Inclusive business models
Empowering women in urban agriculture in Burkina Faso
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Chapter 4

Research Design
4.1 Introduction

This chapter aims to explain the epistemological and methodological building blocks of this research, and how these shaped the research design. I use a case study approach whereby mixed methods guide the data collection and analysis. This chapter is organised as follows. Section 4.2 explains my epistemological and ontological perspective, in connection to the theoretical framework and methodology. Section 4.3 presents the research methodology. Section 4.4 presents the unit(s) of analysis. Section 4.5 describes the research location and sample selection. Section 4.6 presents the data collection sources and methods. Section 4.7 describes the research questions and the data collection methods. Section 4.8 describes the data analysis methods. Section 4.9 presents the GAIB model design and field testing. Section 4.10 addresses the research limitations and ethical issues. Section 4.11 concludes the chapter.

4.2 Ontology and epistemology

This section addresses my epistemological stance. I studied complex and dynamic phenomena on women’s empowerment through inclusive business models in value chains. I focused on how resource-poor women facing gender constraints are included in value chains, from a bottom-up perspective, in order to improve their capabilities (abilities, agency and functioning).

To address these complex and dynamic phenomena, explanatory and comprehensive postures are used and documented in the literature (Zoumba, 2018; Weber & Freund, 1992). The explanatory posture intends to explain the causes and effects of the phenomenon and takes a positivist epistemological stance - to describe the phenomena experienced (Trochim, 2020). The comprehensive posture refers to social activities defined “as the behaviour to which an individual communicates a subjective meaning” (Gonthier, 2004, p.37) and consists of understanding the motives of social activities or means underlying the goals of actions (Zoumba, 2018) and is the interpretivist approach to research or subjectivism (Velmuradova, 2017).

Both approaches are limited as they are individually extreme and a need for an intermediary posture is required to deal with a complex and dynamic topic such as empowerment. This research both intends to understand and explain these social activities, particularly business activities. As the Foucauldian perspective (my ontological stance) adopted in the research was my central tenet, a post-positivist epistemological stance fitted better. As such, the knowledge generated in this research first helped in understanding and explaining the phenomena involved in order to act for bringing a change.
The use of the Foucauldian perspective of a human being in this research required an interdisciplinary approach. For example, to better analyse value chain dynamics, behavioural sciences are necessary to understand how stakeholders in the chain are organised and do business together. For the analysis of value chain components, such as food and their quality and quantity, natural sciences may be utilised to assess the quality of land/soil and water used in goods production/processing. Economics can also be used to assess the profitability of these business activities. Last, to analyse the dynamics or growth of the value chain over time, economic and historical analyses such as life histories or lifecycle of goods and services in the chain may be used. Therefore, the research called for a combination of several techniques (qualitative and quantitative) both for data collection and analysis, which is typical for post-positivism.

Beyond understanding and explaining the social activities, this research paid particular attention to ‘knowing’ the actors (WSEs/WFEs) involved through their individual and collective behaviour. To this end, critical intersubjectivity (Fay, 1999) was used as an inquiry approach. It helped me to be aware that I have the power to influence the studied people’s behaviour (WSEs/WFEs, other actors). Therefore, consideration of ethics was a key element to minimise the potential biases engendered by this power relationship between the researcher and actors.

4.3 Research methodology
I thus used a post-positivist epistemology and mixed methods. This means that qualitative and quantitative methods were used for both data collection and analysis. I also adopted a multiple comparative case-study approach to get more insight into the field and enrich the political implications of the results (see 1.6.6 and 1.6.7).

4.4 Unit(s) of analysis
I used three different units of analysis: individual, WSEs/WFEs group and public policy/programme. First, WSE/WFE groups was used as an entry point to their business activities and participation in value chains and enables research to analyse the collective capabilities, agency, functioning and strategies of WSE/WFEs, and design their collective business model. Second, individual WSE/WFE was used to deepen the analysis of WSE/WFE entrepreneurs in their business place and as a household member of society. This contributed to a better understanding and explanation of their individual capabilities, agency, functioning and strategies. Last, public programmes/policies were used as a unit of analysis to understand how the state intervention affect women and men in general, and women’s
empowerment in particular. For the latter, the policy output analysis framework (Gregg, 1974), was used to better understand how education, agricultural, and other policies empower women in general.

4.5 Research location and sample selection

The capital city of Ouagadougou is located in the heart of Burkina Faso at latitude 12° 21’N and longitude 01° 31’W. It consists of 50 sectors divided into twelve (12) districts. (INSD, 2009, p.20).

Ouagadougou measures approximately 2,805 km² (DEP/CO, 2015), representing 0.2% of the national territory (INSD, 2009). When excluding the peri-urban areas, the urban area measures 500 km² (Ateliers de Cergy, 2019, p.5). The city benefits from the influence of the northern Sudanese climate due to its geographical location. Physically, the forest of Bangr-Weogo (265 ha) and some green spaces constitute the largest forest reserves. The green belt, which was established before the revolution period (i.e. 1983) and is aimed at protecting the capital from drying winds, trapping dust and mitigating the transport of soil through runoff to the dams, was almost totally “consumed” by spontaneous habitats or housing estates (Kafando, 2006). Ouagadougou also has four intra-urban dams, three of which contribute to its drinking water supply. The risks of flooding are enormous for the people living near the rivers and the barrages during heavy rains.

The population density in Ouagadougou is approximately 903 inhabitants/km² (DEP/CO, 2015). The urban part of the city’s developed areas counted 375 km², while the surrounding informal settlements counted approximately 125 km² (Ateliers de Cergy, 2019, p.5).

There is need for additional food in Ouagadougou as more than 31% of the population are food insecure (MASA, 2013). Urban agriculture can supply food to the city as it is inside and in peri-urban areas close to final consumption (African Institute for Urban Management-IAGU, 2007); is mostly market-oriented; and provides perishables such as vegetables, fruits and livestock production.

