dimensions have co-evolved and aligned towards chemical control.

5.2. Lock-in as a trajectory of alignments across multiple analytical dimensions

Section 4 has provided an analytical narrative case tracing the lock-in of the socio-technical system associated with vegetable production in Senegal, through a four-phase periodisation covering 125 years. For each period presented in Section 4, a subsection analysed the lock-in process in terms of: a) alignment scope, referring to the number of analytical dimensions for which the involved actors' practices admit chemical control as an 'obligatory passage point' (OPP); and b) alignment intensity, referring to the reinforcement/attenuation of alignments across periods. The main alignment dynamics can be summarised as follows (see also Fig. 6). First, the period 1900–1960 showed the initial stages of two alignment fronts: multi-alignment towards (European-type) vegetable production, and partial alignment of three analytical dimensions around chemical control from 1945 onwards. Second, the period 1960–1984 was marked by the strengthening of all pre-existing alignments, while public policy started to align towards chemical control, with the implementation of pesticide subsidies. Third, during the period 1984–2000, which corresponds to the generalisation of chemical control among vegetable producers, all the previously established alignments strengthened. In addition, vegetable commercialisation started to align towards chemical control through stronger productivity concerns in an increasingly competitive context. Finally, the period 2000–2024 was marked by a systematic reinforcement of the five alignments previously established.

5.2.1. Partial de-alignments of actors and organisations

Over the last period (2000–2024), certain actors and organisations involved in i) public policy, ii) knowledge production and iii) input supply stopped (exclusively) supporting the growing use of chemical crop protection in the vegetable sector. These shifts can be interpreted as partial de-alignments of the corresponding actors and organisations, that have increasingly reframed chemical control as a 'passage point to be avoided' rather than an 'obligatory passage point', as suggested by the dotted arrows in Fig. 6. This indicates that alignments can remain stable despite the retreat or defection of specific actor groups. This continuity is due to the co-evolution among the actors and organisations associated with the analytical dimensions, which creates an emergent dynamic that either replaces the actors carrying out essential tasks for other groups in case of retreat, or encourages such retreat only after alternative coordination methods have made them unnecessary. For instance, in the case of knowledge production, de-alignments occurred after the marginalisation of the actors and organisations concerned, as formalised research and extension services were functionally replaced by private input retailers from the time of structural adjustment reforms, onwards. The retreat of state actors from technical advice is a more generalised process that can be observed in different sectors. The resulting void in public technical capacity and oversight tends to reinforce private sector logics – in this case, a preference for synthetic inputs and proprietary solutions. Beyond Senegal, this shift from public extension to 'extension as advertising' (Aga, 2019) constitutes a consequence of structural adjustment reforms in many countries of the Global South and plays a major role in the lock-in around pesticides (Mansfield et al., 2023). In the case of the policy dimension, the actors that have stopped promoting pesticide deployment are foreign development donors and operators, historically involved in the promotion of chemical control. However, this partial de-alignment occurred after a change in the way public policy contributes to the deployment of pesticides (this aspect will be discussed in the paragraph below). In any case, changes in objectives pursued by public development aid actors, albeit significant, do not in themselves constitute a truly coherent and articulate public policy; they are more like a superposing layer of public action (often referred to as a 'projectorate'). Similarly, the inclusion of non-chemical inputs in the portfolios of pesticide importers still results from an additive rather than a substitutive approach, marginally integrating alternatives amidst an ongoing trend of growing pesticide imports. In all three cases, the partial de-alignments observed are not significant enough to challenge the general contribution of public policy, knowledge production and input supply to deploying chemical control in the vegetable sector.

5.2.2. Neglectful governance: inaction as a modality of alignment in the global south

Historically made possible by state intervention, the deployment of pesticides in the vegetable sector has accelerated since 2000 despite the ending of this active support. Can we still talk about the maintenance of a policy-pesticide alignment in the absence of explicit pro-pesticide policy interventions, considering that a continuation of this alignment is still evident, in spite of a more hands-off approach to agricultural policy? Accordingly, the contribution of public action to the deployment of pesticides can be interpreted as operating in the mode of 'inaction', insofar as it provides no counterweight to the commercial initiatives of pesticide importers and retailers. As noted by Stegmaier (2022), implicit vetoes and failures to act can also represent measures of support. The latter constitute

[6] The informal sector which accounts for a large proportion of employment in the Global South refers to 'all individual businesses (generally non-agricultural) producing at least in part for the market, which operate on a small scale (below a certain employment threshold; often 5 employees) and/or which are not registered' (Roubaud, 2014, p. 111).

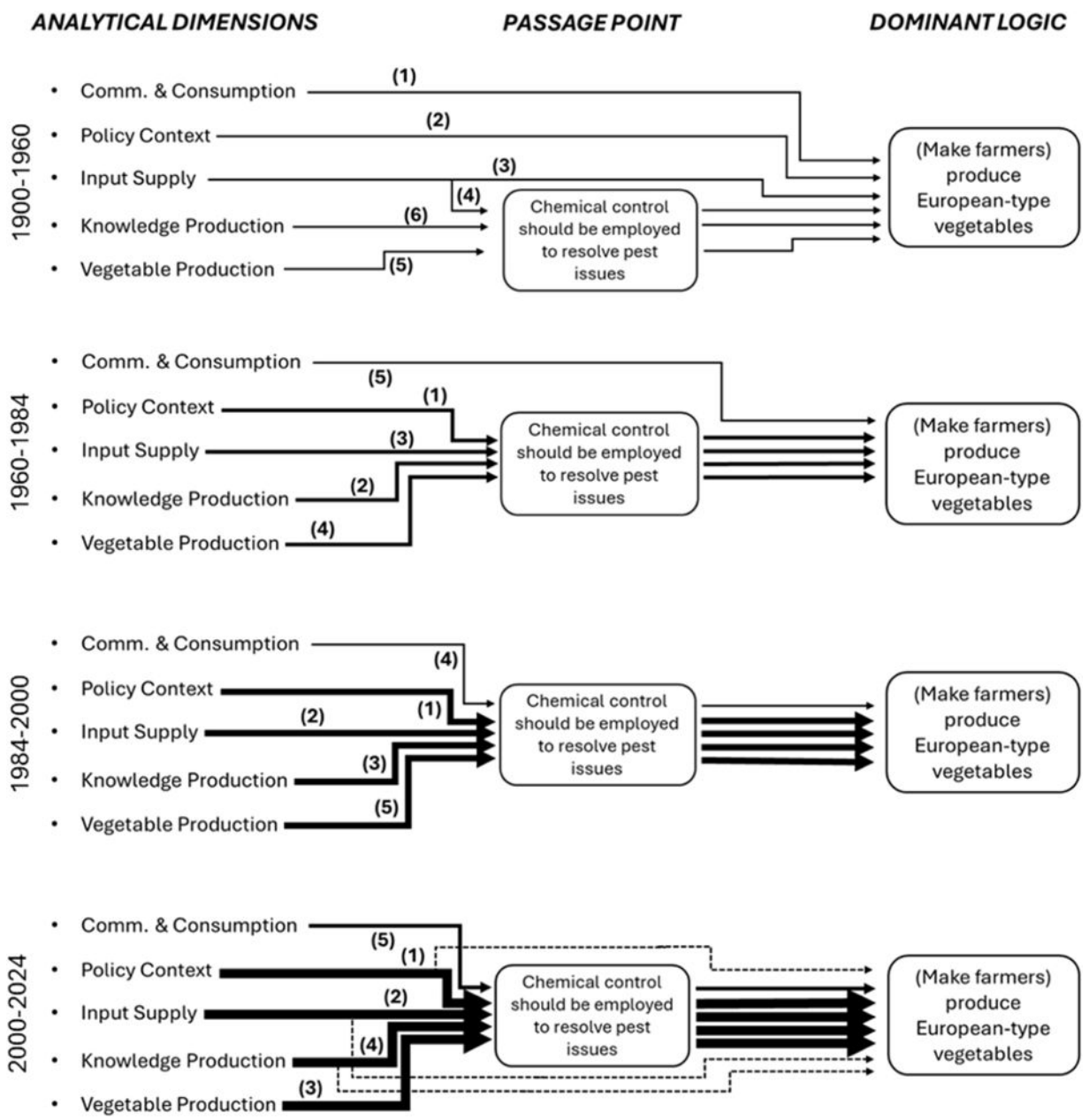
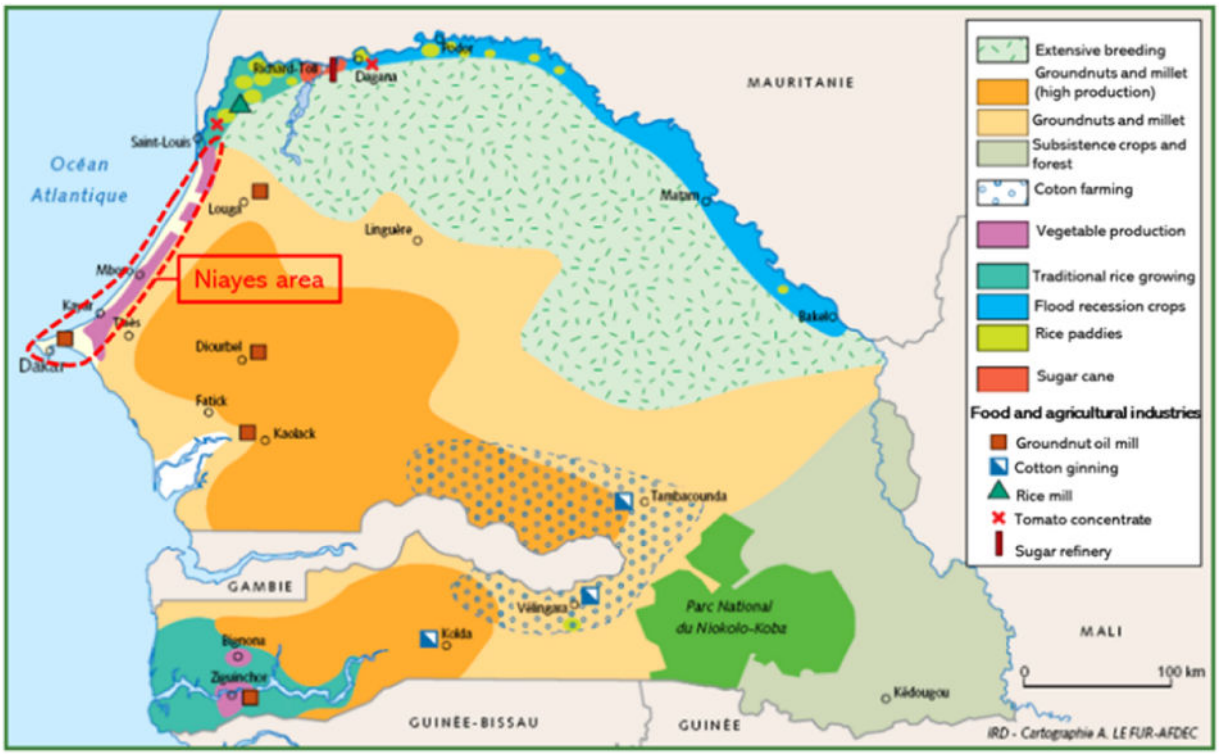


Fig. 6. overall (de-)alignment dynamic across periods (1900–2024).

particular forms of intervention, sometimes referred to as 'neglectful governance' (Newig et al., 2019; Turnheim, 2022). Non-enforcement of pesticide registration standards in Senegal, and the absence of regulations regarding limits of pesticide residues, are two examples of such *de facto* alignments through policy inaction, which is particularly marked in the domestic market, in contrast to the European-export market. Beyond Senegal, this radical asymmetry in the protection of pesticide users and food consumers between the Global North and South has been a central feature of the Global Pesticide Complex as it stands since the 1990s (Galt, 2008) – and even more so since 2000 with the boom in the production of cheap, generic pesticides specifically designed for use in developing countries (Hu, 2020; Mansfield et al., 2023). Alignment through neglectful governance of pesticide trade and use confirms what the literature anticipates as structural North-South inequalities (Wieczorek, 2018; Feola, 2020; Arora and Stirling, 2023; Ghosh and Mguni, 2025) – in this case in terms of safeguarding people from exposure to pesticides.

