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# Agricultural restructuring in Uzbekistan: An empirical analysis of land and labour arrangements

Dissertation

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Gießen, April 2, 2024 Jakhongir Babadjanov

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## List of Abbreviations

| | |
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| AGRICHANGE | Research project “Institutional change in land and labour relations of Central Asia’s irrigated agriculture” |
| ATMs | Automated teller machines |
| FAO | Food and Agriculture Organization |
| FTE | Full time equivalent |
| GDP | Gross Domestic Product |
| IAMO | Leibniz Institute of Agricultural Development in Transition Economies |
| ILO | International Labour Organization |
| IPPAE | International PhD Program for Agricultural Economics, Bioeconomy and Sustainable Food Systems, in JLU |
| JLU | Justus-Liebig University Giessen |
| ML | Maximum Likelihood |
| OLS | Ordinary least squares |
| SDGs | Sustainable development Goals |
| SEZ | Special Economic Zone |
| TIIAME-NRU | Tashkent Institute of Irrigation and Agricultural Mechanization Engineers – National Research University |

# Executive Summary

The collapse of the Soviet Union led Uzbekistan to carry out farm restructuring and reform policies in agriculture during the last three decades. It is a key question for both the policymaking and research world to determine which model is alternative to former collective and state farm systems given the local context. In this study, empirically I have investigated land and labour relations in the context of continuous farm restructuring in Uzbekistan. Overall, this research work consists of four main parts: conceptual framing, overview of agricultural development, establishment of cotton clusters and labour incentives in agriculture. Methodically, this study covers both qualitative and quantitative research methods.

In 2018, the government of Uzbekistan initiated a clustering policy in agriculture for which the cotton sector was a pioneer. This study explores the recent changes under the emerging cluster system through original case studies of the current situation and a review of emerging 'grey literature'. The analyses show an organizational mismatch between clusters in theory and clusters in the Uzbek cotton context. By organizational design, clusters do not compete for the cotton of farmers. The cluster policy eliminated neither the procurement price nor the quota system for cotton. The cases studied show the supervision of cotton growing passed from the state to private enterprises that organize the clusters. This transformation has perpetuated monopsony conditions under which farmers have no alternative marketing channels. The input markets have been disconnected from state agencies, however farms lack access to private input markets, since clusters supervise and monitor the inputs used by farmers. I confirm the grey literature reporting that forced, and child labour has receded. Overall, from the farmers' perspective, recent reform steps led to moderate changes at best, while clusters started to play a dominant role in cotton sector.

This study contributes the understanding of labour arrangements in agriculture as well. In this research, I investigate the labour contractual forms and their effect on the farm production. I argue that different payment methods for the workers influence the farm outcome (revenue, profit). In this sense, I test the hypothesis using cross sectional farm survey data collected in Uzbekistan. I compare farms, which use mixed bonus or piece rate methods with farms, which use time rate labour contracts. The findings show the statistically significant effect of mixed bonus system on the farm outcome. Meanwhile, the strength of the effect of mixed bonus system is higher than piece rate system. I learn that incentivised workers through a mixed bonus system provide more effort, which increases farm output. The conclusion discusses the implications for a broader understanding of labour relations in agriculture of Uzbekistan.


***Key words:*** Agriculture, cotton farms, state procurement system, clusters, labour arrangements, pay systems, incentives, farm outcome, Uzbekistan.

# Zusammenfassung

Der Zusammenbruch der Sowjetunion führte dazu, dass Usbekistan in den letzten drei Jahrzehnten eine Umstrukturierungs- und Reformpolitik in der Landwirtschaft durchführte. Es ist eine Schlüsselfrage sowohl für die Politik als auch für die Forschung, welches Modell angesichts des lokalen Kontexts eine Alternative zu früheren Kollektiv- und Staatswirtschaftssystemen darstellt. In dieser Studie habe ich empirisch die Land- und Arbeitsbeziehungen im Kontext der kontinuierlichen landwirtschaftlichen Umstrukturierung in Usbekistan untersucht. Insgesamt besteht diese Forschungsarbeit aus vier Hauptteilen: konzeptioneller Rahmen, Überblick über die landwirtschaftliche Entwicklung, Einrichtung von Baumwollclustern und Arbeitsanreize in der Landwirtschaft. Methodisch umfasst diese Studie sowohl qualitative als auch quantitative Forschungsmethoden.

Im Jahr 2018 initiierte die Regierung Usbekistans eine Clustering-Politik in der Landwirtschaft, bei der der Baumwollsektor eine Vorreiterrolle spielte. In dieser Studie werden die jüngsten Veränderungen im neu entstehenden Clustersystem anhand von Originalfallstudien zur aktuellen Situation und einem Überblick über die neu entstehende „graue Literatur“ untersucht. Die Analysen zeigen ein organisatorisches Missverhältnis zwischen Clustern in der Theorie und Clustern im usbekischen Baumwollkontext. Aufgrund ihrer Organisationsstruktur konkurrieren Cluster nicht um die Baumwolle der Landwirte. Durch die Clusterpolitik wurden weder der Beschaffungspreis noch die Quotenregelung für Baumwolle abgeschafft. Die untersuchten Fälle zeigen, dass die Aufsicht über den Baumwollanbau vom Staat auf private Unternehmen übertragen wurde, die die Cluster organisieren. Dieser Wandel hat dazu geführt, dass Monopsonverhältnisse bestehen bleiben, in denen Landwirte keine alternativen Vermarktungskanäle haben. Die Input-Märkte wurden von staatlichen Stellen abgekoppelt, die Landwirte haben jedoch keinen Zugang zu privaten Input-Märkten, da Cluster die von den Landwirten verwendeten Inputs überwachen. Ich bestätige die graue Literatur, die berichtet, dass Zwangs- und Kinderarbeit zurückgegangen ist. Insgesamt führten die jüngsten Reformschritte aus Sicht der Landwirte bestenfalls zu moderaten Veränderungen, während Cluster begannen, eine dominierende Rolle im Baumwollsektor zu spielen.

Diese Studie trägt auch zum Verständnis der Arbeitsverhältnisse in der Landwirtschaft bei. In dieser Forschung untersuche ich die arbeitsvertraglichen Formen und ihre Auswirkungen auf die landwirtschaftliche Produktion. Ich behaupte, dass unterschiedliche Zahlungsmethoden für die Arbeiter das landwirtschaftliche Ergebnis (Einnahmen, Gewinn) beeinflussen. In diesem Sinne teste ich die Hypothese anhand von Querschnittsdaten aus landwirtschaftlichen Erhebungen, die in Usbekistan gesammelt wurden. Ich vergleiche Betriebe, die gemischte Bonus- oder Stücklohnmethoden verwenden, mit Betrieben, die Zeitlohnverträge nutzen. Die Ergebnisse zeigen den statistisch signifikanten Effekt des gemischten Bonussystems auf das Betriebsergebnis. Die Wirkungsstärke des gemischten Bonussystems ist höher als die des Stücklohnsystems. Ich zeige, dass Anreize für Arbeiter durch ein gemischtes Bonussystem mehr Aufwand bedeuten, was zu einer Steigerung der landwirtschaftlichen Leistung führt. In der Schlussfolgerung werden die Implikationen für ein umfassenderes Verständnis der Arbeitsbeziehungen in der Landwirtschaft Usbekistans erörtert.

***Schlüsselwörter:*** Landwirtschaft, Baumwollfarmen, staatliches Beschaffungssystem, Cluster, Arbeitsvereinbarungen, Lohnsysteme, Anreize, landwirtschaftliche Ergebnisse, Usbekistan.

# 1. Introduction

## 1.1 Land and labour resources in global agriculture

Agricultural restructuring involves the changes in land use practices, the way labour is employed, water management, and other factors. The relationship between land and labour is interdependent, fundamentally shaping the organization of agricultural activities. According to Lerman (2008), agricultural productivity is defined by both land and labour productivity. Land reforms significantly impact rural livelihoods and the composition of the labour force in various ways. For example, the establishment or dissolution of individual farms results in shifts in on-farm employment. Roumasset and Lee (2007) underscore the interplay between land and labour, describing the dynamic as "land hires labour" in agriculture. Specifically, in the context of incomplete enterprise contracts, capital hires labour due to the high agency costs associated with renting capital equipment. Similarly, land functions as a capital source for agricultural enterprises, and farms that acquire land typically employ labour.

Worldwide, the scholars (Binswanger et al. 1995, Roumasset and Lee 2007, Lerman 2008, Petrick 2017; 2021, Ho & Spoor 2006, Lerman & Sedik 2018) discuss *how land and labour resources are arranged to make agriculture productive*. These discussions include the questions, such as relationship between farm size and productivity, optimal farm models (large farms vs family farms), tenure arrangements (property rights issues), labour type (hired vs family labour), incentivizing issues (piece rate vs time rate etc.), proper measurement of the transaction costs and others. According to Ho & Spoor (2006) there is no single blueprint for agricultural restructuring reforms.

Roumasset and Lee (2007), and Binswanger et al. (1995) discuss theoretical foundations of labour and land relations in agriculture respectively. Particularly, Roumasset and Lee (2007) explore the theoretical and empirical issues of labour factor in farm production. The authors stress out the significance of considering labour as a key input in agricultural production, focusing on understanding labour market dynamics and the factors that impact labour decisions. They mainly discuss how wages for workers, working conditions, technology, and other possible factors can influence supply and demand of the labour, and how farmers can change labour strategies as a response those conditions. They provide a model of farm-household decisions, in which the decisions are interconnected in case of the existing transaction costs. In this sense, hired and family labour play a key role in decision making. Here, the definitional and measurement challenges are discussed. The crucial questions whether the proxies to measure transaction costs are valid and reliable are raised. Moreover, they highlight inverse relationship between farm size and labour productivity. Also, the labour contracts including piece rate, time rate, fixed lease are explored, focusing on the risk behaviour of the farms. They mention the importance of designing and shaping contracts that cover the incentives for workers, which increase labour productivity. Importantly, Roumasset and Lee (2007) provide two stylised facts on land reforms, namely inverse relationship between productivity and farm size, and inefficiency of share tenancy. They criticize top-down rules and institutions, which fail to provide a success story in land reforms.

Binswanger et al. (1995) discuss analytical controversies on farm size and productivity, land policy distortions, and incentives in agriculture. They attempt to provide ideas behind the discussion. For example, they raise questions such as what are the sources of economies of scale? Is it in processing, or production? The next question for land reforms is if large farms are inefficient, if this is case, then why do not large landowners rent lands to family farmers? They highlight that there are several factors, which are associated with economies of scale and an increase in farm efficiency. These factors include farm machinery, management skills, and credit access. The single market imperfection would not be enough to build relationship between farm size and productivity. For example, if the credit rationing exists, but land and labour markets function properly, this condition is not sufficient to conclude about inverse relationship. Only several imperfections in markets lead to introduce an inverse relationship between farm size and productivity.

## 1.2 Land and labour resources in agriculture in Uzbekistan

In 1991, the collapse of the Soviet Union led to restructuring policies in all sectors of the economy including agriculture. Three decades after the demise of Soviet planning, the cotton sector remains a salient reform sector in Uzbekistan. It provides livelihoods and employment for a large fraction of the rural population and contributes to government revenue, but the consumption of irrigation water has also been responsible for the Aral Sea environmental disaster and harvesting campaigns have regularly prompted allegations of forced labour. Cotton has thus been in the centre of attention of policy makers, international donors, and advocacy groups (Pomfret 2008; Shtaltovna and Hornidge 2014; Petrick et al. 2017; Asfaw 2019).

Over the years, the government of Uzbekistan has carried out continuous land reforms by retaining state control in agriculture (Ho & Spoor 2006, Ruziev 2021). Petrick (2021) mentions that the topic of agricultural restructuring still matters in post-soviet countries after three decades. Because farm individualisation policy did not provide farmers with free decision making in production and property rights are not secure yet (Djanibekov & Finger 2018). Mainly, the country underwent top-down reforms in agriculture including clusters which is an example of the recent reforms (Zorya et al. 2019). The land reforms and individualisation failed to follow market-driven mechanisms, rather they were the part of distributive land policy by the government (Lerman & Sedik 2018). In this sense, the full liberalization of agricultural production in Uzbekistan is far to happen yet.

As the biggest cotton producer in the region, Uzbekistan earned a reputation as an especially slow and opaque reformer (Lombardozzi 2020; Djanibekov et al. 2012; Shtaltovna and Hornidge 2014; Asfaw 2021). Several scholars have investigated agricultural restructuring in the transition context of Central Asia, Uzbekistan. Djanibekov et al. (2012), Zorya et al. (2019), Petrick & Djanibekov (2019), Pomfret (2008), Lerman (2008), Lerman et al. (2004), Mukhamedova & Pomfret (2019), Djanibekov & Finger (2018), Veldwisch & Spoor (2008), and Petrick (2021) provide an overview of the farm restructuring and land reforms over years. Regarding labour arrangements, Djanibekov et al. (2013) find that unstable rules of farming, informal land sub-leases, and the existing irrigation system provide the farmers with an arena in which they are engaged in fixed wage, fixed rent, and sharecropping arrangements. Following Mukhamedova & Pomfret

(2019), sharecropping is a response to institutional uncertainties: cash shortages, insecure land tenure and distorted input markets. I highlight that the tradition of informal sharecropping serves as one of the strategies to deal with incentives. According to Petrick (2017), the enriched job design through bonuses tends to become more prevalent as a solution to the incentive problem. Lombardozzi (2020) provides that informal networks play a high role in hiring labour in agriculture.

## 1.3 Knowledge gap

Petrick (2017) highlights that during the Soviet Union, the collective and state farms operated in agricultural production and labour in those farms was designed based on factory-style (adoption of Taylorist method with more focus on piece-rate system). In 1991, after the collapse Soviet Union, the existing land and labour arrangements changed and the relevant question appeared in Uzbekistan: which form of farming and which farm size are optimal? how do farms organize labour relations? and how do farms incentivise workers? In particular, the variety of pay systems and their effect on farm performance in agriculture are not analyzed yet.

In addition, the change of government in the late 2016 accelerated reform pace, in fact triggering a plethora of new policy initiatives, more open debate of reform proposals, and an increasing role of international donors. Against this background, the recent years (2017-2022) saw significant changes, new rules and restructuring policies in agriculture. From early 2018, the government started implementing a new type of local production and processing arrangement focusing on cotton, the "cluster system". It thus chose a term that had gained prominence in the international debate on industrial policy two decades ago (Porter 1998) and that also neighbouring post-Soviet countries had considered attractive for their own reform initiatives (e.g. Kazakhstan; Petrick et al. 2017). The establishment of clusters in cotton production was one of those reforms, which revolutionised land relations and farm restructuring aspects in Uzbekistan. However, what exactly "cluster" means in the context of current cotton reforms in Uzbekistan, which underlying goals the government has in mind by pursuing this new strategy, and especially what effects should be expected to materialise in production practice has not been studied in the academic literature yet. Thus, carrying out research on clusters drew my primary attention.

In general, my overarching goal is here to study land and labour relations in agriculture given the recent changes in Uzbekistan. I contribute to address above mentioned big questions (how to arrange land and labour resources) by analysing cotton clusters and incentives to agricultural workers in Uzbekistan, where cotton sector is highly regulated by the government (Pomfret 2008).

## 1.4 Specific research questions and contribution

In this subchapter, I point out the research questions of the study based on the global question mentioned at the outset of the introduction. That is how to organize land and labour resources in agricultural production? If I move to specific area and context, then how are the land and labour relations in cotton sector of post-soviet Uzbekistan? I attempt to link specific case-based research questions with the so-called big questions of land and labour relations. I can categorize land and labour arrangements as external and internal for the farm production. Because land resources and usage refer to the external environment for the cotton farms, and labour arrangements represent internal environment in the context of Uzbekistan. Generally, I study cotton clusters in the light land reforms, and labour incentives in the context labour arrangements in cotton farms. Below I will explain research questions specifically.

In the thesis, I explore the meaning of cluster formation in Uzbekistan's cotton sector and provide original evidence on the early effects of the new policy in selected cotton producing regions of Uzbekistan. After a brief review of the international literature on cluster formation as an industrial policy, I describe the recent reform steps and provide a first sketch of the emerging production model.

The apparent reform commitment of the government has motivated various journalists, donors, and advocacy groups to monitor the changes on the ground. Many of these stakeholders follow their own political agenda. At the same time, original academic work on recent reform progress has been scarce. Against the ongoing reform dynamic and the many commenting voices, our goal here is to provide primary evidence on cluster reforms that is committed to academic standards, and to review and systematise the insights emerging from other secondary sources ('grey literature'- various reports including news). I investigate our own original case study data based on fieldwork conducted in four emerging clusters and expert interviews recorded in the second half of 2019, after the government had concluded the first round of cotton cluster creation. In structuring the analysis of key reform areas, I review the evidence from the secondary sources in order to provide a comprehensive picture of reform progress to date. I use these sources to describe and preliminarily evaluate the major changes that occurred between early 2018 and mid 2020.

More specifically, I first demonstrate how cotton clusters were established, and then investigate changes in cotton value chains in inputs and services, credit, labour mobilisation, crop choice, cotton price and marketing channels under the cluster system. While much of the grey literature focuses on specific aspects that are of interest to the authors of this literature, such as allegedly forced labour use or land grabs from farmers, I aim at a more balanced and comprehensive evaluation. Our study includes primary data not only from clusters but also from farmers. The study also enters conversation with previous research findings on cotton production in Uzbekistan.

Furthermore, the agricultural restructuring over years raised the questions of the relationship between the farmer and workers as well as incentives to motivate workers, particularly in cotton sector. Djanibekov et al. (2015) and Auty (2003) stress that the structure of state agricultural policy on procurement price, land optimisation and target volumes in Uzbekistan led to disincentives cotton farms in production. Against this background, what kind of labour contracts and incentives does the farmer offer to the workers with the aim of amplifying labour effort?.

The effects of different payment methods on the production of cotton farms in Uzbekistan are not studied yet. In the following empirical analysis, I examine how various payment system impact on farm output. Furthermore, I study management as an input factor in farm production. By doing so, this research contributes into the discussion about the role of management in firm productivity as well, especially in developing countries.

Bloom et al. (2013) provide empirical insights from the research in textile and elaborate the impact of the management practices as input factor on the productivity. For the analyses, I draw on the works of Bloom et al (2013) and Petrick (2017) in the analysis. In this study, I primarily investigate the effect of various payment systems on farm outcome in Uzbekistan. I engage in a dialogue between theory of labour contracts and empirical survey data, considering agricultural context under transition. The contribution of the study to the literature involves providing empirical evidence on the existence of labour arrangements in agriculture in post-soviet country and their impact on the farm output. For that aim, I model individual farmer decision-making regarding wage system and empirically assess it utilizing survey data of individual farmers.

The following passage makes clear the research question on labour incentives.

> *"I am working on various payment systems because I want to find out the relationship between payment systems and farm output, so that I can better understand labour arrangements including incentivizing workers in farms".*

In other words, I attempt to show how farmers organize agricultural labour in the farm production and how they incentivize workers. By doing that, I contribute to the discussion of the organization of the labour resources and solving incentive issues in the developing countries.

Overall, this dissertation covers land and labour aspects under agricultural restructuring in the post-soviet setting of Uzbekistan. To make clear, I ask the following questions: what do I study and why do I study it?. If I start with what question, the main research question is that: What are land tenure and labour arrangements in cotton farms in post-soviet Uzbekistan, which shape agricultural production? If I specify main research questions, I come up with the following specific research questions that I analyse further.

1. How have cotton clusters been established?
2. What are changes in cotton value chains in inputs and services, credit, labour mobilisation, crop choice, cotton price and marketing channels under the cluster system?
3. Which payment systems do cotton farms practice to workers?
4. What is the impact of various payment systems on farm outcome?

The next step is to identify why question (global question) to contribute. The big question is how land and labour resources are arranged in agriculture. In this sense, I will contribute this discussion by providing the evidence in the context of the developing country (Uzbekistan). Having described that, I now turn to the research design, which explains specific research questions in details.

## 1.5 Research design

The factors of the agricultural production such as land and labour resources play an essential role in agriculture (

Figure 1). They represent the fundamental challenges of agricultural restructuring. In this sense, the specification of the overall research question on land and labour was necessary to provide a micro-level analysis for agricultural restructuring. By doing so, the research findings of the dissertation explain the land and labour resources in-depth so that it helps to understand better agricultural restructuring in the case of Uzbekistan. Importantly, this research covers the external and internal environment of the cotton farms. Overall, the findings might be priceless lessons for those countries, which have the similar context (i.e. transition[1], developing etc.) with Uzbekistan.

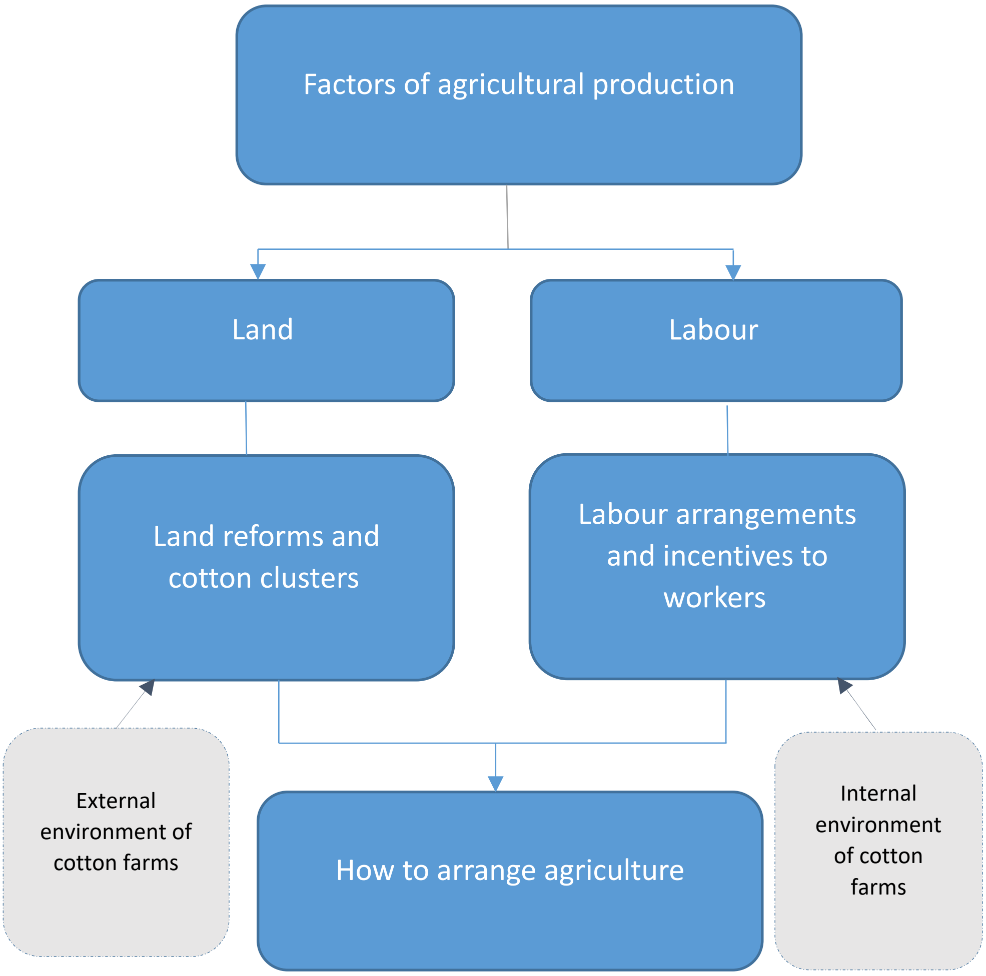



Figure 1. Scheme of study
Source: author.

Having described that, now I will move on to the structure of the monograph.

## 1.6 Organisation of the monograph

This dissertation is written as a monograph, meaning that the chapters are not mutually exclusive; rather they are connected in coherent manner. Therefore, to better understand it is recommended for a reader to start from the introduction chapter. The thesis primarily

[1] I will provide the definition of the terms "transition" and "developing" later in chapter 2.

consists of six chapters. This study attempts to investigate the research questions stated in earlier subchapter. The second chapter elaborates theoretical fundamentals to investigate cluster reforms and labour incentives in agriculture. It mainly consists of the the elements of the institutional economics. First, I provide the definition of the "institution" and continue with transaction costs in 2.1 subsection. After that I provide farming environmental and various models in 2.2. Here the decision making under the different settings is also described.

Following that, in subsection 2.3, I discuss the optimal farm size. Having described that, I move to the more specific concepts for cotton clusters and labour incentives. If I summarize main points here, given the diversity of the definitions of cluster term, it is challenge for the author and a reader to understand what exactly cluster means. Therefore, the discussion about cluster term, its ambiguity and possible explanations in agriculture are given in subsection 2.4.1. Then in subsection 2.4.3, I connect the state-led clusters with industrial policy concept using theoretical foundations.

I also present the attributes and success factors of industrial policy theoretically. Having described that, I will move on to the labour arrangements in agriculture, starting with highlighting the labour as a core of agricultural organisations in subsection 2.5.1. In subsection 2.5.2, the principal-agent model is described, which is a theoretical fundament for labour studies. I also provide brief description of the situation in labour relation in the Soviet Union in subsection 2.5.3., particularly why it was inefficient. Then I cover the contractual forms of labour, evolution of the labour contracts, job designs and pay systems. Here, I also mention about the characteristics of labour in agriculture which are different from other sectors such industry or factory-based production in subsection 2.5.7. This is also one of the key moments to understand, it helps to perceive the settings in which farms operate and support to justify why certain pay systems may work or be used by the farms in agriculture.

Having described that, in the third chapter I focus on the methodology to operationalise the research questions, which were provided in the earlier chapter. It is important to mention that I combine qualitative and quantitative methods in this study. In this sense, I provide data sources in subchapter 3.5, which make possible to employ both methods in this study. The chapter four provides the overview of agriculture and describes establishment of clusters and labour incentives in agriculture. Findings on cotton clusters were published in Babadjanov and Petrick (2023.) In particular, in section 4.2.1, I provide information about how the clusters were established and how cotton supply chain has changed. Subsequently in section 4.2.2, I categorize the clusters in Uzbekistan based on empirical findings on the ground. In section 4.2.3, I compare the international literature on clusters with the case of Uzbekistan to capture the similarities and the differences. Then I analyse the changes along value chain (agricultural inputs and services, credit access, cotton harvest, crop choice, cotton price, and marketing channels) in section 4.2.4. Here I also include the Kazakhstan's experience on clusters to draw some lesson to Uzbekistan.

Then I move on to the labour incentives in section 4.3.1, by describing descriptive statistics of variables, providing distribution of pay systems and farm size, and calculating mean differences for the selected (dependent) variables. I provide the results of the regression analysis in section 4.3.2, which I estimate based on the model specifications and the equations in section 3.2.1.

Having described that, I start the discussion based on empirical findings in chapter five. I focus on the establishment of clusters in subchapter 5.1 and labour incentives in subchapter 5.2 respectively. Finally, the chapter six provides conclusion drawn on the earlier chapters. In addition to that, I include reference list and several tables, figures in Appendix to give complete information for a reader.

In the following chapter, I overview the theoretical foundations, with help of which I further analyse the research questions empirically. Broadly speaking, I group them into two groups that are related to the land relations and farm restructuring, and labour arrangements respectively.