However, urban agriculture faces constraints related to water scarcity, weak infiltration capacity of soils, difficult water drainage and lack of space (UN-Habitat, 2007). For example, previous studies identified only six sites for urban food production: Boulmiougou, Tanghin, Tannerie, Tampouy, Canal hôpital, and Kossodo, with around 1,343 producers composed of 52% women and 48% men (IAGU, 2007).
After preliminary fieldwork at these production sites, I focused on Tanghin, Tampouy and Kossodo using their group creation story, group site size and group mixture (male and/or female) as selection criteria (see 1.6.7). Geographically, the site of Kossodo (Saisonnière) is located in eastern Ouagadougou. Tanghin (Belembaogo) is in the centre and Tampouy (AMIFOB) is the central-western part (see Map 1). In addition, Tanghin and Kossodo are situated on hydromorphic soil, whereas Tampouy is situated on less developed soil. The following subsection addresses the data collection and tools on these sites.

Map 1: Geographical location of the sites

Source: The Author

4.6 Data collection methods

4.6.1 WFEs project baseline data

I used the data of the WFEs project baseline conducted in October 2017 in Kossodo, Tanghin, Tampouy and Boumlioungou (see 4.5). 144 households were surveyed including 24 and 50 women-only households in Kossodo and Tampouy respectively; 1 man and 43 women for the mixed group in Tanghin; and 1 female and 19 males for the group in Boumlioungou. This sampling strategy captures
gender differences. However, I did not use the data from Boulmiougou in regard to the multiple case-studies selected (see 1.6.7 and 4.3). Therefore, the final sample includes 124 men and women, and 118 after cleaning the database (see Chapter 7).

To conduct the survey, the WFE project’s team (including myself) designed a questionnaire for households. Each women food producer was identified as a member of a given household and then considered as a respondent. The questionnaires were composed of several parts. First, the background information, which provided the identity of the household including the type of household (man-led or woman-led), the gender of the respondent, the marital status, religion, education level and the size of the household. Such information contributes to understanding the decision-making process within the household when it comes to production and consumption patterns (Kini, 2016; Savadogo et al., 2012).

Second, information on the household members’ livelihoods, such as the source of income, was gathered. I listed livelihood resources owned or accessed by all members of the household in order to estimate the value of material (income) and non-material assets. The reason is that income is a key determinant of production performance and consumption patterns (Kini, 2016; Akouwerabou, 2014; Zahonogo, 2011).

Third, I investigated the household food consumption to understand the foodstuffs frequently consumed in the household. This helps with assessing the food diversity as part of the households’ state of food security. While research in this field exists in Burkina Faso, only Savadogo (1986) has conducted the most relevant study by investigating food consumption in Ouagadougou. He identified several economic and sociodemographic determinants of food consumption patterns, including prices, income, household composition, education, marital status and urbanization (Savadogo, 1986). However, I only targeted grains such as local cereals (sorghum, millet and corn) and imported cereals (rice and wheat), and it found that consumers preferred imported grains.

Fourth, the baseline questionnaire included social relationships of the household in terms of their network at the community level (see Annex 1). This information enabled an understanding of how the household members interact with their communities, particularly in social groupings. Indeed, evidence shows that when poor and vulnerable people (women and young) are organised within social networks, they can contribute to development through an increase of awareness vis-à-vis their rights, negotiation power and influence in the political sphere (Ouédraogo, 2018).
Hence, the baseline study contributed to characterising WSEs/WFEs individually in their current work. It enabled the identification of household characteristics that determine their individual agency and resources, which these women bring into their business activities. It also enhanced the understanding of household decision making on production and consumption. However, this baseline data was not sufficient to cover all the current research needs, so some primary data were used.

4.6.2 Group capacity assessment

- The group capacity assessment is a tool developed by the Centre for African Bio-Entrepreneurship (CABE) for testing an Adapted Farmer Business School (FBS) model, and the development of a supply chain model for African leafy vegetables (CABE, 2016). I used this tool in focus group discussions (FGD) in November 2017. This helped with understanding the capacities and available resources of the three groups studied. The tool consisted of seven themes:
  - group formation and characteristics including the date, registration, constitution, number of members per gender, capitalisation and assets and their values;
  - group governance, which addresses leadership, meetings held, training and attendance. Variables at this level include the number of executive committee members, the number of production committee members, marketing committee members and other committees, if existing, all accounting for gender. In addition, the number of ordinary meetings, annual general meetings, special general meetings, frequency of elections and trainings on group governance were also included as variables;
  - conflict resolution and management within the group, which included variables such as the occurrence of conflictual situations in the group, how they are resolved, and who is involved in the resolution of such conflicts.
  - group business assessing the business components, financial products and services of the group. The business components comprise the existence of a business plan (planned and on-going activities), group members’ main business (planned and on-going), common group activities (planned and on-going) and out-sourced services. The category of financial services included information on the mobilisation of savings, loans offered to members, revenue collected from group marketing, whereas the financial products were about savings products and loan products owned by the group.
  - group capacity for vegetable production and marketing, which included information on trainings benefitted by the group’s members, technical aspects of vegetable production, value addition and marketing of produced vegetables. Other variables on the production and value addition side were acreage (planned and being produced) at the level of the group and the individuals,
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acreage under vegetable production for each variety, seed stock (variety and amount), quantities added value for each variety and quantities being supplied to markets. On the marketing side, the key variables included the preferred marketing channels (average quantity sold per member per season), institutional market opportunities, average sales per member per week and members’ access to vegetable production and technologies and marketing;

• constraints faced by groups in relation to vegetable production and marketing, and the coping strategies developed; and

• capacity assessment related to the partnerships built by women’s groups. Hence, some variables included the name of the partners, activities supported by the partners, the level of funding to a group and the number of members in the group that benefited from the support.

4.6.3 Focus group discussion on value chain dynamics and economic empowerment

For a better understanding of value chain dynamics and women’s economic empowerment within the three groups of women, I designed and implemented a focus group discussion guideline in October 2017. The guideline consisted of seven sub-themes comprising seven sets of questions:

1. Tell us about your understanding of a value chain, and what are the main ways and factors determining men and women participation in a value chain? Between men and women, who do you think has more opportunities in the value chain and why? Tell us about the channels or activities men and women benefit from by participating in this value chain? At what level of the value chain do you feel you are? Tell us about the production, processing and marketing activities. What are the key factors driving each activity? Tell us about the value chains that you compete with. Give us some examples, please. How do you perceive your relations with the stakeholders of those value chains? Do you have a meeting framework? Do you have an information or knowledge sharing framework?