5.2.3. Un-locking perspectives

Bottazzi and his colleagues, concluding an analysis of the reasons for abandoning agroecological practices among vegetable producers in the Niayes area supported by NGOs, explain that '*the transition to more sustainable forms of agriculture will require much more*



Map 1. Map of Senegal and its agricultural specialization.

than "sensitisation" of farmers and technical transfer' (2023, p.11). The data and analyses presented in this article support these findings. Given that lock-in is systemic, un-locking interventions should be designed at the scale of the socio-technical system associated with vegetable production as a whole or, at the very least, should aim to transform multiple dimensions simultaneously. Three dimensions demonstrate particularly intense alignments towards chemical control, thus playing a major role in marginalising the efforts of producers, NGOs and pesticide distributors themselves to develop alternative crop protection techniques. These are: i) public policy that does not regulate the pesticide trade, which amounts to authorising the import and sale of any substance with a biocidal effect; ii) commercialisation & consumption of vegetables without any maximum residue threshold for vegetables intended for the domestic market; and iii) vegetable production, characterised by exacerbated competition between farms in a context of growing pest pressure. Any attempt at un-locking pesticide dependency should therefore explicitly consider how it can weaken this triple alignment, rather than merely alerting vegetable producers to the dangers of pesticides and the existence of alternatives. Moreover, although certain alignment processes are specific to the sector and country studied, the data and analyses presented in this article also highlight higher-order barriers linked to a Global Pesticide Complex, which will require more coordinated transnational action to dismantle, especially to address the spectacular disparity between the Global North and South in order to safeguard people from pesticide exposure. Finally, it is essential to create and maintain space for the existence and development of alternatives (i.e. socio-technical niches). Although our analysis does not explicitly focus on this point, the elements provided above illustrate the difficulties encountered by the actors struggling to develop alternative crop protection techniques in reframing the obligatory nature of the 'passage point' constituted by chemical control. These findings suggest that trusting the market to overcome pesticide dependency is an unrealistic approach, and that proactive policy intervention is required to form a protected space for alternatives, as part of an explicit plan to phase out pesticides.

6. Conclusion

To understand why and how the Senegalese vegetable sector is locked into a dependency on pesticides, we have relied on a narrative case study method to explore multi-dimensional alignments towards chemical control. We inductively constructed four time periods of alignment, cutting across five empirical domains: agricultural policy, input supply, scientific and technical knowledge, on-farm production, and vegetable commercialisation & consumption. As anticipated by the literature, the lock-in around pesticides examined in this analysis unfolds in three registers: techno-economic, socio-cognitive and politico-institutional. However, unlike the Global North, supermarkets and mass distribution are poorly represented and therefore make a very marginal contribution to the pesticide lock-in. On the contrary, the prevalence of informal distribution networks tends to exacerbate the lack of accountability for food safety and to invisibilise the issue of pesticide residues. In addition, lock-in by industrial sunk investment exerts a relatively minor role, due to the generic turn of the global pesticide market which tends to render pesticides just another commodity traded with

negligible investments. These findings confirm the necessity for transition scholars to more systematically explore case studies from the Global South in order to decentre, extend or revisit current theories and analytical frameworks.

From a longitudinal point of view, the article illustrates the value of framing lock-in as a process of multidimensional alignment towards an 'obligatory passage point'. In our case study, over the four periods considered, we found a progression of the number of actors aligned with chemical control across analytical dimensions (i.e., growing scope of alignment), coupled with a strengthening of alignments across periods (i.e., alignment intensification). In three analytical dimensions – policy, knowledge production, and input supply – certain actors and organisations historically involved in the deployment of chemical control are no longer (exclusively) supporting pesticide use since the early 2000s. While these shifts can be analysed as partial de-alignments, they have been offset by the emergence of new actors and coordination modalities. Alignments can therefore remain stable despite the retreat of specific actor groups, due to multi-dimensional adaptations. These adaptations are likely to occur when state interventions mainly take the form of inaction, which can be framed as 'neglectful governance'. The void resulting from public inaction tends to reinforce private sector initiatives, as exemplified by the shift from public extension to 'extension as advertising' or by the non-regulation of pesticide residues in foodstuffs and pesticide trade more broadly. The latter two aspects illustrate the need for transition scholarship to engage more explicitly with political science, to better conceptualise how polity, politics and policies influence transition dynamics – particularly in the context of institutional voids. These findings also show how structural Nord-South inequalities translate into differentiated levels of protection from pesticide exposure and participate in the lock-in of socio-technical systems in the Global South, stressing once again the need to decentre the analysis, still too focused on the Global North.

Concerning un-locking opportunities, given the multidimensionality of lock-in, interventions should be designed at the scale of the socio-technical system associated with vegetable production as a whole. At the very least, interventions should explicitly consider how they can weaken the particularly intense alignments that affect the following three dimensions: i) public policy that *de facto* authorises the import and sale of any substance with a biocidal effect; ii) commercialisation & consumption of vegetables that does not set any maximum residue threshold on vegetables intended for the domestic market; and iii) vegetable production, characterised by exacerbated economic competition between (industrial and family) farms, in a context of growing pest pressure. In other words, development aid interventions that focus on sensitising farmers to the dangers of pesticides and the existence of alternative crop protection technologies are largely futile. More broadly, our findings suggest that trusting the market to overcome pesticide dependency is unrealistic, and that proactive policy intervention is required to form a protected space for alternatives, as part of an explicit plan to phase out pesticides. The implementation of such measures globally seems unlikely without significant political struggles.

CRediT authorship contribution statement

Baptiste Gaillard: Writing – original draft, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Bruno Turnheim:** Writing – original draft, Supervision, Methodology, Funding acquisition, Conceptualization. **Raphaël Belmin:** Writing – original draft, Supervision, Methodology, Funding acquisition, Conceptualization. **Allison Marie Loconto:** Writing – original draft, Supervision, Methodology, Funding acquisition, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendices

Appendix A. Keywords used for the identification of documentary resources

Analytical dimensions	French keywords
Agricultural policy	Politique agricole Sénégal et légumes Politique agricole Sénégal et horticulture Politique horticole Sénégal Politique maraichère Sénégal Politique légumes Sénégal Appui au secteur maraicher Sénégal Appui au secteur horticole Sénégal

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Analytical dimensions	French keywords
	Subventions maraichage Sénégal
	Subventions horticulture Sénégal
	Subventions pesticides maraichage Sénégal
	Subventions pesticides horticulture Sénégal
	Subventions pesticides production légumes Sénégal
	Subventions produits phytosanitaires maraichage Sénégal
	Subventions produits phytosanitaires Sénégal
	Subventions produits phytosanitaires légumes Sénégal
Input-supply	Législation pesticides Sénégal
	Législation produits phytosanitaires Sénégal
	Commerce pesticides Sénégal
	Commerce produits phytosanitaires Sénégal
	Commerce pesticides maraichage Sénégal
	Commerce produits phytosanitaires maraichage Sénégal
	Marché privé pesticides Sénégal
	Marché privé produits phytosanitaires Sénégal
	Distribution pesticides Sénégal
	Distribution produits phytosanitaires Sénégal
	Vente pesticides Sénégal
	Vente produits phytosanitaires Sénégal
Scientific and technical knowledge	Recherche agricole maraichage Sénégal
	Recherche agricole horticulture Sénégal
	Recherche agricole légumes Sénégal
	Recherche agronomique maraichage Sénégal
	Recherche agronomique horticulture Sénégal
	Recherche agronomique légumes Sénégal
	Vulgarisation maraichage protection des cultures Sénégal
	Vulgarisation horticulture protection des cultures Sénégal
	Vulgarisation légumes protection des cultures Sénégal
	Expérimentations protection des cultures maraichage Sénégal
	Expérimentations protection des cultures horticulture Sénégal
	Expérimentations protection des cultures légumes Sénégal
	Recherche protection des cultures légumes Sénégal
	Recherche protection des cultures horticulture Sénégal
	Recherche protection des cultures maraîchères Sénégal
	Recherche alternatives pesticides maraichage Sénégal
Vegetable commercialisation & consumption	Commercialisation des légumes Sénégal
	Commercialisation horticulture Sénégal
	Commercialisation maraichage Sénégal
	Filière légumes Sénégal
	Filières maraichères Sénégal
	Filières horticoles Sénégal
	Chaîne de valeur légumes Sénégal
	Chaîne de valeur maraichage Sénégal
	Chaîne de valeur horticulture Sénégal
	Consommation légumes Sénégal
	Histoire consommation légumes Sénégal
Vegetable production	Histoire maraichage Sénégal
	Histoire horticulture Sénégal
	Histoire production légumes Sénégal
	Horticulture et pesticides Sénégal
	Maraichage et pesticides Sénégal
	Légumes et pesticides Sénégal
	Horticulture et produits phytosanitaires Sénégal
	Maraichage et produits phytosanitaires Sénégal
	Légumes et produits phytosanitaires Sénégal
	Consommation pesticides maraichage Sénégal
	Consommation pesticides horticulture Sénégal
	Consommation pesticides production légumes Sénégal
	Lutte chimique maraichage Sénégal
	Lutte chimique légumes Sénégal
	Lutte chimique horticulture Sénégal

Appendix B. Document database

	Title	Author(s)	Date
1	Pest Management Strategies in Traditional Agriculture: An African Perspective	Abate, T.; van Huis, A.; Ampofo, J. K. O.	2000
2	Les produits phytosanitaires d'AGROPHARM. Catalogue 2023	Agropharm	2023
3	Catalogue Phyto. Homologué CSP. Catalogue 2020	Albisia	2020
4	Mise en oeuvre des politiques régionales sur les pesticides en Afrique de l'Ouest: Rapport de l'étude de Cas au Sénégal	Amadou DIARRA et Boubacar DIALLO; DIALO, Boubacar	2017
5	La bourgeoisie d'affaires sénégalaise	Amin, Samir	1969
6	Passive sampling devices enable capacity building and characterization of bioavailable pesticide along the Niger, Senegal and Bani Rivers of Africa	Anderson, Kim A.; Seck, Dogo; Hobbie, Kevin A.; Traore, Anna Ndiaye; McCartney, Melissa A.; Ndaye, Adama; Forsberg, Norman D.; Haigh, Theodore A.; Sower, Gregory J.	2014
7	Pesticides et médicaments en santé animale: rencontre interdisciplinaire Nord-Sud de technologies, 16–17–18 février 1989, Bruxelles/Liège (Belgique)	Ansay, M.	1990
8	Situation économique et sociale du Sénégal 2017–2018. Ministère de l'économie, du plan et de la coopération	ANSD	2020
9	Les parasites animaux des plantes cultivées au Sénégal et au Soudan	Appert, Jean	1957
10	Norme Sénégalaise NS 03–0171. Produits horticoles: limites maximales de résidus (LMR) de pesticides	ASN	2019
11	Impacts sur la santé des pratiques des agriculteurs urbains à Dakar (Sénégal)	Ba, Abou; Cantoreggi, Nicola; Simos, Jean; Duchemin, Éric	2016
12	Les mécanismes financiers relatifs aux services de conseil agricole pilotés par la demande - De la vulgarisation à l'appui-conseil au Sénégal	Ba, Cheikh Oumar; Faye, Adama; Diagne, Doudou	2018
13	Suivi des politiques agricoles et alimentaires au Sénégal 2021	Baborska R.	2021
14	Labour control and the labour question in global production networks: exploitation and disciplining in Senegalese export horticulture	Baglioni, Elena	2018
15	La stratégie de croissance accélérée du Sénégal: une alternative pour le développement ?	Bassene, Théophile E S	2011
16	Réponses des organisations paysannes aux besoins de financement des exploitations familiales	Benegouch, Nedjma; Mees, Marc	2014
17	Complément du cours polycopié de maraîchage II. La pomme de terre	Beniest, Jan	1983
18	Rapport de phytopathologie 1982/1984 et synthèse des programmes d'amélioration de la tomate pour la résistance aux maladies	Beniest, Jan	1985
19	Guide pratique du maraîchage au Sénégal	Beniest, Jan; Bourdouxhe, L; Navez, Serge; Francq d'Hondt, Mia	1987
20	Atelier de prospections des préocupations du monde maraîcher	Beniest, Jan; Seck, Papa Abdoulaye	1986
21	Analyse des plans d'investissements agricoles: les cas du Sénégal, du Mali et de la CEDEAO	Benkahla, Amel	2010
22	Analyse du plan national d'investissement dans le secteur agricole du Sénégal	Benkahla, Amel	2011
23	Programme sous-régional de formation participative en gestion intégrée de la production et des déprédateurs à travers les champs-écoles des producteurs pour le Burkina Faso, le Mali et le Sénégal (GCP/RAF/378/NET) Mission d'évaluation	Bikienga, Issa Martin; Diarra, Batiana; Gassama, Alioune; Van Paasen, Anne-Marie; Van der Valk, Harold	2005
24	Economic and Environmental Performances of Organic Farming System Compared to Conventional Farming System: A Case Farm Model to Simulate the Horticultural Sector of the Niayes Region in Senegal	Binta BA, Amadou; Barbier, Bruno	2015
25	Etude d'impact des normes privées et réglementations européennes sur les filières horticoles sénégalaises Cas de la Mangue et du Haricot Vert	Blondeau, Antoine	2007
26	Etude d'impact social du PSAOP 2. Rapport Final	Bocoum, Mouhamadou Lamine; Faye, Mbaye Mbengue	2005
27	Esquisses sénégalaises, physionomie du pays, peuplades, commerce, religions, passé et avenir, récits et légende.	Boilat D.	1853
28	The agroecological transition in Senegal: transnational links and uneven empowerment	Boillat S., Belmin R., Bottazzi P.	2022
29	Agroecology as a pathway to resilience justice: peasant movements and collective action in the Niayes coastal region of Senegal	Boillat S., Bottazzi P.	2020
30	Mettre en ordre et discipliner les tropiques: Les sciences du végétal dans l'empire français, 1870–1940	Bonneuil Christophe	1997
31	Political Agroecology in Senegal: Historicity and Repertoires of Collective Actions of an Emerging Social Movement	Bottazzi P., Boillat S.	2021
32	Beyond motivations: A framework unraveling the systemic barriers to organic farming adoption in northern Senegal	Bottazzi P., Seck S.M., Niang M., Moser S.	2023
33	Government influence on pesticide use in developing countries	Bottrell, D.G.	1984
34	Appendice. Renseignements concernant l'exploitation horticole de M. J. B. Graulle	Bouffil, P.	1950
35	Les principales maladies des plantes cultivées au Sénégal	Bouhot, A., Mallamaire, D.	1965
36	Problèmes entomologiques des cultures maraîchères au Sénégal: situations actuelles et recommandations	Bourdouxhe, L	1985
37	La protection des principales espèces maraîchères du Sénégal	Bourdouxhe, L; Collingwood, E.F; Defrancq, M	1981