# 2. Agricultural restructuring: A conceptual framework

Since Uzbekistan is a developing (transition) country, I attempt to provide concepts and approaches which were found or implemented in developing(transition) countries, considering that the similar contexts exist. Following Lerman et al. (2004), transition refers to shift from centrally planned economy to a market-oriented economy. The core objective of the transition to market is to increase productivity and efficiency. One of the dimensions of the transition relates to changes in agricultural sector, more specifically, land reforms and restructuring of the traditional soviet style farms. Developing refers to the group of the countries that have low and middle income based on Gross National Income (GNI) per capita. Uzbekistan is also in the list with 2 190 USD (GNI per capita)[2] (worlddata.info 2024)

According to Swinnen and Rozelle (2006), under the changing property rights, there are many circumstances, in which agricultural restructuring could lead to productivity falls (at least in the short term). For example, if farm managers are not certain about the future of farming, they would be less willing to provide effort and investment. In this sense, it is crucial to involve farmers in discussion of land property rights in case of agricultural restructuring. Binswanger et al. (1995) highlight that improved work and investment incentives are associated with security of the land tenure. According to Lerman et al. (2004, p. 96), the agricultural model in market economies is founded on private land ownership with full transferability of use rights. Lerman & Sedik (2018) highlight that individualization of land tenure (individual land use right) is the not the same as privatization of legal land ownership.

Below I provide the comparison table of the land property rights in the selected transition countries (Table 1). This table compares the land property practices as of 1998. As it can be seen, Uzbekistan is the ranked the last one among Central Asian counties. There is only land use right for farmers, however it is impossible to transfer or to own the land privately.

Table 1. Varieties of land property rights in Central Asian countries

| Counties | Individual use right | Transfer of use right | Individual ownership right | Transfer of ownership right |
|---|---|---|---|---|
| Kazakhstan | + | + | - | - |
| Kyrgyzstan | + | + | + | - |
| Turkmenistan | + | - | + | - |
| Tajikistan | + | + | + | - |
| Uzbekistan | + | - | - | - |

Source: Based on Swinnen and Rozelle (2006), Lerman and Sedik (2018)

This practice has been survived without any change till 2024. Regarding transfer of use rights, there has been a recent change according to the Presidential Decree No 15 dated

[2] Income below 995 USD: low-income countries. Income below 12 055 USD: middle-income countries. Income above 12 056 USD: high-income countries (https://www.worlddata.info/developing-countries.php).

18 January 2024. From March 1, 2024, it is possible for landowners to arrange sub-renting practices. However, its application and operationalization in practice must be seen yet.

If I look at the agricultural practices in Soviet Union, agricultural production followed the similar pathways. Prohibiting running a private farm and state land ownership led farm managers to act as workers in the factories. At the same time, monitoring workers was difficult due to large size of units. The state made investments, crop planting plans, input supply and other provisions. This working environment degraded the incentives for the harder work and achieving the farm profitability.

Against this background, Swinnen and Rozelle (2006, p. 54) provide three ways to overcome inefficient farm practices. First, more incentives are needed to elicit the efforts of the farmers and the workers. The incentives should be practical and possible to implement. Second, the operational size should be reconsidered so that farm managers can manage crop growing. This refers to the smaller farm size, so that it reduces the monitoring and coordination costs, as a result, it improves the daily information exchanges. Third, the measures to reduce resource use should be in the agenda. The better labour or optimal fertilizer use, and use of other inputs which were being wasted, are needed to consider.

## 2.1 Institutional economics

### 2.1.1 The definition of the term "Institution"

Ellis (1993) provides that "institution" refers to social rules and conventions between people. In this sense, the terms of agrarian institutions and agrarian arrangements can be used interchangeably. Schmid (1972, p. 893) refers to institutions as "sets of ordered relationships among people which define their rights, exposures to the rights of others, privileges, and responsibilities". Williamson (1996, p 4) agrees with variety of definitions and, provides that institutions refer to constraints and they structure political economic and social interactions. The constraints can be informal and formal. The informal one covers customs, sanctions, traditions, code of conducts etc. and the formal one includes property rights, laws, etc. He divides the institutions into two groups: institutional environment (laws, polity, normative documents etc.) and the institutions of governance (markets, hierarchies, rules etc.). The institutions are also considered as the mechanisms of the governance. One of the main elements of institutional economics is transaction cost, which I will explore below.

### 2.1.2 Transaction costs

In perfect market, it is assumed there is no transaction cost. Ellis (1993) highlights that market exchanges are never costless, there are always some costs. These costs are associated with the information obtained, the negotiations of the terms and the conditions, the monitoring and the coordination of the activities, and the contract enforcement aspects. This type of the costs refers to the transaction costs. The less transaction costs exist, the better the market exchanges tend to function. If the transaction costs rise, the actors in the market attempt to reduce it or avoid by finding or practicing various tools and methods. For example, the lack of the land and labour market leads to sharecropping practices to be prevalent (Mukhamedova & Pomfret 2019). Arrow (1969, p 48) provides that the transaction costs impede and sometimes block the formation of markets. In this sense, he refers to transaction costs as 'costs of the running economic systems'. For example, an incentive of the vertical integration (by which the transaction costs may be reduced) is aimed to replace the costs of buying and selling the inputs, the services, and the products on the markets. Williamson (1996, p 5) connects the presence of the transaction costs with the coordination problems, which rise extensively in complexity. Swinnen and Rozelle (2006) indicate that the disruptions in the farm management from restructuring reforms cause the collapse of the institutions of the exchange, which result in rising transaction costs. The scholars (Arrow 1969, p 48), Williamson (1996, p 5), and Roumasset and Lee (2007) highlight that identification and measuring transaction costs pose difficulties in different contexts.

## 2.2 Farming environment and models

Restoring lands to private landowners gives them greater incentives, because they become residual claimants of the farming activity. They make the rational decisions to earn from the farming. If this is not case, the farming follows inefficient paths of agricultural production (Swinnen and Rozelle 2006). Below I provide the comparison of some indictors formulated based on Lerman et al. (2004), which show the farm operating behaviour in two different settings (Table 2).

Table 2. Comparison of farm operating decisions

| Dimensions | Decision in market economy | Decision in central planning regime |
|---|---|---|
| Sales | Based on consumer demand | Produce to meet state targets |
| Input | Work with the best suppliers, quality matters. 3Es (economy, efficiency, effectiveness) function | Based on push-delivery by state. Prices are predetermined. 3Es do not function |
| Credit | Rational decisions, credit limits due to risk of bankruptcy | Credit allocated centrally, no rational decision |
| Labour | Adjusting labour force considering production volumes | Fixed labour force |
| Profit | Control sale and costs to maximise profit | No control, no maximisation |

Source: adopted from Lerman et al. (2004, p 30).

Table 2 above summarizes the farm operating decisions in market economy and socialist economy contexts. Theoretically, farm behaviour is rational and based on maximising profit. Following that, practically the farms are profit maximisers under the market-oriented context. To achieve this, the farms produce in response to the demand emerged in the market. In this sense, the farms seek suppliers of the inputs, which can provide economy and effectiveness of the resources to the farms. As free competition under the market economy develops, the quality of inputs plays a key role in the long-term relations of the farm with other actors. The farms care about the inputs because it directly effects the sales and ultimately farm profit. Also, the farms engage in credit agreements based on the needs and by considering the risk. The use of labour force depends on the production targets, if there is a high production volume, the farm manager hires more workers, otherwise it does not occur. These all aspects I discussed above practically fail to function under the centrally regulated economies. First, the production volumes are targeted, which means a farm does not control cost, or identify demand. All decisions related to the agricultural production come from the central governments. Having described that, below I provide the institutional settings of the various farm types being practiced in developing countries.

### 2.2.1 Institutional environment of farm types in developing countries

I provide the institutional environment of farms in the developing countries to understand better the land reforms and agricultural restructuring. Here I refer to the farm practicing models in various developing countries and regions based on Lipton (2009, p. 124).

- *Communal tenure.* A household or group of people make decision in farm operations, however, there is limit by the community to transfer, rent, or sell the land. For example, cropland is used privately, a farmer plant crops and run business, however the above-mentioned rights regarding land must be conducted based on the community agreement, such as via local authority.
- *Smallholder private tenure.* Farms are run by families, and most of them is around 2 ha. Sale and rent rights are possible but often limited. This gives more efficient resources use in farming.
- *Latifundia-minifundia.* This type of the farm model is mostly met in Latin America. The large private landowners with 20-20 000 ha hire people and run farming. The hired people can also rent some plots if they are capable or some of them obtain the land from the landowner to compensate the payment for their labour payments. However, both cases renting and obtaining can occur based on 1-2 ha of the land.
- *Large scale state led farms*. State and collective farms existed in Soviet Union and Eastern Europe before 1990. Both types of farm models were practiced in Uzbekistan.
- *Big private farms.* Like state and collective farms, certain people command the most farmland, irrigation, or input supply. For example, there are some plantations in Latin America, where workers are provided with monopolised services like schooling or housing. As a result, labour emigration is restricted.

### 2.2.2 Paradigms for land reforms

I continue with Lipton (2009, p. 126) to understand the types of land restructuring policies better. There are many paradigms how to design and how to approach for the agricultural restructuring including land reforms. I provide here several of them one by one.

*Classic land reforms.* In this approach, the landowners must return the land to the state which is the above the threshold. This redistributes the land to landless people, poor people, and others. This is often the case in plantation systems in Latin America. The crucial questions arises: how can one find optimal threshold so that it is used as a reference in land reforms?

*Tenancy reduction*. It prohibits some relations between landowners and tenants. For example, sharecropping. Instead, this paradigm offers the practice of the rights of purchase for the tenants. However, it is also difficult in cases where political environment (elite) is not favour of the liberalisation.

*Tenancy rebalancing*. This refers to support the tenants by setting some limits for renting. It includes some practices and security measures against evictions. Ellis (1993) describes the case where interlocking tenancy occurs with the consumption loans to tenants. The tenant must repay the debt that means more output is required. This cycle continues, and the tenant cannot escape from this situation or is located in the condition like "poverty trap".

*Collectivisation and de-collectivisation*. These paradigms contradict each other. The former one means lands are transferred to state ownership, while the latter one refers to privatisation and state land allocation to people. Notably, Uzbekistan has practiced collectivisation and de-collectivisations (even though it is not full liberalisation yet) approaches in agrarian sphere.

*Consolidation*. Fragmented landowners can be grouped into bigger one so that the rural area benefit from it. Again, I raise the question, how big should it be after consolidation of small plots?

*New wave*. This is adjusted model of classical one. The main difference is that surplus land can be traded or negotiated via markets not via local authorities.

In our analysis, cotton clusters provide clear practical appearance of several paradigms that I have discussed here. It covers *consolidation* mostly and shows issues during the implementing restructuring reform. Having overviewed this, now I turn to the farm size in agriculture.

## 2.3 Optimal farm size

As a farm size becomes larger, the costs related to monitoring the business operations increase. Accordingly, the labour discipline also matters in large farms. Lipton (2009) provides that there is a direct relationship between farm size and land productivity in the developed countries, at the same time there is an inverse relationship between them in the developing countries, where labour resources are abundant. Respectively, the small farms manage labour and large farms manage capital more efficiently. Petrick and Djanibekov (2024) highlight that the large farms using mechanisation and capital infusion produce more on average per hectare compared to the smaller size of farms and found U-shaped relationship between farm size and land productivity.

Even though the farm size is not main determinant of land productivity in developing countries, it still plays a key role due to lack of other sources of farm growth (Lipton 2009).

In this sense, it is important to consider labour availability and access to labour resources which are critical questions in the land abundant settings. Lerman et al. (2004) concludes that centrally controlled farms are larger in land endowment than those in market oriented. Because it is easier to control large units than many smaller units from political point of view. They connect this view with idea of collectivisation and creating the large farming units. At the same time, Lerman et al. (2004) limit themselves to provide optimal farm sizes and highlight that it really depends on the resource endowment of countries. Lerman and Sedik (2018) hold the view that the small scale farms are more efficient than the large farms. In principle, they have advantage in avoiding the costs with regard to labour monitoring. Binswanger et al. (1995) bring the attention to the holistic analysis around the cases, before concluding the relationship between farm size and productivity. The general accepted approach is downsizing and support individualised farming structure rather than large size collective organization in agriculture.

## 2.4 Cluster approach in the light of the agricultural reforms

As I mentioned in the previous sections, the land and labour resources are the production agents, therefore they key roles in agriculture. The land use and land reforms design the external environment of farms in which the state intervention occurs there frequently, Therefore, I divide theoretical literature review into two broad categories: one is more on the policy perspective of the land resources and the next one is more about the farm organization and its internal design. In this sense, the aim of this chapter is to investigate and understand theoretical bases to address the research questions raised in subchapter 1.4. In particular, the key interests to perceive theoretically are as follows: what does cluster term mean exactly? Is a cluster one of industrial policies? Are there factors that make industrial policy successful? In what follows, I provide those above-mentioned points in a subsequent manner. The findings I provide were published in Babadjanov and Petrick (2023).

Below I reflect on two strands of literature that provide theoretical perspectives on the definition of clusters and the role of government in promoting certain industrial sectors. I use these perspectives in the subsequent empirical sections to analyse and assess the actual cluster implementation in the cotton sector of Uzbekistan.

### 2.4.1 The definition of a "cluster"

Porter (1998, 2000) defines clusters as groups of interconnected firms, suppliers, related industries and specialised institutions in particular fields that are present in particular locations. According to Porter (1998), linkages and complementarities among companies within clusters delineate the boundaries of clusters. Wardhana et al. (2020) provide characteristics of agricultural clusters as a) social and economic interactions between farmers; b) mutual relationship between farmers and related actors in agricultural production; c) linkages with supporting actors such as universities and research society; and d) connections between farming activities and other sectors. However, the definition of a cluster itself is not straightforward in different contexts. Porter (2000) himself admits that the definition of a cluster can differ in different locations and contexts, depending on the market segments in which actors compete with each other and the strategies which they practice. Brown (2000), Martin & Sunley (2003), Glăvan (2008) and Ketels (2003) show the ambiguity of the cluster concept due to the absence of a unified theoretical framework to apply for practical implementations. They argue that the cluster term implies neither a specific project nor any type of single organization. Nallari and Griffith (2013) highlight that clusters are not limited to one specific geographic zone but may cross regional or national boundaries. Yamawaki (2002), Menzel & Fornahl (2010) and Abbasiharofteh (2020) explore the evolution of clusters and show potential drivers that trigger cluster formation. Porter (1998), Rosenfeld (1997), Wardhana et al. (2020) discuss the role of clusters as drivers for regional economic development (see also appendix).

I provide below possible visualisation of agricultural clusters based on Shakya (2009). As it can be seen from (Figure 2), the cluster operates as a system of interconnected diverse firms: farmers, fertilizer providers, processors, and other stakeholders. The proximity in the location and activities of these actors provides benefits (Shakya 2009). For example, access to specialised human resources and suppliers or the close interaction between growers and processors. Particularly, actors in clusters are independent with regards to decision making. Let's look at farm equipment. The suppliers of farm equipment are not necessarily subsidiaries of farmers or processors. They are independent economic actors working together based on mutual interests and benefit. There is a competition among farm equipment suppliers, so farmers may choose the most beneficial offer.

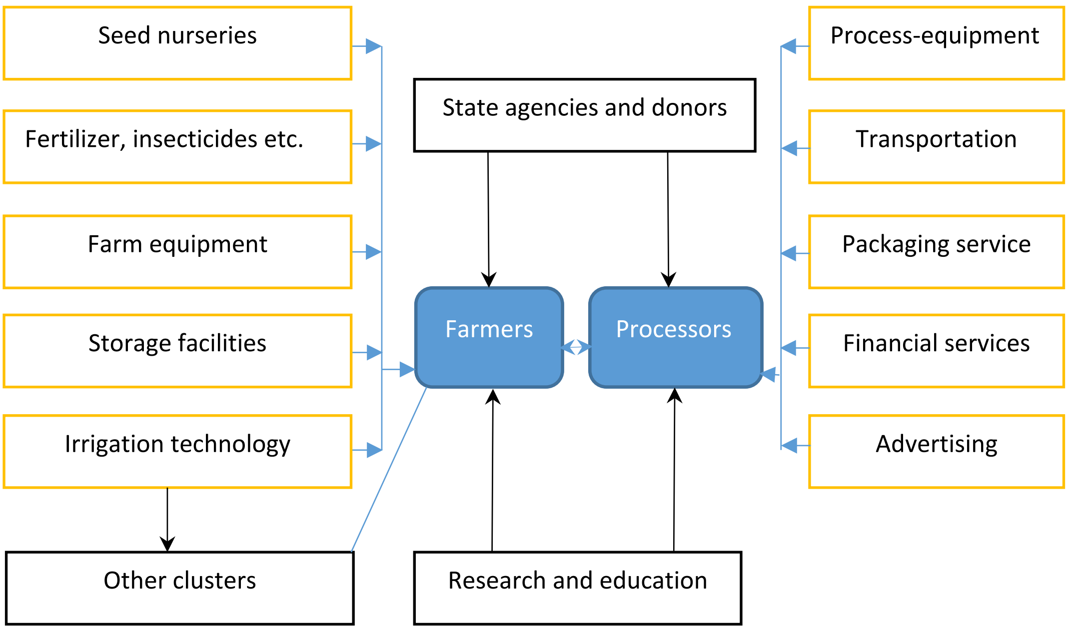


Figure 2. An agricultural cluster as a combination of various actors
Source: author based on Shakya (2009).

Despite the range of interpretations, the literature widely agrees on a set of core characteristics of clusters: their potential economic strength is due to the agglomeration of *several* enterprises, possibly smaller and bigger and active in different stages of the value chain. It is the interplay among these enterprises, possibly on a competitive basis, that sets the conditions for innovation, individual firm growth and further expansion of the cluster as a regional development engine. So, what then is the role of government in coordinating economic activity, such as through the creation of clusters?

### 2.4.2 The government' role in clusters

The role of government in the framework of industrial policy is to create an enabling condition for industrial development and growth. Nallari and Griffith (2013) stress that the government plays a vital role in providing a regulatory environment for the businesses in the clusters. Moreover, government policies influence the education and research activities, which are combined with other actors in clusters. Porter (2000) and Ketels (2003) highlight several roles of government in cluster-based development, such as *a)* ensuring political stability, *b)* developing an educated workforce and physical infrastructure, *c)* establishing incentives governing competition that in the end encourage productivity growth, *d)* developing long term action plans, and *e)* facilitating cluster development and upgrading. Furthermore, Porter (2000) highlights that governments should support the established or emerging clusters rather than creating new ones. Because new clusters emerge from established advanced ones as economies develop in general.

### 2.4.3 Clusters and industrial policy

Galvan (2007), and Pack and Saggi (2006) highlight that the cluster approach is a particular form of organizations in the frame of industrial policy. Nathan and Overman (2013) focus on government policies and clusters, referring to clusters as one type of industrial policy. Following Pack and Saggi (2006), and Nathan and Overman (2013), industrial policy refers to any type of selective government intervention in favour of certain sectors. Chang (2006) defines industrial policy 'as a policy aimed at affecting particular industries to achieve the outcomes that are perceived by the state to be efficient for the economy as a whole'. Andreoni & Chang (2019) point out that industrial policy is not about solo policy, sector, or institution in an isolation, rather this approach should embrace the whole package of designs, implementation, and strategic coordination which support the targeted sector. According to the infant industry argument, a country needs to defend industries in an early stage from the potential competition of external powerful producers, in the same way as parents protect children before adult age (Pack and Saggi 2006; Andreoni and Chang 2019). In this sense, I assume that the reform with regard to the cotton clusters in Uzbekistan is one of the examples of an industrial policy approach, since the central government was directly involved in organizing cotton clusters.

### 2.4.4 Success factors of industrial policy

The breaking grip of the central planning raised a fundamental question about the role of government in its successor arrangement, the "market economy". The current interventionism in economic policy clearly sees a coordinating and active role for the government that goes beyond the mere establishment of a functioning market system (Rodrik 2009). Market imperfections such as due to information asymmetries in capital and labour markets as well as public goods in health, education and social policies provide the economic justification for it. But governments also widely engage in the promotion of certain industrial sectors, calling these promotional activities ‘science parks’, ‘export facilitation’, ‘promotion of foreign investment’, ‘free-trade zones’. According to Rodrik (2009), the question to ask is thus not why, but rather how to do industrial policy that provides maximum benefits for the domestic economy. Lall (2006) also underlines that development outcomes do not depend on whether the governments intervene, but how they devise and implement the intervening strategies.

Rodrik (2009) emphasizes three attributes of successful industrial polices: embeddedness, carrot and sticks, and accountability. Embeddedness refers to the close collaboration between the government and the private sector. The government (as the principal) designs the rules, and the private sector (the agent) performs based on those rules. The government often has only obscure ideas of the activities, instruments, and behaviour of the private sector. That is why it requires embeddedness, i.e. the intensive collaboration and information exchange between the government and the private sector to make appropriate decisions, learn from experience and to correct mistakes. These focused interactions decrease the information asymmetry which may arise between parties. For example, councils, development forums, sectoral round tables, discussions, and associations facilitate interaction between the state and private sectors.

Through the 'carrot and stick approach, governments incentivize firms (e.g. by providing subsidies), monitor their performance based on certain criteria (i.e. export volume, investment duty, job creation) and raise concerns if they fail. This may happen through the discipline of the market. In any case, it is of vital importance to be explicit about the criteria by which the industrial policy program will be judged. Accountability must work both ways: bureaucrats monitor the private sector, which monitors the bureaucrats. One of the fundamental mechanisms of accountability is transparency. The decision-making process, activities within industrial policy, events and other related information should be transparent to the public since the public is considered the ultimate principal.

Meanwhile, Andreoni and Chang (2019) are concerned about the current debates of industrial policy and highlight three classic problems which they claim have been lost in recent industrial policy approaches: coordination of structural interdependencies, building institutions, and managing conflicting interests. First, the economic system embraces several sectors connected by structural interdependencies at different stages of aggregation. During structural transformation, these interdependencies may not be allocated proportionally across sectors and production processes. In other words, different parts of the system change at different rates. Furthermore, the development of one sector (i.e. production) is limited by other sectors (i.e. lack of sufficient demand). This situation creates structural tensions that continuously form barriers to production within and across sectors. Therefore, there is a need for strategic coordination by governmental agencies.

Second, the government is required to set up various institutions (e.g. a property rights regime) and deploy various policy alignments with regards to strategic coordination of structural interdependencies (Andreoni and Chang 2019). Thus, the mere existence of institutions is insufficient, they must be built and connected in a coherent manner. Third, industrial policy evolves within the political economy, in which different actors or groups promote their interests (Andreoni and Chang 2019). Involving different actors such as landowners, service providers, farmers, processors, and others shows to what extent their interests are included in industrial policy reform. In this sense, policymakers play a vital role in solving conflicting interests and organize them around a clear development vision.

Looking back, all Central Asian economies maintained a strong central control of economic activity after political independence. In Uzbekistan, that certainly applies to the agricultural sector (Pomfret 2008; Zorya, Djanibekov and Petrick 2019). This control often seemed to be guided more by rent extraction and bureaucratic overregulation than by the active promotion of innovative entrepreneurship and the provision of complementary public goods. In the following, building on the above theoretical analysis, I describe the structure and function of clusters in Uzbekistan and how these have changed cotton value chains in terms of inputs and services, credit, labour mobilisation, crop choice, cotton price and marketing channels.

Having described, I move on to the labour arrangements.

## 2.5 Labour arrangements and incentives in agriculture

Here, I attempt to understand: Does principal-agent model represent farm-worker relations in agriculture? What kind of contractual arrangement exist in literature? Does job design matter? How can I model pay systems given theoretical foundations? In the following, I describe the principal agent model and try to link it with farm-worker relations in agriculture. In addition, I dig into contractual forms in agriculture and their specifications and characteristics in section 4.2. Then, I show the differences between narrow and enriched job designs in section 4.3. In the end, I model the monetary pay systems, which I use in estimations in the subsequent analysis.

### 2.5.1 Labour as a core of agricultural organisation

The labour is the largest part of the total costs in crop growing, especially in plantations. Economies of scale emerges in the stages of processing and marketing rather than farm operations due to the demand for the labour, for example in harvesting oil palm or manual cotton harvest. The New Institutional Economics is aimed to economise transaction costs in farm production, for instance by long-term contracts workers or providing them with on-farm residences. Roumasset and Lee (2007) analyse labour as the central element of the agricultural firms, rural institutions evolution and agricultural development. They raise question about the inefficiency of hired labour compared to family labour. Since, there is no recruiting and supervision costs, family labour can avoid from transaction costs and effort shirking. In this sense, family labour shows its superiority in market imperfections.

Roumasset and Lee (2007) also agree with inverse relationship between size and productivity, which is also consistent with labour use. One possible justification could be that the landowners can adjust the size of family farms so that they can balance the marginal product of labour across land area irrespective land quality matters. This results in higher yield per ha in smaller farms. At the same time, the researchers call attention to that it is also important to distinguish between family farms and commercial farms. The commercial farms may get benefit in credit and other markets which outweigh the inefficiency of the labour. One of the big issues in the analysing is measuring relevant costs appropriately. Because, employing different proxies in measurement of supervision or monitoring costs, leads to achieve various results in comparisons family labour with hired one. For example, Frisvold (1994) uses hours of family supervision as a supervision cost, and others use selling time as proxy for Information and searching cost.

### 2.5.2 The principal-agent model

The principal-agent model orthodoxy describes an interaction in which two actors are involved. The principal, who possesses a number of resources, designs the contracts i.e. rules and norms to maximize own objective (Braun & Guston 2003). This framework scrutinizes the relationships between actors with incomplete contracts, such as the interaction between a farmer (employer) and a worker (employee). Following Roumasset and Lee (2007), and Bowles et al. (2017), the semantics of incomplete contract is a failure to cover the wishes of the employers on the one hand and the effort levels of workers to provide on the other. According to Bowles (1985), the ownership and control of the means of production are factors that structure the employer - employee relationships. For example, a farmer owns the land and high value assets i.e. buildings or tractors. By having these resources, the farmer constructs the communication with the workers. At least, two main characteristics are embodied in this relationship. First, here is a conflict of the interests of two groups: a farmer and a worker. At one extreme, the farmer seeks profit maximization, and at the other extreme, the worker strives his or her own well-being, happiness, or leisure and so on. Second, the farmer has a power of capital (i.e. land and other assets) which might execute costs on the workers who reject the interests of the farmer. In liberal economy, the costs on the workers might be imposed through either wage variabilities or a job termination.

### 2.5.3 Factors that made labour use inefficient in the Soviet Union

In socialist farms under Soviet Union regime, Lerman et al. (2004) mentions that one of the main inefficiency factors in the large farms was labour behaviour. Because the workers received fixed terms of job irrespective labour effort. This policy made them reluctant to work harder. Second, as I mentioned monitoring intensity was poor even practically did not exist. In this sense, without monitoring it is impossible to demand to provide more effort from the workers. Third, there was system of equal remuneration for workers, that contradicts the idea of more incentives for more effort. Subsequently, labour shirking and free riding were prevalent, which raised the agency problem.