2. What do you understand by upgrading, and how does it operate? Tell us about the drivers of the upgrading process?

3. Tell us about the market or demand for your products. Who are your buyers? What do you think are the key drivers of the demand for your products? How can the demand for your food products be fostered?

4. Tell us about the storage, preservation or handling/processing of your food products? What opportunities do you see in your field? Can those opportunities be taken and how? What challenges need to be overcome in this field?
5. Tell us about the other stakeholders participating in your products value chains. Who are they? Are you able to negotiate in a balanced way?

6. Tell us about the information or knowledge sharing or flow between you and the other stakeholders in your products value chain. How does it work? How do you get information on new technologies or skills related to your production, processing and marketing activities? What channels do you use to share or receive information or knowledge from those interacting with you? How much does it cost you to share or benefit from information or knowledge? What is the frequency of information or knowledge sharing/receiving?

7. Tell us about women’s empowerment. What does it mean to you? How do you perceive it in society? How can women be empowered? What are the main drivers of empowerment? What are the main constraints? What is the best way to empower women?

4.6.4. Production and demand follow-up

Following the focus group discussions (see 4.6.2 and 4.6.3) I examined the production and demand follow-up process. I systematically followed production and marketing activities of fresh vegetables on the three production sites on a weekly basis by going to the production sites from 6:00 am to 6:00 pm each Saturday or Sunday over 9 weeks. The content of these activities is described as follows.

Production follow-up activities

These activities consisted of gathering data on the set of vegetable crops grown on each site; to take a census of all crops grown at the three production sites, and the underlying costs, using a semi-structured questionnaire. First, the questionnaire included general information on the production site, notably its location, the duration of the production follow-up activities (start hour and end hour). Second, it also included the number of vegetable crops grown at each site. Third, the questionnaire included an inventory of the number of planting areas (pieces of land on which vegetables are grown) per type of crop, date of planting (or number of days the crop has been growing), current stage (beginning, growing, ripe or ready for sale), the quantity of crops ready for sale, and the amount of expenses since the planting day. Finally, the questionnaire included information on the process related to each vegetable crop grown.

Over 9 weeks, I got to understand the production process until the selling moment, therefore gaining important insight into the cost of production. The costs (including seeds, manure and other purchases of inputs) and quantity of vegetable
crops are important variables that contribute to a better understanding of the technical and allocative efficiency of this activity through the multi-inputs and multi-outputs perspective (Bako, 2016; Savadogo et al., 2016; Akouwerabou, 2014; Combaray & Savadogo, 2012). These data were combined with the data of the WFE project baseline (see 4.6.1), particularly the socio-demographic data, to be able to make an analysis at the individual level. Indeed, all women within their groups are primarily individual entrepreneurs with a certain plot of land that they exploit, meaning that they are seeking gains related to activities of production.

Demand follow-up activities

This follow-up consisted of a daily census of all the buyers that purchased vegetables at the three production sites using a semi-structured questionnaire to gather quantitative and qualitative data from the interaction between producers and buyers. Based on this experiment, a total sample of 300 was reached with some buyers repeatedly interviewed (but 242 different buyers were interviewed), therefore generating longitudinal data. A first period of 9 consecutive weeks covered these follow-up activities, starting from the 2nd of December 2017 to the 20th of January 2018.

The questionnaire contained several themes. First, it addressed the general information on the buyers/consumers who came to buy the food at the production site. The data gathered included the site where the interview happened, the duration of the interview, the identity of the buyer (including gender), the buyer’s residence location and the distance between the site and his/her residence. Second, it addressed the number and type of vegetable crops purchased, the quantity and price of each crop purchased. Third, the questionnaire also comprised of both mutually supporting closed and open questions. The questions included, among others, were: What is the foreseen destination or utilisation of each purchased crop? What are the motivations for the purchaser to buy these vegetable crops? What is the buyer’s perception of the quality of the crop they purchased? What is the frequency or number of times in the week or month the buyer purchases these vegetables crops? What is the buyer’s appreciation of the purchase price of each vegetable crop? Do the buyers make comments/feedback towards the vegetable producers? Why? Does the buyer share his/her knowledge with the vegetable producers in relation to the activities (production, marketing)? How? The recoded

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24 This section is based on the author’s published article “Organic vegetables demand in urban area using a count outcome model: case study of Burkina Faso”. Agricultural and Food Economics (2020) 8:22.
25 The open questions were later recoded to redefine new variables to support the analysis.
answers and narratives allowed us to get data on all the variables presented in the theoretical model in Figure 3.1. In addition, we were able to assess the number of buyers per day, per site, and per data collection period.

After a preliminary analysis of the data gathered in the first period, I found that many aspects of the production and demand for vegetables at the production sites were missing. Thus, I revised the questionnaire on the demand-side by adding the missing questions and undertook a second fieldwork from September to October 2018. Some missing information included the buyer’s gender, age, marital status, occupation sector, job sector, exact job position, level of education, household size, means of transport to go to the production site and why choosing this means of transportation. Other missing questions included: How many times a day do you visit the site? What is the cost of transport to the production site by motorcycle (round trip)? What is the cost of transport to the production site by car (round trip)? What is the average monthly income of the buyer? What are the total monthly expenditures in the household? What is the average monthly expenditure on food products? What is the average monthly expenditure on market garden products? Finally, questions on interaction between producers and purchasers included: Since when have you gone to this site? What do you think about the governance of the site? What changes have you observed on women behaviour, individually and in groups? ... on production techniques? ... on product diversity? ... on product availability? ... on product quality? ... on sales techniques? ... on women’s material wellbeing? ... on individual and collective women’s achievement? ... on women’s ability to create added value?