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	Title	Author(s)	Date
38	Rapport des ateliers de co-construction de scénarios prospectifs pour la zone sud des Niayes	Bourgeois, Robin; Bourguoin, Jérémy; Camara, Astou; Camara Clémentine; Ciss, Ibrahima; Daouda, Gueye Pape; Diop Mbaye; Fall Dialo, Mbaye; Faye, Amy; Gaye, Diery; Diop, Djibril; Jahel, Camille; Jankowsky, Frédérique; Gueye Ndiaye, Ali; Gueye Ndéye, Yacine; Kane, Oumar; Mbaye, Thérèse; Ndiaye, Mamadou; Ndoye Khady, Thiane; Niang, Seydou; Nourou Sy Elhadji, Seydou; Sané, Mamadou; Ségnane, Serigne; Seye, Ndiankou; Sow, Mamadou; Thiao, Ibrahima Paul; Tounkara, Sidy	2018
39	La diversification des cultures et ses problèmes au Sénégal	Bouthier, M.	1965
40	DIVECOSYS: Bringing together researchers to design ecologically-based pest management for small-scale farming systems in West Africa	Brévault, Thierry; Renou, Alain; Vayssières, Jean-François; Amadji, Guillaume; Assogba-Komlan, Françoise; Diallo, Mariama Dalanda; De Bon, Hubert; Diarra, Karamoko; Hamadoun, Abdoulaye; Huat, Joël; Marnotte, Pascal; Menozzi, Philippe; Prudent, Patrick; Rey, Jean-Yves; Sall, Dieynaba; Silvie, Pierre; Simon, Serge; Sinzogan, Antonio; Soti, Valérie; Tamò, Manuele; Clouvel, Pascal	2014
41	Politique indigène et administration coloniale au Sénégal (1890–1920)	Bruschi, F.	2005
42	Atelier-formation des nématologistes francophones d'Afrique: Dakar (Sénégal) 7 au 14 avril 1997	Cadet, Patrice	1997
43	Evaluation de la virose du jaunissement et de l'enroulement en cuillère des feuilles de tomate (Lycopersicon esculentum Mill) sur divers cultivars au Sénégal	Camara, Mouhameth; Mbaye, Abdou Aziz; Samba, Samba Arona Ndiaye; Gueye, Tala; Noba, Kandioura; Diao, Samba	2013
44	Etude analytique des organismes ayant effectué des tentatives d'organisation de la commercialisation des légumes. Les causes de leur échec. Recommandations et suggestions pour les nouvelles implantations	CDH	1974
45	Projet du programme de travail pour la campagne 1977–1978 CDH	CDH	1977
46	Les cultures maraîchères au Sénégal. Bilan des activités 1972–1985 du CDH	CDH	1986
47	Rapport de synthèse du programme culture maraichères	CDH	1987
48	Synthèse des travaux réalisés par le CDH de 1972 à 1979	CDH	1980
49	Centre de recherche pour le développement horticole (CDH). Résumé du Centre	CDH	2011
50	Programmation scientifique et budgétaire 2016 du CDH	CDH	2015
51	Techniques de production de semences d'oignon au Sénégal	CDH	1996
52	Maladies des cultures maraîchères au Sénégal et sensibilité variétale	CDH	1984
53	Note concernant une prospection maraîchère dans la région de Casamance	CDH	1983
54	Programmation scientifique et budgétaire 2022	CDH	2021
55	Projet d'Appui à la Transition Agroécologique en Afrique de l'Ouest	CEDEAO	2018
56	Partenaires d'innovations paysannes	CFSI	2016
57	Participatory action research for environmental health among senegalese peri-urban farmers	Chaudhuri, Ipsita Nita	2010
58	Chevalier A. 1950. Sur une entreprise horticole moderne des environs de Dakar pour la production des fleurs d'Europe et des légumes difficiles à réussir	Chevalier, A.	1950
59	Bienvenue sur le Portail Web de l'INSAH – SIGEPAO – Système Intégré de Gestion des Pesticides en Afrique de l'Ouest	CILSS	2017
60	Aperçu des principales réalisations du CILSS de 1973 à 2013	CILSS	2013
61	Liste globale des pesticides autorisés par le Comité Sahélien des Pesticides	CILSS	2018
62	Concertation du Cirad avec ses partenaires au Sénégal sur la recherche et la formation - Rapport Général	CIRAD; ISRA	2009
63	Horticulture et usage des pesticides dans la zone des Niayes au Sénégal	Cissé I., Fall S.T., Badiane M., Diop Y., Diouf A.	2006
64	Usage incontrôlé des pesticides en agriculture périurbaine: cas de la zone des Niayes au Sénégal	Cissé, Ibrahima; Tandia, Abdoul Aziz; Fall, Safiétou Touré; Diop, El Hadji Salif	2003
65	La production du bissap (Hibiscus sabdariffa L.) au Sénégal	Cisse, Mady; Dornier, Manuel; Sakho, Mama; MarDiop, Codou; Reynes, Max; Sock, Oumar	2009
66	L'émergence de nouvelles coopératives semencières au Sénégal – Analyse de l'impact de la recherche-développement sur l'arachide de 1999 à 2016	Clavel, Danièle; Gaye, Matar	2018
67	Les propositions paysannes: Pour une réforme foncière Sénégalaise garante d'un développement agricole et rural durable au Sénégal	CNRC	2012
68	COLEACP - Homepage	COLEACP	2021
69	Private Standards, Trade and Poverty: GlobalGAP and Horticultural Employment in Senegal: PRIVATE STANDARDS, TRADE AND POVERTY	Colen, Liesbeth; Maertens, Miet; Swinnen, Johan	2012
70	Sénégal notre pirogue: au soleil de la liberté journal de bord, 1955–1980. Paris	Colin, R.	2007
71	Rapport des essais insecticides 1980–1981. Synthèse des résultats 1976–1981	Collingwood, E.F; Bourdouxhe, L; Diouf, M	1981

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	Title	Author(s)	Date
72	Protection des végétaux. Rapport des essais pesticides 1975–1980. Deuxième partie: fongicides nématicides	Collingwood, E.F; Defrancq, M	1980
73	Protection des végétaux. Rapport des essais pesticides 1976–1979. Première partie: insecticides	Collingwood; Bourdouxhe	1980
74	Congrès sur la lutte contre les Insectes en Milieu Tropical Marseille (France). Perspectives offertes par les pyréthinoïdes de synthèse dans la lutte contre divers insectes des cultures maraichères au Sénégal	Collingwood; Bourdouxhe, L	1979
75	Les productions horticoles	Coly, Emile Victor; Seck, Pape Abdoulaye; Mbaye, Abdou Aziz	2005
76	Au Sénégal, le coût de la campagne agricole 2020/21 sera de FCFA 60 milliards	Commodafrica	2020
77	Les 9 programmes du nouveau ministre de l'Agriculture au Sénégal	Commodafrica	2019
78	Liste globale des pesticides autorisés par Ie Comité Sahélien des Pesticides. Version de Juillet 2023	CSP	2023
79	Le Sénégal veut abandonner les pesticides et produire bio	Cznech, Jeannine	2014
80	Direction de l'horticulture/SHEP: « Ce programme a contribué aux performances très satisfaisantes de l'horticulture au Sénégal. Des records de production ont été réalisés durant ces trois ans »	Dakaractu	2019
81	L'oignon dans la vallée du fleuve Sénégal: une filière en émergence	David-Benz H., Ba D.	2000
82	Oignon: une production en plein essor pour répondre à la demande urbaine	David-Benz, Hélène; Diop, Mouhamadou; Fall, Charles; Wade, Idrissa	2010
83	Quelques éléments d'analyse sur les itinéraires techniques pratiqués par les producteurs d'oignon de la vallée du fleuve Sénégal	David-Benz, Hélène; Huat, Joël; Ba, Dieynaba	2001
84	Améliorer la qualité de l'oignon au Sénégal: contractualisation et autres mesures transversales	David-Benz, Hélène; Seck, A	2018
85	Development of vegetable cropping systems in the Niayes zone of Senegal	De Bon H., Faye F., Pagès J.	1997
86	Pratiques d'utilisation des pesticides par les producteurs agricoles en Afrique Sub-saharienne	De Bon, Hubert	2016
87	Rendements et pratiques des cultures maraîchères en agriculture biologique au Sénégal	de Bon, Hubert; Brun-Diallo, Laure; Sène, Jean-Michel; Simon, Serge; Sow, Mamadou Abdoulaye	2019
88	Conception de systèmes de cultures maraîchers en Afrique de l'Ouest	de Bon, Hubert; HortSys, UR	2013
89	Pesticide risks from fruit and vegetable pest management by small farmers in sub-Saharan Africa. A review	de Bon, Hubert; Huat, Joël; Parrot, Laurent; Sinzogan, Antonio; Martin, Thibaud; Malézieux, Eric; Vayssières, Jean-François	2014
90	Rapport Protection des Végétaux, Phytopathologie	Defrancq, M	1983
91	Les principales maladies bactériennes et chryptogamiques de la pomme de terre	Defrancq, M	1984
92	Synthèse par culture des méthodes de lutte disponibles	Delhove, Gilles	
93	Première approche sur l'inventaire et l'importance des ennemis de 10 cultures maraîchères dans les 10 pays du RADHORT	Delhove, Gilles; Coly, Emile Victor	
94	Etude pour la planification des cultures maraichères au Sénégal: 2e partie	Delvaque, J	1980
95	Etude pour une planification des cultures maraichères au Sénégal: les facteurs de production	Delvaque, JM	1980
96	Perspective des productions maraichères au Sénégal rapport final	Delvaque, JM	1980
97	Accords de partenariat économique: Le baiser de la mort	Demba Moussa Dembélé	2016
98	Pesticide legislation in Senegal	Deuse J.P.L.	1975
99	PAPSEN. Centre de services et formation pour l'horticulture Bambey	Di Vecchia, Andrea; Coly, Emile Victor; Ba, Touna; Niang, Youga; Robbiati, Giorgia	2013
100	Interaction territoires-temporalités et processus de fabrication de la discontinuité. Exemple du Nouakchottien dans la fragmentation spatiale et dans l'organisation territoriale des Niayes (Sénégal)	Dia, S.	2018
101	Revue des politiques publiques menées au Sénégal sur la période 1960–2016	Diagne, Atoumane	2017
102	Sécurité alimentaire et libéralisation agricole	Diagne, Rokhaya	2013
103	Assessment of a cabbage/pak choï crop association to manage aphid and parasitoid populations on cabbage crops in Senegal	Diallo, Aguibou; Sall-Sy, Dienaba; Bordat, Dominique; Diarra, Karamoko	2017
104	Evaluation des besoins en information agricoles dans les états du groupe Afrique-Caraïbe-Pacifique (ACP)	Diallo, Alassane	2008
105	Efficience des stratégies endogènes d'adaptation du secteur agricole aux changements climatiques dans le bassin de la région de Thiès (Sénégal)	Diallo, Souleymane; Nacro, Hassan Bismarck; N'diaye, Aminata	2017
106	Situation et contraintes des systèmes urbains et périurbains de production horticole et animale dans la région de Dakar	Diao, Maty	2004
107	Mise en œuvre des politiques régionales sur les pesticides en Afrique de l'Ouest: Rapport de l'étude de Cas au Sénégal	Diarra, A.; Diallo, B.	2017
108	Etude diagnostic du système agraire de la petite côte: région de Nguekokh - Sénégal	Diarra, Abdoulaye	2005
109	Des pratiques culturales influent sur les attaques de deux ravageurs de la tomate dans les Niayes au Sénégal	Diatte, Mamadou; Brévault, Thierry; Sall-Sy, Diénaba; Diarra, Karamoko	2016
110	Modélisation numérique du transport de solutés: prévision des risques de contamination de la nappe des Niayes (Sénégal) par les pesticides	Diaw, El Hadji Bamba; Lo, Mamadou Lamine; Wade, Mamadou; Ndao, Seydou; Diallo, Ablaye; Sissoko Grégoire	2016