### 2.5.4 Nature of labour contracts

The economic literature provides principally three types of labour contracts (Eswaran and Kotwal 1985a; Agrawal 1999; Roumasset and Lee 2007; Djanibekov et al. 2013). They consist of fixed wage contracts, fixed rental contracts and share contracts (sharecropping). In line with Roumasset and Lee (2007), labour contract dimensions include the average amount of wages and changes over seasons, basis of payment (piece, time rate or mixed), means of payment (cash, harvest, plot), durations (day, months, season), task and supervision.

In mainstream labour contracts, fixed wage refers to certain amount of wage payment monthly or seasonally regardless of farm production. Under fixed rental contracts, the worker leases the land from the farmer, and pays the rents. In the share contracts, both farmers and workers provide some inputs, for example, land is provided by the farmer, meanwhile the worker provides labour. In the end, the output is shared based on the initial agreement, such as fifty/fifty. Scholars (Agrawal 1999; Shaban 1987; Jacoby and Mansuri 2019) study labour contracts, highlighting whether monitoring and supervision of the labourers are required in farm production. They conclude that farms should follow either sufficient systematic monitoring (supervision) or alternative labour contracts, which do not require monitoring and supervision. Having described this, following Roumasset and Lee (2007), I focus on the aspects of payment bases (time rate, piece rate and mixed bonus) associated with means of payment (cash, harvest, and plot) in our study.

### 2.5.5 Evolution of labour contracts

Roumasset and Lee (2007) provides the development of labour contracts in Figure 3. As it is seen, during phase I (rows 1&2), labour is mainly provided by farm household, and they exchange arrangements with other neighbouring people. This has changed over years based on time, specialisation, farm size, cropping practices and other factors. In general, the evolution process of contracts supports the specialisation of farms both vertically and horizontally.

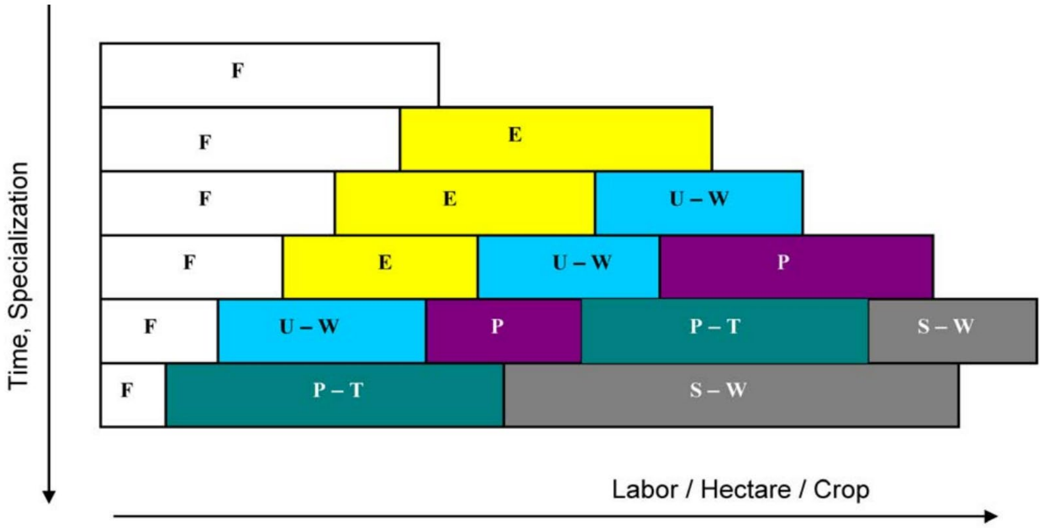



Figure 3. Evolution of labour contracts

Source: Roumasset and Lee (2007)

Note: F-family farm, E-exchange labour, U-W- undifferentiated wage labour, P-piece rate labour, P-T- piece rate with team labour, S-W- specialised wage labour.

In Phase II (rows 3,4 and 5), as the specialisation increases, hired labour emerges and are more prevalent. In the beginning, people are hired on a wage basis, and the allocation of tasks does not matter which means all hired labour is assumed the same. As the horizontal specialisation continues further, there is a need for the selected tasks which form piece rate system in practice. As a result, the practice of undifferentiated wage labour starts to decline.

In Phase III (row 5), there is a further decline of both undifferentiated wage labour and piece rate system, instead, two types of labour start to rise which are piece rate with team labour and specialised wage labour. The new forms dominate the other forms of hired labour. Piece rate with teams and specialized wage labour replace individual piece rate contracts and undifferentiated wage labour respectively.

Having described that, now I turn to the specific research questions related to the land and labour relations which I provide empirical analysis based on the grounds of Uzbekistan. The micro level analysis on land and labour resources contributes to explore the external and internal environment of the farms.

### 2.5.6 Job designs: narrow (classic) vs enriched (modern)

Job designs delineates attributes and conditions of a workplace in a wider scope (Fahr 2011). Since the late 1980s, job design has shifted away from Taylorist model of specialisation towards more flexible arrangements, which contains more multi-tasking structures and less specialized work duties (Takahashi 2011). Petrick (2017) classifies these approaches as ‘narrow’ and ‘enriched’ job designs. In ‘narrow’ job design, detailed instructions and work norms shape the production process. This style serves as an instrument to monitor the workers and pay based on the performance. Here, ‘specialisation’ or ‘specialized’ terms refer to the concentration on narrowly instructed tasks. As Fahr (2011) describes, these terms may not be mixed with term ‘qualified’ in the analysis. In the framework 'narrow' job designs, workers take orders or instructions rather than entering into active discussions with the employer. This job design represents elements of piece rate system.

However, in the 'enriched' job design, the objectives of the workers and the firm converge to the certain extent, under which workers provide much effort and inherent satisfaction based intrinsic motivation (Petrick 2017). This approach is connected to 'innovative' or 'new' work practices based on psychological aspects (Fahr 2011). This style creates an arena, in which workers perform well. Meanwhile, the employers expect that workers improve production process and lead them to deal with decentralised decision-making. In this sense, this approach emphasises that workers identify tasks or jobs, in which they are good at performing, and employers focus on such attachments. According to Takahashi (2011), the adoption of 'enriched' job design leads to the productivity increase in the long term. This job design shows the aspects of mixed bonus system. In a nutshell, 'enriched' job designs provides more freedom and autonomous decision making than 'narrow' job designs. These designs involve intrinsic and extrinsic motivation of workers respectively.

### 2.5.7 Characteristics of agricultural labour

On-farm employment is a decisive element in rural development and poverty reduction policies (Roumasset and Lee 2007; Motiram 2007). Many scholars (Gietzmann 1996; Ulph et al. 2001; Bowles et al. 2017; Roumasset and Lee 2007) point out how labour contracts are incomplete, i.e. they fail to explicitly describe the wishes of two parties. The relationship between the farm owner and workers goes beyond the simple contractual agreement, constructed based on rational of economic efficiency (Nye 2020). There are several external factors, which shape the bonds between them. According to Nye (2020), such as variety of tasks, skill of the worker, labour costs, labour availability, competition, market structure, weather conditions and other factors build the farmer-worker relationship.

Moreover, the majority of agricultural tasks are difficult to monitor, and it is often physically demanding, such as ploughing, fertilizer application process, watering fields and other tasks (Pal 1999; Motiram 2007). The complexity and mixture of agricultural tasks make challenging evaluate the performance of the workers based on the output produced (Petrick 2017). A careful reading of the theoretical literature suggests that there is a number of features of labour contracts to study in different context and fields.

### 2.5.8 Modelling monetary pay systems

Inspired by Petrick (2017), I postulate that an employee gives effort, $e$, to the farm production. The outcome of the farm, $q$, is a function of effort, $e$. Due to difficulty of measuring the effort and possible impacts of other factors on the farm output, the farmer cannot make a contract for the effort of the worker. Consider, the output function involving the effort of worker, $e$, and other random factors, $\varepsilon$, might take the following form:

$$q = f(e) + \varepsilon \qquad (1)$$

To extract the effort from the worker, the farmer may suggest a linear wage, *w*, containing of a fixed rate, *r,* and a portion, $\alpha$, in output:

$$w = r + \alpha q, \quad 0 \leq \alpha \geq 1 \qquad (2)$$

According to Roumasset and Lee (2007), and Petrick (2017), I assume different scenarios or contractual models that may appear from the formula above (2):

a) $r > 0$ and $\alpha = 0$, expresses a fixed wage contract;
b) $r = 0$ and $0 < \alpha < 1$, expresses the pure piece rate contracts;
c) $r > 0$ and $0 < \alpha < 1$ expresses a mixed contract;

Roumasset and Lee (2007) claim that fixed wage contract may lead to labour shirking and the farmer bear the risk if production fails. Vice-versa, under piece rate contract, the worker bears the risk if the production fails. However, workers are paid commensurate with their productivity. Basically farmers draw on piece rates more frequently, if the task behaviour is straightforwardly observable. Otherwise, farmer tends to use time rate system. Moretti and Perloff (2002) provide that under piece rate, on the one hand the worker spends more effort, on the hand the quality of the tasks fulfilled by the worker decreases. Petrick (2017) states that mixed contract would be optimal to both sides: a farmer and a worker. I now move on to the empirical agricultural context, which helps to understand the labour arrangements to a greater degree.

Having described that, the review of the mainstream literature on the labour arrangements leads us to the following hypothesis to be tested empirically:

**$H_1$:** Adoption of mixed bonus system increases the output per farm.

**$H_2$:** the effect strength of mixed bonus system on output per farm is higher than piece rate system.

Now I move on to the methodology chapter, in which I attempt to operationalise the research question of the study.

# 3. Empirical research methodology

In this research, I employed not only inductive but also deductive reasoning bases. In particular, I focus on the establishment of the clusters based on primarily inductive reasoning, for which I use qualitative data. In addition, I investigate the labour incentives in agriculture based on mainly deductive reasoning by drawing on quantitative data. Helper (2000) disagrees with many economists who have skeptical attitude to qualitative research methods including fieldworks, interviews and observations. Because, Helper (2000) believes that there are many valuable insights and contextual circumstances to consider, in which one can fail to investigate the true story using only quantitative research. By taking into account those arguments, I try to cover the aspects of both qualitative and quantitative methods in this research. In this sense, I aim to provide more valid and reliable research findings.

## 3.1 Inductive vs deductive reasoning

I discuss inductive and deductive reasoning here[3]. I primarily draw on the explanations and descriptions of those approaches (beliefs) by Bromley (2006, chapter 6). Table 3 summarizes the construction of those beliefs that represent the combination of the terms: Rule, Case, Results. The inductive reasoning starts with certain phenomena or case and formulates or builds particular rules, alternatively stated, from specific to general. When there is little known about particular circumstance (case), inductive reasoning is applicable to explore the empirical world. In this sense, as I partly mentioned at the beginning of this chapter (3), I follow the inductive belief to investigate the cotton clusters. It is a new reform, and scientific findings lacks on this topic. I visit clusters, conduct interviews to understand the situation on the ground.

Table 3. The structure of logical inference

| | From | And | To |
|---|---|---|---|
| *Inductive belief* | Case | Result | Rule |
| *Deductive belief* | Rule | Case | Result |
| *Abductive belief* | Result | Rule | Case |

Source: adopted from Bromley (2006, p.88-102).

In economics, the deduction is the most frequent approach among them (Bromley 2006). The deductive belief derives from the general rules, major premises or theories (Rule) and provides particular outcomes (Results) based on certain cases. In other words, it covers the paths from general to specific context. The second research question of this study is based deductive approach, in which I first study theoretical foundations of labour arrangements and incentives, and then apply those theories to specific case of Uzbekistan. Meanwhile, I also acknowledge that I cannot claim that I have employed these beliefs as stated above solely from the beginning to the end. During the process, it was

[3] Inspired by the presentation of my supervisor (Prof. Dr. Martin Petrick) at IPPAE seminar about 'Managing theory and methods in your PhD'.

sometimes mixed of both approaches (i.e. back and forth). Finally, the third approach is abductive belief, which starts with empirical circumstances (Results) and ends in the cases. If I consider the establishment of clusters as Results, in this sense, I touched the abduction in the first research question to certain extent.

## 3.2 Type of research

As a researcher, I am always interested in knowing what I am doing and what kind of research I am carrying out. For this reason, I discuss here various types of research following Kumar (2018). There are three perspectives, from which Kumar (2018) defines the research types, namely application, objectives, and inquiry (Figure 4).

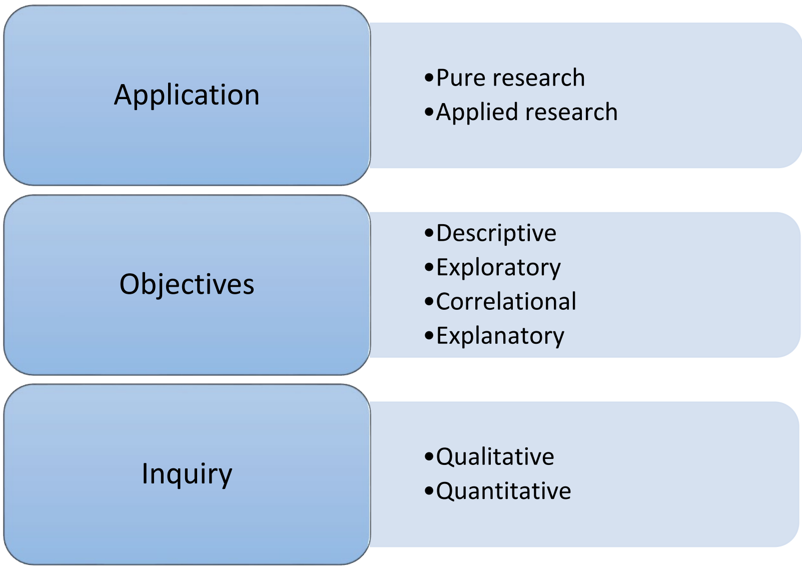



Figure 4. Type of research
Source: adopted from Kumar (2018)

From an application point of view, studies can be divided into pure and applied research. In this sense, I am doing pure research in this monography. Secondly, based on objectives, there are descriptive, exploratory, correlational and explanatory research. My first research questions apply for descriptive research, in which I primarily describe recent changes in the context of the clusterization reform. The second research question leads to conduct explanatory study, in which I have some variables, and I attempt to explain the changes in dependent variables.

Finally, with regard to inquiry mode, studies can be quantitative and qualitative research. It is worth noting that, I employ both types in this study. The first research question is based qualitative, and the second one is based on quantitative research respectively.

## 3.3 Qualitative methods

### 3.3.1 Case study approach

Cotton production under the emerging cluster system is complex and context specific which requires an inductive analysis. According to Kumar (2018), the case study approach is helpful when investigating an area in which little is known, as is the case here where the government introduces a new policy approach. I take a cluster (enterprise) as a case unit that means one cluster is one case in this research. One of the advantages of a case study is that the researcher achieves detailed study results, however, the difficulty in aggregation of the findings is a disadvantage. Since clusters have been established in different provinces of Uzbekistan, covering all clusters was impossible due to lack of time and finance. I therefore chose cases that are typical and particularly instructive examples and emerge from different regions of the country (following guidance in Flick 2018, p. 108, and Yin 2003, p. 12). This takes into account the varying conditions in the cases and helps to generalize the findings for the country.

Kumar (2018) suggests selecting cases based on purposive or information-oriented sampling. Therefore, I selected four 'clusters' from various locations to study as 'cases' (Figure 5), thus using a descriptive case study with multiple cases (Yin 2003, p. 5). The sampling of cases draws on the list of the cotton clusters provided in governmental resolutions (Resolution of Cabinet Ministers No 53 from 25.01.2018 and Resolution of Cabinet Ministers No 230 from 18.03.2019; 77 clusters in total). Given financial and time resources, I picked four clusters for further study. I attempted to cover different regions and contractual arrangements in a purposive sampling procedure. I also wanted to cover one of the pioneers in clustering.

### 3.3.2 Study sites to explore clusters

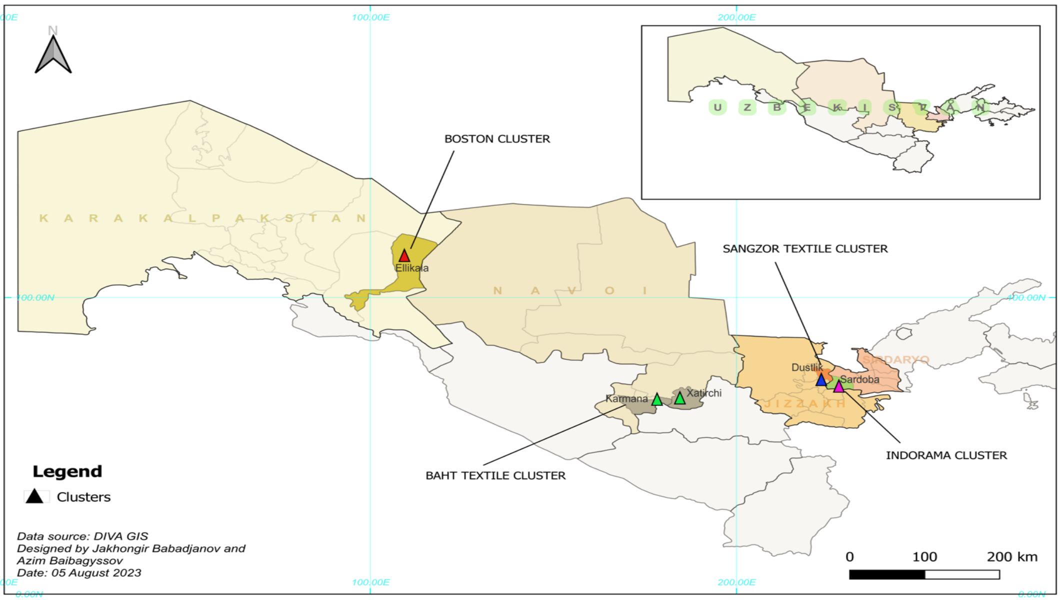



Figure 5. Sites of clusters in Uzbekistan covered in this study
Source: author.

‘Baht textile cluster’ represents a pioneer of clusterization policy. The land area covers between 6000 ha and 11000 ha, respectively. The cases represent contract farming and direct farming practices, to be explained below. Bo’ston cluster, Baht textile cluster and Sangzor textile cluster had concluded contracts with 223, 585 and 648 farmers correspondingly.

Table 4. Overview of cases

| **Name** | **Province** | **Year of establish ment** | **land, ha** | **Contractual arrangement** | **Farm numbers included** |
|---|---|---|---|---|---|
| Bo’ston cluster | Karakalpakstan | 2018 | 10 764 | Contract farming | 223 |
| Baht textile cluster | Navoiy | 2017 | 8 400 | Contract farming | 585 |
| Sangzor textile cluster | Jizzakh | 2019 | 11000 | Contract farming | 648 |
| Indorama cluster | Syrdarya | 2019 | 6000 | Direct farming | - |

Source: author.

## 3.4 Quantitative methods

### 3.4.1 Econometric model specification

I follow the equation (3), which draws on Petrick (2017) to investigate the impact of payment systems on farm production. The following model covers three dummies of payment systems, which I test piece rate and mixed bonus system against fixed rate system:

$$y_i = \alpha x_i + \beta^p t_i^p + \beta^m t_i^m + \varepsilon_i \qquad (3)$$

*y* is farm production (revenue and profit) and x is vector of control variables. $t^p$ and $t^m$ are dummy variables that show presence of piece rate system and mixed bonus system respectively. $\varepsilon$ is error term and *i* indicates the individual farm. Overall, I compare farmers that use piece rate and mixed bonus system with farmers that use fixed rate payment, with respect to farm outcome. In this sense, $\beta$’s are the parameters of our interest. I consider permanent workers (alternatively referred as tied labourers, estate labourers, farm servants, regular labourers and attached labours in mainstream labour literature) in our analyses.

One of the concerns of OLS estimation is endogeneity. It refers to the existing covariance between independent variables and error term, which Cov(x, $\varepsilon$) is not equal to zero. As I use cross sectional data set and our key independent variables are endogenous, this requires addressing endogeneity to achieve unbiased parameters. Because I assume that farmers choose payment methods autonomously that means it is not exogenous to the farmers. In this sense, I run next model using joint estimation equation 3 and 4. Our dummy variable (mixed pay systems) surmises the existence of a latent choice variable that shows whether mixed bonus system is used or not. The equations is as follows:

$$t_i^m = \begin{cases} 1, & \text{if } \boldsymbol{w}_i\lambda + \mu_i > 0 \\ 0, & \text{otherwise} \end{cases} \qquad (4)$$

In the equation (4), **w** is a vector of determinants of mixed bonus system $\lambda$ is a parameter vector and $\mu$ is error term. Furthermore, the error terms in farm revenue equation (3) $\varepsilon$ and in the mixed bonus system equation $(4)$ $\mu$ are assumed a bivariate normal distribution with mean zero and correlation *p, corr(ε, μ ) = p.* Even though, solving endogeneity issue in cross sectional data is challenging, I try to address it to some degree using endogenous treatment effects. In this sense, I estimate equations 3 and 4 jointly using Maximum Likelihood (ML) as endogenous treatment-regression model.

### 3.4.2 Definition of variables used in analyses

The farm revenue refers to the revenue from selling crops that farm produced in 2018, namely crop harvest is multiplied by selling price (see Table A *7* Appendix). The respondents answered the questions about crop production and selling based on four crops. I checked how many crops farmers in general grow and I found that more than 95% of farmers mentioned that they grew four crops. In this sense, the revenue variable based on four crops represents the whole farm revenue. To define farm profit, I extract labour and material costs from the revenue. I mean by saying material costs fuel cost, fertilizer cost, and pesticide cost. The labour costs represent the costs, which were paid to hired workers. Both farm revenue and profit are converted to USD based on the average exchange rate of Central Bank of Uzbekistan for the year 2018. Control variables are farm size (ha), fertilizer (kg), fuel (litre), pesticide cost (USD), hired and family labour (FTE), and secondary cropping (dummy).

The key independent variables in the analyses are different payment systems: fixed rate, piece rate and mixed bonus (see Table A *6* appendix). The farmers could choose the different options they practice. I have done two-stage grouping. In the first stage, I identified farmers if they choose fixed, mixed or piece rate based on means of payment i.e. cash, harvest, and plot. In the second stage, I grouped them into three final categories (mixed bonus, piece-rate, and time-rate) irrespective means of payment.

- Under the fixed rate, farm workers receive the fixed amount salary or earlier agreed quantity of the harvest irrespective total harvest. For instance, tractor driver in cotton farms, who does the various tasks over the year: land preparation, cultivation, or transporting harvest etc.
- Piece rate system refers to the payments based on service the workers provide. This is not prevalent, but an example would be seasonal workers during harvesting cotton.
- Mixed bonus payment basically refers to the mixture of the time rate and piece rate systems. It primarily includes cash, harvest, and plots as a bonus based on the farm production and performance of workers. This bonus is additional to the minimum payments for workers. For example, as a bonus the farmer allocates some portion of wheat to the workers during harvest or gives the land for the second cropping in Uzbekistan.

### 3.4.3 Assumptions and expected effects

I assume theoretically that production function is concave, and a farmer has profit maximising behaviour in agricultural production. Based on these assumptions, in Table 5 I formulate the following expectations regarding the possible effects of factors on the farm outcome.

As you can see, the production factors such as land, fertilizer, fuel, and pesticide usage, hired labour, and second cropping influence the farm outcome positively. The mixed and piece rate systems are also predicted to impact positively, since workers have more incentives under those systems and thus spend more effort to achieve farm output. In addition, family labour is expected to impact stronger than hired alternatives due to the concept of residual claimants.

Table 5. Expected impact of independent variables on the outcome variables

| | Variable | Expected impact on farm revenue | Expected impact on farm profit |
|---|---|---|---|
| 1 | Total land, ha | +, CPF[1], PM[2] | +, CPF, PM |
| 2 | Fertilizer, kg | +, CPF, PM | +, CPF, PM |
| 3 | Fuel, litre | +, CPF, PM | +, CPF, PM |
| 4 | Pesticide cost, USD | +, CPF, PM | +, CPF, PM |
| 5 | Mixed bonus system | +, more incentives, enriched job designs | +/- |
| 6 | Piece rate system | +, more incentives, but risky, narrow job designs | -/+, it is costly |
| 7 | Hired labour | +, CPF, PM | +, CPF, PM |
| 8 | Fam/relatives labour | +, residual claimants | +, residual claimants |
| 9 | Second cropping | +, PM | +, PM |

Source: author.

Note: [1]CPF - concave production function, [2] PM- profit maximization behavior of the farm. The average exchange rate for 2018, 1 USD= 8079.86 UZS; 1 USD=346,33 KZS. I replace missing values with 0.01. To define farm profit, I first extract material and labour costs from the farm revenue.

## 3.5 Data sources

### 3.5.1 Primary sources: qualitative data

Following Yin (2014), I used a range of sources including documents (i.e. announcements, formal evaluations, and reports), open-ended interviews, and observations during field visits. The case reports were aggregated to provide a general overview of research findings. From the various sources, I learned how the cluster was established first and then how input provision, credit, labour mobilisation, crop choice, cotton price and marketing channels were changed under case clusters.

I conducted open-ended interviews with key actors including farmers, staff of cotton clusters, heads of Machine Tractor Parks (MTPs), and staff of the Council of Farmers. Furthermore, interviews were extended to specialists of the Ministry of Agriculture, local authorities, representatives of the State Support Fund of Agriculture (the Fund), donor organisations (World Bank and the Food and Agricultural Organisation (FAO)), and university researchers. I cite the interviews in the text by indicating 'I1, I2,…I##'. The list of interview partners is given in the Appendix. I collected the empirical data including interviews and field visits to case-clusters between May and November 2019. Also, during the cotton harvest of 2019, he engaged in participatory observation to observe the cotton harvest. In addition, I continued interviews in 2021 and 2022 years with relative actors.

### 3.5.2 Secondary sources: qualitative data

I complement the case study with a systematic review of 'grey literature'. I refer to reports from international organisations, private stakeholders and news reports that were not published in academic journals as 'grey literature' in our study. I briefly portray the key reports as follows (see Table A *3* in Appendix).

ILO (2019) conducted a rapid assessment of clusters established in 2018 and derived recommendations for reforms in the cotton sector. That study built on qualitative analysis, but primary data from farmers was not gathered. Zorya and Babaev (2020) provide a recent review of cotton cluster policy, based on official government resolutions and stakeholder consultations. Synovitz and Ashur (2019), correspondents of Radio Free Europe/Radio Liberty (RFE/RE), describe the cotton cluster approach in Uzbekistan. Their investigation builds on interviews with farmers affected by the clusters, academic researchers, and regional officials. Lasslett (2020) analyses the risk potential of 20 cotton clusters in the series Power Brief of Ulster University. The report employs information from corporate registries, stock exchange filings, and legal databases available in Uzbekistan, Russia, Switzerland, Singapore, Thailand, and the United Kingdom.

Asfaw (2019) looks at cotton reforms and the introduction of cotton clusters in a policy brief of Westminster University in Tashkent, based on interviews with stakeholders. Yusupov (2019) reviews the cotton sector, highlighting the key problems that need reforms. The author employs official statistical data and findings from research projects. Srokina (2020) reports on environmental and social impacts of establishing Indorama cluster to attract the financial fund of international lenders. The document comprises desktop study of secondary sources, site visits to Kashkadarya and Syrdarya regions, and interviews with relevant actors including farmers. Schweisfurth (2021) is a news article on land grabs in Uzbekistan and includes six cotton clusters. The story consists of data from governmental resolutions, various websites, Uzbek Forum for Human Rights and other sources.