The idea of this second period of data collection was to complete the missing information on the demand side in the previous fieldwork by calling the 242 buyers who had been interviewed in the first period. However, only 120 buyers were reached. Thus, to increase the sample size, I conducted a third data collection (follow-up of the demand and production activities) at the three sites in December (5 consecutive weeks) and life story interviews targeting food producers themselves (see 4.6.6).

In total, over the data collection periods, 401 buyers were interviewed (159 in December 2018 and 242 between December 2017 and January 2018), among those, 244 buyers surveyed through a revised questionnaire.
4.6.5 Ethnographic research methods

I used ethnographic methods (O’Reilly, 2019; Hammersley & Atkinson, 2007) to investigate WSEs in the three groups. These methods included distant observation method (Moussaoui, 2012) and participant observation (Bird, 2019), and were conducted for a week on each research site in November 2018. First, distant observation was conducted 3 days on each research site. It consisted of going early in the morning (7:00 am) to the research sites, spending the day while observing and taking notes on women’s work on their production sites. I particularly observed the time they arrived at the sites; how they started working on their plots (digging, watering, planting, weeding, and vending); when (and for how long) they took their lunch-break and went back to work; and at what time they completed their working-day. I also observed how women socialise with each other at the production sites. Second, participant observation was conducted for 4 days on each research sites. It consisted of going to the sites in the morning (around 9:00 am) during the first two days and in the afternoon (around 5:00 pm) the last 2 days. While helping (some) women (older, middle-age and younger) in digging their plots, watering their crops and weeding their plots we discussed their activities and social life. In total, I helped 10 women per research sites in order to understand their production activities.

4.6.6 Life story

The questions asked in life stories were organised in three parts. The first part was related to the producers’ life story. Questions included: Can you tell me your life story? What lessons did you learn and what advice can you give to those who do not have the opportunity to carry out activities like yours? What is your ambition or the thing you would like to achieve the most, and what do you value most? How long have you been doing your current activities? What was your highest expectation when starting the current activities? Do you think that you have achieved this? If yes, how and to what extent (score on 0 to 10)? If not, what happened?

The second part was related to the resources at the disposal (before engaging in this business and now) of the producers at the individual level and collective level. The following questions were asked:

- **Time resource (then and now):** Indicate the typical use of your day, between 6:00 am and 12:00 pm. Who controls/influences this time (yourself or your husband)? Indicate the typical use of your week, from Monday to Sunday? Indicate the typical use of your month? What do you usually do during the year?
• **Space Resource:** Before joining the group, did you have access to space? Who controls (owner) the current space resource and why? What role does this resource play in your individual and collective activities and in your household or community?

• **Material Resource (financial):** Before joining the group, did you have access to material (and financial) resources? If yes, who controlled them? Who controls (owner) the current material (financial) resource and why? What role does this resource play in your individual and collective activities and in your household or community?

• **Human resources (human capital and relations):** Before joining the group, did you have access to human capital and/or relational resources? If yes, who controlled it? Who controls (owner) the current resource and why? What role does this resource play in your individual and collective activities and in your household or community?

• **Natural Resource:** Before joining the group, did you have access to natural resources including ecosystem services? If yes, who controlled it? Who controls (owner) the current resource and why? What role does this resource play in your individual and collective activities and in your household or community?

The third part is related to the information on the group and business activities, and the following questions were asked to interviewees. Tell us about the association/group you belong to. What do you think about the group governance? What do you think about the group performance or outcomes from its activities? Has there been any change? If yes, what changes? What do you think about relationships between group members? What does “doing business” mean to you? How do you do business? Do you do business according to you? Do you consider your current activities as businesses? Do you consider your association or group to be conducting a profit-based business or social business (non-profit)? Is it private or collective? At the beginning, what was your strategy (or did you have a strategy) to undertake such activities? And now, did your strategies change? What defines a success or failure of a business? And what about your own activities?

This set of data from different sources contributes to answering the research questions, by combining the data as well as their sources, as presented in the next section.

### 4.7 Data analysis methods

I used three main econometric models to analyse the causal relationships between the interest variables and their potential explanatory factors. On the production side, the main goal was to understand the profit-making behaviour
by women themselves, as profit is the main material outcomes of their economic empowerment. Beyond the profit, the aim was also to analyse the perceived overall impact of women business models on their wellbeing (or living conditions) both materially and non-materially.

On the demand side, I aimed to analyse the demand behaviour of the consumers interacting with women in order to identify the factors determining this behaviour. This contributes to understanding the social value or benefit that the business brings to the entire community of WSEs. In doing so, I used different econometric models for each analysis and related goal: the quantile regression models, negative binomial regression model and linear regression model. All these three types of models were used in the analysis of the demand, whereas only the quantile regression was used in the analysis of profit and perceived outcomes of empowerment on the production side.

**Quantile regression models on the production side**

Quantile regression models are part of the non-parametric models. A rich literature exists addressing the difference between non-parametric and parametric methods (Greene, 2002; Wooldridge, 2002; Vandal, 2005; D’Haultfoeuille & Givord, 2014; Boelaert, 2014; Kurzawa & Lira, 2015). Although the parametric model captures the core information from data within its parameters, “its main weakness is that it focuses on the mean of the distribution” (D’Haultfoeuille & Givord, 2014, p.2); the non-parametric model can subtly draw information on non-obvious aspects of the data, making it possible to foretell any prospective data, including other distributional features besides the mean (D’Haultfoeuille & Givord, 2014; Kurzawa and Lira, 2015). As such, in non-parametric methods, the parameters are usually said to be infinite in dimensions and can express the characteristics in the data much better than parametric models. It has more degrees of freedom and is more flexible even though it requires a sample size beyond 30.

Hence, I choose the non-parametric method to analyse profit-making behaviour as well as the perceived outcomes of the gender-aware inclusive business model. The quantile regression model enables the use of atypical observations (e.g., outliers) and it has the advantage of using the whole sample, so there is no problem of overreliance on certain parameter estimators (Kurzawa & Lira, 2015).