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111	Les politiques agricoles en Afrique subsaharienne: une symphonie inachevée	Dieye, Dr Papa Nouhine	2008
112	Problèmes de développement des activités du secteur primaire dans la banlieue de Dakar	Dione, D.	1986
113	Diagnostic des pratiques d'utilisation et quantification des pesticides dans la zone des Niayes de Dakar (Sénégal)	Diop, Amadou	2013
114	Les nématodes parasites des cultures maraîchères au Sénégal. Distribution de Pasteuria penetrans actinomycète, parasite des nématodes du genre Meloidogyne	Diop, Mamadou Thiam	1994
115	Terminal Evaluation of the UNEP/GEFproject: "Reducing Dependence on POPs and other Agro-Chemicals in the Senegal and Niger River Basins through Integrated Production, Pest and Pollution Management"	Diouf, Alexandre	2016
116	Evaluation environnementale stratégique (EES) et Plan de Gestion environnementale et sociale (PCGES)	Diouf, M Birame	2013
117	Programme national de relance de l'horticulture (PNRH): opportunités d'investissement dans l'agri-business au Sénégal	Diouf, M.	2021
118	Partenaires DIVECOSYS - Centre pour le Développement de l'Horticulture (CDH) de l'Institut Sénégalais de Recherches Agricoles (ISRA)	DIVECOSYS	2020
119	Gestion agroécologique des bioagresseurs et de la fertilité des sols pour des systèmes de cultures résilients face au changement climatique. Projet scientifique 2018–2023	DIVECOSYS	2018
120	Gestion agroécologique des bioagresseurs et de la fertilité des sols pour des systèmes de cultures résilients face au changement climatique. Projet scientifique 2019–2023	DIVECOSYS	2019
121	PPAAO/WAAPP pest and pesticides management plan	Doucouré, Djibril	2007
122	Ateliers de formation sur la lutte et l'usage sécurisé des pesticides	DPV	2022
123	« Si vous faites l'âne, je recours au bâton ! », Mamadou Dia et le projet de décolonisation du Sénégal: lignes de force, limites et perceptions (1952–2012)	Dramé, P., Niang, B.	2019
124	Transition agro-écologique du maraichage en périphérie de Dakar (Sénégal) nécessité agronomique, protection des consommateurs ou effet de mode ?	Dugué, Patrick; De Bon, Hubert; Kettela, Victor; Michel, Isabelle; Simon, Serge	2017
125	Diversité des processus d'innovation dans les systèmes maraîchers des Niayes (Sénégal): entre intensification conventionnelle et transition agroécologique	Dugue, Patrick; Kettela, Victor; Isabelle, Michel; Simon, Serge	2016
126	Etude de faibilité du projet maraichage agro-écologique dans la région de Ndiongolor Diouroup (Sénégal)	Dugué, Patrick; Simon, Serge	2016
127	Les organisations interprofessionnelles agricoles au Sénégal: de nouveaux outils de régulation des marchés ?	Duteurte, G; Dieye, Papa Nouhine	2008
128	Contribution aux politiques nationales pour une transition agroécologique au Sénégal	DyTAES	2020
129	La politique agricole régionale de l'Afrique de l'Ouest: l'ECOWAP	ECOWAP	
130	Circuits courts solidaires à Dakar (Sénégal)	ENDA	2020
131	Analyse et mise en perspective de deux systèmes de production	Enda Pronat	2017
132	Fiches de capitalisation sur l'agriculture écologique et biologique au Sénégal de 2015 à 2017	Enda Pronat; Biovision; EOA; Fenab	2017
133	Des pesticides à une agriculture saine et durable: la souveraineté des peuples	ENDA-PRONAT	2010
134	Fenab – Enda Pronat	ENDA-PRONAT	2022
135	Tomate locale et production de concentrés: la force des contrats entre paysans et industrie (Chapitre 8)	Fall, Amadou Abdoulaye; David-Benz, Hélène; Huat, Joel	2009
136	Impact de libéralisation commerciale au Sénégal: évaluation de l'accord de partenariat économique sur l'agriculture et les ménages sénégalais	Fall, Cheickh Sadibou	2016
137	Etude de l'évolution des résidus de deux produits phytosanitaires (Endosulfan et Diméthoate) sur deux types de culture maraîchère (tomate et laitue), au Sénégal	Fall, M.	1991
138	Cités horticoles en sursis? l'agriculture urbaine dans les grandes Niayes au Sénégal	Fall, Safiétou Touré; Fall, Abdou Salam	2001
139	Intégration horticulture - élevage dans les systèmes agricoles urbains de la zone des Niayes (Sénégal)	Fall, Safiétou Touré; Fall, Abdou Salam; Cissé, Ibrahima; Badiane, Aminata; Fall, Cheikh Alassane; Diao, Maty	2001
140	Atelier national sur la gestion des pesticides au Sénégal	FAO	2008
141	Sénégal: Stratégie Nationale de la Petite Irrigation	FAO	1999
142	Cadre de programmation par pays (CPP) 2013–2017 FAO	FAO	2014
143	Centre pour le développement de l'horticulture Sénégal. Conclusions et recommandations du projet	FAO	1975
144	Programme de Gestion intégrée de la production et des déprédateurs en Afrique	FAO	2021

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145	Project brief: Reducing Dependence on POPs and other Agro-Chemicals in the Senegal and Niger River Basins through Integrated Production, Pest and Pollution Management	FAO	2005
146	Horticulture Cultivars Performance Database	FAO	2014
147	Initiative de passage à l'échelle supérieure de l'agroécologie. Transformer l'alimentation et l'agriculture au service des ODD: une proposition préparée pour le symposium international sur l'agroécologie	FAO	2018
148	Achieving Social and Economic Development in Africa through Ecological and Organic Agricultural Alternatives	FAO; AUC	2018
149	13th JOINT CIPAC/FAO/WHO OPEN MEETING (60th CIPAC Meeting and 15th JMPS Meeting)	FAO; CIPAC; WHO	2016
150	Analysis and Diagnosis of the Agrarian System in the Niayes Region, Northwest Senegal (West Africa)	Fare Y., Dufumier M., Loloum M., Miss F., Pouye A., Khastalani A., Fall A.	2017
151	Origine et transformation d'un système agraire au Sénégal. La zone des Niayes	Fare, Yohann	2018
152	Implications structurelles de la libéralisation sur l'agriculture et le développement rural au Sénégal (1950 – 2006)	Faye, Jacques; Ba, Cheikh Oumar; Dieye, Papa Nouhine; Dansoko, Mamadou	2007
153	Stratégie nationale et programmes prioritaires de sécurité alimentaire. Partenariat avec le CILSS	Faye, Mamadou	2002
154	Plan de gestion des pestes et pesticides du Projet du Pôle de Développement de la Casamance	Faye, Mbaye Mbemgue	2013
155	Actualisation du Plan de Gestion des Pestes et des Pesticides	Faye, Mbaye Mbemgue	2013
156	Conception de systèmes de cultures agro-écologiques par la gestion agroécologique des bioagresseurs et l'utilisation de résidus organiques (DIVECOSYS): projet 2019–2024	Fernandes, P.; Silvie, Pierre; Amadji, G.; Belmin, R.; Bocar Bal, A.; Brévault, T.; Chailleux, A.; Clouvel, P.; Dannon, E.; Diallo, M.D.; Diarra, K.; Diatta, P.; Djigal, D.; Faye, E.; Feder, F.; Legros, S.; Lopez Llandres, A.; Médoc, J.M.; Mensah, A.; Niang, Y.; Parrot, L.; Simon, S.; Soti, V.; Téréta, I.; De Bon, H.; Maiga, D.; Sanon, A.; Koné, D.; Akantetou, P.; Babin, R.	2019
157	Amélioration de la productivité et des modes d'utilisation de la patate douce par la diffusion des acquis	FNRAA	2010
158	Résultats de présélection du 1er appel à proposition PPAAO/WAAPP PHASE II: 2013 – 2017	Fonds National de Recherches Agricoles et Agro-alimentaires (FNRAA)	2013
159	Former les acteurs d'une nouvelle économie agricole et rurale. Orientations et stratégies de formation à l'horizon 2015 Rapport du Groupe de Travail	Formation Agricole et Rural (FAR)	1999
160	Etude pour la relance des interventions de l'expertise française en matière de formation professionnelle agricole dans les pays d'Afrique subsaharienne. Rapport de la mission réalisée au Sénégal et au Mali du 16 au 28 Septembre 2004	Fusiller; Bouyer; Maragnani	2004
161	Financement ou financiarisation du développement ? Une question en débat	Gabas J.-J., Ribier V., Vernières M.	2017
162	Etude sur le financement du développement agricole en Afrique de l'ouest. Synthèse tirée de l'analyse comparative des études de cas: Côte D'Ivoire, Ghana, Sénégal	Gabas, Jean-Jacques; Ribier, Vincent; Varlet, Frédéric; Brochard, Valentin	2015
163	(Bio)porodi rekk? Structuration des savoirs paysans de protection des cultures et dépendance aux pesticides en maraîchage – Cas d'une commune maraîchère de la zone des Niayes (Sénégal)	Gaillard, B.	2022
164	Politique hydro-agricole et résilience de l'agriculture familiale: Le cas du Delta du fleuve Sénégal	Garambois, Nadège; El Ouaamari, Samir; Fert, Mathilde; Radzik, Léa	2018
165	Projet d'Appui aux Filières Agricoles (PAFA) - Impact assessment report	Garbero, Alessandra; Diatta, Dieynab; Olapade, Markus	2018
166	Critical review of the role of PPE in the prevention of risks related to agricultural pesticide use	Garrigou, A.; Laurent, C.; Berthet, A.; Colosio, C.; Jas, N.; Daubas-Letourneux, V.; Jackson Filho, J.-M.; Jouzel, J.-N.; Samuel, O.; Baldi, I.; Lebailly, P.; Galey, L.; Goutille, F.; Judon, N.	2020
167	Évaluation des problèmes critiques de la recherche et développement agricole au Sénégal: le cas de l'institut sénégalais de recherches agricoles (ISRA)	Gaye L., Sène L.	2014
168	Les commerçants privés et l'approvisionnement du monde rural - cas des facteurs de production au Sénégal	GAYE, Matar	1991
169	La réforme du système coopératif au Sénégal: caractéristiques des nouvelles structures	GAYE, Matar	1991
170	Identification des possibilités d'appui aux filières de commercialisation porteuses	Gergely, Nicolas; Hathie, Ibrahima; Coronel, Célia	2014
171	Les pesticides une menace pour le Sénégal ?	Germain P., Thiam A.	1983
172	Private-Sector Agricultural Research and Innovation in Senegal Recent Policy, Investment, and Capacity Trends	Gert-Jan, Stads; Sème, Louis	2011
173	PAPSEN. Etude préliminaire sur l'horticulture dans les régions de Thiès, Diourbel et Fatick	Giunta, Rosella; Kane, Papa Demba; Direnzo, Paolo; Diatte, Mamadou; Diop, Fatou; Laghetti, Gaetano	2015
174	Produits phytosanitaires du Sénégal	Go Africa Online	2020
175	Pesticides, Corporate Irresponsibility, and the Fate of Our Planet	Goulson, Dave	2020