Cotton Campaign (2021) reports about the decline of forced labour in the 2020 cotton harvest in Uzbekistan. This publication uses data mainly from monitors of Uzbek Forum for Human rights in six regions in Uzbekistan with the team of twelve experienced persons. Asfaw (2021), published in an academic journal, investigates the liberalisation and privatisation process under clusters in Uzbekistan and its early effects. The review paper draws mainly on WB and ILO reports, governmental resolutions, and websites sources, and partly on key informant interviews. Most of these reports focus on single topics and some of them follow a clear political agenda. I place them in a broader context in the following.

### 3.5.3 Farm survey: quantitative data

This quantitative analysis is based on more deductive analysis, particularly from general theories to empirical estimations. I employ cross sectional farm survey data 'Agrichange II' in the study. A farm survey was conducted in the framework of the AGRICHANGE (Institutional change in land and labour relations of Central Asia's irrigated agriculture [www.iamo.de/en/agrichange](www.iamo.de/en/agrichange)) project in Turkistan (Kazakhstan) and Samarkand (Uzbekistan) provinces from March to April 2019.

The respondents answered the survey questions based on the farm activity for 2018. The survey deployed random sampling framework in data collection process. The data set involves in total 963 individual farms from six districts of Turkistan (Kazakhstan) and Samarkand (Uzbekistan) provinces: Maktaaral, Shardara and Sariagash districts from Turkistan, and Pastdargam, Payarik and Jomboy districts from Samarkand accordingly (Table 6). 460 out of 963 farmers were surveyed in Uzbekistan, which I draw on in this study. The data collection points in district level are also visualised in Figure 6.

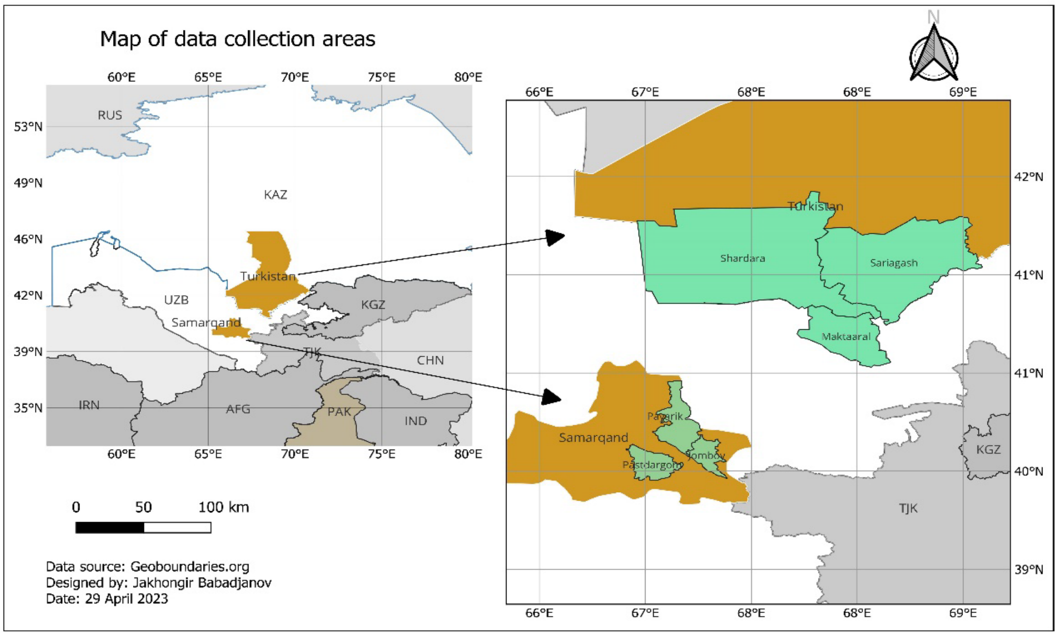



Figure 6. Data collection districts
Source: author.

Table 6. Data collection sites

| Country | Province | District | Farms | Percent |
|---|---|---|---|---|
| Uzbekistan | Samarkand | Pasdargam | 154 | 15.58 |
| | | Payarik | 156 | 16.20 |
| | | Jomboy | 150 | 16.99 |
| Kazakhstan | Turkistan (South Kazakhstan) | Maktaaral | 171 | 17.76 |
| | | Shardara | 166 | 17.24 |
| | | Sariagash | 166 | 17.24 |
| Total | | | 963 | 100 |

Source: author.

The survey includes questions about the personal characteristics and behaviour of the farm manager, land ownership and transactions, farm labour, farm filed quality, crop production and marketing, sharecropping, access to information and farming skills, machinery and equipment, financing farm activity, cooperation with other farms, water use, and other aspects in the farm activity. Having explained that, I now turn to the empirical results of this study in the subsequent chapter.

# 4. Empirical results on land and labour relations

## 4.1 Overview of agriculture and land reforms

Here I provide general information about agriculture so that it helps to understand the challenges and characteristics of agricultural restricting in Uzbekistan. More specifically, the next sub chapters are structured as follows. The objective of the first subchapter (4.1.1) is to present dynamics of agricultural indicators over years. Then, I move on to the background of the land reforms (4.1.2). It describes the phases of land reforms and makes a reader familiar with the process of farm restructuring over the years after the independence of Uzbekistan. It also provides comparisons between collective and state farms. The next subchapter (4.1.3) describes the major crops grown and farm categories. Here I provide the characteristics of dekhkan farm and individual farms in detail. After that I will move on to the agricultural employment in 4.1.4. It outlines the characteristics of labour in agriculture and provides general information about minimum wage, average wage, labour force in agriculture and other indicators. Then, I focus on land and labour productivity and their change over years in subchapter 4.1.5. After that, empirically, I analyse farm size changes and establishment years in 4.1.6 based on our survey data. This is supportive empirical finding to which I highlight earlier based on the literature review and other secondary data sources.

### 4.1.1 Agricultural share in GDP and growth rate

Figure 7 below presents the agricultural contribution to the gross domestic product, and the growth rate over years. I use official statistics data to visualise these indicators. The contribution of the agriculture to GDP was in the range 22-30 % in the given period.

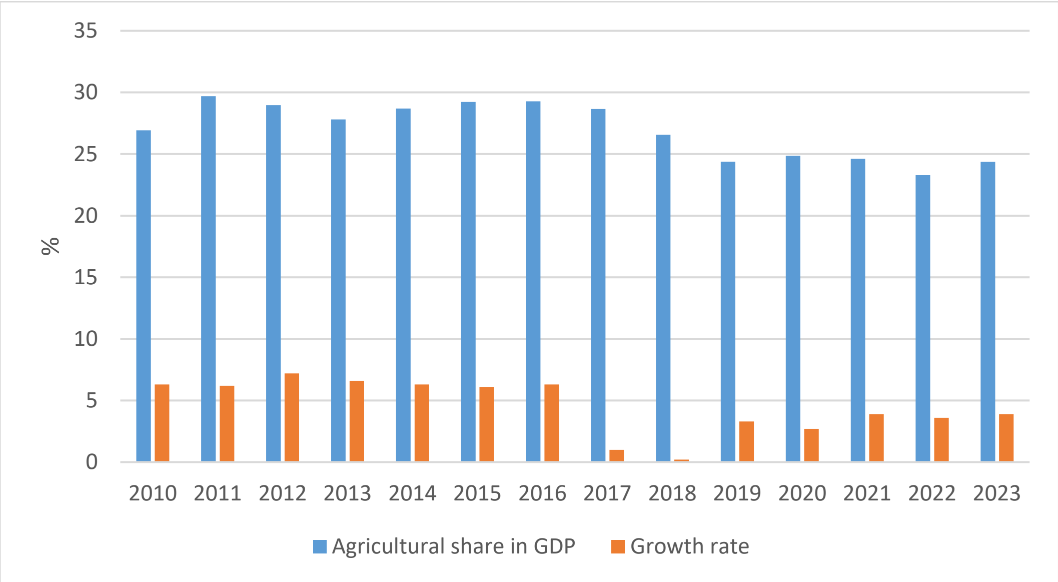



Figure 7. Dynamics of the agricultural share in GDP and growth rate
Source: author based on www.stat.uz (https://stat.uz/uz/rasmiy-statistika/national-accounts-2).

Specifically, the share of agriculture in GDP made up around 27% in 2010, which declined to around 24% in 2023. Notably, there is a gradual decline starting from 2018. This might come from the policy reforms (such as cotton clusters etc.), that were caried out after the change in the government in the late 2016.

The growth rate is given in the percentage term, and it compares the current agricultural production with a previous year respectively. In general, there is an increase in agricultural production since the growth rate shows positive indicators in the period. However, the growth rate shows a decline in the years 2017 and 2017, after which it again starts to rise.

### 4.1.2 Land consolidation

Land consolidation is one of the elements of the agricultural reforms or restructuring carried out by the government. In general terms, in planned manner it refers to readjustment and rearrangement of the land parcels and their ownership. The objective is using land rationally, to improve agricultural production and ultimately to achieve productive agriculture. I will describe below how it functions and has been used by the government as a tool of agricultural restructuring and retaining centralized control over years.

In early 1990s, Uzbek agriculture was dominated by large-scale collective farms(kolkhoz) and state (sovkhoz) farms. The main differences between them were the size and source of financing. The state farms (sovkhoz) were much larger than collective farms (kolkhoz), and were exclusively financed by the state budget, while collective farms were self-financed (Djanibekov et al. 2012). In addition to that, I provide other comparisons below (Table 7), formulated based on Lerman et al. (2004) and Lerman (2008).

Table 7. Features of collective and state farms

| | Collective farm (kolkhoz) | State farm (sovkhoz) |
|---|---|---|
| Ownership of land | State, with collective uses statues | State |
| Ownership of other assets | Collective | State |
| Financing of capital investment | Long-term loans from the government | New equity from the state |
| Status of residents | Collective members | Sovkhoz employees |
| Individual income | Distribution of residual collective income | Salaries and wages |
| Subsidiary income | Household plots | Household plots |
| Management | Chairman elected formally by collective members | Director appointed by the state |

Source: Lerman et al. (2004).

This style of the production was the core of agriculture in the countries of the Soviet Union. The practices of setting target volumes, input supply by state organizations, procurement price for crops were residuals of those production forms, which survived also in post-Soviet Uzbekistan for several decades. According to Djanibekov et al. (2012), central planning system provided output levels, which was not realistic to achieve. This led to the substantial losses in agricultural production and created the arena to rise inefficiency. Thus, one of the main tasks after independence was to reform agriculture and to restructure production forms and practices. However, Uzbekistan followed the cautionary path and tried to retain land rights and other key aspects. Consequently, farm restructuring involved the allocation of land through lease contracts. This was questioned by Djanibekov et al. (2012), who mentioned about the needs of real land privatization, rather than leasing tenure practices. According to Djanibekov et al. (2013), individual farms in practice are not private rather quasi-private, as the farms fail to own the productive asset (land). Overall, different phases of agricultural restructuring touched farm size and tenure arrangements and they had to be modified over years accordingly.

Petrick (2021) likens farm restructuring in post-soviet countries to the laboratory, where the governments seem to have experimented with their own farmers. In this sense, Uzbekistan is a typical example of changeable continuous land reforms. From 1991 onwards, Uzbekistan started to restructure the organizational style of agriculture, which involves several phases (Djanibekov et al. 2013, Lerman 2008, Veldwisch & Spoor 2008, Lerman & Sedik 2018, Ni et al. 2024, Ilkhamov 1998). Lerman and Sedik (2018) mention that Uzbekistan followed a “conventional” approach for land reforms. It includes the increase in the portion of the land attached to the individual farms. Also, it led to enlargement of household plots over years.

Table 8 below summarizes the six phases in farm restructuring process in Uzbekistan. Every phase includes the specific components of transformation based on farm types and policy objectives.

Table 8. Main transformation process and farm restructuring since 1991

| | Phases | Transforming process | Farm types | Policy objectives |
|---|---|---|---|---|
| 1 | State farm decollectivization (1992-1997) | Transformation of sovkhozes into kolkhozes | Kolkhozes, sovkhozes | Expansion of wheat area, reorganization of state farms |
| 2 | Partial fragmentation (1998-2002) | Transformation of kolkhozes into shirkats, land lease to individual farms | Shirkats, individual farms, dekhan farms | Specialization of newly established individual farms |
| 3 | Complete fragmentation (2003-2008) | Transformation of shirkats into individual farms | Shirkats, individual and dekhan farms | Crop diversity and livestock farms |
| 4 | Farm consolidation (2009-2015) | Farm-size changes | Individual farms and enterprises | Relocation of cotton fields |
| 5 | Production specialisation (2016-2019) | Fragmentation of farm size | Individual farms of different specialization | Relocation of cotton and wheat fields, multi-profile farms |
| 6 | Farm consolidation (2019-present) | Farm-size optimization and organizing clusters | Individual farms, clusters | Relocation of cotton and wheat fields |

Source: author based on Djanibekov et al. (2012) and Zorya et al. (2019).

*Phase I (1992-1997).* This include the process of restructuring *sovkhoz* and transform them into *kolkhoz* farms. This reform aimed to increase wheat areas to provide self-sufficiency (Ruziev 2021). In 1996-1997, people in rural areas were suffering from lack of wheat resources. Within this period, pilot individual farming (for example around 16-20 ha) was practiced in parallel with *kolkhoz.*

*Phase II (1998-2002).* Organizing shirkats, individual farms and dekhan farms started massively with adoption of the relevant laws in 1998. The laws provided the definitions and rules for establishing those forms of production units. During this phase, the kolkhozes were converted into shirkats[4], individual farms and dekhan farms fully. This restructuring was characterised by a transformation of land property from the government to collective ownership. Niyazmetov et al. (2021) mention that shirkats functioned inefficiently due to the members' poor motivations, frequent state interventions into shirkats, poor financing mechanisms and unsustainable production pricing practices. The period (1998-2004) of shirkats did not survive long, as they were restructured to individual farms later (2004). In the beginning, small-scale individual farms with approximately 20 ha were established as a pilot project. According to Djanibekov et al. (2012), these small-scale individual farms did not contribute much to the total agricultural production. The policy objective of this reform was the expansion of specialised individual farms. Based on the production specialisation, three types of individual farms emerged that were cotton and wheat farms, horticulture (e.g. fruit and vegetables) farms and livestock farms

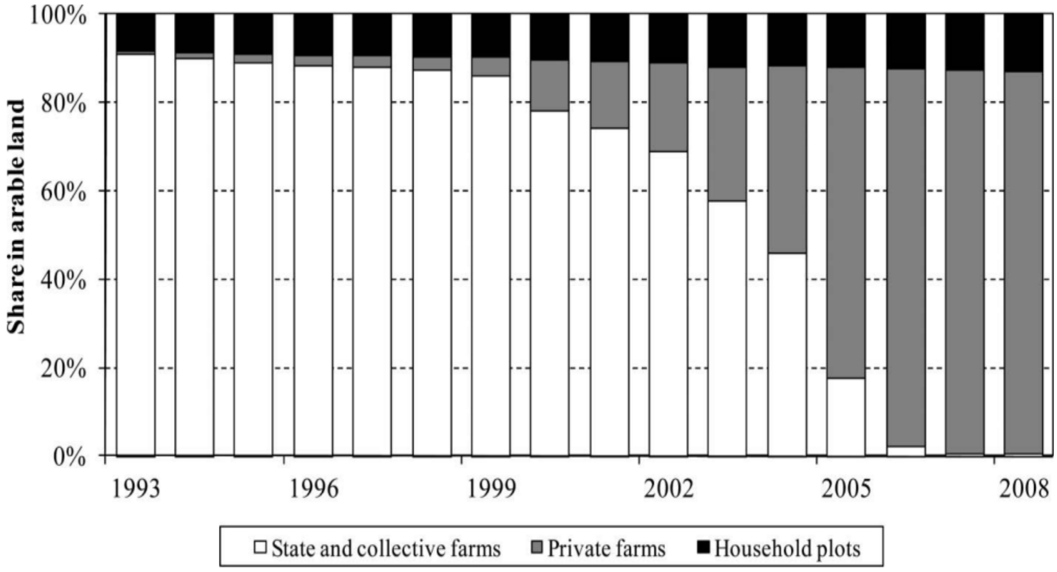



Figure 8. Land transfer from state and collective farms to private (individual) farms
Source: Djanibekov et al. (2012).

*Phase III (2003-2008).* In this phase, the state established the individual farms massively however, the production obligation (state procurement system) for cotton and wheat

[4] *Shirkat (agricultural cooperative)* - a form of an agricultural organization based on the production contracts with small family farms, who could lease land from shirkats for 3–5 years (Niyazmetov et al. 2021). It is based on membership shares and produce mainly wheat and cotton (Lerman 2008)

survived in agriculture. Shirkats were converted to individual farms fully in crop productions[5]. The crop diversity got attention and multi profile individual farms were facilitated. For example, cotton farms grow mainly cotton, but this farm has vineyards or fruit gardens. In case of Khorezm province of Uzbekistan, Djanibekov et al. (2012) visualise the restructuring process in Figure 8 above. As it is seen, a dramatic decline of the state and collective farms (sovkhoz and kolkhoz) and the establishment of individual farms occurred in this period. The similar scenario was throughout Uzbekistan.

Veldwisch & Spoor (2008) highlight three forms of production in agrarian system: (1) state-ordered production (state procurement system), which includes production of cotton and wheat; (2) production for commercial purposes , for example, fruit and vegetables, rice, and fodder production; and (3) household production based on small volumes, which are primarily for home consumption (Table A 10). However, it also includes production for barter and small-scale sales at local markets. The forms informally compete for the limited water source, land allocation, and labour resources. These practices continued until 2020 when government abolished state procurement system.

*Phase IV (2009-2015).* This period has witnessed the unsecure property right practices. Under label of "optimisation" the state agencies consolidated small farm groups into bigger ones. For example, in one village, instead of 20-30 farms, just one or two farms appeared. As a result, the number of individual farms decreased from around 220 thousand in 2008 to about 102 thousand, which shows more than double decline (Figure 9). The lowest point occurred in 2011, which was around 70 thousand farms. In this period, average sown area per farm was around 45 ha

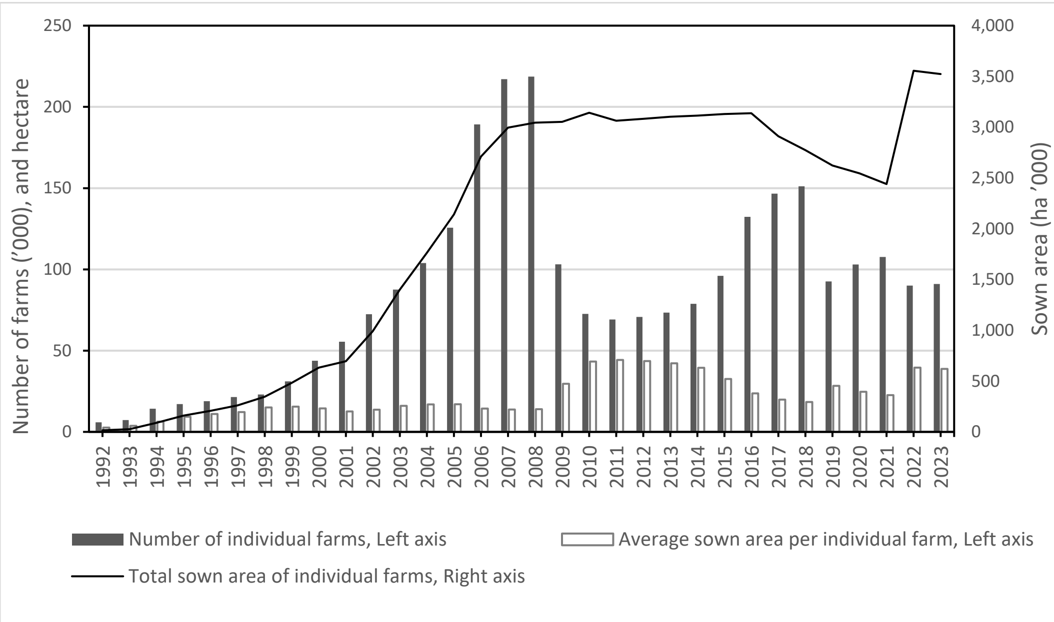



Figure 9. Changes in the average sown area and the number of individual farms
Source: updated based Zorya et al. (2019) and data of Ministry of Agriculture.

[5] Note: There are some shirkats of Karakul sheep breeding. But they exist for the research and expansion of those type of sheep.

The average size of individual farms (land area) increased starting from 2008 to 2012 (this can also be seen in Figure 9). In general, this change applied for all farms, which are specialized differently. However, in the longer term, the farm size in all farms showed a gradual decline.

Remarkably, the sharp increase in farm size was in cotton and wheat farms during this period. It principally rose from around 40 ha to about 130 ha between 2008 and 2010, which was more than three times. After that it shows the slow negative trend to 2016. The farm fragmentation policy in 2016 reduced farm size comparatively, which made up around 75 ha in 2016. The effects of reform on the farm size of other farms, which are specialised to vegetable/melons, and garden/vineyard was not much noticeable in this time framework. They also represent positive trend, however, in 2016, small reduction in average farm size occurred.

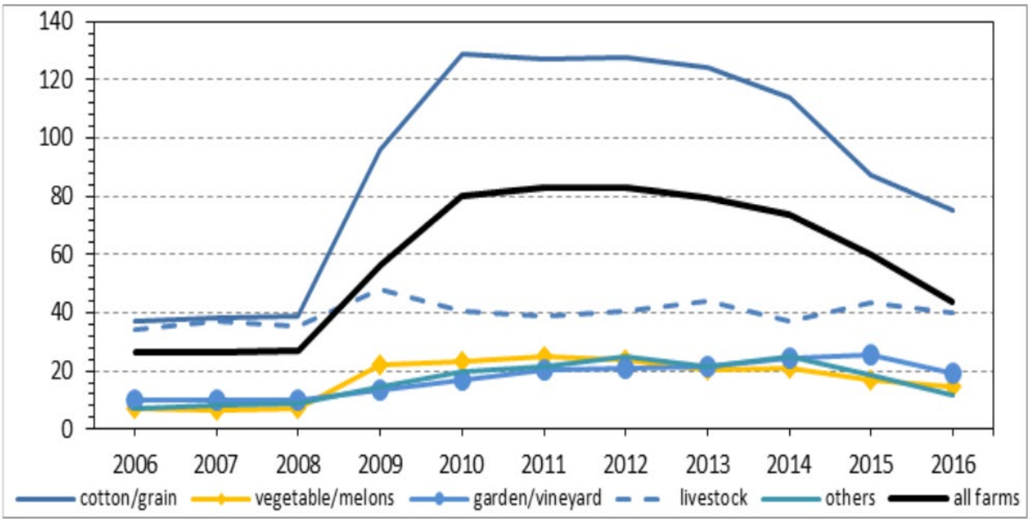



Figure 10. Average farm size of individual farms
Source: Zorya et al. (2019).

At this stage, individual farms started to be dominant in agriculture and along with them, small number of agricultural enterprises like limited liability companies appeared, for example in fruit gardening and processing. The government agencies supported a consolidation idea by highlighting the lack of capacities of small farms to run productive agriculture. Overall, the farm consolidation reform weakened the land rights and decreased the beliefs of the farms on the land property. Some farms lost the farm fields and other remained farms started to doubt to continue the business in the long-term.

*Phase V (2016-2019).* in 2016, the new policy was carried out on the fragmentation of the large-scale farms to the smaller specialized farms on certain crops, such as fruit and vegetables. Since then, the sown land area of cotton and wheat crops has decreased, while other crops started to get more attention by allocating them more sown area. In terms of vegetables, the sown land area was around 190 thousand in 2015 and it made up 280 thousand ha in 2020. Fruits and melons also show the positive trend over this period (Figure 11). As a result of this reform, there appeared many non-cotton/wheat farms in small scales. At the same time, the government has preserved strict control over agriculture by implementing state quota system, subsidized loans, crop allocation policy, and state-subsidy provision for cotton and wheat production. This paralyzed farmers to have an opportunity for land use adjustments and efficient crop production.

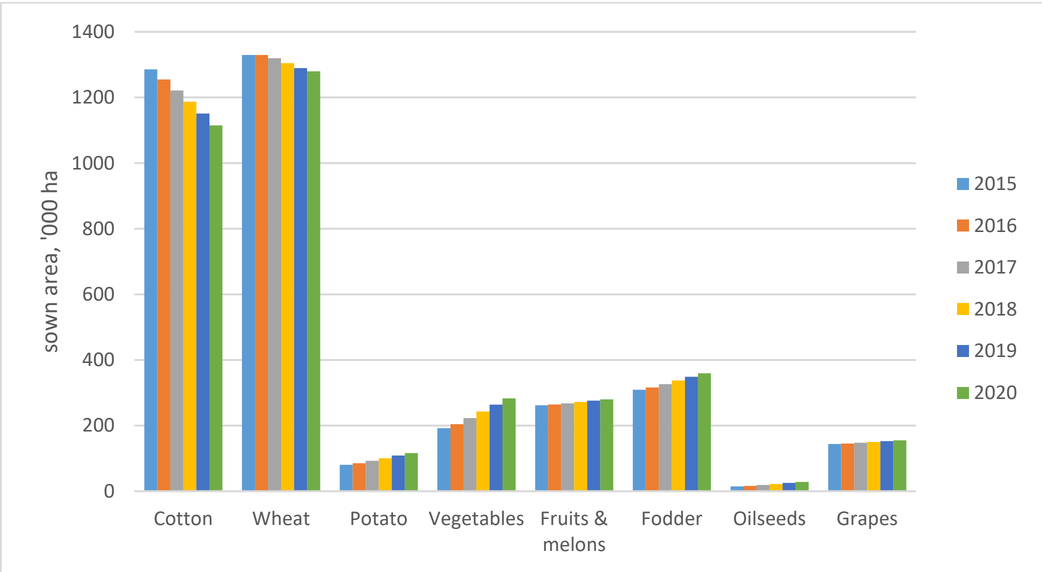



Figure 11. Crop production changes
Source: author based on Zorya et al. (2019) and statistics agency (www.stat.uz).

*Phase VI (2019-present).* In 2019, again farm consolidation (mainly on cotton and wheat farms) was continued, and cluster policy was integrated. During the farm consolidation steps, several farms lost the lands and remained as workers of successor farms or were involved in off-farm jobs. From 2019 onwards, cotton clusters were established intensively in all provinces of Uzbekistan as a next wave of the farm restructuring reform. According to Petrick (2021), the government's interest in cotton exports has shaped restructuring measures over years following various stages of top-down farm optimisations and establishment of clusters. Against the background of the recent reforms, state quota system for cotton was abolished in 2020, however state crop allocation policy remained yet. In 2021, the sub-leasing of the farmland under the certain conditions has been allowed in the context of liberalisation in agricultural production.

### 4.1.3 Major crops and farm types

The major crops grown are cotton and wheat in agricultural production. In 2019, their distribution relative to total sown area made up 32% and 35% respectively (Zorya et al. 2019). Other crops make up ten percent or less of the total sown area.

Overall, as I have also described earlier, the agricultural production is built on two main producers in Uzbekistan, namely individual farms and dekhkan farms (peasant farms). The agricultural enterprises also co-exist, which are more specialized in fruit and vegetables or livestock. It is important to mention that the role and contribution of the agricultural enterprises, especially in cotton sector, has increased in the light agricultural reforms in the recent years.