The quantile regression model can be presented in the following form (Kurzawa & Lira, 2015).
where:

$$y_i = \beta_0^{(p)} + \sum_{j=1}^{K} \beta_j^{(p)} x_{ij} + \varepsilon_i^{(p)} \quad (E.1)$$

$$Q_p(y_i|x_{ij}) = \beta_0^{(p)} + \sum_{j=1}^{K} \beta_j^{(p)} x_{ij} \quad (E.2)$$

is the conditional $p$-th quantile of dependent variable $Y$ (the profit) with known values ($y_i$) and $x_{ij}$ (socio-demographic characteristics of women) taking the $x_{ij}$ values as the independent variables with $i = 1, 2, \ldots, n.$ as number of observations; and $j = 1, 2, \ldots, K$ is the number of independent variables and $0 < p < 1$ is the index defining the regression parameters for the $p$-th quantile of the variable $Y$ distribution.

The principle is that the estimation of each quantile uses the total sample, but a different parameter is estimated for each quantile of the dependent variable. Thus, the estimation of the quantile regression parameters consists of the minimisation of the weighted sum of the absolute remainder values as follows:

$$\min \sum_{i=1}^{n} \rho_p = \left( |y_i - (\beta_0^{(p)} + \sum_{j=1}^{K} \beta_j^{(p)} x_{ij})| \right) \quad (E.3)$$

$$\rho_p(z) = \begin{cases} pz & \text{for } z \geq 0 \\ (1-p)z & \text{for } z < 0 \end{cases} \quad (E.4)$$

$$z = y_i - (\beta_0^{(p)} + \sum_{j=1}^{K} \beta_j^{(p)} x_{ij}) \quad (E.5)$$

Empirically, the quantile regression models are presented as follows:

In the profit analysis model (see chapter 9), the dependent variable $Y$ is the natural logarithm of profit earned by WSEs/WFEs (lnProfit). The independent variables ($x_{ij}$) used are

$X_j = (Age, Marital Stat, Education, Size, Meal adult, Meal Child, Duration, Educ2, Govern),$

where: $Age$ is the age of the interviewee; $Marital stat$ is the marital status; $Education$ is the level of education; $Size$ is women’s household size; $Meal adult$ is the number of meals per day per adult; $Meal child$ is the number of meals per day per child; $Duration$ is the number of years in the business and can be seen as the experience in the business; $Educ2$ is the education squared or human capital (know-how) acquired (through capacity building trainings) over the years in the business. In this analysis, the quantiles 10 to 90 were regressed over the independent variables in regard to the dataset at disposal.
In the perceived impact of the business, the dependent variable \( Y \) used is the Extent (the extent of the perceived impact or achievement). The independent variables \( (x_j) \) used are such as:

\[
x_j = \text{Production time, Domestic time, Space, Material, Financial, Human, Relational, Natural}
\]

where production time is the net change in the time dedicated to the business activities or other income generating activities; domestic time is the net change in the time dedicated to household work; space is the net change in the access to space resources; material is the net change in the access to material resources; financial is the net change in the access to financial resources; human is the net change in access to human capital; relational is the net change in access to social or relational capital or resources; and natural is the net change in access to natural resources (see chapter 8). In this analysis, the main quartiles (25, 50 and 75) were regressed over the independent variables in regard to the data set at disposal.

Quantile regression models on the demand side

On the demand side, I used quantile regression models to analyse the amount or value of the demand for food products. Thus, the dependent variable \( Y \) used is value. The independent variables included are as follows:

\[
x_j = \text{Distance, Use, Health, Remark, Know, Gender, Age, Marital, Education, Size, Frequency, Duration, Cost, Income}
\]

where: Distance is the distance travelled by food buyers to the production sites; use is the destination or utilisation of the purchased food; Health is the health attribute of the food; Remark is the remarks made by buyers to the producers; Know is the knowledge and information sharing between buyers and the producers; Gender is the gender of the buyers; Age is the age of the buyers; Marital is the marital status of the buyers; Education is the education level reached by the buyers; Size is the household size of the buyers; Frequency is the number of times the buyers go to the site per month; Duration is the number of years the buyers frequent the site; Cost is the cost of transportation for a round-trip; and Income is the buyer income or estimated household income.

In this analysis, the quantile 10 to 90 were regressed over the independent variables in regard to the data at disposal.

Negative binomial regression model
The negative binomial regression model is the count outcomes regression model (and Extension of the Poisson Regression Model) that is used in this research to analyse an aspect of the demand for food from the production sites. I have used this model before (Kini et al., 2020) with a subset of the data used in this research. The model principles and estimation challenges (Kini et al., 2020) are merely referred to in this research. Thus, the empirical model can be presented as follows:

\[ \text{Demand} = f(\text{Distance}, \text{Use}, \text{Quality}, \text{Remark}, \text{Marital}, \text{Education}, \text{Size}, \text{Duration}, \text{Govern}, \text{Income}) \]  \hspace{1cm} (E.6)

where \( f(\cdot) \) is a function which mathematical form is specified as follows:

Since the dependent variable (Demand=Frequency or Freq) is the number of times, or frequency, by which consumers purchase vegetables at the production sites over a month, this count variable fulfils the conditions of the Poisson distribution (Chesneau, 2018; Wooldridge, 2002; Greene, 2002). That is,

\[ \text{Demand} \sim P(\lambda(x)), \text{ where } \lambda(x) = E(\{X = x\}) \]

where

\[ X = (\text{Distance}, \text{Use}, \text{Quality}, \text{Remark}, \text{Marital}, \text{Education}, \text{Size}, \text{Duration}, \text{Govern}, \text{Income}) \]

the set of the explanatory variables of food demand. As such, for any \( k \in \mathbb{N} \), the probability:

\[ P(\text{Demand} = k | \{X = x\}) \text{ is } P_k(x) = \exp(-\lambda(x)) \frac{\lambda(x)^k}{k!} \]  \hspace{1cm} (E.7)

With regards to the sample size, equation (E.6) can be rewritten for buyer \( i \) as follows: \( \text{Demand}_i = f(\text{Distance}, \text{Use}, \text{Quality}, \text{Remark}, \text{Marital}, \text{Education}, \text{Size}, \text{Duration}, \text{Govern}, \text{Income}) \)

with \( i = 1, 2, \ldots, n \), \( n \) being the sample size, that is, 230 clients.