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176	Lettre de Politique de Développement Agricole - Programme d'ajustement Sectorial Agricole PASA	Gouvernement du Sénégal	1995
177	Document d'Orientation Stratégique sur la Politique Agricole	Gouvernement du Sénégal	1998
178	Programme national d'appui à la sécurité alimentaire (programme de relance des productions vivrières)	Gouvernement du Sénégal; FAO	2003
179	Filière fruits et légumes. Présentation de la filière	GRET	2015
180	Evaluation des pratiques d'irrigation, de fertilisation et d'application de pesticides dans l'agriculture périurbaine de Dakar, Sénégal	Gueye-Girardet, Anne	2010
181	Role of Nutrients in Controlling the Plant Diseases in Sustainable Agriculture	Gupta, Nitika; Debnath, Sovan; Sharma, Sushma; Sharma, Prachi; Purohit, Jyotika	2017
182	La mise en œuvre du PDDAA 2025 au Sénégal: Y a-t-il une convergence d'idées entre les parties prenantes ?	Henning, Christian; Fall, Cheickh Sadidou; Johnson, Michael; Dia, Djiby	2017
183	La mise en œuvre du PDDAA 2025 au Sénégal. Identification des secteurs clés et des politiques favorisant une croissance pro-pauvre	Henning, Christian; Hedtrich, Johannes; Fall, Cheickh Sadibou; Johnson, Michael	2015
184	La politique agricole de l'UEMOA: aspects institutionnels et politiques	Hermelin, Bénédicte	2003
185	Problems and Policy for Pesticide Exports to Less Developed Countries	Hill, R.	1988
186	Approches agroécologiques et autres approches novatrices	HLEP	2019
187	Analyse des dépenses publiques en soutien à l'agriculture et l'alimentation au Sénégal, 2010–2015	Hummel, L; Mas Aparisi, A	2016
188	Après dix années de PDDAA, où en est le développement agricole en Afrique ?	Immenschuh, Sarah; Diop, Hawa	2013
189	Analyse du plan national d'investissement dans le secteur agricole du Sénégal: Résumé exécutif	IPAR	2011
190	Subventions des intrants agricoles au Sénégal: Controverses et Réalités. Rapport annuel sur l'état de l'agriculture et du monde rural au Sénégal	IPAR	2015
191	Contribution de l'IPAR au processus d'amélioration des pratiques de subventions agricoles au Sénégal	IPAR	2018
192	Traçabilité et impacts des subventions agricoles	IPAR	2015
193	Riposte à la covid-19 par la protection sociale et le renforcement des systèmes alimentaires locaux: le cas des Niayes au Sénégal	IPAR	2021
194	Interdiction de l'endosulfan au Sahel dans les pays d'Afrique de l'Ouest. Groupe de Travail PAN/IPEN sur les pesticides POPs (Polluants Organiques Persistants)	IPEN	2008
195	Production de riz et d'oignon: les bons points de la Coopération ISRA/KOPIA	ISRA	2019
196	La lettre de l'ISRA. Lettre d'information trimestrielle pour la recherche et le développement agricoles au Sénégal	ISRA	2017
197	Dynamique des populations des principaux ravageurs des cultures maraîchères au Sénégal	ISRA; CDH	?
198	Bilan de la recherche agricole et agroalimentaire au Sénégal ISRA-CIRAD	ISRA; CIRAD	2005
199	Rapport d'information fait au nom de la Commission des Affaires économiques et du Plan, à la suite de la mission effectuée au Sénégal, en Côte-d'Ivoire et au Cameroun, du 28 janvier au 12 février 1970, concernant le développement économique de ces pays et les problèmes liés à la politique de coopération avec la France et la Communauté économique européenne	Jager R., Laucournet R., Prêtre H., Bajeux O., Gargar M., Golvan V., Pauzet M.	1970
200	Measuring pesticide ecological and health risks in West African agriculture to establish an enabling environment for sustainable intensification	Jepson, P. C.; Guzy, M.; Blaustein, K.; Sow, M.; Sarr, M.; Mineau, P.; Kegley, S.	2014
201	Julie L. 2014. Dakar Food: Between Permanence and Change	Julie, L.	2014
202	Le ceebu jën: un plat révélateur de la dualité de l'alimentation sénégalaise entre approbation sociale et dévalorisation sanitaire	Ka A., Leport J.	2023
203	L'exploitation maraichère et fruitière dans la région de Sangalkam	Kane, Ahmadou	1973
204	Femmes prolétaires du Sénégal, à la ville et aux champs	Kane, F.	1977
205	Sénégal, crise économique et ajustement structurel	Kassé, M.	1990
206	Pesticides agricoles: ce qu'en savent les agriculteurs Daganois, circuits de distribution et réglementation.	Kedjo, Elie Michel	2015
207	Determinants of parasitoid assemblages of the diamondback moth, Plutella xylostella, in cabbage farmer fields in Senegal	Labou B., Brévault T., Bordat D., Diarra K.	2016
208	Spatial and temporal incidence of insect pests in farmers' cabbage fields in Senegal	Labou B., Brévault T., Sylla S., Diatte M., Bordat D., Diarra K.	2017
209	Importance de la "Teigne du chou" dans les Niayes au Sénégal: interrelations avec la température et les cultivars utilisés	Labou, Babacar; Bordat, Dominique; Brevault, Thierry; Diarra, Karamoko	2016
210	Caractérisation des systèmes de production agricole au Sénégal. Document de synthèse	LADA	2007
211	Évaluation des risques liés à l'utilisation de pesticides en culture cotonnière au Mali	Le Bars, Marjorie; Sidibe, Fatoumata; Mandart, Elisabeth; Fabre, Jacques; Le Grusse, Philippe; Diakite, Cheick Hamalla	2020
212	Spatial and Historical Analysis of Pesticide Externalities in Locust Control in Senegal - First Steps.	Leach, Adrian Warneford; Mullié, Wim C.; Mumford, John D.; Waibel, Hermann	2015

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	Title	Author(s)	Date
213	Causes écologiques et conséquences démographiques de l'économie maraîchère en milieu rural sénégalais	Léger, Jean-Francois	2001
214	L'UNCAS annonce 1.000 coopératives agricoles intégrées-bio	Lejecos	2014
215	Sénégal: Horticulture - Une filière avec ses multiples contraintes	Lejecos	2014
216	Zone des Niayes. Prix de la meilleure horticultrice: Le Paden stimule la performance des femmes dans les Niayes	Lequotidien	2018
217	Horticulture - Mévente, concurrence déloyale: L'oignon pourrit sur l'axe Keur Moussa-Diender	Lequotidien	2021
218	Horticulture: Concurrence déloyale, absence de chambre froide	Lequotidien	2021
219	GOANA: Programme agricole 2008–2009: La Grande Offensive Agricolepour la Nourriture et l'Abondance	MA	2008
220	Evolution de la production des principales spéculations maraîchères.	MA & DH	2003
221	Contribution à l'étude de l'effet d'une culture associée entre l'armoise africaine (Artemisia Afra Jacq. Ex Willd.) et le chou pomme (Brassica Oleracea Var. Capitata L.) sur les ravageurs du chou pomme dans la région de Thies au Sénégal	Machiels, L	2017
222	Programme National de Relance de l'Horticulture (PNRH)	MAER	2020
223	Programme d'Accélération de l'Agriculture Sénégalaise: volet agricole du Plan Sénégal Emergent - document cadre	MAER	2014
224	PPAAO/WAAPP. Programme de Travail et Budget Annuel 2013. Rapport d'activités annuel	MAER	2014
225	Revue 2018 du sous-secteur agricole	MAER	2018
226	Horticulture Exports, Agro-industrialization and Farm-nonfarm Linkages with the Smallholder Farm Sector: Evidence from Senegal	Maertens, Miet	2008
227	Programme de développement des marchés agricoles du Sénégal (PDMAS) - Plan de Gestion des Pestes et des Pesticides	MAH	2012
228	Quel équilibre entre sécurité et compétitivité alimentaires pour le système agricole sénégalais: le cas de la chaîne de valeur des fruits et légumes"	Makosso-Pemba, Sonia Aïcha	2014
229	Why an agroecological approach in WestAfrica? Elements for a regional project	Malézieux E., Vayssieres J.-F., Ratnadass A.	2009
230	Synthèse de travaux de recherches sur la lutte biologique contre les bio-agresseurs au Sénégal (Tome 1)	Maodo M., Dasylva J.	2017
231	Participatory guarantee systems in Senegal: shifting labour dynamics in agroecology	Marfurt, Franziska; Haller, Tobias; Bottazzi, Patrick	2024
232	Green Agendas and White Markets: The Coloniality of Agroecology in Senegal	Marfurt, Franziska; Haller, Tobias; Bottazzi, Patrick	2023
233	Budgets de culture au Sénégal	Martin, Frédéric	1991
234	Traditional Leafy Vegetables In Senegal: Diversity And Medicinal Uses	Mathieu G., Meissa D.	2008
235	Le financement de la production maraîchère: l'exemple de la zone de Potou, Sénégal	Mbengue Dieye, Binéta	2006
236	Les défis de l'agriculture sénégalaise dans une perspective de changements climatiques	Mbow, Madeleine	2017
237	Commercialisation des produits agricoles – MCCPME	MCCPME	2022
238	Nouvelle Politique Agricole 1984	MDR	1984
239	Plan Sénégal Emergent - PSE Structuration du Programme PSE Vert	MEDD	2021
240	SGH - Renforcement des capacités nationales en vue d'une application du système général harmonisé de classification et d'étiquetage des produits chimiques	MEDD	2017
241	Structures agraires et accès des jeunes à la terre: gestion intrafamiliale du foncier et stratégies d'autonomisation des jeunes	Merlet, Michel; Levesque, Robert; Range, Charline	2019
242	Plan de Gestion des Pestes et des Pesticides du Projet d'Appui Régional à l'Initiative pour l'Irrigation dans le Sahel (PARIIS)	MHA	2016
243	Une stratégie de sécurité alimentaire au Sénégal. Tome I résumé du diagnostic, les stratégies les chantiers et les défis. Version provisoire	Ministère de l'Agriculture	1999
244	Revue diagnostique des dépenses publiques de base dans le secteur agricole. Rapport final	Ministère de l'Agriculture	2012
245	Programme d'Accélération de l'Agriculture Sénégalaise: volet agricole du Plan Sénégal Emergent - document cadre	Ministère de l'Agriculture et de l'Equipement Rural	2014
246	PRACAS document principal	Ministère de l'Agriculture et de l'Equipement Rural	2014
247	Programme de Travail et Budget Annuel (PTBA) 2014. Rapport d'acivité annuel	Ministère de l'Agriculture et de l'Equipement Rural	2015
248	Lettre de Politique Sectorielle de Développement de l'Agriculture (LPSDA) 2019 −2023	Ministère de l'Agriculture et de l'Equipement Rural	2018
249	Programme d'aménagement et de développement économique de la zone des Niayes (PADEN): rapport final	Ministère de l'Agriculture et de l'Equipement Rural	2013
250	Fiche 4: Elaboration des documents de politiques agricoles, contribution du PAPA	Ministère de l'Agriculture et de l'Equipement Rural; Feed The Futur Senegal; Projet d'Appui aux Politiques Agricoles	2018
251	Arrêté ministériel n°3309 en date du 15 mars 2000 portant organisation de la Direction de la Protection des Végétaux	Ministère de l'Agriculture et de l'Equipement Rural; République du Sénégal; Direction de la Protection des Végétaux	2000