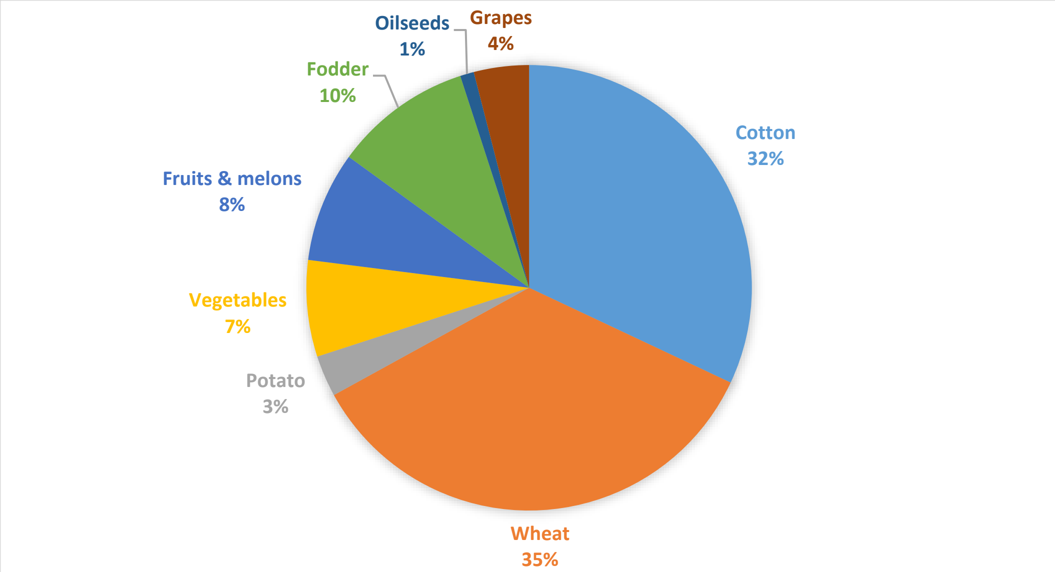



Figure 12. The percentage distribution of sown area of crops in Uzbekistan in 2019
Source: author based on Zorya et al. (2019).

To provide more insights, several characteristics of the individual farms and dekhkan farms by following analytical dimensions in agricultural production are provided (Table 9). The main difference is that the dekhkan farms are small-scale (around 0.35-0.5 ha) that primarily grow crops for their domestic needs. Family labour is dominant, and the land ownership is transferred from parents to the next generations. However, individual farms are large-scale (around 100 ha), and they follow state-determined frameworks, such as crop allocation practice and land lease contracts.

Table 9. Characteristics of individual and dekhkan farms in Uzbekistan

| Dimensions | Individual farm | Dekhkan farm |
|---|---|---|
| Definition | Legal entity, operating on leased land | Family based, operating on household plot |
| Labour sources | Hired and family workers | Mainly family workers |
| Land tenure | Long-term state lease up to 49 years | Lifetime ownership |
| Land size | Large scale, based on production specialization, e.g. average 100 ha in cotton and wheat farms | Small scale, around 0.35-0.5 ha |
| State crop allocation | Yes | No |

Source: author, based on Zorya et al. (2019) and Lerman et al. (2004).

Having described the difference, I provide the Figure 13 below, which shows the share of individual farms, dekhkan farms and other agricultural enterprises in agricultural production. In other words, agricultural output by farm categories is provided in percentage term over years. In this sense, it answers, who produces and how much in agriculture? The agricultural output (production volume) here includes the production of cotton, grain, potato, fruit and vegetables, and other crops, excluding livestock products. I lack the date for 2007, 2008 and 2018 due to several reasons. For example, one of them is that the statistics agency did not provide the shares of farm types in 2018, but from 2019 onwards, again started to provide the information about the shares of farm types on crop production. In addition to that, I cover nine months (January-September) for 2023 due to data accessibility. The proportion of farm types is given in percentage, and it makes up hundred percent if all three are summed up.

I divide the period into four phases, considering the land consolidation years. The first phase is described by the presence of large agricultural enterprise and rural households in 1990s. In the second stage, individual farms emerged during 1998-2006, which stated to play a role in agricultural production. The third phase highlights the almost equal productions by categorized actors (individual farms, agricultural enterprises, rural households) in 2003-2004 before the farm consolidation policy started. The final phase is characterized by the dominance of individual farms, which led to in the end to the decline of agricultural enterprises.

In terms of figures, the share of agricultural enterprises has declined gradually to 2017, after which again, their share in crop production started to be notable. This might be due to the increasing number of clusters. Apart from that, the individual farms started to contribute to crop production significantly starting 2006. Till 2023, they remain as dominant farm type in crop production in Uzbekistan. Regarding dekhkan farms (households), there is a gradual decline in their contribution to total crop production. They have been affected by the agricultural restructuring to less extent than individual farms and agricultural enterprises since its change less dramatic than others.

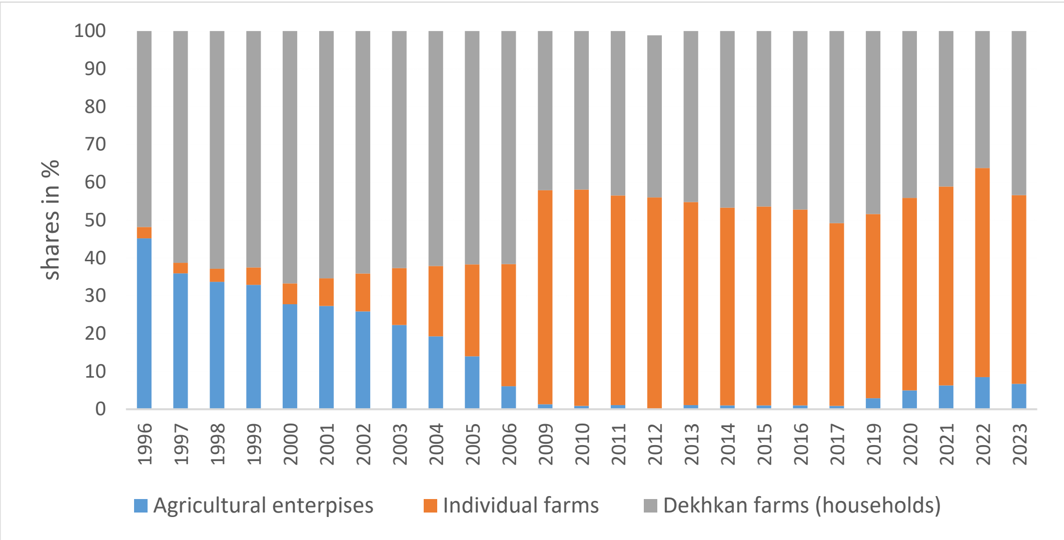



Figure 13. Share of farm types in crop production
Source: author based on [www.stat.uz.](http://www.stat.uz)

### 4.1.4 Agricultural employment

As I mentioned in the very beginning, the organizational form of agriculture in the Soviet Union represented the factory-style collective enterprises and it was operated by hierarchically manner. However, after the disintegration of the Soviet Union, the newly established individual farms, dekhkan farms and agricultural enterprises started to arrange labour resources in their productions (Mukhamedova & Pomfret 2019, Petrick 2017). In case of individual farms, two alternatives appeared for the local people: either being hired as a worker for the farms or find off-farm jobs. Hasanov & Sanaev (2018) provide that people, who lost their jobs due to the agricultural restructuring, benefited from internal migration to the cities and external migration to neighbouring countries, such as Russia and Kazakhstan. Ruziev (2021) also supports that Uzbekistan benefits from remittances sent by citizens working in Russia and Kazakhstan. In addition to this, small peasants established dekhkan farm, which was third option.

Since then, agricultural labour market has developed slowly in Uzbekistan. According to Lombardozzi (2020), the agrarian labour is structured by informal networks. The neighbours and relatives i.e. localized networks play an important role in the recruitment process. It is also common to share some harvest with workers. In addition, farmers give some plots areas to workers to cultivate for their self-consumption. I provide the figure which shows the minimum and average monthly wage for workers in Uzbekistan. Both indicators have risen gradually (Figure 14). An increase in payments serves as support for workers.

The visualisation covers the period from 2019 to 2022. Notably, both indicators have showed the positive trend in the given period. More specifically, the minimum wage has changed in the range of 65 and 85 USD during this period. Meanwhile, the change in average wage was more significant, from around 250 to 350 USD.

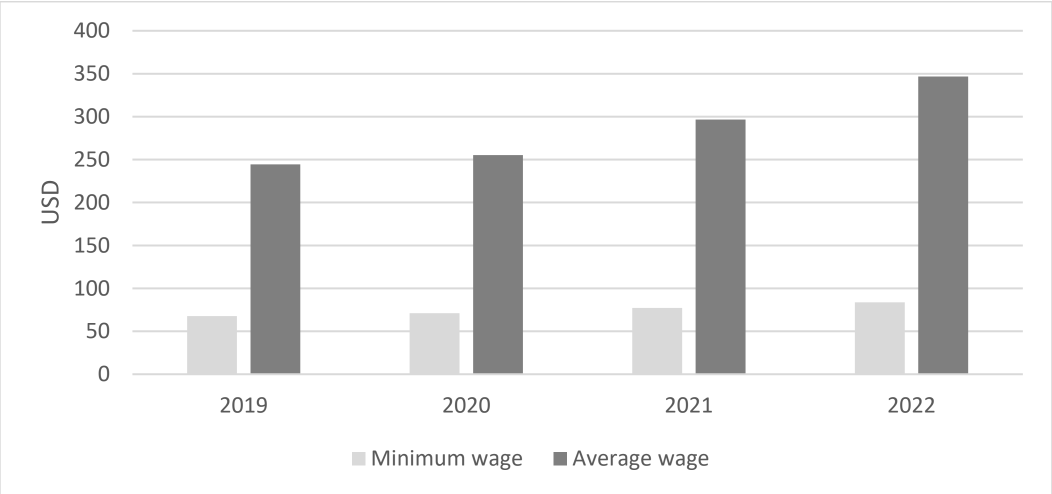



Figure 14. Minimum and average wage changes over years
Source: author based on www.stat.uz.

Having provided that, I visualize below the information about the total population and the share of the rural and population in Figure 15. In addition, total labour force is also visualised. Overall, in Uzbekistan the total population is increasing, being 21 443 thousand in 1992 and 36 024 thousand in 2022 respectively.

At the same time, the share of the people, who live in rural areas, has decreased slowly in recent years. For example, the share of rural population was around 58% in 1992 and it made up around 49% in 2022. This ended up with the increase in the share of urban people starting in 2010. People started off farm employment opportunities in the context of the land reforms.

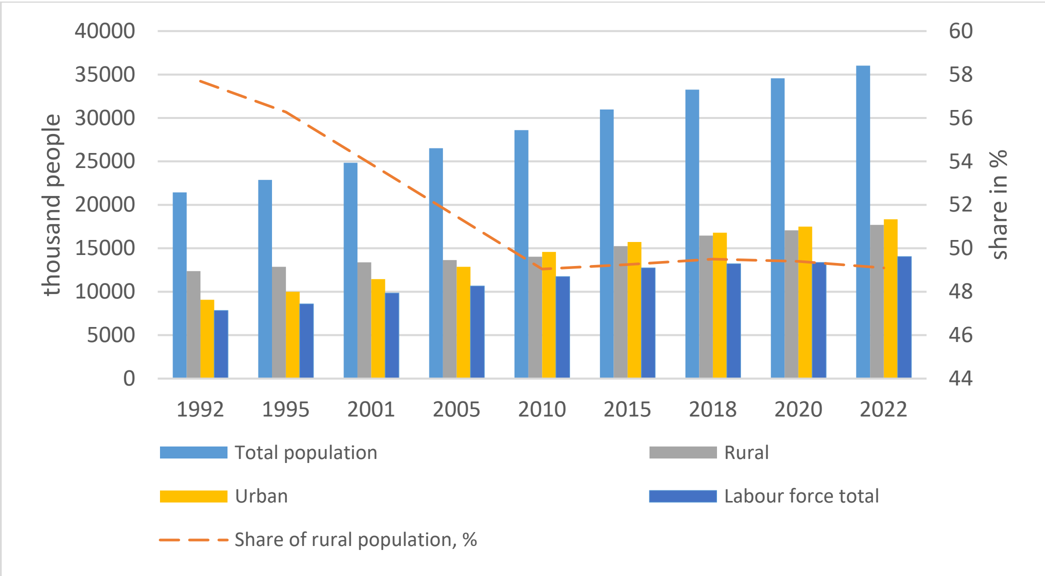
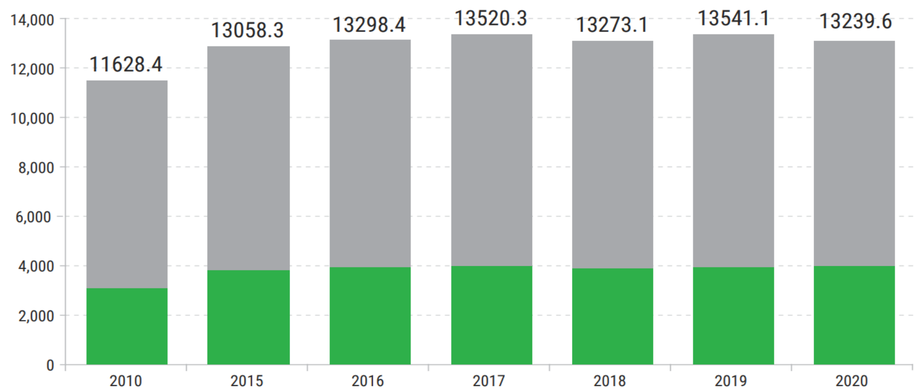



Figure 15. Dynamics of population by categories in Uzbekistan
Source: author based on population data of FAO and WB (https://data.worldbank.org/indicator/SP.POP.TOTL?locations=UZ https://www.fao.org/faostat/en/#country/235).

Moreover, I present the employment in agri-food sector and in the rest of the economy (Figure 16).




| | 2010 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|---|
| The rest of the employment | 8,510.3 | 9,169 | 9,345.5 | 9,512.4 | 9,371.1 | 9,570.6 | 9,217.1 |
| Agri-food sector employment | 3,118.1 | 3,889.3 | 3,952.9 | 4,007.9 | 3,902 | 3,970.5 | 4,022.5 |

Figure 16. Employment in agri-food sector of Uzbekistan, thousand people
Source: Shukurov et al. (2022).

The agri-food sector covers several subsectors such as wholesale and retail trade with agri-food products, catering, food, textiles, agriculture, forestry, and fisheries. The employment is given in thousand people.

In 2010, as it can be seen that 3 118.1 out of 11 628.4 thousand people were busy in agrifood sector, which made 21% share of the total employment. In 2020, the total employment was 13 239.6 thousand people, out of which 4 022.5 thousand people (30%) were in engaged in the agricultural jobs. From that, it is notable there is positive trend in the share of agri-food sector in total employment. In terms of figures, 21% and 30% of total labour force are busy in agri-food sector in 2010 and 2020 respectively.

This might be surprising, because, as economy develops and is more industrialized, share of employment in agriculture decreases theoretically. However, I need to make clearer that this figure covers not only agriculture, but also industries which process agricultural products (i.e. fruit processing, textile etc.). In addition, the cotton processing in the recent years has also joined significantly and ultimately contributed the employment share.

The next step is to investigate which subsectors of agri-food system contributed this change. In this sense, the Figure 17 below disaggregates agri-food sector into five subsectors which are shortly agriculture, textile, food, catering and wholesale. Because, as I mentioned, it is important to know the source of rising or declining of employment in agri-food to have better analysis.

Within the agri-food sector, the share of the employment in agriculture, forestry and fisheries did not increase in 2020 compared to 2015, while all other sub sectors showed positive trends. For example, in 2020, textile (cotton processing) subsector shows around 60% increase compared to 2015. This can be explained by cluster policy of Uzbekistan, which supported textile sector significantly.

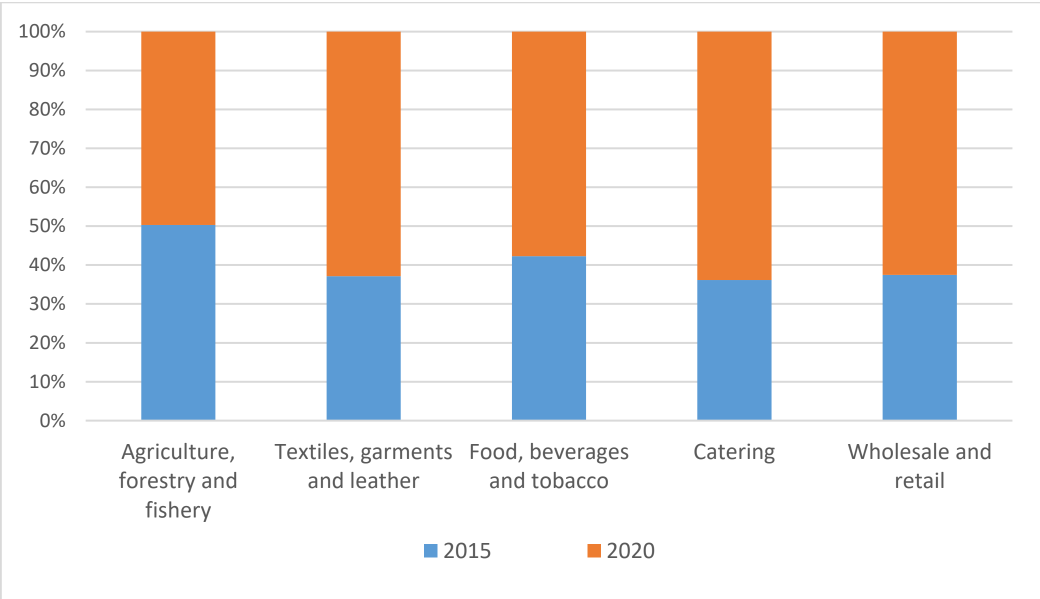



Figure 17. Disaggregation of the employment within agri-food sector in 2020
Source: author based on Shukurov et al. (2022).

Now I focus on the agriculture sector within agrifood sector specifically.Figure 18 below shows the dynamics of the employment share in agrarian sector. It cover the period from 2009 to 2021. As you can see, there is a slight decrease in the share of employment provided by agriculture in the given period. In terms of figures, it made up 26.8% in 2010, while it declined to 25.9% in 2021. This can be due to the migration of the rural people to neighboring countries, which Hasanov & Sanaev (2018) and Ruziev (2021) also mention about benefits of remittances for rural people.

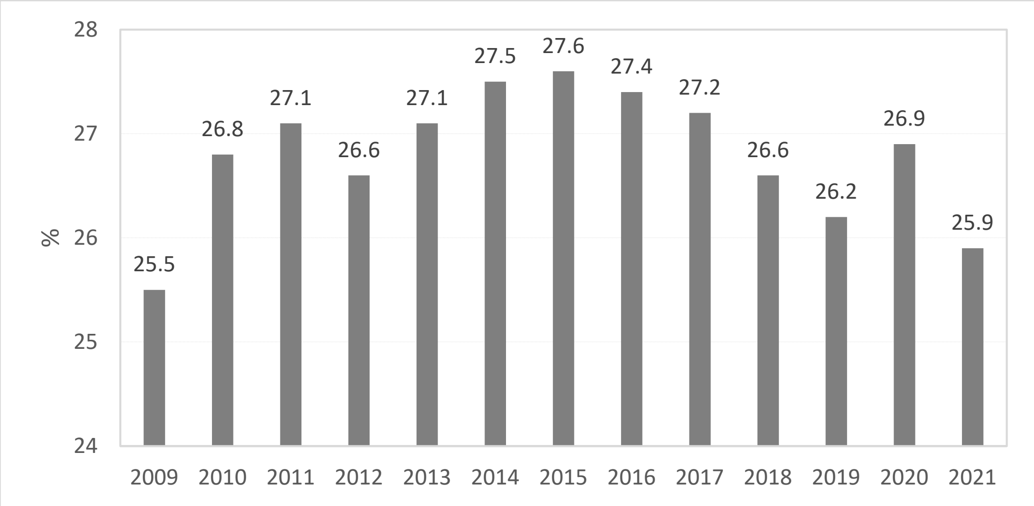



Figure 18. Share of employed in agriculture, forestry, and fishing in total employment
Source: author based on statistics agency and Shukurov et al. (2022).

### 4.1.5. Land and labour productivity.

Below Figure 19 shows land productivity in case of agricultural enterprises, rural households, individual farms, and their total volume. As rural households were much productive in term of land use.

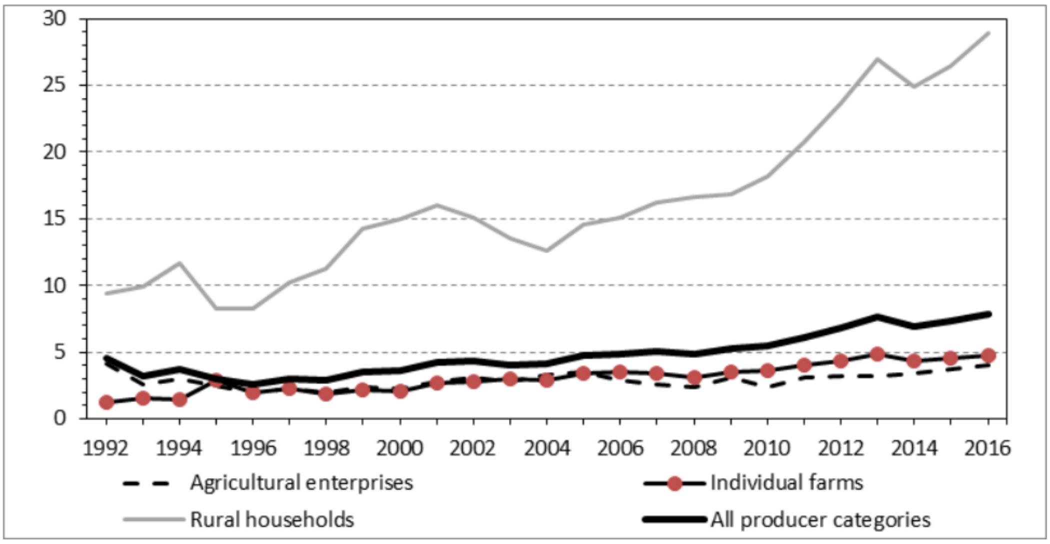



Figure 19. Land productivity by producer type, million constant 2016 UZS/ha
Source: Zorya et al. (2019).

This means they earn more than others per ha of the land. The approximate difference in land productivity between individual farms and rural households was 25 million UZS in 2016. Land productivity in case of all producer categories shows gradual positive increase in the given period.

As a complementary to the above mentioned, Petrick (2021) also provides the land productivity (land use and output respectively) based on different producer categories in post-soviet settings (Figure 20).

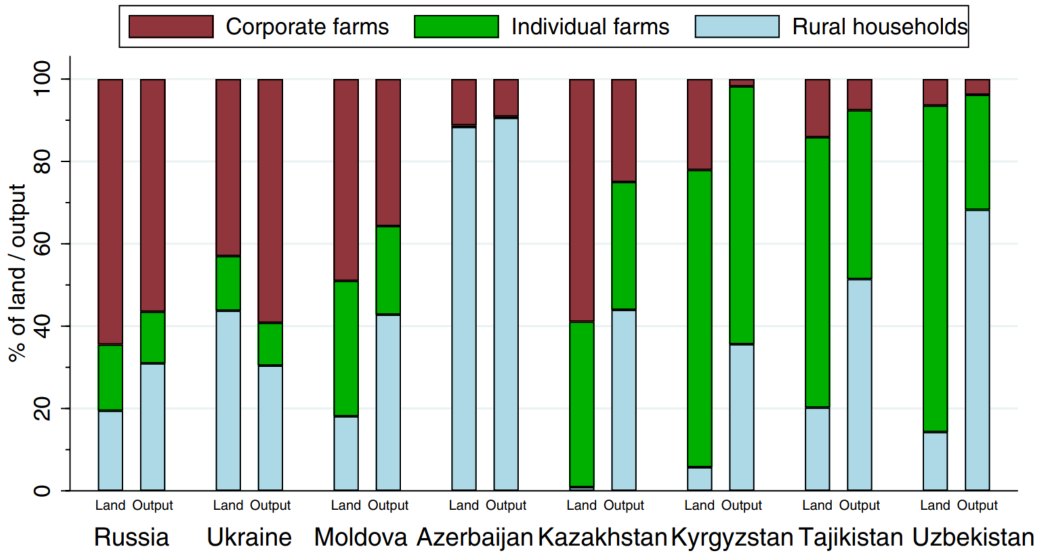



Figure 20. Land use and output by farm types in 2019
Source: Petrick (2021).

Corporate farms here in case of Uzbekistan refers to agricultural enterprises other than individual farms and rural households. The dominant land user in 2019 was individual farms, since it covers the higher range among other two actors (agricultural enterprises and rural households). However, the dominant output was provided by the rural household even though they use less land than individual farms. From this, it can be described that overall land productivity (output is divided by land) was higher in case of rural households compared to individual farms and agricultural enterprises. Output and land area of households are given in blue color. If I divide output by land area, I find more land productivity than individual farms. In case of individual farms (green colour), they produce less output while use more lands. This gives less land productivity compared to households. In this sense, as I mentioned, household model of farming is more productive than other forms of farm models.

Labour productivity is measured as a ratio of gross agricultural product divided by the number of agricultural workers. The indicator in 1992 was assumed as 100 percent. It shows the lowest decline in 1996, before restructuring state and collective farms into individual farms massively (above Figure 21), as I described land consolidation phases. After that, it started to increase gradually, which showed up to approximately 65 percent increase in 2016 compared to 1992.

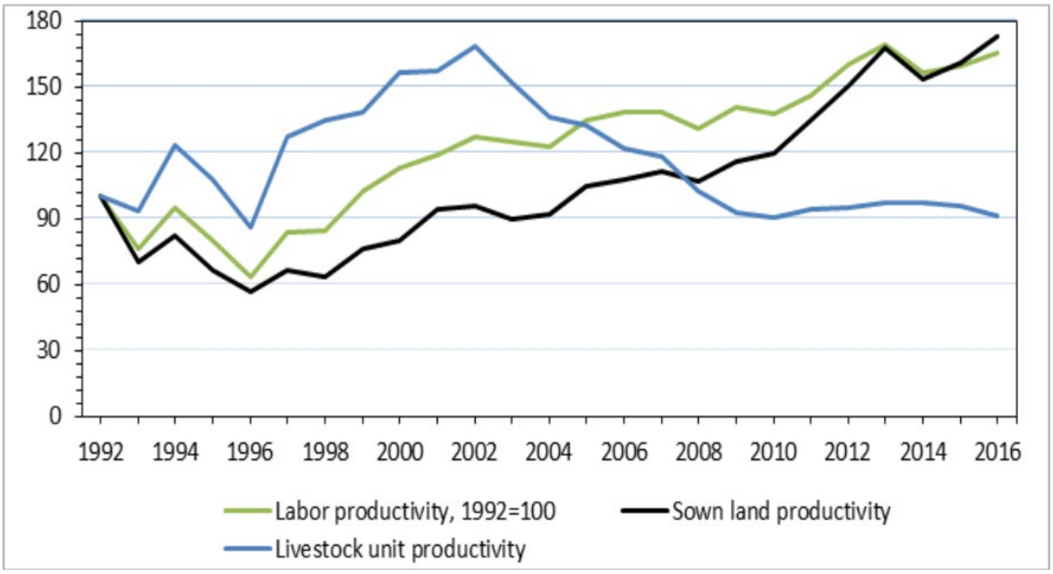


Figure 21. Agricultural output per labour, land and livestock unit in Uzbekistan (1992=100)
Source: Zorya et al. (2019).