Equation (E.7) can be rewritten as follows:

\[ \ln(\lambda(x)) = \beta_0 + \beta_1 \text{Distance} + \beta_2 \text{Use} + \beta_3 \text{Quality} + \beta_4 \text{Remark} + \beta_5 \text{Marital} + \beta_6 \text{Education} + \beta_7 \text{Size} + \beta_8 \text{Duration} + \beta_9 \text{Govern} + \beta_{10} \text{Income} \]  \hspace{1cm} (E.8)
That means:

\[ \lambda(x) = \exp(\beta_0 + \beta_1Distance + \beta_2Use + \beta_3Quality + \beta_4Remark + \beta_5Marital + \beta_6Education + \beta_7Size + \beta_8Duration + \beta_9Govern + \beta_{10}Income) \]  

(E.9)

The aim is to estimate the \( \beta_0, \beta_1, \ldots, \beta_{10} \) from the data set, that means estimating \( \lambda(x) \) and \( p_k(x) \) by substitution. Therefore, the Conditional Maximum Likelihood Method was used for that purpose (see Wooldridge, 2002; Kini et al., 2020).

**Linear regression model**

The linear regression model is the single most useful tool in econometrics. It often is the departure point for the full analysis and remains the device that is used to start almost all empirical research (Greene, 2002). In particular, the multiple linear regression model is used to study the relationship between a dependent variable and one or more independent variables (Greene, 2002). The generic form of the linear regression model is:

\[ y = f(x_1, x_2, \ldots, x_k) + \varepsilon \]  

(F.10)

\[ = \beta_1x_1 + \beta_2x_2 + \cdots + \beta_kx_k + \varepsilon \]  

(E.10)

where \( y \) is the dependent or explained variable (the demand value in this research); \( x_1, x_2, \ldots, x_k \) are the independent or explanatory variables; and \( \varepsilon \) is a random disturbance, named as such because it disturbs an otherwise stable relationship (Greene, 2002).

For each observation in the sample, the model (E.10) can be rewritten as follows:

\[ y_i = \beta_1x_{i1} + \beta_2x_{i2} + \cdots + \beta_kx_{ik} + \varepsilon_i, i = 1,2,\ldots,n \]  

(E.11)

The empirical multiple linear regression model in regard to the data in the current research can be rewritten as follows:

\[ Value_i = \beta_1Distance_i + \beta_2Utilisation_i + \beta_3Quality_i + \beta_4Remark_i + \beta_5Know_i + \beta_6Gender_i + \beta_7Age_i + \beta_8Size_i + \beta_9Duration_i + \beta_{10}Income_i + \beta_{11}Frequency_i + \beta_{12}Govern_i + \varepsilon_i, i = 1,2,\ldots,n \]  

(E.12)

with \( n = 230 \), the number of buyers interviewed at the production sites.
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The parameters $\beta$ were estimated under the Robust Estimation method, which provides more consistent standard errors than the ordinary least squared estimation method (Greene, 2002).

4.8 Research questions

4.8.1 What do urban food value chains look like and what position do BoP women take therein?

To answer this research question, I used the data from focus group discussions on value chain dynamics and women’s economic empowerment. I particularly focused on discussions leading to the identification of their activities within these value chains (their position), who are their buyers (end-consumers or (semi) wholesalers or retailers).

4.8.2 How do current business strategies of WSEs/WFEs contribute to building their capabilities collectively?

To answer this research question, I combined several data sources and techniques. First, the group’s capacity assessment data were used. This allowed an assessment of the resources at the disposal of the women’s groups collectively such as physical, financial, time, space, relations/networking and natural resources (including ecosystem services). Second, focus group discussions on value chain dynamics and women’s economic empowerment were used to deconstruct certain ‘concepts’ found in the literature such as value chain, women’s economic empowerment, gender in business, inclusive business and capabilities. This focused on the definitions and meanings that the women’s groups give or perceive in those ‘constructs’.

Third, I used ethnographic methods in 4.6.5 to investigate the collective agency of these WSEs/WFEs. These methods included distant observation method (Moussaoui, 2012) and participant observation (Bird, 2019).

Ethnographic methods helped me to understand the various segments or nodes of the value chains. In particular, these methods helped to better understand factors such as the political and economic institutions; the social/cultural, environmental, organisational, vertical and horizontal linkages in the value chains; gender and communicational issues among the stakeholders (including women) as agents. In addition, the methods helped me understand how these factors influence or shape collective agency, processes of resource access (collective) as well as how they shape food production and marketing (and consumption/demand). Moreover, participant observation (Bird, 2019) and distant observation (Moussaoui, 2012)
of food production and marketing helped with understanding the interaction between vendors and producers, vendors and processors or with final consumers. Both also help with investigating how WSEs/WFEs behave collectively within the group they work in. Therefore, all these primary data were gathered to answer this research question (see chapter 6).

Overall, I analysed the data from focus group discussions in two ways to answer this research question. The first way considered the quantitative data that were estimated during the group discussions, which were about certain quantifiable indicators. Specifically, these data were from the group capacity assessments that mostly focused on women groups’ assets. The second way was related to the qualitative data, meaning that they are not measurable in a quantifiable way. Some of these data were coded to allow comparison between the three women groups.

### 4.8.3 How do current business strategies of WSEs/WFEs contribute to building their capabilities individually?

To answer this research question, I combined several data sources and techniques. First, the data of the baseline study (survey), which allowed me to understand women household’s individual social, demographic, nutritional, and economic characteristics. Indeed, the baseline survey also provided knowledge on some resources of each women food entrepreneur based on the household they are from. Second, interviews of women individually took place after the distant and participant observations, which allowed me to triangulate the data. It is worth noting that these individual interviews also included the life story interviews of WSEs/WFEs.