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	Title	Author(s)	Date
252	Loi d'Orientation Agro-Pastorale	Ministère de l'Agriculture et de l'Hydraulique	2004
253	Renforcement des capacités de micro-irrigation pour l'intensification de l'horticulture. Zone des Niayes - Rapport d'identification de projet	Ministère de l'Agriculture, de l'Elevage et de l'Hydraulique; Direction de l'Horticulture	2004
254	Projet d'appui à la promotion de la qualité sanitaire des exportations horticoles de la zone des Niayes (Littoral Nord-Ouest) Sénégal	Ministère de l'Agriculture; Direction de Protection des Végétaux	2010
255	Proposition de stratégie opérationnelle du secteur agricole. Rapport principal. Version Finale	Ministère de l'Agricuture et de l'Elevage	2001
256	Lettre de Politique Sectorielle de Développement de l'Agriculture (LPSDA)2018 −2022	Ministrère de l'Agriculture et de l'Equipement Rural	2018
257	Contribution à une meilleure connaissance du secteur informel de vente au détail de pesticides au Sénégal	Moussa, F.	2014
258	West African Regional Consortium of IPM Excellence	Mullins, D.E.	2008
259	Etude de l'effet du piochage repete des parcelles, de la culture de patate douce et de l'utilisation du roundup dans la lutte contre Cyperus rotundus en parcelles de maraîchage	N'Diaye, Moussa; Traore, Nasiriman; Dembele, Daouda	
260	Situation, organisation, production et perspectives des cultures maraîchères au Sénégal	Navez S.	1983
261	Revue des études agro-industrielle et la transformation des produits agricoles	Ndiaye, Augustin	2005
262	Analyse des politiques agricoles et commerciales au Sénégal: sécurité et souveraineté alimentaire compromises ?	Ndiaye, Ousmane	2018
263	Les impacts du maraîchage sur la végétation ligneuse dans la région des Niayes centrales (Mboro-Diogo) au Sénégal	Ndjekouneyom S.	2007
264	Guide des bonnes pratiques phytosanitaires pour la culture des aubergines	Neave, Suzanne	2009
265	Etude de l'évolution des résidus de pesticides dans les produits horticoles de grande consommation au Sénégal	Ngom, Saliou; Manga, Anastasie; Diop, Moussoukhoye; Thiam, Mamadou Bocar; Rousseau, Jean; Cisse, Ibrahima; Traore, Seydou	2013
266	Impact de l'intervention de l'Agence Nationale de Conseil Agricole et Rural sur les Organisations de Producteurs de la Communauté Rurale de Mpal	Ngom, Yacine	2006
267	PASPEN. Etude de la commercialisation des produits horticoles dans les régions de Thiès, Diourbel et Fatick: offre, demande, configuartion des marchés et analyse économique et financière de la production et de la commercialisation	Ngom, Yacine; Touré, Katim; Fall, Ousseynou; Faye, Amy	2015
268	Effect of Organic Fertilizers on the Susceptibility of Tomato Lycopersicon esculentum: Solanaceae to Helicoverpa armigera Lepidoptera: Noctuidae in the Niayes Area Senegal.	Niassy, Saliou; Diarra, Karamoko; Niang, Youga; Niang, Seydou; Pfeifer, Hans-Rudolf	2010
269	Protected cultivation of vegetable crops in sub-Saharan Africa: limits and prospects for smallholders. A review	Nordey, Thibault; Basset-Mens, Claudine; De Bon, Hubert; Martin, Thibaud; Déletré, Emilie; Simon, Serge; Parrot, Laurent; Despretz, Hugo; Huat, Joël; Biard, Yannick; Dubois, Thomas; Malézieux, Eric	2017
270	Commercialisation des intrants agricoles dans la Région de Saint-Louis Sénégal: Résultats d'enquête 1980–1990	Ouedraogo, Ismaël	1991
271	Les politiques agricoles 2000–2012: entre volontarisme et incohérence	Oya, Carlos; Ba, Cheikh Oumar	2013
272	Guide de bonnes pratiques de production de la carotte dans la zone des Niayes au Sénégal	PADEN	2014
273	Fiche technique de bonnes pratiques de production d'oignons dans la zone des Niayes au Sénégal	PADEN	2014
274	Fiche technique de bonnes pratiques de production du chou dans la zone des niayes au Sénégal	PADEN	2014
275	Les systèmes de culture maraîchers dans la vallée du fleuve Sénégal Pratiques paysannes - Évolution	Pagès, Jacques	1995
276	PDIDAS. Plan de Gestion des Pestes et d'utilisation des Pesticides	Pare, Samuel	2012
277	Paris-Dakar n°3575	Paris-Dakar	1947
278	Paris-Dakar n°4106	Paris-Dakar	1949
279	Agricultures et développement urbain en Afrique Subsaharienne: environnement et enjeux sanitaires	Parrot, Laurent; Njoya, Aboubakar; Temple, Ludovic; Assogba-Komlan, Françoise; Kahane, Rémi; Diao, Maty Ba; Havard, Michel	2008
280	Filière fruits et légumes	PAS	
281	Projet de Développement Inclusif et Durable de l'Agribusiness au Sénégal (PDIDAS) Développement de méthodes d'allocation de terrains par les communautés rurales et identification de leurs besoins en assistance technique Zones de Gandon et du lac de Guiers	Patrick, D'Aquino; Mohamed, Seck Sidy	2013
282	Plan National d'Investissement Agricole (PNIA) 2011–2015	PDDAA	2010
283	Revue conjointe du secteur agricole 2017	PDDAA	2018
284	Évaluation environnementale stratégique des activités relatives à la promotion de l'irrigation dans les Niayes, le Bassin arachidier élargi à la région de Tambacounda et la Casamance	PDMAS	2009
285	Construction du mouvement paysan et élaboration des politiques agricoles en Afrique subsaharienne: Le cas du Sénégal	Pesche, Denis	2009
286	Rapport d'activité du projet FAO/GCPSEN/033/BEL	Pierard, Eric	1993

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	Title	Author(s)	Date
287	Principaux ennemis des cultures de tomates dans la vallée du fleuve Sénégal	Pierard, Eric	1995
288	Allocations budgétaires optimales et options de réformes pour le secteur agricole dans le Plan Sénégal Emergent 2019–2023.	Pierre, Boulanger; Hasan, Dudu; Emanuele, Ferrari; Alfredo, Mainar-Causapé; Federica, Angelucci; Renata, Baborska; Thibault, Meilland	2018
289	Projet d'intensification éco-soutenable de l'agriculture dans les Niayes (PIESAN)	PIESAN	2021
290	Tuta absoluta (Meyrick). Un ravageur invasif des cultures maraîchères pour l'Afrique sub-saharienne	PIP	2013
291	Programme National d'Investissement Agricole pour la Sécurité Alimentaire et la Nutrition - Rapport Final	PNIASAN 2018–2023	2018
292	Tonnage annuel de produits phytosanitaires (TOP10 chargeurs) 2021–2023	Port de Dakar	2024
293	Actualisation du Plan de Gestion des Pestes et Pesticides. Rapport Final	PPAAO	2012
294	Contribution à la mise en place d'un système durable de production de semences certifiées au Sénégal	Programme de Productivité Agricole en Afrique de l'Ouest (PPAAO)	2017
295	Projet « Promotion d'une Agriculture Compétitive et Durable » (PACD) Convention de financement AFD CSN n°3002 RAPPORT ANNUEL 2007	Projet PACD	2008
296	Les techniques de production précoce pour l'étalement de la culture de l'oignon au Sénégal. Cultures à partir de bulbilles et par semis direct	RADHORT	
297	La culture du haricot nain au Sénégal	RADHORT	2012
298	Techniques de production de semences de tomate au Sénégal	RADHORT	2012
299	La Production et Protection Intégrées appliquée aux cultures maraîchères en Afrique soudano-sahélienne	RADHORT	2012
300	Analyse-diagnostic agraire dans le bas-delta du fleuve Sénégal: impacts des politiques agricoles et foncières visant à accroître la sécurité alimentaire	Radzik, Léa; Fert, Mathilde	2016
301	Plan de gestion intégrée des vecteurs et des pesticides du projet PRSRSM/REDISSE	Regional Disease Surveillance Systems Enhancement Project (REDISSE)	2016
302	Paying the price: pesticide subsidies in developing countries	Repetto	1985
303	SNDES: Stratégie Nationale de Développement Economique et Social 2013–2017	République du Sénégal	2012
304	Plan Sénégal Emergent: Plan d'Actions Prioritaires 2019–2023	République du Sénégal	LU
305	Programme d'Urgence de Développement communautaire	République du Sénégal	2019
306	DSRP II - Document de Stratégie pour la croissance et la Réduction de la Pauvreté 2006–2010	République du Sénégal	2006
307	Plan d'investissement 2011–2015 du Plan National d'Investissement Agricole (PNIA)	République du Sénégal	2011
308	Projet pilote de promotion des exportations agricoles. Evaluation environnementale	République du Sénégal	1997
309	Pacte national ECOWAP/PPDAA du Sénégal	République du Sénégal	2020
310	Stratégie de croissance accélérée pour la grappe agriculture et agro-industrie	République du Sénégal	2007
311	Projet de Promotion des Exportations Agricoles (code PPEA/BM 3017/SE). Financement des exportations horticoles	République du Sénégal Ministère de l'Agriculture et de l'Elevage	2001
312	Vers une accentuation des disparités dans le financement de l'agriculture en Afrique de l'Ouest ?	Ribier, Vincent; Gabas, Jean-Jacques	2016
313	Pour le développement d'une Agriculture Régénératrice au Sénégal - Rapport National du projet de recherche: Les Politiques qui Marchent pour L'Agriculture Durable et la Régénération des Economies Rurales	Rodale Institute; Green Sénégal	2000
314	Rapport final de la première phase du programme RuralStruct - Les implications structurelles de la libéralisation sur l'agriculture et le développement rural au Sénégal (1950 – 2006)	RuralStruct	2007
315	Les exploitations agricoles familiales face aux risques agricoles et climatiques: stratégies développées et assurances agricoles	Sall, Moussa	2015
316	Comment les exploitations familiales peuvent-elles nourir le Sénégal ?	Sall, Nadjirou; Diop, Papa Assane; Barbedette, Loïc	2010
317	Pratiques agricoles et risques sanitaires associés à l'utilisation des produits phytosanitaires en milieu rural casamançais: Cas des villages de Diannah et de Kabadio au District de santé de Diouloulou, Sénégal	Sambou, Abdou Kadri; Mbaye, Ibrahima; Fall, Mamadou; Thior, Mamadou	2019
318	La décentralisation au Sénégal, ou comment réformer pour mieux maintenir le statu quo	Sané, Youssouph	2016
319	Diagnostic de l'utilisation des pesticides dans les cuvettes de Gouré	Sani Ado, Maman Nasser; Tankari Ban-Badjo, Abdourahamane; Guero, Yadji; Tidjani, Adamou Didier; Dan Lamso, Nomaou; Ambouta, Karimou Jean-Marie	2018
320	La place du « ceebu-jën » dans l'alimentation des populations suburbaines de Dakar	Sankale M., Wone I., Morosov T., Morosov S., de Lauture H.	1980
321	Perception des risques liés à l'usage des pesticides. Enquête menée dans la communauté rurale de Mboro	Seck L.T.M.	2001
322	Progrès techniques et satisfaction des besoins légumiers dakarois: un regard sur l'horizon 2001	Seck, P. A	1991
323	Quelques mesures de relance pour le secteur maraicher sénégalais	Seck, Pupa Abdoulaye	1992

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	Title	Author(s)	Date
324	Le Sénégal au défi de l'ajustement structurel	Seck, Tom Amadou	1998
325	Stratégie Nationale de Sécurité Alimentaire et de Résilience (SNSAR) 2015–2035	Secrétariat Exécutif Conseil National de Sécurité Alimentaire	2015
326	À la découverte de l'école de formation en horticulture de Cambérene	SenePlus	2020
327	Plan REVA - Nouvelle orientation de la politique agricole, note introductive	Senghor, Farba	2006
328	Generic, growing, green?: The changing political economy of the global pesticide complex	Shattuck A.	2021
329	Human health and pesticide use in Sub-Saharan Africa	Sheahan, Megan; Barrett, Christopher B.; Goldvale, Casey	2017
330	Gestion Intégrée de la Production et des Déprédateurs dans la SAED (tomate, oignon, patate douce)	SNRAA	
331	Pratiques phytosanitaires paysannes dans les savanes d'Afrique centrale	Sougnabe, S P; Yandia, A; Acheleke, J; Brevault, T; Ngartoubam, L T	2009
332	Le Synjarmar, Syndicat des Jardiniers et Maraîchers de la Région du Cap Vert. Document agricole n°8	Souillac, P.	1965
333	Souillac P. 1965a. Le Synjarmar, Syndicat des Jardiniers et Maraîchers de la Région du Cap Vert. Document agricole n°1	Souillac, P.	1965
334	L'évolution des structures agricoles dans la zone rurale du Cap-Vert. Contribution à la problématique de la réforme agraire	Sow, Abdoulaye	1975
335	Etat des lieux de La filière fruits et légumes au Sénégal	Sow, Ibrahima	2006
336	Etude socio-économique sur l'utilisation des pesticides au Sénégal	Sow, Mariam; Marone, Mamadou; Saliou Ndiaye; Mullié, Wim C.	2008
337	The international register of potentially toxic chemicals (IRPTC) its databank and network partners	Sundén A., Huismans J.W.	1990
338	Invasion de la mineuse de la tomate, Tuta absoluta (Lepidoptera: Gelechiidae) au Sénégal: dynamique des populations, gamme d'hôtes et potentiel de régulation biologique	Sylla, Elhadji Serigne	2018
339	Compte-rendu visite et débat ferme moderne de l'ANIDA à Ngomène	TAFAE	2018
340	Les zones humides en domaine sahélien face aux mutations des modes de mise en valeur agricoles (lacs de Mal, d'Aleg et bas delta du fleuve Sénégal)	Taïbi, Aude Nuscia; Barry, Mohamed El Habib; Gassani, Jean; Ballouche, Aziz; Moguedet, Gérard; Jiddou, Mohamed Ould; Baba, Mohamed Lemine Ould; Ghadi, Ahmed El	2005
341	Portraits de l'agriculture familiale en Afrique de l'Ouest	Tan, Su Fai; Guèye, Bara	2005
342	La dynamique sociale des GIE, village de Donaye (département de Podor, communauté rurale de Guédé)	Tarrière-Diop, C	?
343	Cas de la noctuelle de la tomate, Helicoverpa armigera et de la teigne du chou, Plutella xylostella	Tendeng, E; Brévault, T; Diatte, M; Dabo, A; Diallo, A O; Diarra, K	
344	Résistance aux insecticides chez deux ravageurs clés des cultures maraîchères au Sénégal	Tendeng, Etienne; Brévault, Thierry; Diatte, Mamadou; Faye, Coumba; Dabo, Abdourahmane; Diallo, Amadou; Diarra, K.	2018
345	Actualisation de l'entomofaune des cultures maraîchères en Basse Casamance (Sénégal)	Tendeng, Etienne; Labou, Babacar; Djiba, Saliou; Diarra, Karamoko	2017
346	Les produits phytosanitaires dans le delta du fleuve Sénégal	Thiam, Abou	1996
347	Evaluation de la mise en oeuvre des principaux instruments juridiques internationaux relatifs à la gestion des produits chimiques au Bénin, Mali et Sénégal	Thiam, Abou; Sagna, Mamadou Bamba	2009
348	Monitoring des pesticides au niveau des communautés à la base - Rapport régional Afrique	Thiam, Abou; Sagna, Mamadou Bamba	2009
349	Etude de la dispersion de Bactrocera dorsalis (Hendel) (Diptera: Tephritidae) dans la zone des Niayes	Thiao D.S.	2017
350	Bilateral Donor Agencies and the Environment	Tobin, R.J.	1996
351	Pest management, the environment, and Japanese foreign assistance	Tobin, R.J.	1996
352	Programme sous-régional de Formation Participative en Gestion intégrée de la Production et des Déprédateurs des culturesà travers les Champs-Ecoles des Producteurs (GIPD/CEP) –pour Bénin, Burkina Faso, Mali et Sénégal (GCP/RAF/009/NET)	Ton, Peter; Doucoure, Hamadi Souholy; Hinnou, Cossi Léonard; Sankara, Stanislas; Sarr, Souleymane	2010
353	Exploitations familiales et entreprises agricoles dans la zone des Niayes au Sénégal	Touré, Oussouby; Seck, Mohamed	2005
354	Rapport de synthèse des ateliers paysans sur la réforme foncière et les enjeux de sécurisation foncière des exploitations familiales au Sénégal	Touré, Oussouby; Seck, Mohamed; Dieye, Abdoulaye; Ba, Cheikh Oumar; Faye, Ibrahima	2012
355	Etude de faisabilité ENDA-PRONAT. Partenariat multi-acteurs pour la tranition agroécolgique	Touré, Oussouby; Sylla, Ibrahima	2018
356	Histoire de la recherche agricole en Afrique tropicale francophone. Volume V. Le temps des stations et de la mise en valeur 1918–1940/1945	Tourte R.	2005
357	Histoire de la recherche agricole en Afrique tropicale francophone. Volume VI. De l'empire colonial à l'Afrique indépendante 1945–1960: la recherche prépare le développement	Tourte, René	2005
358	Edges of exposure: toxicology and the problem of capacity in postcolonial Senegal	Tousignant, Noémi	2018
359	Gestion des pesticides dans l'espace UEMOA: le Sous-Comité Phytosanitaire de l'UEMOA en conclave à Ouagadougou	UEMOA	2019