The next table below, show the changes in labour productivity across subsectors (Table 10). Particularly, the agricultural labour productivity rose up significantly over 1996 and 2016. It is shown that an average change, it grew by 1.53 percent per year.

Table 10. Changes in labour productivity, %

| | 1996-2000 | 2001-2008 | 2009-2011 | 2012-2016 | 1996-2016 |
|---|---|---|---|---|---|
| Agriculture | 2.16 | 1.84 | 1.68 | 0.90 | 1.53 |
| Manufacturing | 0.27 | 1.29 | 0.20 | 0.83 | 0.92 |
| Construction | -0.10 | 0.22 | 0.16 | 1.11 | 0.41 |
| Trade and catering | 0.57 | 0.48 | 1.53 | 1.28 | 0.77 |

Source: Zorya et al. (2019).

The average percentage growth of labour productivity is much higher in agriculture than other sectors like manufacturing, construction, trade and catering during 1996-2016. However, Zorya et al. (2019) argue that the increase in agricultural productivity has not led to better job quality. The primary jobs were in cotton and wheat farms, which were characterised by seasonal availability and low payments to workers. Moreover, the agricultural labour share in total labour force declined from 43 percent in 1996 to 30 percent in 2016 respectively (Table 11). Off-farm employment occurred by the movement to construction, trade and catering, or out-migration. This means agriculture has not created jobs for the rural people. Even though the employment level in agriculture did not increase significantly, the agricultural output rose dramatically, which resulted in labour productivity increase. Self-sufficient wheat production and crop diversification measures might lead to an increase in agricultural production (Figure 11).

Table 11. Employment and labour productivity changes, 1996-2016

| | Employment, million | | | Labour productivity (output per worker), thousand UZS | | |
|---|---|---|---|---|---|---|
| | 1996 | 2016 | Change, % | 1996 | 2016 | Change, % |
| Agriculture | 3.51 | 3.69 | 5.1 | 738 | 2 275 | 208.2 |
| Food industry | 0.82 | 0.71 | -13.1 | 1 698 | 10 650 | 527.4 |
| Light Industry | 0.21 | 0.14 | -33.9 | 1 812 | 6 031 | 233.0 |
| Construction | 0.54 | 1.26 | 134.4 | 957 | 2 730 | 185.2 |
| Trade and catering | 0.71 | 1.52 | 112.6 | 1 068 | 3 751 | 251.1 |
| Total | 8.21 | 12.28 | 49.6 | 1 158 | 2 811 | 142.6 |

Source: Zorya et al. (2019).

### 4.1.6. Survey data analysis on land consolidation.

More specifically, using Agrichange II data set[6], I analysed the changes in farmland, which means the difference in the farm size between establishment time and survey time 2018. The survey questions makes us enable to find this difference. In particular, I provide the average changes of farm size per farm in district level (Jomboy, Payarik, and Pastdargam of Samarkand province) and overall.

Table 12. Farm size changes between farm establishment and 2018, ha

| | Levels | Obs. | Mean | Min | Max |
|---|---|---|---|---|---|
| 1 | Jamboy district | | | | |
| | negative change | 24 | -24.8 | -199 | -1.2 |
| | positive change | 36 | 10.1 | 0.5 | 56.2 |
| | no change | 69 | - | - | - |
| 2 | Payarik district | | | | |
| | negative change | 21 | -36.1 | -92 | -0.6 |
| | positive change | 64 | 34.4 | 1 | 98 |
| | no change | 68 | - | - | - |
| 3 | Pastdargom | | | | |
| | negative change | 19 | -32.9 | -95 | -1 |
| | positive change | 81 | 35.1 | 1 | 114 |
| | no change | 49 | - | - | - |
| 4 | Overall | | | | |
| | negative change | 64 | -30.9 | -199 | -0.6 |
| | positive change | 181 | 29.8 | 0.5 | 114 |
| | no change | 186 | 0 | 0 | 0 |

Source: author based on Agrichange II survey data.

[6] This is cross sectional farm survey data which were collected in Uzbekistan and Kazakhstan in 2019. I will provide a detailed description of the survey data in the methodology section.

As it can be seen from Table 12, farms in Jomboy district saw less change on average compared to other districts. In terms of figures, the land size change of farms in Jomboy district was average -24 and 10 ha respectively. The positive or negative change in Jomboy, in Payarik, and in Pastdargom occurred to 46%, 56%, and 67% of the total farms accordingly. Overall, farm size of more than half of the farms either increased or decreased between establishment year and survey time.

In addition, I also have explored the establishment years of farms based on survey data. This gives us an opportunity to understand to a greater degree the intensity of changes in certain time framework. As you can see, there are few farms which were established in the in the first decade after independence of Uzbekistan. In other words, they belong to the first phase, and partly to the second phase of land restructuring reforms, which I discussed in earlier chapters. In the second decade, there was stable trend in establishing farms, which were around 20 farms per year. Finally, in the third decade, it can clearly be seen that there was a peak (around 80 farms). Apparently, most farms were established in the third decade, approximately during 2014-2016.

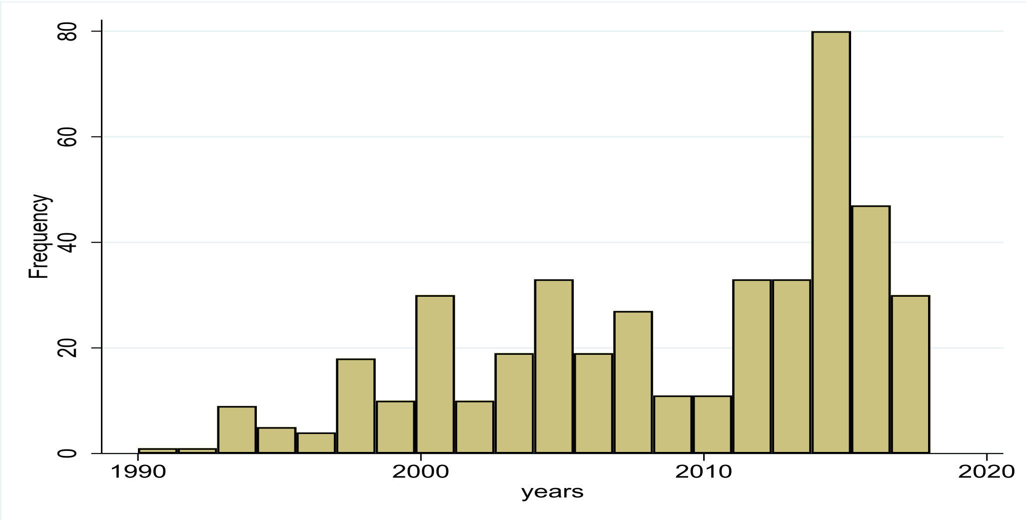



Figure 22. The establishment year of the farms surveyed
Source: author based on Agrichange II.

Having provided overview of the agriculture of Uzbekistan, now I turn to the empirical analysis of cotton clusters in the light of agricultural restructuring in the recent years.

## 4.2 Cotton clusters in the light continuous agricultural restructuring

### 4.2.1 The establishment of clusters

In 2017, the new government started massive reforms in many directions, which included the privatization of cotton production and clusterisation in the cotton sector (Asfaw 2021). The reform's aim is to reduce the role of the state and give more freedom to private entrepreneurs. The government liquidated the state cotton agency (Uzpahtasanoat) and announced the cluster approach.[7] The government established 13 cotton clusters in 2018,

[7] Uzpahtasanoat was established in 2001. It involved 172 joint stock companies, seven limited liability companies and one joint venture (Rudenko et al. 2009).

and their number only increased over next years and reached 134 in 2022 (Table 13). The land area which clusters covered was 140 thousand ha in 2018 and 1034 thousand ha in 2022 respectively. Meanwhile the processed cotton has also increased during this period.

Table 13. Rise of clusters over years

| Indicators | 2018 | 2019 | 2020 | 2021 | 2022 |
|---|---|---|---|---|---|
| Number of clusters | 13 | 77 | 97 | 122 | 134 |
| Land area, thousand ha | 140 | 668 | 917 | 1034 | 1034 |
| Number of farms | - | 20981 | 25150 | 28206 | 28206 |
| Seed cotton, thousand tons | - | 1800 | 2700 | 3400 | 3600 |
| Cotton fiber processed, tons | - | 294700 | 421000 | 862130 | 862130 |

Source: author based on data of Ministry of Agriculture, and www.agro.uz.

The establishment of clusters receives much attention among farmers, textile firms, input providers, administrative bodies and other interested parties. According to a World Bank specialist, 'The main objectives of organizing clusters are to reduce the role of the government in cotton production, create jobs and position Uzbekistan as an exporter of textiles and garments rather than raw cotton' (ILO 2019, 76).

Asfaw (2019) argues that attracting foreign investments was a major goal of the cluster policy. In one of our interviews, the manager of Baht textile cluster (I4) illustrates the change of attitude on the side of the government:

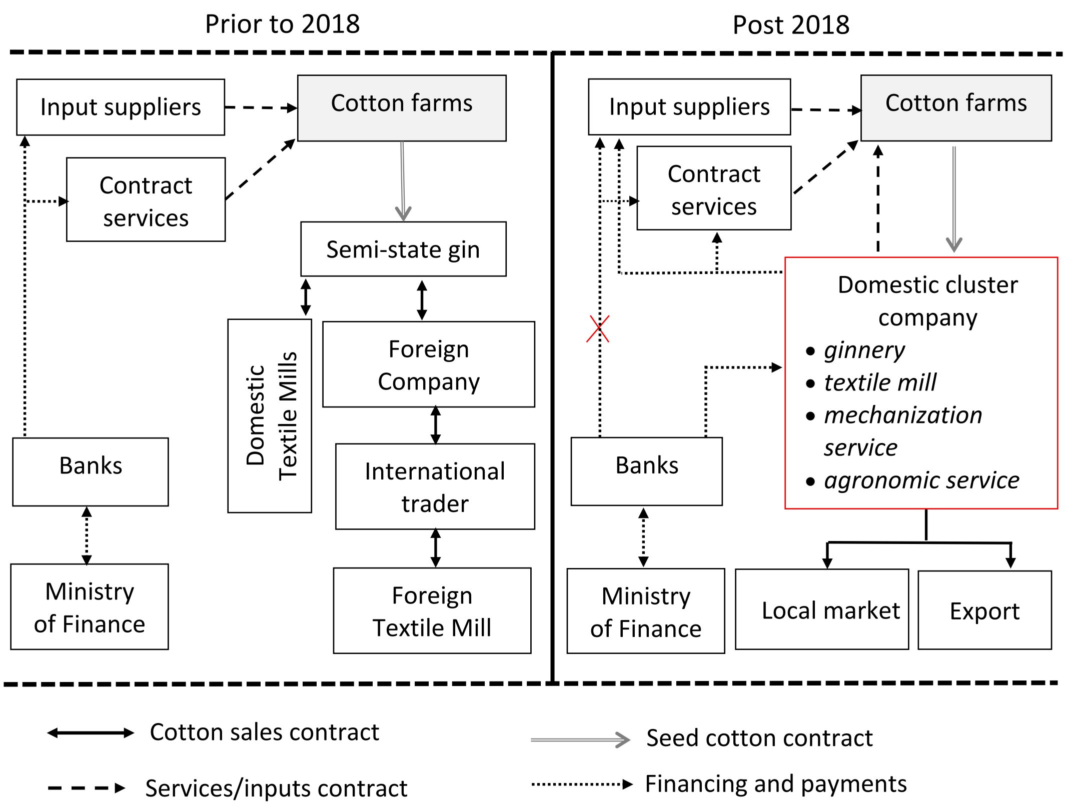
> *"After organizing textile firm in 2006, we wanted to establish cluster system that time. However, we could not get permission from government and Uzpahtasanoat (state agency) was against it. In 2017, during the visit of President to the region, we presented the project i.e. establishing cluster, processing cotton, export and job places, and we got permission" (August 12, 2019).*

Starting in 2018, the government set up the clusters following a top down approach through formal resolutions (see a summary including major objectives in Table A 2 see Appendix). Our case clusters followed the same route. A governmental resolution provided the list of clusters to establish and the cotton area to be planted in each cluster. The existing gins were sold to the clusters based on subsequent resolutions (I1, I4, I7, I10, I16). Textile firms initiate the establishment of clusters by submitting an investment proposal to provincial authorities (*khokimiyats*). Then, *khokimiyats* review the investment proposals and send the list of applicants to Uztextileassociation, a representation of textile firms. After that Uztextileassociation lists the potential applicants and also reviews several criteria of applicants such as investment potential, processing capacity, jobs to be created and others. Then, Uztextileassociation prepares the necessary documents to adopt a governmental resolution on establishing clusters. The final decision is made by the Cabinet of Ministers by adopting the corresponding resolutions (Zorya and Babaev 2020, I17).

Principally, districts and sub districts were taken as boundaries of clusters. In 2017, Baht textile cluster as a pilot project was organized in Qiziltepa district of Navoiy province (ILO

2019) that covered all farmers in the district. In 2018, the government broadened the cluster policy by adopting Resolution No 53 from 25.01.2018 in which 13 clusters were established and the assets of Uzpahtasanoat in those districts were sold to the clusters (Figure 23). The textile firms established a new sort of legal enterprise, the cotton cluster company. They privatized the semi-state ginneries and integrated them into the new company as a part of the cluster. Hence, cluster refers to a certain 'enterprise' in Uzbek cotton context that owns at least a ginnery and a textile mill with a sole manager.

Figure 23. Cotton supply chain before and after 2018




Source: author, based on Sadler (2006), Rudenko et al. (2013), Djanibekov and Finger (2018).

Synovitz and Ashur (2019) report about the links between cluster owners and officials of state agencies, but fail to provide detailed information. From the interviews (I1, I4) it becomes clear that clusters are private firms and owners of clusters are business people. They are not affiliated with provincial administrations or state agencies. Clusters hired key personnel like agronomists, machine operators and irrigators to provide mechanization, agronomic and other services.

Also, the clusters are the members of 'the cotton-textile clusters association' that was established based on Resolution of Cabinet Ministers of Uzbekistan No 397 from 22 June 2020. The activity of association is described by its specialist as fallows (I19):

> *"Main objective is to protect the interests of cluster companies. The association is nowadays trying to obtain tax exemptions, export support or subsidized loans to its members. All cotton clusters are members of the association. If there is a misunderstanding between a farmer and a cluster, or the state and a cluster, the association is involved to tackle this issue. The association is non-governmental*

*organization and its budget is composed of membership fee and other sponsors payments. Membership fee is paid yearly. From the government budget, money is not allocated to the association." (August 25, 2021).*

According to ILO (2019, 76), the cluster term describes 'a transaction whereby the government allocates a defined area to a private investor who in return commits to growing cotton (either by direct farming or by contracts with existing farmers) and to establishing processing and/or manufacturing facilities in the local area'.

Additionally, the relevant governmental resolutions determined the administrative regions of clusters and farmers in those areas did not have any choice whether to join the cluster or not. During the implementation process, transparency and accountability to the farmers was widely lacking (Zorya and Babaev 2020, Asfaw 2021). Hardly any stakeholders and no farmers were involved in the decision-making process to the extent that during the field study the uncertainty among the stakeholders about the future farming conditions loomed large (I2, I15).

Interviews with a farmer of Bo'ston cluster (I2) reveal that in practice the farming activity is uncertain due to cluster policy:

*"The cluster system provided more supervisors over farms to control than before. We work in the field, they just come and control or order to do something, and they do not care about the future of farming. Everyone tries to control farms here. The cluster does not pay more than the governmental minimum price. Land should be private. We do not want to invest in land improvements. Because we do not know what would be tomorrow" (July 10, 2019).*

### 4.2.2 Types of clusters in Uzbekistan

ILO (2019) and Asfaw (2021) distinguish clusters by their contractual arrangement with farmers, either contract or direct farming. This is not the only way to categorize clusters, but I follow it here due to its substantial impact on the decision making of farmers. Contract farming clusters conclude agreements with farmers who remain autonomous though. Farmers grow cotton and deliver it to clusters. The clusters process the raw cotton as downstream business. Under contract farming, farmers and cluster organizations act as two sides of a market relation.

Under direct farming, clusters receive the land from the state based on a lease agreement and turn the farmers into workers. The clusters grow cotton by themselves as a vertically integrated business (Resolutions in Appendix, ILO 2019, Zorya and Babaev 2020). Direct farming clusters hire people to grow cotton, they identify brigade leaders for certain cotton fields. These leaders will have several workers under their control and they are responsible for the cotton cultivation process.

According to ILO (2019), during the establishment of direct farming clusters, cluster organizations may tacitly seize the land use rights held by the incumbent farmers. In the Indorama case, the state gave the land to the Indorama cluster for up to 49 years with an option for extension. More than 100 farmers lost their land area and previous occupation as an independent farmer (I10, I11). Strokina (2020, p.7) reports that farmers who terminated farming activity were offered by Indorama cluster to work for the cluster organization based on labour contracts and approximately 45% out of total decided to join the cluster as workers. According to the Resolution of the Cabinet of Ministers of Uzbekistan No 22 from January 31, 2013, under the termination process of farms, the investment and land improvement costs have to be reimbursed by the organizations (farms, clusters etc.), that are newly received this land. According to Strokina (2020, p.20), as all farmers were willing to terminate the land lease contracts voluntarily, an obligation to compensate did not arise. Schweisfurth (2021) argues that land lease termination of farms was involuntary, even though cluster and local khokimiyat officials labelled it as a voluntary. The author also highlights the apparent hardship of rural communities in renting small plots, cultivating fruit and vegetables and grazing livestock due to direct farming clusters. Our primary data does not allow us to conclude whether the land lease termination was voluntarily or not, and what those farmers are currently doing.

Following Ketels (2003), I can categorize cotton clusters in Uzbekistan based on whether the investor's origin is local or foreign. I checked open source websites such as stat.uz and www.indorama-agro.com to derive information about cluster shareholders. Based on searching the sources above and on the observations of the first author during interviews, I can classify Bo'ston cluster, Baht textile cluster, and Sangzor textile cluster as local. These three clusters are run by local business people, while Indorama Holdings BV (The Netherlands) is a foreign investor in the Indorama cluster. More specifically, Indorama Corporation Pte. Ltd (Singapore), which is an associate of Indorama Holdings BV, implemented the cotton cluster in Uzbekistan. Therefore, it is common among local people to call Indorama cluster a "Singapore company". I admit that checking all current 134 cotton clusters one by one is time consuming. In this sense, I conducted an interview with the specialist of the Ministry of Agriculture (I20).

> *"Around 10% of 134 clusters have a portion of foreign direct investments. Investors are from the US, UK, Singapore, Russia and so on. Other clusters were established by local investors" (September 19, 2022).*

### 4.2.3 The nature of cotton clusters

Our empirical analysis elucidates the striking differences between the definitions of the cluster in the economic literature (even if it is ambiguous itself) on the one hand and the implementation in Uzbekistan on the other. Table 14 below recaps the major differences of the cluster approach in international experience and in Uzbekistan.

Table 14. The different characteristics of clusters.

| Elements of clusters | International practice | Uzbekistan |
|---|---|---|
| Cluster participants | Various stakeholders | Single textile firm |
| Cluster boundaries | No limit | Limited |
| Choice to join or not | Free choice | No choice |
| Policy design | Bottom up | Top down |

Source: author.

First, the main difference is about the cluster participants. The cluster definition in the literature refers to a group of the interconnected independent economic actors in a particular location (Shakya 2009; Porter 1998, 2000; Ketels 2003), while for the Government of Uzbekistan, a cluster is a single company from the textile industry (see Figure 23). Secondly, in the view of the international literature (Porter 1998, 2000; Rosenfeld 1997; Ketels 2003; Abbasiharofteh 2020), the boundaries of clusters may cross administrative borders, but our case clusters are just based on territories of districts and sub districts. The clusters are the privatised successors of the former semi-state ginneries in their existing locations. Third, the cluster members are free to join and exit, while in Uzbekistan, the clusterization process failed to give choice to the farmers. Finally, the policy design of clusters in Uzbekistan represents a top-down approach, while international experts and literature advocate for bottom-up initiatives to make the policy successful.

### 4.2.4 Reform effects along the cotton value chain

Advances in recent cluster policy in Uzbekistan made cotton a hotspot of the reform debate. Table 15 compares the situation before and after the introduction of clusters in Uzbekistan. I find that clusters in general replaced the several roles of the state in management, but changes for farmers from the production perspective were minimal.

Table 15. Cotton value chains before and after implementation of cluster strategy.

| Reform area | Prior to 2018 | Post 2018 |
|---|---|---|
| *Agricultural inputs & services* | Input supply by the state. Control and supervision of farms | Liberalized input market. Clusters control inputs/services |
| *Credit access* | State provides loans to farms and controls their use. | Clusters and farmers receive and allocate the loan to input providers. |
| *Cotton picking* | Mobilized labour to pick cotton through state organizations | Reduced forced labour of students or teachers |
| *Crop choice and production* | Procurement quota for cotton, no crop choice | Procurement for minimum volume, no crop choice |
| *Cotton price* | Procurement price set by state | Procurement minimum price set by state |
| *Market power of cotton processors* | A single state cotton company. Monopsony power | Predefined clusters. Monopsony power |

Source: author, based on own fieldwork, Pomfret (2008), Rudenko et al. (2009, 2013), Djanibekov et al. (2010), Shtaltovna & Hornidge (2014), Djanibekov and Finger (2018), ILO (2019).

Specifically, the analytical dimensions cover input and services supply, access to credit, labour mobilization for cotton harvesting, crop choice and finally marketing channels. I compare the situation in the aspects focusing on the before and after the cluster reform in the cotton industry.

#### *4.2.4.1 Inputs and services*

Since independence, inputs for cotton have been provided by a centralized system through state programs (Sadler 2006, Lombardozzi 2020, Djanibekov and Finger 2018). The Joint Stock Company (JSC) Uzagrokimyohimoya provides fertilizers and pesticides. In addition, this company exercises a government mandate to combat locust, pests and plant diseases (Uzagrokimyohimoya.uz 2020). However, after the introduction of clusters, JSC Uzagrokimyohimoya lost its dominant position in input provision. At the time of fieldwork, some branches had already been closed due to a lack of demand (I1, I3, I13). Now clusters may purchase inputs from local private companies, or they can import from other countries (ILO 2019). JSC Uzbekneftegas branches provide farmers with fuel. This company implements the government policy on fuel and gas resources in practice. It involves more than 50 enterprises, including 13 foreign joint ventures and other local enterprises. 99.9% of shares of Uzbekneftegas belong to the government, and foreign investors and locals own the rest of the share. (Ung.uz 2020). Farmers receive diesel based on the price, determined at Uzbek commodity exchange at the time the clusters purchase it. The Ministry of Agriculture controls the cotton seed production and distribution. The first author interviewed a specialist of Sangzor textile cluster regarding input supply:

> *"Inputs for farmers were provided without any problem on time such as spare parts for equipment, fuels, fertilizers, salary to the workers. Also, fertilizers like nitrogen, phosphate and others were imported from Kazakhstan and farmers used them" (August 24, 2019).*

The interviews were extended with a farmer of Sangzor textile cluster (I8).

> *"We are receiving inputs on time, no problem. We will cover all costs from cotton harvest. If we cannot fulfill plans, it is going to be a problem for us. We will see what will happen. We do not have a clear idea how we work with the cluster yet. We have our plan for cotton production and we are trying to fulfill that plan. We receive the price that was guaranteed by the government" (August 24, 2019).*

When the first author asked the specialist of Sangzor textile cluster (I7) why they did not use local fertilizers, he stressed that the quality of imported fertilizers is better, but the price is also a bit higher. The same situation prevails in Baht textile cluster, which also imported some fertilizers from Kazakhstan and sold it to farmers (I4, I5). Those findings are supported by ILO (2019) reporting that some clusters imported phosphate and other fertilizers since they considered the quality of local fertilizers as low. Indorama cluster invested in a fertilizer production plant in Fergana province to supply cotton with their own fertilizers (I10) (Table 15). These empirical findings indicate a positive trend of input market liberalisation due to the cluster policy.

In line with Shtaltovna & Hornidge (2014), Machine Tractor Parks (MTPs) are supposed to provide mechanization services to farmers. However, farms struggle to use the services of MTPs due to its cost and lack of availability of technics (Lombardozzi 2020). As I observed, MTPs are poorly functioning and farmers (I8, I12) complain about the quality of mechanization services. Several MTPs are expected to be sold to private companies including clusters. Bo'ston cluster is going to buy Ellikkala MTP. However, the manager of Baht textile cluster mentioned that they are not willing to provide MTP services (I1, I4). The MTP head in the territory of Sangzor textile cluster remarked that their MTP will not be sold and it will continue operating (I9). Indorama textile cluster purchased John Deere agricultural machinery to provide mechanization services by the cluster (I10, I11).

#### *4.2.4.2 Credit*

The Fund under Ministry of Finance directs the credit to the joint stock commercial Agrobank for further allocation to cotton farmers.[8] However, as argued by Djanibekov et al. (2010), Shtaltovna & Hornidge (2014), MacDonald (2012) and Rudenko et al. (2009), farmers are not able to control any loans extended to them since they are already targeted to specific uses (Table 15). According to Shtaltovna & Hornidge (2014), farmers should direct the loans in the ways they choose and have access to their bank accounts to invest in the farm further. After establishing clusters in Uzbekistan, the loan allocation has changed and clusters started to receive the subsidized loan (Table 15). Farmers do not obtain the loans directly. To make clear the loan system, the first author interviewed a specialist of the Fund (I18).

> *"At present about 30% of cotton is grown by farms in the old system. Their account is in commercial Agro bank. Our Fund transfers money to the Agro bank directly to provide farmers with loans. Newly established clusters grow roughly 70% of cotton. Their account is not only in the Agro bank but also in other banks like Asaka or Orient Finance Bank. The Fund directs the loans to these banks of clusters (not to farmers) to use. Then, clusters transfer money to input providers or farmers based on needs and schedule". (July 20, 2019)*

When asking about loan allocation, the deputy manager of Bo'ston cluster mentioned that they transfer money to Agro banks to provide farm staff with salary. However, for other services and inputs, the cluster directly transfers money to the providers (I1). This is the same in Baht textile cluster and Sangzor textile cluster as well (I4, I7). There might be challenge if a farmer fail to fulfil the plan and cannot pay the interest costs occurred. The similar case described by the farmer during our field visits (I2).

> *"My farm was established in 1996, one of first farms. I could not fulfill the plan of cotton growing last season (2018) for 12 million sum (around 1500 dollars). The factors like unfavorable seasonal condition and lack of water resources led to low harvest. As a result I had to find money to pay debts including loan interests. I was required to ask for financial help from relatives and I also sold some livestock for example cattle and sheep" (July 11, 2019).*

ILO (2019) reports that some clusters attracted loans from commercial banks based on general terms. Since a cluster is an 'enterprise' in the Uzbek context, additional loans from commercial banks are available with higher interest rate (around 20%) than subsidized loans (5%), but collaterals are required.