Third, data from the surveys (follow-up activities), both from the production side and demand side, were treated in a quantitative way. Indeed, narrative answers were recoded into new variables, so that this process contributed to capturing more variables to the econometric modelling used in this research.
4.8.4 What are the conditions for a business model to be gender-aware and inclusive for poor women in value chains? What does an empirically tested gender-aware inclusive business model imply?

To empirically answer this research question, I used interviews with the main actors involved in or linked to the value chains, such as women entrepreneurs, policy makers, practitioners and NGOs. So far, the data sources described in section 4.6 contributed to partly answering this research question at the group level, in particular the group capacity assessment, focus group discussions on the value chain and on empowerment, demand follow-up activities, and life story (see chapter 8).

However, these data were insufficient for fully grasping how WSEs/WFEs’ capabilities are empirically linked to gender-aware inclusive business models. To this end, ethnographic methods were used, particularly distant observation and individual interviews as well as focus group discussions, with all the key stakeholders of these value chains, on agency, capabilities, opportunities as well as the influences of political and economic institutions.

In addition, some concerns were raised related to the durability of women’s business activities. Many women are ageing and they don’t have enough physical strength to pursue these activities in the long term. This issue was further investigated to find out who will be the future owner of the share/part of the current plots of land they are working on. This was considered important as the material support those women may presently get will stop benefiting their household if they are retiring or no longer able to work their plot of land.

Overall, to answer this research question, I used a causality analysis (Cox & Wermuth, 2001). Indeed, in this causality analysis, a gender-aware inclusive business model that was operationalised by an index of inclusiveness and gender awareness was designed. This index comprised five components (see 3.1.2): innovative, adaptable, applicable, affordable and viable. Based on data from interviews with all the key stakeholders participating in the women’s groups food value chains, the sub-indicators of each component of the business model were identified as well as the thresholds defined (conditions to reach this threshold were defined based on data from interviews): gender issues were included in each component of this business model. This allowed us to design a hypothetical index in which the values depend on the type of business intervention, a necessary framework to simulate the impact of this business intervention on the material and non-material gains (see chapter 8).
4.8.5 How does a gender-aware inclusive business contribute to empowering or achieving WSEs/WFEs' functioning in the urban context?

The data needed to answer this empirical research question also combined all the data sources (qualitative and quantitative) as described in the previous sections (see chapter 9). Here all aspects of the research investigated on the ground have been synthesised, in order to construct a case of a gender-aware inclusive business model that fits with the particular conditions, capabilities, opportunities, resources and agency both at the individual and collective level. In addition, I included data on the political and economic institutions that influence the business activities within the value chain. Thus, primary (qualitative) data was based on field research such as group capacity assessments, focus group discussions on empowerment and value chains with women groups, focus group discussions on agency and capabilities of the various stakeholders in the value chain, individual interviews with those stakeholders on individual and collective agency. In sum, answering this research question implied having a holistic and comprehensive approach of data collection that combined quantitative and qualitative data. The quantitative data comprised the follow-up activities on the production sites and were the main data used to measure the material gains from business activities as presented in the next section. The non-material gains are based on qualitative data and are also described in the next section.

Furthermore, in order to answer the research questions, several methods of analysis were clustered into qualitative and quantitative causality analysis. The qualitative causality analysis is merely about the narrative from interviews and group discussions stating the causal linkage between the indicators in our conceptual framework. This was mostly applied to the non-quantitative causality analysis, referred to as the econometric modelling of such causal linkages (see chapter 9).

4.8.6 How does policy context contribute to empowering WSE/WFE? What are its strengths and weaknesses? What can be improved?

To answer these research questions, I mainly used secondary data based on policy documents and practice analysis at the national and local (urban) level to investigate institutions and their roles in the process of accessing resources by WSEs/WFEs, as parts of the urban food chains. Hence, I identified and analysed the power and financial resources that make decision implementation happen in a given field or sphere. In addition, the economic institutions were described and their linkages with the political sphere, and the preconditions to achieve inclusion of the poorest is highlighted (see chapter 5). The outcomes of the previous
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questions also contributed to answering this research question. The main research methods used in answering this research question is the descriptive policy analysis (Patton et al., 2016) (see 1.6.3) as well as descriptive statistics.

Hence, Table 4.1 below summarises the research questions, methods used and period of use.

<table>
<thead>
<tr>
<th>Research questions</th>
<th>Methods</th>
<th>Period of use</th>
</tr>
</thead>
<tbody>
<tr>
<td>What do urban food value chains look like and what position do BoP women take therein?</td>
<td>Focus group discussions (content analysis) Ethnographic methods</td>
<td>November 2017</td>
</tr>
<tr>
<td>How do current business strategies of WSEs/WFEs contribute to building their capabilities collectively?</td>
<td>Group capacity assessment Focus group discussions (content analysis)</td>
<td>October 2017 November 2017</td>
</tr>
<tr>
<td>How do current business strategies of WSEs/WFEs contribute to building their capabilities individually?</td>
<td>Baseline survey Individual interviews (life story) Follow-up of the demand and production Ethnography (distant observation and interview methods)</td>
<td>October 2017 October 2016; November 2018 November-December 2017; December 2018 November-December 2018</td>
</tr>
<tr>
<td>What are the conditions for a business model to be gender-aware and inclusive for poor women in value chains?</td>
<td>Group capacity assessment Focus group discussions (content analysis) Follow-up of the demand and production Interviews of other stakeholders Individual interview (life story)</td>
<td>November 2017 October 2016; November 2017 November-December 2017; December 2018 October 2016; November 2018 December 2018</td>
</tr>
<tr>
<td>How does a gender-aware inclusive business contribute to empowering or achieving WSEs/WFEs’ functioning in the urban context?</td>
<td>Group capacity assessment Focus group discussions (content analysis) Individual interviews (life story)</td>
<td>November 2017 October 2016; November 2017 October 2016; November 2018 November-December 2017; December 2018</td>
</tr>
</tbody>
</table>

Follow-up of the demand and production
How do public policies contribute to empowering WSE/WFE? What are their strengths and weaknesses?