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	Title	Author(s)	Date
360	Règlement n°04/2009/CM/UEMOA relatif à l'harmonisation des règles régissant l'homologation, la commercialisation et le contrôle des pesticides au sein de l'UEMOA	UEMOA	2009
361	Project executive summary. Reducing Dependence on Persistent Organic Pollutants and other Agro-Chemicals in the Senegal and Niger River Basins through Integrated Production, Pest and Pollution Management	UNEP; GEF	2000
362	TER peer review of the program: Reducing dependence on agro-chemicals in the Senegal and Niger River Basins through integrated production, pest and pollution management	UNEP; GEF	2016
363	Rapport d'évaluation d'impact de Naatal Mbay	Univeristé Gaston Berger de Saint-Louis	2019
364	Senegal Naatal Mbay - Impact assessment highlight	USAID	2019
365	Systèmes d'information de marché, coordination et gestion des risques dans les filières agricoles: cas des produits maraîchers au Sénégal	Wade I.	2009
366	Réseau de transport et commercialisation de l'oignon dans les Niayes sur la grande Côte du Sénégal	Wade, Cheikh Tidiane	2010
367	Information et régulation des filières maraîchères au Sénégal	Wade, Idrissa; David-Benz, Hélène; Egg, Johny	2004
368	DR Macoumba Diouf «L'horticulture est le sous secteur le plus performant de l'agriculture sénégalaise mais …»	Walfadjri	2014
369	How China's Export Laws Are Affecting Supply	Wan D.	2014
370	Breaking the Barriers to IPM in Africa: Evidence from Benin, Ethiopia, Ghana and Senegal	Williamson S.	2005
371	Trends in pesticide use and drivers for safer pest management in four African countries	Williamson S., Ball A., Pretty J.	2008
372	Pesticide provision in liberalised Africa: out of control ?	Williamson, Stephanie	2003
373	Plantes pesticides et protection des cultures maraichères en Afrique de l'Ouest (synthèse bibliographique)	Yarou, Boni Barthélémy; Silvie, Pierre; Komlan, Françoise Assogba; Mensah, Armel; Alabi, Taofic; Verheggen, François; Francis, Frédéric	2017
374	Global pesticide consumption and pollution: with China as a focus	Zhang W., Jiang F., Ou J.	2011
375	Lettre de Politique de Développement Institutionnel (LPDI) du Secteur Agricole		1998
376	Stratégie Nationale de Formation Agricole et Rurale. Actualisation de la SNFAR		2005
377	Nianga, laboratoire de l'agriculture irriguée en moyenne vallée du Sénégal		1995
378	Amélioration de la productivité de la tomate dans la vallée du fleuve Sénégal		2007

Appendix C. Sampled documents from the document database

Policy	Input supply	Science & technical knowledge	Vegetable production	Commercialisation and consumption
DyTAES, 2020	Commodafrica, 2020	Appert, 1957	de bon et al., 1997	Amin, 1969
Faye et al., 2007	Deuse, 1975	Ba et al., 2018	Fare, 2018	CDH, 1974
IPAR, 2011	Diarra & Diallo, 2017	Bouhot & Mallamaire, 1965	Giunta et al., 2015	David-Benz & Ba, 2000
MA, 2008	IPAR, 2015	CDH, 1980	MA & DH, 2003	David-Benz et al., 2010
MAER, 2014	MAH, 2012	CDH, 1986	Makosso-Pemba, 2014	Ka & Leport, 2023
MAER, 2020	MHA, 2016	CDH, 2011	Souillac, 1965a	Sankale et al., 1980
Ribier & Gabas, 2016	Ouedraogo, 2011	CDH, 2015	Souillac, 1965b	Souillac 1965a
MEDD, 2021	Repetto, 1985	Collingwood et al., 1981	Touré & Seck, 2005	Souillac, 1965b
Seck, 1998	Tobin, 1996	Dugué et al., 2017	Williamson et al., 2008	Wade et al., 2004
Senghor, 2006	Williamson, 2003	Gaye & Sène, 2014	Diop, 2013	Sow, 2006
Tourte, 2005	Moussa, 2014	Malézieux et al., 2009	Chevalier, 1950	Duteurte & Dieye, 2008
Oya & Ba, 2013	Sow et al., 2008	Tourte, 2005	Fall & Fall, 2001	Julie, 2014

Data availability

Data will be made available on request.

References

Abbott, A., 2009. 11. À propos du concept de Turning Point. Bifurcations. La Découverte, pp. 187–211.

Aga, A., 2019. The marketing of corporate agrichemicals in Western India: theorizing graded informality. J Peasant Stud 46 (7), 1458–1476. https://doi.org/10.1080/03066150.2018.1534833.

Arora, S., Stirling, A., 2023. Colonial modernity and sustainability transitions: a conceptualisation in six dimensions. Environ. Innov. Soc. Transit. 48, 100733. https://doi.org/10.1016/j.eist.2023.100733.

Arthur, W.B., 1989. Competing technologies, increasing returns, and lock-In by historical events. Econ. J. 99 (394), 116. https://doi.org/10.2307/2234208.
Bahn, R.A., Abebe, G.K., 2020. Food retail expansion patterns in Sub-Saharan Africa and the Middle East and North Africa: institutional and regional perspectives. Agribusiness 36 (3), 453–481. https://doi.org/10.1002/agr.21634.
Bakker, L., Van Der Werf, W., Tittonell, P., Wyckhuys, K.A.G., Bianchi, F.J.J.A., 2020. Neonicotinoids in global agriculture: evidence for a new pesticide treadmill? Ecol. Soc. 25 (3), art26. https://doi.org/10.5751/ES-11814-250326.
Beck, S., Jasanoff, S., Stirling, A., Polzin, C., 2021. The governance of sociotechnical transformations to sustainability. Curr Opin Env. Sustain 49, 143–152. https://doi.org/10.1016/j.cosust.2021.04.010.
Bell, M., 2004. Farming For Us all: Practical Agriculture and the Cultivation of Sustainability, 20th anniversary edition. The Pennsylvania State University Press, University Park, Pennsylvania, p. 299.
Bevan, P., 2004. Conceptualising in/security regimes. Conceptualising In/Security Regimes. Cambridge University Press.
Bottazzi, P., Seck, S.M., Niang, M., Moser, S., 2023. Beyond motivations: a framework unraveling the systemic barriers to organic farming adoption in northern Senegal. J Rural Stud 104, 103158. https://doi.org/10.1016/j.jrurstud.2023.103158.
Bricas, N., Malézieux, E., 2021. Faut-il doubler la production alimentaire pour nourrir le monde ? Une écologie de L'alimentation.
Burch, D., Lawrence, G. (Eds.), 2007. Supermarkets and Agri-Food Supply chains: Transformations in the Production and Consumption of Foods. Edward Elgar, Cheltenham, UK : Northampton, MA, p. 330.
Bureau-Point, E., 2021. Pesticides et récits de crise dans le monde paysan cambodgien. Anthropol. Santé (22). https://doi.org/10.4000/anthropologiesante.9054 [consulté le 15 décembre 2021] url. http://journals.openedition.org/anthropologiesante/9054.
Burton, R.J.F., Forney, J., Stock, P., Sutherland, L.-A., 2021. The Good farmer: Culture and Identity in Food and Agriculture. Routledge, Abingdon New York, NY. Coll. Earthscan food and agriculture series.
Callon, M., 1984. Some elements of a sociology of translation: domestication of the scallops and the fishermen of St Brieuc Bay. Sociol Rev 32 (1_suppl), 196–233. https://doi.org/10.1111/j.1467-954X.1984.tb00113.x.
Callon, M., 1991. Techno-economic networks and irreversibility. In: Law, J. (Ed.), A Sociology of monsters: Essays On power, Technology and Domination. Routledge, London, pp. 132–161. Coll. Sociological review monograph.
Clapp, J., 2021. Explaining growing glyphosate use: the political economy of herbicide-dependent agriculture. Glob. Environ. Change 67, 102239. https://doi.org/10.1016/j.gloenvcha.2021.102239.
Clunies-Ross, T., Ross, N., 1992. The Politics of Industrial Agriculture. Earthscan, London.
Cochrane, W.W., 1958. Farm Prices: Myth and Reality. U of Minnesota Press, p. 200.
Cochrane, W.W., 1979. The Development of American agriculture: a Historical Analysis. University of Minnesota Press, Minneapolis, p. 464.
Cowan, R., Gunby, P., 1996. Sprayed to death: pest control strategies and technological lock-In. Econ. J. 106, 521–542.
Das Nair, R., 2020. The "supermarket revolution" in the South. In: Crush, J., Frayne, B., Haysom, G. (Eds.), Handbook On Urban Food Security in the Global South. Edward Elgar Publishing.
David P.A. 1985. Clio and the economics of QWERTY75 (2): 332–337.
Farmer, B.H., 1977. Technology and change in rice-growing areas. In: Farmer, B.H. (Ed.), Green Revolution? Technology and Change in Rice-growing Areas of Tamil Nadu and Sri Lanka. Palgrave Macmillan UK, London, pp. 1–6.
Feola, G., 2020. Capitalism in sustainability transitions research: time for a critical turn? Environ. Innov. Soc. Transit. 35, 241–250. https://doi.org/10.1016/j.eist.2019.02.005.
Gaillard, B.. (Bio)porodi rekk ? Structuration des savoirs paysans de protection des cultures et dépendance aux pesticides en maraîchage – Cas d'une commune maraîchère de la zone des Niayes (Sénégal). vertigo. https://doi.org/10.4000/vertigo.36398.
Galt, R.E., 2008. Beyond the circle of poison: significant shifts in the global pesticide complex, 1976–2008. Glob. Environ. Change 18 (4), 786–799. https://doi.org/10.1016/j.gloenvcha.2008.07.003.
Galt, R.E., 2014. Food Systems in an Unequal world: pesticides, vegetables, and Agrarian Capitalism in Costa Rica. The University of Arizona Press, Tucson, p. 291. Coll. Society, environment, and place.
Garud, R., Kumaraswamy, A., Karnøe, P., 2010. Path dependence or Path creation? J. Manag. Stud. 47 (4), 760–774. https://doi.org/10.1111/j.1467-6486.2009.00914.x.
Geels, F.W., Schot, J., 2007. Typology of sociotechnical transition pathways. Research Policy 36, 399–417.
Geels F.W., Turnheim B. 2022. The Great Reconfiguration: a comparative socio-technical analysis of low-carbon transitions in UK electricity, heat, and mobility systems.
Geels, F.W., 2002. Technological transitions as evolutionary reconfiguration processes: a multi-level perspective and a case-study. Res Policy 31 (8–9), 1257–1274. https://doi.org/10.1016/S0048-7333(02)00062-8.
Geels, F.W., 2004. From sectoral systems of innovation to socio-technical systems. Res Policy 33 (6–7), 897–920. https://doi.org/10.1016/j.respol.2004.01.015.
Geels F.W. 2014. Regime resistance against low-carbon transitions: introducing politics and power into the Multi-level perspective20.
Geels, F.W., 2019. Socio-technical transitions to sustainability: a review of criticisms and elaborations of the Multi-Level Perspective. Curr Opin Env. Sustain 39, 187–201. https://doi.org/10.1016/j.cosust.2019.06.009.
George, A.L., Bennett, A., 2005. Case Studies and Theory Development in the Social Sciences. MIT Press, Cambridge, Mass, p. 331. Coll. BCSIA studies in international security.
Ghosh B., Mguni P. 2025. Sustainability transitions in the Global South.
Goldstein, J.E., Neimark, B., Garvey, B., Phelps, J., 2023. Unlocking "lock-in" and path dependency: a review across disciplines and socio-environmental contexts. World Dev 161, 106116. https://doi.org/10.1016/j.worlddev.2022.106116.
Gould, F., Brown, Z.S., Kuzma, J., 2018. Wicked evolution: can we address the sociobiological dilemma of pesticide resistance? Science 360 (6390), 728–732. https://doi.org/10.1126/science.aar3780.
Goulet, F., 2013. Mettre en récits et partager l'expérience : Éléments pour l'étude des savoirs dans des collectifs professionnels. Revue d'anthropologie des connaissances 7, 501–524. https://doi.org/10.3917/rac.019.0501.
Goulet, F., 2021. Characterizing alignments in socio-technical transitions. Lessons from agricultural bio-inputs in Brazil. Technol Soc 65, 101580. https://doi.org/10.1016/j.techsoc.2021.101580.
Hansen, M., 1988. Escape from the Pesticide treadmill: Alternatives to Pesticides in Developing Countries. Institute for Consumer Policy Research, Mount Vernon, USA.
Hardin, S., 2019. Charging responsibility for the repercussions of pesticide usage in post-war francophone Africa. Env. Hist Camb 27 (1), 37–63. https://doi.org/10.3197/096734019X15463432086973.
Hill R. 1988. Problems and policy for pesticide exports to less developed countries23.
HLPE, 2017. Nutrition and food systems. A report by the High Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security. Committee on World Food Security, p. 152.
Hu, Z., 2020. What socio-economic and political factors lead to global pesticide dependence? A critical review from a social science perspective. Int J Env. Res Public Health 17 (21), 8119. https://doi.org/10.3390/ijerph17218119.
IPBES, 2019. Global assessment report on biodiversity and ecosystem services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. Zenodo.
IPCC, 2022. Climate Change 2022: Mitigation of Climate Change. Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change.
Köhler, J., Geels, F.W., Kern, F., Markard, J., Onsongo, E., Wieczorek, A., Alkemade, F., Avelino, F., Bergek, A., Boons, F., Fünfschilling, L., Hess, D., Holtz, G., Hyysalo, S., Jenkins, K., Kivimaa, P., Martiskainen, M., McMeekin, A., Mühlemeier, M.S., Nykvist, B., Pel, B., Raven, R., Rohracher, H., Sandén, B., Schot, J.,