[8] Agrobank was established in 1995. The shareholders of the Bank are the Fund for Reconstruction and Development of Uzbekistan (66%), Ministry of Finance (24%), private entities (7%), and others (3%) (Agrobank.uz 2018).

#### 4.2.4.3 Labour mobilisation

Shtaltovna & Hornridge (2014) and McGuire & Laaser (2018) provide evidence that people including teachers and students harvest cotton manually. The model of centrally governed cotton production in Uzbekistan had caused the use of child and forced labour in the cotton harvest (Table 15). One of the anticipated results of clusters in Uzbekistan is a reduction of child and forced labour in cotton production (ILO 2019). The first author has not observed and has not been informed about forced labour of staff like teachers, students, doctors and others from state organizations and use of child labour during field visits and interviews. Since 2019, the first author has been an affiliated in a local university. The university does not bother PhD students to engage in harvesting, which supports the findings about the reduction of forced labor. This is consistent with Cotton Campaign (2021), which reports about a massive decline of forced labour during the cotton harvest of 2020. After the launch of the cluster policy, farmers started to attract local people or use cotton-harvesting combines. Also, farmers are willing to use harvesting combines if the cotton combines provide high quality service in harvesting (I8). ILO (2019) expects that the cost of labour in the coming years will double. The clusters studied were eager to gradually shift to the practice of harvesting combines too.

In accordance with ILO (2019) and Asfaw (2019), cotton harvesting after cluster policy is structured in the same fashion throughout the entire country. The Council of Farmers, which looks like a non-governmental organization, but de facto operates as a state agency (Shtaltovna and Hornidge 2014), hires the so called 'cotton picker brigades'. This is absolutely voluntary. Each district includes approximately 80-120 such brigades, according to area, and 70-100 cotton pickers are hired in each brigade respectively. Brigade leaders are selected by the Council of Farmers. Indeed, the majority of the brigade leaders are from villages and familiar with the locals. The payment to the brigade leaders is organized by the Ministry of Employment and Labour Relations. The minimum payment under the first und the second picking has also increased over years (Table 16). There are several farmers which pay higher based on picking time and capacity. For example, in October 2022, one farmer paid 0.21 USD per kilo under the second picking, which is higher than the minimum payment given below.

Table 16. Payment for manual harvest.

| Indicator | 2018 | 2019 | 2020 | 2021 | 2022 |
|---|---|---|---|---|---|
| Payment for manual harvest per kilo under the first picking, USD | 0.081 | 0.085 | 0.096 | 0.112 | 0.136 |
| Relative change to previous year | - | +5% | +13% | +16% | +21% |
| Payment for manual harvest per kilo under the second picking, USD | 0.123 | 0.127 | 0.135 | 0.141 | 0.164 |
| Relative change to previous year | - | +3% | +6% | +4% | +16% |

Source: author based governmental resolutions.

#### *4.2.4.4 Crop choice*

For the Uzbek government, cotton remains a strategic crop (Sadler 2006, Djanibekov et al. 2012, Bae and Mah 2019, Asfaw 2019) and centrepiece (Rudenko et al. 2013) of agriculture (Table 15). The fate of any farmer, with regard to whether he/she remains as a farmer or becomes landless, rests on the farmer's performance in meeting the state ordered cotton targets (Shtaltovna & Hornridge 2014, Djanibekov et al. 2015, Djanibekov and Finger 2018, Lombardozzi 2020). The establishment of cotton clusters eliminated neither the production quota nor the price setting (Petrick & Djanibekov 2019). The generally accepted procedure inherited from the planned economy is that every winter, the government approves the plans for the next season which provides guidelines and instructions to follow in cotton production. This has not changed after the introduction of the cluster policy in 2018 (Table 15). Presidential Decree No 4633 from 06 March 2020 also did not eliminate this procedure. However, this Decree abolished the practices of the state quota determination and state price settings.

The new cluster system does not grant farmers the freedom to choose their crops independently neither. ILO (2019) reports that due to several reasons such as unfavorable weather conditions or pest control problems, the cotton harvest was lower than expected in certain clusters in 2018. As a result, up to 15 percent of farmers went into arrears concerning the repayment of their debts. During the interviews, the manager of Baht textile cluster (I4) highlighted that:

> *"In 2017, when the cluster started, there were 1600 farmers, nowadays the cluster has 585 farmers due to farm consolidation and farmers' performance" (August 12, 2019).*

Since land allocation for crop growing is still governed by the state, cluster managers do not influence the crop choice directly, but their role in the process of decision making on crop choice is increasing. The cotton area can be changed with the agreement of state organizations only under certain circumstances: weather conditions, water availability, or the implementation of a crop diversification program. As mentioned earlier, since the initiators of clusters originate from the textile industry, if compared, their major focus is processing raw material to create final products for sale rather than growing cotton. From this point of view, growing cotton itself is the main responsibility of farmers. It does not necessarily mean that clusters do not care about field works. Farmers, clusters and local khokimiyats interact in cotton growing as a certain form of embeddedness.

#### *4.2.4.5 Cotton price*

The Uzbek government has kept a strict control on the price of raw cotton over years (Table 15). Farmers had to deliver the cotton harvest to the semi state processors at the state procurement price, that was much less than the potential market prices (Djanibekov and Finger 2018). In 2017, the farm gate price was an average 200-250 USD/tons (Figure 24), however, it increased to 342 USD in 2018 (ILO 2019). In 2019, the farm gate price for raw cotton comprised an average 4 500 000 UZS per ton that is about 474 USD (Governmental resolutions & interviews).

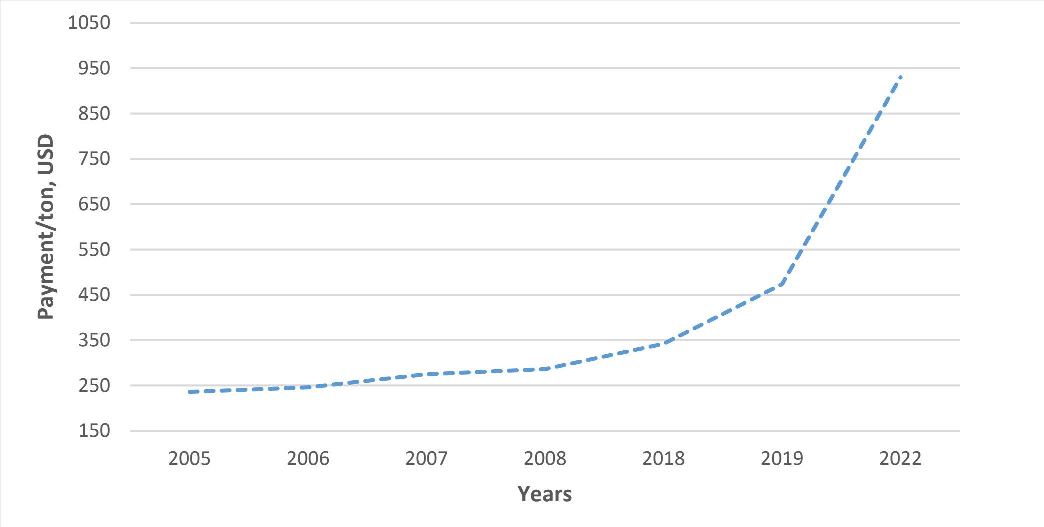



Figure 24. The trend of the farm gate price for the cotton in Uzbekistan.
Source: author, based on Rudenko et al. (2009), ILO (2019) and governmental resolutions.

To provide both agents, farmers and cluster organizations, with incentives, Presidential Decree No 4633 from 06 March 2020 announced the abolishment of price setting practice by the state. However, the decree also refers to the minimum price that will be determined by governmental agencies as of 1st December of the current year for the next season. From this, one could conclude that raw cotton price will be negotiated by cluster organization and farmers based on the minimum price. In this case, it really depends on clusters to pay more or just the minimum price to farmers for the raw cotton.

#### *4.2.4.6 Marketing channels*

Sadler (2006) compared the value chain of developed countries and Central Asian countries. His findings indicated that the gin played a dominant role in the cotton sector in Uzbekistan, while in Australia and the USA, the farmer was dominant in the supply chain. Importantly, gins were run and controlled by SJSC Uzpahtasanoat, which had monopoly power in the cotton sector. As a result, gins were the main actors as they decided whether to sell fiber to domestic markets or export (Pomfret 2008, Golub and Kastelmen 2015).

As displayed in Table 15, before 2018, farmers did not have alternatives to sell to different gins based on market competition since they delivered the raw cotton to predefined gins. Local authorities controlled and monitored the delivery during harvest. Under this condition, farmers did not have bargaining power in the contractual relations with gins. (Shtaltovna & Hornidge 2014, Sadler 2006, Rudenko et al. 2009, 2013, Djanibekov et al. 2015).

Findings from cases show that farmers under the cluster system are obliged to deliver the raw cotton to the 'predefined' clusters and they have no alternatives (Table 15). ILO (2019) emphasizes the risk that current clusters turn into private regional cotton monopsonies. According to the deputy manager of Bo'ston cluster (I1):

> *"The cluster is a single one in the district and there is no other cluster. Farms have only the option to conclude agreements with this cluster. Farms, which are located near to*

*other districts, cannot make an agreement with clusters of other districts" (July 10, 2019).*

As I have found from our cases during interviews, all cotton farmers in the districts have to make agreements with the 'predetermined' clusters. Farmers have no rights to deliver to other clusters, at the same time other clusters do not accept cotton from other farmers if those farmers are from other clusters (I1, I4, I6, I17). Yusupov (2019) mentions that farms have to sell raw cotton to so-called clusters according to the new model. However, this model does not necessarily mean the emergence of cotton market, while it creates a new form of dependency of the farms on clusters.

Nevertheless, the area of marketing of processed cotton is where cluster effects should be most visible compared to other steps of the cotton value chain. As remarked above, while the field production and primary processing stages of cotton seems to be fairly standardised, more flexibility and potential competition may emerge in the further processing and marketing stages, e.g. concerning innovative products, or products tailored to specific groups of customers, or specific export channels. That would be a "playground" of business activity that a cluster could promote. The share of textile goods in Uzbekistan's total export has increased over recent years, from 9,1% to 16,5% (Table 17). Notably, the raw cotton export stopped in 2022 compared to 2018.

Table 17. Uzbekistan's export of textile goods and countries with highest shares in export, in mln. USD

| Indicators | 2018 | 2019 | 2020 | 2021 | 2022 |
|---|---|---|---|---|---|
| Total export | 14257.9 | 17458.7 | 15127.7 | 16610.6 | 19309.1 |
| Textile goods | 1300.3 | 1626.9 | 1922.2 | 2927.2 | 3178 |
| Share % | 9.1 | 9.3 | 12.7 | 17.6 | 16.5 |
| Cotton fibre | 222.1 | 281.6 | 78.8 | - | - |
| Share % | 1.5 | 1.6 | 0.5 | - | - |

Source: author based on stat.uz

Table 18. Top six countries for Uzbekistan's export of textile goods, in mln. USD

| Countries | 2018 | 2019 | 2020 | 2021 | 2022 |
|---|---|---|---|---|---|
| Russia | 542.8 | 592.3 | 655.5 | 910.7 | 1264.9 |
| China | 326.7 | 437.6 | 438.2 | 636.3 | 274 |
| Kyrgyzstan | 70.2 | 96.6 | 283.9 | 401.1 | 513.4 |
| Turkey | 119.8 | 196.7 | 206.1 | 461.1 | 519.1 |
| Kazakhstan | 39.2 | 39.7 | 42.3 | 48.6 | 61.1 |
| Tajikistan | 8.7 | 13.7 | 34.7 | 21.7 | 71.9 |

Source: author based on stat.uz

In 2022 compared to 2018, the export of processed textile goods to Kyrgyzstan, Turkey and Tajikistan increased substantially (Table 18).

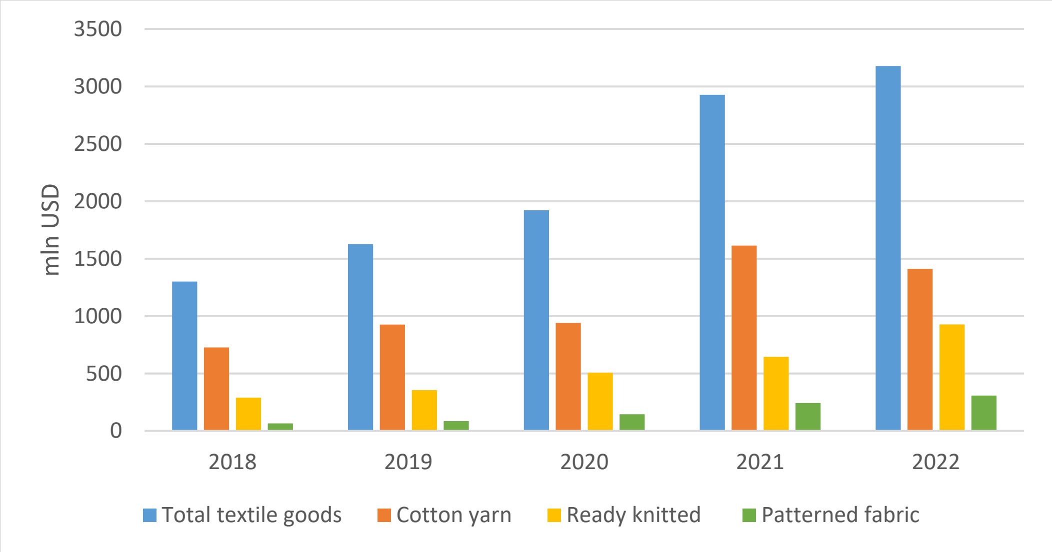



Figure 25. Dynamics of the textile goods export over years.
Source: authors based on stat.uz

However, full processing of cotton including all steps (namely fibre, yarn, fabric, and end product) is still lacking. According to the interviews and field visits, clusters primarily process the cotton fibre one step further as yarn and export it to Turkey or Russia directly, or they sell it in the domestic market. Figure 25 displays the export of total textile goods and the share of yarn, ready knitted and garments, and knitted fabric in the export of textile goods.

Cotton yarn is the dominant textile product exported from Uzbekistan, with around 52% share on average. The ready knitted and patterned fabric make up approximately 24% and 7% of total textile goods on average respectively in the given period.

### 4.2.5 Recent policy developments

Over the last few years, the government adopted many regulatory documents in the cotton sector. The 2020-2030 agriculture development strategy of Uzbekistan ('the strategy') serves as a guideline. In general, the strategy outlines reforms for every year step by step until 2030. In the framework of the strategy, the Presidential Resolution No. 4633 from March 2020 was adopted that includes the following major points:

- Continuing crop placement by the government. As provided in the empirical part, the government continues to adopt resolutions that allocate the cotton area under the crop placement system.
- Abolishment of the state production target for cotton. The elimination of the state production targets in 2020 will remove the responsibility from provincial khokimiyats to fulfil cotton production plans.
- Reform of the state financing of cotton production. The resolution mentions several reforms in financing cotton farmers and implements the inclusion of other commercial banks into the credit provision as alternative options.

- Introduction of a minimum procurement price for raw cotton. The resolution introduces an indicative price (a minimum price) for cotton that is based on production costs and export parity prices.
- Provincial governments are no longer responsible for labor mobilization. The resolution shifts the responsibility for labour mobilisation from the provincial khokimiyats to farmers and clusters. It forbids provincial khokimats to intervene into the labour provision process during cotton harvesting.
- Elimination of state cotton procurement and marketing. Until 2020, the government was responsible for buying all raw cotton produced. The resolution eliminates the state production targets and the state procurement. The government will compensate a certain part of the interest rate of the commercial credits attracted by the clusters to purchase the raw cotton from the farmers.

Even though abolishment of the state production target for cotton has been considered as historical reform, the state crop allocation practice may create the space to conduct governmental policy in agriculture. According to the Presidential Resolution No 5009 from February 26, 2021, up to three cluster companies can operate in the district and farmers can decide to conclude contracts with these clusters. In addition, Presidential Decree No 14 from November 16, 2021, states that farmers can contract with other clusters in the corresponding province. If implemented, it will address our major concern about monopsony structures in cotton processing, but that remains to be seen.

### 4.2.6 Kazakhstan's experience

At the beginning of the independence from the Soviet Union in 1991, the Kazakh government liberalized cotton production (Petrick et al. 2017, Shtaltovna & Hornridge 2014). The Soviet procurement price and quota system had been abolished. Farmers made their own choices concerning which crops to grow and inputs to use. The liberal environment in cotton production led to an increase of sown area and physical output of cotton in the early 2000s. Competition induced cotton processors to offer higher prices to farmers for the amount that exceeded the agreement (Petrick et al. 2017).

However, after 2005, a state-initiated reform of the cotton sector commenced and disrupted the relations between farmers and cotton processors. As one of the significant components of that reform, the government established the 'Ontusik' Special Economic Zone (SEZ) as a cotton cluster near the city of Shymkent. However, capital outflow from the cotton sector occurred due to restrictions on the activities of gins as input and other services provider according to the new 'Law on the Development of the Cotton sector in 2007'. Particularly, the 'cotton receipt' system was implemented under which gins could act only as storages for cotton and give farmers receipts about the amount stored cotton (Petrick et al. 2017).

As a new regime, the receipt system should have created opportunities for farmers in obtaining loans. However, this 'cotton receipt' system failed in practice for several reasons. Due to a lack of experience with the storage, farmers preferred to sell the output to spot markets. Furthermore, cotton receipts could not be accepted by commercial banks as collateral due to a lack of trust and a weak regulatory framework. These barriers led to a drop in both cotton area and physical output (Petrick et al. 2017).As another critical point the cluster was located about 250 km away from the fields where farmers grow cotton, which led to high transportation cost. Tax exemptions failed to increase the attractiveness of the cotton cluster to investors too.

The Kazakhstani experience allows to draw some conclusions for the Uzbek cotton reform and cluster approach. In a nutshell, and somewhat oversimplified, they could be summarized as follows:

- Don't undermine competition among farmers and gins: it resulted in higher prices for farmers and a sharing of benefits between them and the gins.
- Don't constrain financial arrangements between farmers and gins: banning gins from directly financing farmers led to a drop in output.
- Don't bureaucratise cluster formation by meddling in entrepreneurial decisions of farmers and managers: it led to a series of questionable contracting and locating decisions.

## 4.3 Labour incentives in agriculture

### 4.3.1 Descriptive statistics and pay systems

At the outset, I present percentage usage of various payment systems over farms, which mainly grow cotton and other crops. If I look at all farms in Figure 26, (since cotton farms shows the almost same scenario), the share of the mixed bonus system is dominant in Uzbekistan.

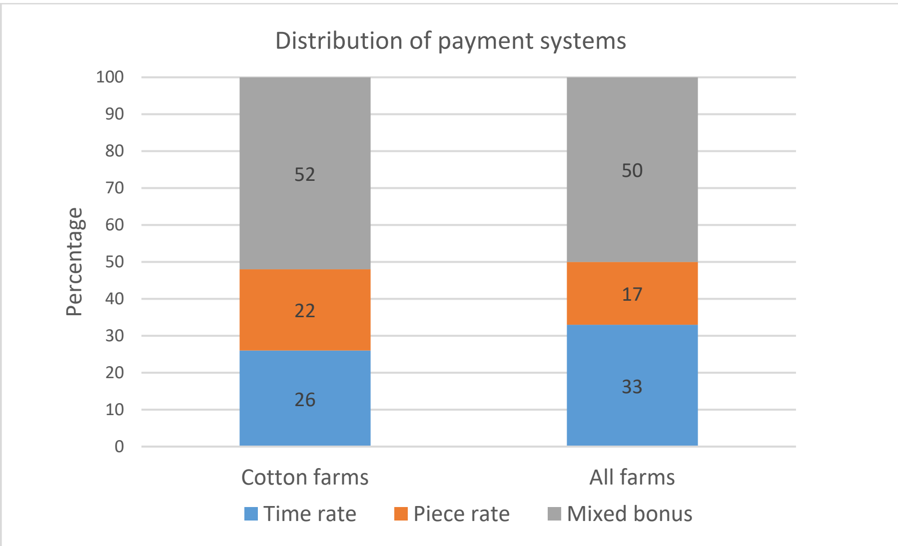



Figure 26. The distribution of various payment systems across farms.
Source: the author based on Agrichange II.

Namely, 50% of farms employ mixed bonus system. The time rate and piece rate systems take sequential places after the mixed bonus. In terms of figures, their share was 33% and 17% respectively. I also provide descriptive statistics of variables which I employ in our regression analyses (Table 19). The min, max, mean, and median values of variables and number of observations are provided. Mainly, the average yearly farm revenue and profit are 23.5 and 14.8 thousand USD respectively. The farm size 38.4 ha on average. In particular, the share of hired labour (FTE) is almost five times as high as family labour (FTE), which make up 10.3 and 2.2 FTE respectively.

Table 19. Descriptive statistics of variables.

| Variables | Min | Max | Mean | Median | N |
|---|---|---|---|---|---|
| Farm revenue, '000 USD | 0.65 | 100 | 23.56 | 18.89 | 431 |
| Profit, '000 USD | 0.04 | 78.08 | 14.82 | 11.03 | 431 |
| Farm size, ha | 4 | 143 | 38.43 | 34.0 | 431 |
| Labour cost, '000 USD | 0.00 | 18.56 | 3.75 | 2.83 | 431 |
| Fertilizer, tons | 1.66 | 97.24 | 25.09 | 21.10 | 431 |
| Pesticide costs, '000 USD | 0.00 | 2.48 | 0.47 | 0.38 | 431 |
| Fuel, tons | 0.00 | 19.85 | 3.25 | 2.48 | 431 |
| Family/relatives labour (FTE) | 0.00 | 6.20 | 2.21 | 2.23 | 431 |
| Hired labour (FTE) | 0.00 | 67.40 | 10.31 | 7.95 | 431 |
| Crop type (1/0) | 0.00 | 1.0 | 0.20 | 0.0 | 431 |
| Mixed wage (1/0) | 0.00 | 1.0 | 0.52 | 1 | 431 |
| Fixed wage (1/0) | 0.00 | 1.0 | 0.26 | 0.0 | 431 |
| Piece wage (1/0) | 0.00 | 1.0 | 0.22 | 0.0 | 431 |
| Distance to farmland, km | 0.00 | 30.0 | 4.39 | 3.0 | 431 |
| Plot numbers, counts | 1.00 | 17.0 | 4.16 | 4 | 431 |

Note: FTE refers to Full Time Equivalent.
Source: author based on Agrichange II.

Table 20 below illustrates the mean and the mean differences test for outcome variables that I employed. As expected, farmers with mixed bonus system receives higher revenue compared farmers with fixed rate.

Table 20. Mean and mean differences for outcome variables

| | Mean | | | Difference | | | N |
|---|---|---|---|---|---|---|---|
| | Mixed bonus | Piece rate | Fixed rate | Mixed-Piece | Mixed-Fixed | Piece-Fixed | |
| Farm revenue ('000 USD) | 27.78 | 21.43 | 18.99 | ** | *** | - | 460 |
| Profit ('000 USD) | 15.61 | 11.62 | 9.41 | *** | *** | - | 460 |

Note: Mean values are shown. *p < 0.1, **p <0.05, ***p <0.01.
Source: author, based on Agrichange II survey.

However, the difference is especially large for mixed bonus system with reference group (time rate). The second indicator shows the profit of farms under various payment systems, which describes the similar trend with farm revenue. As seen clearly, the highest indicator is related to mixed bonus system. Following that, piece rate and time rate receive the second and third highest proportion respectively.

I also visualise the densities of the distribution of farm size using the Kernel density (Figure 27). Taking the natural logarithm makes densities of distributions approximately bell shaped for farms. The peak value is around 49 ha of farm size.

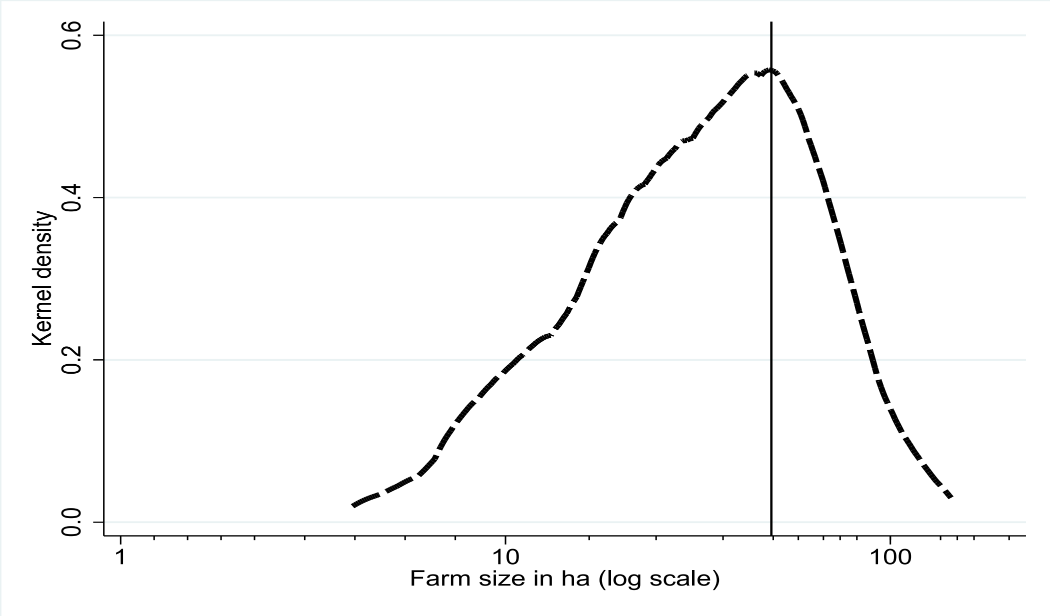



Figure 27. Distribution of land area by farms in 2018
Source: author based on Agrichange II.

Following this brief descriptive exploration, I move on to the empirical estimations to investigate the impacts of various payments systems on farm output.

### 4.3.2 Estimation results

In the following, I provide estimation results using the equations 3 and 4, which I showed earlier in the methodology chapter. If I start with the model 1, which is based on the equation 3, the dependent variable is farm revenue in log form. My key interest here is to analyse the effect of payment systems on farm revenue. In this sense, I find the statistical significant effect of the mixed bonus system on the farm revenue (Table 21). Meanwhile, the strength of the effect of mixed bonus system is higher than piece rate system. In this sense, I accept both above-mentioned hypotheses. It is important to highlight that I disaggregate the labour force of the farm into two category: hired and family labour. According to the theory, family labour provides more effort than hired one. Thus, I could show the relationship family labour with the farm revenue, which shows the statistical significant impact on the farm revenue. Moreover, I find the positive effect of secondary cropping on the dependent variable, which is also consistent with the expectations due to profit maximizing behaviour of the farmer. With regard to pesticides, I assume that it might be costly and not efficient relative to its price as it shows negative impacts on farm revenue.