Descriptive or ex-post policy analysis

July 2018-December 2019

Source: The author

4.9 GAIB Model Design and Field-testing (purpose and parameters)

The purpose of designing a gender-aware inclusive business model is merely to set up an operational tool or framework for the analysis and assessment of gender and inclusion issues in business. It may help policies to monitor and evaluate the so-called inclusive business interventions.

As presented in 3.1.2, gender-aware inclusive business components26 are: Innovative (I), Credible (C), Affordable (A), Adaptable (A), Viable (V). The operational definitions and measurements are based on literature (2.2 and 2.3), my practical knowledge from the ground and data collected from fieldwork. Table 4.2 gives a summary of their contents. Each component of the index is composed of several indicators, which are assessed through the questions shown in 3.1.2.

<table>
<thead>
<tr>
<th>Table 4.2: Gender-aware Inclusive Business Components, Indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Components</strong></td>
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<tr>
<td>----------------</td>
</tr>
<tr>
<td>Innovative (I)</td>
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<td></td>
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<td></td>
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<td>Credible (C)</td>
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<td>Affordable (A)</td>
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</tbody>
</table>

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26 Dimension is sometimes used as a synonym of component, thus both terms are used interchangeably.
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<table>
<thead>
<tr>
<th>Adaptable (A)</th>
<th>Business environment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Market conditions requirements</td>
<td></td>
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<tr>
<td>Political institutions requirements</td>
<td></td>
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<tr>
<td>Economic institutions and resources</td>
<td></td>
</tr>
<tr>
<td>Social environment</td>
<td></td>
</tr>
<tr>
<td>Ability to cope with natural environment</td>
<td></td>
</tr>
<tr>
<td>Zero gender barriers in the environment</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Viable (V)</th>
<th>Demand</th>
</tr>
</thead>
<tbody>
<tr>
<td>Production cost</td>
<td></td>
</tr>
<tr>
<td>Revenue</td>
<td></td>
</tr>
<tr>
<td>Benefit</td>
<td></td>
</tr>
<tr>
<td>Other outcomes&lt;sup&gt;27&lt;/sup&gt;</td>
<td></td>
</tr>
</tbody>
</table>

Source: The Author

The mathematical form of the GAIB index follows the composite index consisting of multiple indicators. The literature addresses the choice of the adequate form of a composite index (e.g., see Kini, 2017; Kini, 2016; Giné & Pérez-Foguet, 2010, Sullivan et al., 2003; Sullivan, 2002) in various fields including food security and water poverty. Some authors argue for the additive form of the index (Nardo et al., 2005; Sullivan et al., 2003; Booyesen, 2002); whereas others prefer the multiplicative or geometric form (Kini, 2017; Giné & Pérez-Foguet, 2010; Nardo et al., 2005).

In this research, I have adopted the multiplicative form as the index’s mathematical formulation, because it prevents the possibilities of a compensation among the five components of the index (Giné & Pérez-Foguet, 2010). Thus, let GAIB Index denote the gender-aware inclusive business model or index,

\[
GAIB \text{ Index} = \prod_{i=1}^{n} X_i^{w_i} \quad i = 1, 2, 3, 4, 5; \text{and } GAIB \text{ Index} \in [0, 1] \quad (E.12)
\]

Where \( X_i \in X = (I (\text{innovative}), C (\text{Credible}), A_1(\text{Affordable}), A (\text{Adaptable}), V (\text{Viable})) \) the different components of the GAIB; and \( w_i = w_1, w_2, w_3, w_4, w_5 \), with \( \sum w_i = 1 \) is the sum total (sigma) of the respective powers of the components innovative, credible, affordable, adaptable and viable.

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<sup>27</sup> Including positive change in gender relationship between men and women.
Thus, based on equation E.1:

\[
GAIB\ Index = I^{w_1} \ast C^{w_2} \ast A^{w_3} \ast V^{w_4}, \quad i = 1, 2, 3, 4, 5 \tag{E.13}
\]

4.10 Research limitations and ethics

The most limitative aspect of this research is tied to the sample size, particularly for the quantitative analysis. Indeed, due to the qualitative research methods used at the departure point of this research and also the small number of food producers for the three cases studied, the total sample size was limited, particularly on the production side (varied between 39 and 118 see chapters 7, 8 and 9). On the demand side, the sample was higher, but the difficulty was related to the data collection period, as follow-up activities required two complementary questionnaires in the second step while certain former interviewees were unavailable. In addition, the non-responses to certain questions led to a small sample (130) of the estimations, while the sample size included (240) was reasonably significant (see 9.2.2).

The scale of analysis used in this research is limited as it is focused on the urban context, which can be considered as a local analysis level. That was good as it enabled an understanding of inclusion and gender dynamics in a value chain on a small scale. However, the interactions between the urban (local) and the rural areas were not investigated. Consequently, the economics and political institutions that strongly influence the rules of the market, the interactions between the micro-scale (local), the meso-scale as well as the macro-scale (national and international) of these businesses have not been captured in this research even though they do play a role on the ground.

However, the main weakness remains the use of the then and now analysis instead of the with and without impact analysis. Indeed, with regard to the definition of empowerment as advocated by Riisgaard et al. (2010, p.6) related to “business intervention in value chain”, the expectations were to clearly identify a business intervention in the three cases studied, and to measure the impact after an experimental period. This would have provided more insightful results in combination with the current analysis (then and now).

4.11 Conclusion

First, the quantity of data and their sources, as well as the mixture of quantitative and qualitative analysis methods used in this research, shed light on the complexity of the mixed methods approach. This is understandable because the current research is systemic, and as such, many and various components of this system needed to be analysed, notably the value chain representing the system.
Second, qualitative methods for data collection (focus group, life story, participant and distant observation) and analysis (content analysis) reinforce the validity of the quantitative results as they allowed for triangulation. Indeed, quantitative methods used in this research yielded quantified outcomes of the research. However, by cross-checking the meaning of these outcomes with the qualitative sources, there was a high potential of better grasping the reality behind the study of a system (here the value chain). Hence, the research generated promising results one can build on.