Sovacool, B., Turnheim, B., Welch, D., Wells, P., 2019. An agenda for sustainability transitions research: state of the art and future directions. Environ. Innov. Soc. Transit. 31, 1–32. https://doi.org/10.1016/j.eist.2019.01.004.
Kaiser, A., 2023. Discursive struggles over pesticide legitimacy in Switzerland: a news media analysis. Environ. Innov. Soc. Transit. 49, 100777. https://doi.org/10.1016/j.eist.2023.100777.
Klitkou, A., Bolwig, S., Hansen, T., Wessberg, N., 2015. The role of lock-in mechanisms in transition processes: the case of energy for road transport. Environ. Innov. Soc. Transit. 16, 22–37. https://doi.org/10.1016/j.eist.2015.07.005.
Koch, J., 2011. Inscribed strategies: exploring the organizational nature of strategic lock-in. Organ. Stud. 32 (3), 337–363. https://doi.org/10.1177/0170840610397486.
Konefal, J., Mascarenhas, M., Hatanaka, M., 2005. Governance in the Global Agro-food System: backlighting the role of transnational supermarket chains. Agric Hum. Values 22 (3), 291–302. https://doi.org/10.1007/s10460-005-6046-0.
Lamine, C., Marsden, T., 2023. Unfolding sustainability transitions in food systems: insights from UK and French trajectories. Proc. Natl. Acad. Sci. 120 (47), e2206231120. https://doi.org/10.1073/pnas.2206231120.
Laurent, C., Rémy, J., 2004. Multifonctionnalité des activités, pluralité des identités. Cah. multifonctionnalité 7.
Leonard-Barton, D.A., 1995. Wellsprings of Knowledge: Building and Sustaining the Sources of Innovation. Harvard Business School Press, Boston.
Liebowitz S.J., Margolis S.E. 1995. Path dependence, lock-In, and history.
Luna, J.K., 2020. Pesticides are our children now': cultural change and the technological treadmill in the Burkina Faso cotton sector. Agric Hum. Values 37 (2), 449–462. https://doi.org/10.1007/s10460-019-09999-y.
Mansfield, B., Werner, M., Berndt, C., Shattuck, A., Galt, R., Williams, B., Argüelles, L., Barri, F.R., Ishii, M., Kunin, J., Lapegna, P., Romero, A., Caicedo, A., Abhigya, Castro-Vargas M.S., Marquez, E., Ojeda, D., Ramirez, F., Tittor, A., 2023. A new critical social science research agenda on pesticides. Agric Hum. Values 41 (2), 395–412. https://doi.org/10.1007/s10460-023-10492-w.
Maxwell, J.A., 2013. Qualitative Research design: an Interactive Approach, 3rd ed., 41. SAGE Publications, Thousand Oaks, Calif, p. 218. Coll. Applied social research methods.
Mayntz, R., 2004. Mechanisms in the analysis of social macro-phenomena. Philos Soc Sci 34 (2), 237–259. https://doi.org/10.1177/0048393103262552.
McGuire, J., Morton, L.W., Cast, A.D., 2013. Reconstructing the good farmer identity: shifts in farmer identities and farm management practices to improve water quality. Agric Hum. Values 30 (1), 57–69. https://doi.org/10.1007/s10460-012-9381-y.
Meynard, J.-M., Charrier, F., Fares, M., Le Bail, M., Magrini, M.-B., Charlier, A., Messéan, A., 2018. Socio-technical lock-in hinders crop diversification in France. Agron. Sustain. Dev. 38 (5), 54. https://doi.org/10.1007/s13593-018-0535-1.
Murphy, J.T., 2015. Human geography and socio-technical transition studies: promising intersections. Environ. Innov. Soc. Transit. 17, 73–91. https://doi.org/10.1016/j.eist.2015.03.002.
Newig, J., Derwort, P., Jager, N.W., 2019. Sustainability through institutional failure and decline? Archetypes of productive pathways. Ecol. Soc. 24 (1), art18. https://doi.org/10.5751/ES-10700-240118.
Oliver, T.H., Boyd, E., Balcombe, K., Benton, T.G., Bullock, J.M., Donovan, D., Feola, G., Heard, M., Mace, G.M., Mortimer, S.R., Nunes, R.J., Pywell, R.F., Zaum, D., 2018. Overcoming undesirable resilience in the global food system. Glob. Sustain. 1, 9. https://doi.org/10.1017/sus.2018.9.
Putnam, R.D., 1993. The Prosperous Community: Social Capital and Public Life, 4. The American Prospect, pp. 35–42.
Ramos-Mejía, M., Franco-Garcia, M.-L., Jauregui-Becker, J.M., 2018. Sustainability transitions in the developing world: challenges of socio-technical transformations unfolding in contexts of poverty. Env. Sci Policy 84, 217–223. https://doi.org/10.1016/j.envsci.2017.03.010.
Reardon T., Timmer P., Berdegue J. 2004. The rapid rise of supermarkets in developing countries: induced organizational, institutional, and technological change in agrifood systems1 (2).
Roubaud, F., 2014. 7. L'économie informelle est-elle un frein au développement et à la croissance économiques ? Regards croisés sur écon. 14 (1), 109–121. https://doi.org/10.3917/rce.014.0109 n°.
Saugeres, L., 2002. Of tractors and men: masculinity, technology and power in a French farming community. Sociol Rural. 42 (2), 143–159. https://doi.org/10.1111/1467-9523.00207.
Smith, A., 2007. Translating sustainabilities between green niches and socio-technical regimes. Technol. Anal. Strateg. Manag. 19 (4), 427–450. https://doi.org/10.1080/09537320701403334.
Smith, E., 2009. Imaginaries of development: the Rockefeller Foundation and Rice Research. Sci Cult (L.) 18 (4), 461–482. https://doi.org/10.1080/09505430903186070.
Stegmaier, P., 2022. Conceptual aspects of discontinuation governance. Technologies in Decline. Routledge, London, pp. 78–116.
Stirling, A., 2019. How deep is incumbency? A 'configuring fields' approach to redistributing and reorienting power in socio-material change. Energy Res. Soc. Sci. 58, 101239. https://doi.org/10.1016/j.erss.2019.101239.
Stone, G.D., Flachs, A., 2018. The ox fall down: path-breaking and technology treadmills in Indian cotton agriculture. J Peasant Stud 45 (7), 1272–1296. https://doi.org/10.1080/03066150.2017.1291505.
Sundén, A., Huismans, J.W., 1990. The international register of potentially toxic chemicals (IRPTC) its databank and network partners. Rev. Educ. Pedagogy Cult. Stud. 17 (1), 1–6. https://doi.org/10.1080/1071441950170102.
Thrupp, L.A., 1988. Pesticides and policies approaches to pest-control dilemmas in Nicaragua and Costa Rica by. Lat Am Perspect 15 (4), 37–70.
Tostado, L., Bollmohr, S., 2023. Atlas Des Pesticides 2023. Heinrich-Böll-Stiftung European Union and Heinrich-Böll-Stiftung European Union.
Tousignant, N., 2018. Edges of exposure: Toxicology and the Problem of Capacity in Postcolonial Senegal. Duke University Press, Durham.
Turnheim, B., 2022. Destabilisation, decline and phase-out in transitions research. Technologies in Decline. Routledge, London, pp. 43–77.
UNFSS U, 2021. Secretary-General's Chair Summary and Statement of Action on the UN Food Systems Summit. United Nations [consulté le 27 avril 2023]. https://www.un.org/en/food-systems-summit/news/making-food-systems-work-people-planet-and-prosperity.
Unruh, G.C., 2000. Understanding carbon lock-in. Energy Policy 28 (12), 817–830. https://doi.org/10.1016/S0301-4215(00)00070-7.
Vanloqueren, G., Baret, P.V., 2008. Why are ecological, low-input, multi-resistant wheat cultivars slow to develop commercially? A Belgian agricultural 'lock-in' case study. Ecol. Econ. (66), 436–446. https://doi.org/10.1016/j.ecolecon.2007.10.007.
Walker, W., 2000. Entrapment in large technology systems: institutional commitment and power relations. Res Policy 29 (7–8), 833–846. https://doi.org/10.1016/S0048-7333(00)00108-6.
Watson, D. (Ed.), 2018. Pesticides and agriculture: Profit, Politics and Policy, 0. Burleigh Dodds Science Publishing. edn.
Watterson, A., 2001. Pesticide health and safety and the work and impact of international agencies: partial successes and major failures. Int J Occup Env. Health 7 (4), 339–347. https://doi.org/10.1179/oeh.2001.7.4.339.
Wieczorek, A.J., 2018. Sustainability transitions in developing countries: major insights and their implications for research and policy. Env. Sci Policy 84, 204–216. https://doi.org/10.1016/j.envsci.2017.08.008.
Wolff, H., Recke, G., 2000. Path dependence and implementation strategies for integrated pest management. Q. J. Int. Agric. 39 (2), 149–171.
Wood, G., Gough, I., 2006. A comparative welfare regime approach to global social policy. World Dev 34 (10), 1696–1712. https://doi.org/10.1016/j.worlddev.2006.02.001.