Table 21. Regression estimates of the effects of payment systems on farm revenue[1, 2]

| Variable | Model 1: farm revenue (OLS)[3] | Model 2: farm revenue, endogenous mixed system (ML)[4] |
|---|---|---|
| Output equation | | |
| log farm size (ha) | 0.555*** (< 0.001) | 0.499*** (< 0.001) |
| log pesticide cost (USD) | -0.046* (0.097) | -0.027 (0.333) |
| log fertilizer (tons) | 0.442*** (< 0.001) | 0.398*** (< 0.001) |
| log fuel (tons) | -0.009 (0.706) | -0.007 (0.880) |
| mixed bonus system (1/0) | 0.083* (0.088) | 0.823*** (< 0.001) |
| pure piece rate system (1/0) | -0.030 (0.610) | -0.028 (0.599) |
| hired labour FTE[5] | 0.001 (0.960) | 0.003 (0.235) |
| family labour FTE | 0.030** (0.025) | 0.025** (0.027) |
| secondary crop (1/0) | 0.086* (0.079) | 0.081* (0.057) |
| Payarik district | 0.189*** (0.002) | 0.205*** (< 0.001) |
| Pastdargom district | 0.091 (0.164) | 0.122** (0.047) |
| Mixed bonus system | | |
| age of farmer (years) | - | 0.001 (0.761) |
| distance to farmland (km) | - | 0.022*** (< 0.001) |
| plot numbers (counts) | - | 0.049*** (0.003) |
| Prob > F | < 0.001 | < 0.001 |
| $R^2$ | 0.79 | - |
| N | 431 | 431 |

[1] Dependent variables are log farm revenue (USD).

[2] *P*-values in the parentheses.

[3] OLS =ordinary least squares.

[4] ML=Maximum likelihood.

[5] FTE=Full time equivalent.

In Model 2, I estimated the equations 3 and 4 jointly. The dependent variables are farm revenue in log form and mixed bonus system (dummy). As you can see, I achieve almost the same results with the model 1. However, the strength of the effects is greater. The mixed bonus system shows the strong statistical significant effect on farm revenue. Likewise, the strength of the effect of mixed bonus system is also higher than piece rate system. Moreover, the plot numbers and distance between the farmland and the farmer's house also show the significant impact on the choice of mixed bonus system by the farms.

In addition, I extended our subsequent analysis to the farm profit as well. As you can see from Models 3 below, the impact of the mixed bonus system on the farm profit is even stronger compared to farm revenue (Model 1). In this sense, I find the statistical significant effect of the mixed bonus system on the farm profit (Table 22). It is similar with farm revenue model that the strength of the effect of mixed bonus system is higher than piece rate system.

Table 22. Regression estimates of the effects of payment systems on farm profit[1, 2]

| **Variable** | **Model 3: farm profit (OLS)[3]** | **Model 4: farm profit, endogenous mixed system (ML)[4]** |
|---|---|---|
| Output equation | | |
| log farm size (ha) | 0.678*** (< 0.001) | 0.590*** (< 0.001) |
| log pesticide cost (USD) | -0.197*** (< 0.001) | -0.190*** (0.003) |
| log fertilizer (tons) | 0.437*** (< 0.001) | 0.432*** (0.001) |
| log fuel (tons) | 0.030 (0.586) | 0.001 (0.044) |
| mixed bonus system (1/0) | 0.234** (0.018) | 1.156*** (< 0.001) |
| pure piece rate system (1/0) | 0.020 (0.860) | -0.001 (0.993) |
| hired labour FTE[5] | 0.001 (0.757) | 0.002 (0.549) |
| family labour FTE | 0.053** (0.047) | 0.050* (0.064) |
| secondary crop (1/0) | 0.045 (0.644) | 0.045 (0.646) |
| Payarik district | 0.204* (0.099) | 0.236** (0.038) |
| Pastdargom district | 0.046 (0.726) | 0.073 (0.559) |
| Mixed bonus system | | |
| age of farmer (years) | - | -0.004 (0.388) |
| distance to farmland (km) | - | 0.028*** ( 0.002) |
| plot numbers (counts) | - | 0.058*** (0.006) |
| Prob > F | < 0.001 | < 0.001 |
| $R^2$ | 0.54 | - |
| N | 416 | 416 |

[1] Dependent variables are log farm profit (USD). I first extract material and labour costs from the farm revenue, and drop farm profit with negative values.

[2] *P*-values in the parentheses.

[3] OLS = ordinary least squares.

[4] ML=Maximum likelihood.

[5] FTE=Full time equivalent.

Other variables shows the similar effects with earlier models, for example family labour. However, here I do not observe the effect of secondary cropping on farm profit statistically. The determinants of mixed bonus system, which are the plot numbers and distance between the farmland and the farmer’s house, show statistical effects.

# 5. Discussion

The chapter aims at synthesizing and discussing the research results of the dissertation. In subchapter 5.1 I provide a discussion on the findings of the cotton clusters focusing on the theoretical and empirical analysis. The subchapter 5.2 discusses findings of the labour incentives, connects with conceptual explanations.

## 5.1 Overview of major findings of the cluster study

### 5.1.1 The establishment of clusters

This empirical study from the cotton sector of Uzbekistan contributes to the discussion of top-down vs bottom-up dichotomy in policy designs. One of the disadvantages of a top-down approach is the exclusion of various actors from the decision-making. Zorya and Babaev (2020) are concerned about the lack of transparency for the farmers during organization of clusters. International observers and researchers suggest a bottom-up approach in policy designs that means involving a wide array of stakeholders, which are key to make the policy successful.

Petrick (2021) who discusses the agricultural reforms of post-soviet countries, which followed various restructuring paths (smallholders, individual farms, corporate farms, agro-holdings etc.), brings attention to the importance of the flexibility and transparency of farm consolidation process. Under the current design of the cluster system, farmers may not endeavour to increase productivity or efficiency, and respectively clusters do not provide farmers any incentives owing to the absence of competition. The clustering experience of neighbouring Kazakhstan shows that regulation over the heads of local stakeholders can fail (Petrick et al. 2017). Glăvan (2008) also clearly highlights that cluster formation enhances the productivity only if it evolves naturally from the voluntary engagements of producers.

### 5.1.2 The cotton value chain development

I draw on the work of Rodrik (2009) to investigate the attributes of industrial policy: embeddedness, carrot and sticks, and accountability in case of cotton clusters. Along with that, I also refer to the points underlined by Andreoni & Chang (2019). By doing so, I provide analytical discussion of the cotton sector, thus integrating the views of Rodrik (2009) and Andreoni & Chang (2019).

Embeddedness and strategic coordination

The empirical data documents a shift of responsibilities of stakeholders after the establishment of clusters. As mentioned, the SJSC Uzpahtasanoat and JSC Uzagrokimyohimoya lost their dominant roles in the cotton sector in recent years while Uztextileassociation integrated into the cotton sector as a representative of clusters. The cotton-textile clusters association, which was founded recently, does not play a significant role yet. The Ministry of Agriculture continues its crop allocation policy and cotton seed supply. The role of the Council of Farmers is negligible and does not represent the interests of farmers. The main responsibility shift concerns the activity of provincial khokimiyats. For example, before they mobilized the labour force for the cotton harvest.

However, after the cluster reform, the clusters gradually became responsible for organizing the cotton harvest. On the positive side, child and forced labour in the cotton sector decreased in the course of cluster implementation and cluster managers show their interest to further develop the mechanization of the cotton harvest. Our findings are consistent with ILO (2020) that mentions 'systematic child labour is no longer used during the cotton harvest in Uzbekistan. Schoolchildren and students were not mobilized for cotton picking`.

It should be emphasized that the Council of Farmers and the cotton-textile clusters association are important to create an arena in which farmers, state and clusters cooperate regularly. They may identify where the potential bottlenecks are, design measures, and learn from the mistakes. One potential example of bottlenecks would be an agreement between the cluster and farmers on cotton delivery. Which responsibilities and rights do they have? Do they work in practice? This also describes strategic coordination through institutions mentioned by Andreoni & Chang (2019). Then, clusterization may mitigate the information asymmetry among farmers, clusters and other actors and create a sustainable atmosphere.

Carrot and sticks

After the reform, the cluster emerged between the state and farmers in financing cotton production. Giving clusters subsidized credits is a manifestation of incentives to promote investments in non-traditional areas (the carrots). The input market liberalization could be another example of the 'carrot' which is also a sort of incentive or support for clusters. The clusters now decide autonomously which inputs, such as fertilizers and crop protection, to purchase and from where. In this sense, the role of state agencies in providing those inputs decreased.

The resolution of Cabinet of Ministers of Uzbekistan No 397 from June 22, 2020 outlines the evaluation criteria for the clusters. Based on that, governmental agencies including the Ministry of Agriculture monitor the cluster activity. If the clusters fail to fulfil the criteria, then the government stops cluster's activity. Therefore, non-performing clusters could be eliminated in the future. However, the authorities did not spell out in detail yet how the evaluation process is supposed to work. For example, it is unclear whether and how clusters stop the activity, a "stick" mechanism. However, the new resolution of Cabinet of Ministers of Uzbekistan No 733 from December 4, 2021 highlights the discontinuation of evaluation practices which was supposed in previous resolution. Instead, the new resolution mentions the agreement among the Ministry of Agriculture, provincial khokimiyats, clusters' association and cluster owners. According to the agreement, cluster owners take responsibilities for capital investment, job creation, and exports. In the meantime, the activity of clusters are monitored by the Ministry of Agriculture, provincial khokimiyats, clusters' association at least once a year.

Accountability and considerations of various stakeholders

*As* Zorya and Babaev (2020) mention, the implementation process of clusters lacked transparency and accountability to the farmers. Since clusters were established through a top down approach, the competitive public tenders and transparency failed to happen.

An important step refers to the identification of clusters before their establishment. Authorities should make transparent who the owners of the cluster are, whether they are local or foreign investors, when operations started, where contact details can be found, how many workers are hired, etc. Synovitz and Ashur (2019) criticize the lack of accountability of clusters to farmers by pointing out that cotton farmers even could not find an office building or the address of the corresponding cluster organization. This was a clear example of the accountability attribute, mentioned by Rodrik (2009). Also, Andreoni & Chang (2019) highlight the importance of the considerations of interests. However, this lacked in the industrial policy reform in the cotton sector of Uzbekistan. Next, if I look at price setting, following Andreoni & Chang (2019), an explicit inclusion of farmers in price setting diminishes the conflict of interests between farmers and clusters. This may lead to the increase in the role and bargaining power of farmers. The reform does not consider farmers to be involved in price setting. Most likely, clusters just provide the state announced price as I observed in the cases. In this sense, the bargaining power of farmers in negotiating the price remains questionable.

Structural interdependencies

The analyses on marketing channels provide us with two scenarios. On the one hand, farmers lack selling options, on the other hand, there is an increasing role of clusters in processing. Before, the upstream of value chain was limited by misconnection between cotton inputs and producing textile products, However, after the reform, the export of textile goods has expanded, which means clusters received advantage from the state reform by having guaranteed raw cotton input. Even though, the upstream processing of the raw cotton including all stages including sale as an end product are still lacking in our case clusters. Only yarn plays a major role in the exports of textile products. This shows not everything changes at the same speed and time as argued by Andreoni & Chang (2019).

Moreover, Uzbekistan mostly maintains the traditional model of state funding due to its still unreformed banking sector. ILO (2019) highlights the insufficient liquidity of commercial banks to supply farmers with credit sources. Also, collateral requirements and high interest rates make farmers restricted to easy access of financial sources. In this sense, the development of the financing sector is still much lacking. This is an example of what Andreoni & Chang (2019) described 'one sector development is limited by another one'. Therefore, Andreoni & Chang (2019) bring attention to the whole package of measures in industrial policy.

Institutional development and policy alignment

The governance approach in Uzbekistan, highlighted by Amirova et al. (2019), refers to the style ‚paternalistic and dogmatic'. The cotton reform only encompasses the resolutions from central government and local implementations, but not all aspects between them. The various resolutions express that the government still lacks concrete and clear development pathways for cotton clusters. Our analysis shows that the land ownership risk and lack of crop choice (i.e. property rights issues) are still the pain points in cotton production. The cluster reform does not affect the crop allocation regime of the government and there exist the risk and uncertainty of the farm activity in future.

Niyazmetov et al. (2021) also find out that the farmers are skeptical to the reforms in agriculture in Uzbekistan.

As I have observed from the empirical case studies, the cluster model is an unconventional approach to agriculture. It requires some time for farmers, cluster owners and other agricultural actors to cognize the elements of the cluster concept. However, the government establishes clusters without considering the readiness and interests of these actors. For instance, during the years 2018-2020, around hundred cluster organizations started their business, covering 87.7% of the cotton land (Uzts.uz 2020). Lasslett (2020) emphasizes the potential risk for transparency and governance due to rapid reforms in the cotton sector. Asfaw (2021) also criticizes the speed of cotton cluster establishment. In that sense, industrial policy of Uzbekistan with regard to cotton clusters lacks institutional development and measures on policy alignment over time.

Further aspects

As I provided in Table 1, land property right in Uzbekistan is very unsecure, and the Uzbek farms have only the use rights of the land resources practically and theoretically. Other rights, such as transfer of use right, individual ownership right, and transfer of the individual ownership right are not permitted, which makes agriculture led by the state. In this regard, Uzbekistan is at the bottom among post-soviet central Asian countries. Swinnen and Rozelle (2006). Following Williamson (1996, p 4), the restriction on the land use is one of the institutions of the state in running agriculture.

Even though, I do not provide empirical analysis on transaction costs, they are supposed to be high in Uzbekistan, where non perfect market in agriculture prevails. At least, as I described in land relations. I attempt here to connect transaction costs with the cluster analysis. Ellis (1993) provides that the more market develops liberally, the less transaction costs exist. In this sense, cluster policy does not reduce the transaction costs since they increase the control rather than enabling liberal environment. As Lipton (2009, p. 124) describes some forms of farming reform, the cotton clusters represent the elements of "big private farms" which means certain people command the farmlands and provide inputs as well. Moreover, it took the "consolidation" approach for land reforms in the framework of cotton clusters. This contradicts with idea of downsizing farms which are more efficient than large ones.

One interesting point regarding the principle - agent model appears in the cotton context. The cluster policy reform has created the working environment in which cotton cluster owners act as principle and farms acts as workers. One cluster has more than hundred farms, for example. The input supply is by the clusters, and they also monitor farms from to time. Even though, my study does not cover this aspect, it is interesting to investigate how they work and address principle-agent problems.

## 5.2 Overview of major findings of the labour incentives study

According to Bowles (1985), since labour input is embodied in people, it is different from other inputs in production process. There is a social relationship between the farmer and the worker. In this sense, analysing the settings, farm production environment and the myriad other factors play an important role in addition to regression analysis.

Likewise, Helper (2000) highlights in her work titled "Economists and field research: you can observe a lot just by watching" the importance of field visits and observations, which often lack in research by economists. Importantly she refers to two remarkable research findings. The first one is about a move from time-rate to piece-rate payment systems in auto-glass production, and in the end, the owner of the firm achieved higher profit. The findings of the second research show a change from piece-rate to time-rate payment system at shoe manufacturing. In this case, the shoe-manufacturing firm earned higher profit. Indeed, time-rate system at shoe manufacturing facilitated the reduction of inventories and the increase of the time spending on new products by introducing modern production process. In this sense, it is far essential to analyse not only regression analysis but also insights of production and settings existed in learning payment systems. In our example, I explored that uzbek farms employ mixed bonus system to incentivise workers. They cannot monitor workers due to large size and monitoring requires financial investment as well, which might be a challenge for the farmers who are uncertain about future of farming. In this sense, time rate system is not dominant one.

In this study, I disclosed the different payment systems as management technique and its impact on the farm profitability in Uzbekistan. With regard to management as an input factor, the findings of this study are in line with Bloom et al. (2013), who investigate the impacts of the management practices on the firm productivity. In addition, the findings are consistent with the explanations by Romasset and Lee (2007), who highlight the importance of designing and shaping labour contracts that include incentives which in the end increase the labour productivity and farm performance.

As I explained evolution of labour contracts in conceptual farming, the case in Uzbekistan represents Phase II to certain extent (see Figure 3). In cotton farms, hired labour exists and are more prevalent. The people are hired on a mainly wage basis (time rate payments). Also, task allocation is not in the agenda as an important factor, and all hired labour is assumed to have the same skills. As specialization grows more, labour contract based on the undifferentiated wage is expected to decline.

Eswaran and Kotwal (1985b) postulate that farms hire permanent workers for the certain tasks, which is easily either non-monitorable or not supervised. If tasks allow to monitor the performance of workers, seasonal workers are usually hired, for example harvesting time. If this was a case, farms may not evade labour shirking and low effort by workers without incentivising the permanent workers. Empirically, I have seen in the analyses how farmers face the issue and how they deal with it. Uzbek farms own large areas, which makes daunting to monitor the performance of workers. For instance, a farmer may have around 100 ha of land, which constitute of several plots. In this sense, monitoring workers is physically and financially demanding, and farmers cannot monitor all of the workers as they are distributed to fulfil different tasks. Some workers are responsible for water management, some are for mechanization, and some are for bringing fertilizers and such. Therefore, farmers provide bonuses or incentives to workers in addition to payments to avoid labour shirking. Based on the available resources, farmers choose bonuses (incentives), for example crop harvest or plots. Indeed, wheat harvest and plot area are much prevalent, practiced in Uzbekistan as an incentive to workers. Sarap (1991) also explores in India that pieces of land are allocated to the permanent workers of the farm as incentives.

The findings of the study are consistent with Key and Runsten (1999), who mention that family labourers do not require monitoring and supervision, because they are residual claimants that obtain the total product of their labour. The researchers also postulate that optimal scale of land in terms of supervision and monitoring is that land, which is cultivated by family labour. In case of Bangladesh, Chowdhury (2016) finds that family labour is more productive than hired labour in farm production. Roumasset and Lee (2007) find that family labour addresses the issues, such as fulfilment of tasks with low quality and effort shirking, which farmers encounter in the paradigm of hired labour. As I found, the strength of the effect of family labour on productivity is higher than the hired labour. This can be justified by the fact that it does not require any monitoring or supervision costs since the family members are the residual claimants in the production.

# 6. Conclusion

## 6.1 Establishment of clusters

The empirical analysis of the study shows the striking differences between the definitions of the cluster in the economic literature (even if it is ambiguous itself) on the one hand and the implementation in Uzbekistan on the other. The main difference is about the cluster participants. The cluster definition in the literature refers to a group of independent economic actors in a particular location, while for the Government of Uzbekistan, a cluster is a single company from the textile industry (Figure 23). Theoretically, the boundaries of clusters may cross administrative borders, but our case clusters are just based on territories of districts and sub districts. The clusters are the privatised successors of the former semi-state ginneries in their existing locations.

Overall, the involvement of the private sector in cotton production has increased in the recent reforms and our case studies show that the state has partially withdrawn from cotton production and processing, e.g. in input provision. However, the recent cotton reform has by far not eliminated state control over cotton production completely. Rather than providing farmers with a liberalized environment, the state passed on several responsibilities to the newly established 'cluster' organizations. Clusters received control over the subsidized credit sources and the input allocation in cotton production, which may entail some efficiency improvements compared to the state administration. The state still continues its policy of crop placement, implying that farmers don't have a choice whether to grow cotton or not.

Although the government has increased the farm-gate price recently, clusters don't pass on international market prices to farmers. The current design of cotton clusters exhibits a monopsony condition in which farmers have to sell their products to the single predefined cluster organization. Our cases confirm a tendency also observed in the grey literature that forced and child labour receded in the cotton sector. The government does not attract people from state organizations to the cotton harvesting any more. In turn, clusters and farmers start or at least support using cotton harvesting combines and agronomic expertise more broadly. I conclude that from the farmers' perspective, recent reform steps led to moderate changes at best, while clusters started to play a dominant role in the cotton sector.

In addition, the empirical findings represent that the establishment of clusters among farmers widely lacked transparency. The government should support the clusters that emerge evolutionally because of the initiatives and interactions of actors: farmers, processors, suppliers, and agencies. Based on the insights of the industrial policy literature, the Uzbek government should implement strategies that allow farmers' voice to be heard. Rather than establishing clusters in larger scales, an institutional environment that enables bottom-up initiatives should be promoted. As part of such an institutional environment, I suggest that the cluster reform should address several emerging questions in the cotton sector. For instance, are farmers as main cotton grower ready to work with clusters? Do legal frameworks to organize clusters exist? Which norms, rules and procedures function in practice? Who decides what?

The FAO (2018) recommendations provide hints for developing such an enabling environment for contract farming. These include (i) improving farmers' technical and contractual capacity, (ii) addressing power imbalances and unfair practices, and (iii) increasing certainty through dispute resolution mechanisms under cluster policy. They should be taken seriously in future reforms of the cotton value chain.

Following Rodrik (2009), a cluster policy should combine attributes of embeddedness, carrot and sticks and accountability as discussed before. First, the government should promote a regular cooperation among the state agencies, farmers, and clusters, to make the cluster policy more effective. In turn, the Council of Farmers and the cotton-textile clusters association should act as bridge in the implementation process of clusters. Second, the government should monitor how the improved incentives from input market liberalization, or the credit subsides that clusters receive, translate into an enhanced performance of clusters, e.g. by creating new jobs or increasing export revenue. Finally, the government should promote an atmosphere of accountability that motivates farmers. Establishing clusters through a systematic tender system would allow farmers, other cotton stakeholders, and the public at large to better judge the benefits of this reform.

Lerman et al. (2004, p 108) mention that small scale individual or family farms are the prevailing types of organizational structures in agriculture within market economies. This was also supported in the overview of agriculture in this dissertation, where dekhkan farms (households) provide more productivity than other larger forms of agricultural production (see Figure 19). Moreover, Lerman and Sedik (2018) hold the view that the small-scale farms perform better than the large enterprises. However, as I have described the cluster policy was carried out along with the farm consolidations, which make the farms even bigger.

## 6.2 Labour incentives for workers in agriculture

Lerman et al. (2004, p. 47) highlight that labour behaviour contributes agricultural inefficiency in certain conditions. First, large scale farms find difficult to monitor the behaviour of individual workers. Without it, enforcement of effort is also impossible though basic persuasion. Moreover, introducing the equal remuneration collapse the relationship between the effort workers provide and what they receive. At least these two factors led agriculture in Soviet time unproductive, which should be lesson for today's reforms.

In this part of the study, I have presented the various payment systems in post-soviet setting, Uzbekistan, basically, fixed rate, piece rate and mixed bonus system. I also explored what these payment systems refer in case of Uzbekistan. For example, mixed bonus system comprises cash and harvest, plot allocations to the workers. Generally, based on wheat harvest, workers receive wheat and straws for their animals. In this sense, the total harvest influences the amount of wheat allocation per worker as a means of incentives.

The findings investigated indicate that uzbek large scale farms employ more permanent workers and provide more bonuses. Because monitoring and supervision are physically and financially challenging. Moreover, I postulate the magnitude of payment in agriculture has a great meaning in explaining labour contracts. As discussed above, labour payment in Uzbekistan is low and workers require additional bonuses to survive due to a cheap labour market. In this sense, farms provide extra incentives based on available resources (harvest sharing or plot for secondary cropping etc.) to keep permanent workers and avoid labour shirking.

In addition, the findings are consistent with Petrick (2017), who presents the effects of payment systems in the case of North Kazakhstan, where exist large farm enterprises. This is similar with Uzbekistan case, where the farms size is large and hires more permanent workers. Our research findings show that various payment systems play a role in farm performance, as the mixed bonus system shows a positive statistically significant impact on farm revenue and profit. In this sense, I accept the hypothesis which state incentivised workers provide more effort and farm output increases generally.

Finally, I infer that the analysis is limited in that I do not consider non-monetary incentives to workers broadly. The econometric model I used includes only harvest or plot sharing aspects in addition to cash. Indeed, there might or might not be other sorts of non-monetary incentives in practice. Thus, further research calls into question the role or existence of non-pecuniary incentives in farm production in Uzbekistan more largely. This provides the research on the labour arrangements with more holistic analyses and embellishments.

Overall, the implications of our findings on clusters and labour incentives contribute to the overarching question (how to arrange agriculture). This study provides microanalysis of land and labour factors in agriculture which are fundamental to the agricultural restructuring. Without focusing on them, successful agricultural restructuring is questionable. Namely, formal privatisation and definitions without actual meaning do not necessarily bring the changes on the ground. A performance of farm operations does not tend to be positive unless agricultural restructuring represents actual liberalisation. First, true restructuring and reforms require farmers to be involved and them to perceive the meaning of the reforms. Because they are true implementers of the policies on the ground.

Labour environment in the agriculture is different from other sectors due to its seasonality, the task nature and monitoring difficulties. In this sense, farmers use various payment methods to overcome incentivising issues. The current labour contracts in Uzbekistan show the situation (evolution phase) where tasks are not different based on skills (undifferentiated wage contracts in Figure 3). Uzbek farms operate based on more hired workers than family labour and thus attempt to provide incentives. From my point of view, land reforms influence labour arrangements in the framework of agricultural restructuring that means labour contracts can be designed and shaped based on farm size, ownership issues, permission of subleasing of land etc.

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# 9. Appendix

Table A 1. List of interview partners

| No | Interview partners |
|---|---|
| I1 | Deputy Manager (Bo’ston cluster) |
| I2 | Farmer (Bo’ston cluster) |
| I3 | Specialist of local administration (Bo’ston cluster) |
| I4 | Manager (Baht textile cluster) |
| I5 | Specialist (Baht textile cluster) |
| I6 | Specialist of local administration (Baht textile cluster) |
| I7 | Specialist (Sangzor textile cluster) |
| I8 | Farmer (Sangzor textile cluster) |
| I9 | MTP head (Sangzor textile cluster) |
| I10 | Specialist (Indorama cluster) |
| I11 | Specialist of local administration (Indorama cluster) |
| I12 | Farmer working in old system |
| I13 | Specialist (Council of Farmers) |
| I14 | World Bank expert in Tashkent |
| I15 | Researcher from Tashkent State Agrarian University |
| I16 | FAO expert in Tashkent |
| I17 | Specialist of Ministry of Agriculture |
| I18 | Specialist of State Support Fund of Agriculture |
| I19 | Specialist of cotton-textile clusters association of Uzbekistan |
| I20 | Specialist of Ministry of Agriculture |

Source: author.

Table A 2. Major policy events on cotton clusters in Uzbekistan

| No | Policy event | Main objective |
|---|---|---|
| 1 | Resolution of Cabinet Ministers No 53 from 25.01.2018 | Create 13 cotton clusters |
| 2 | Presidential Decree No 3574 from 28.02.2018 | Payment for harvest till the end of each year |
| 3 | Resolution of Cabinet Ministers No 253 from 31.03.2018 | Transferring (selling) gins to clusters |
| 4 | Resolution of Cabinet Ministers No 744 from 19.09.2018 | Create 44 new cotton clusters in 2019 |
| 5 | Resolution of Cabinet Ministers No 230 from 18.03.2019 | Create 17 new cotton clusters |
| 6 | Resolution of Cabinet Ministers No 914 from 18.11.2019 | Create 14 new cotton clusters in 2020 |
| 7 | Resolution of Cabinet Ministers No 397 from 22.06.2020 | Create cluster association and evaluate clusters |
| 8 | Presidential Resolution No 5009 from 26.02. 2021 | Up to three clusters can operate in one district |
| 9 | Presidential Decree No 14 from 16.11. 2021 | Create a commission for the establishment and support of clusters |
| 10 | Resolution of Cabinet Ministers No 733 from 04.12.2021 | Rules for establishment of clusters and agreement with clusters |

Source: author based on www.lex.uz.

Table A 3. Grey literature on cotton reforms in Uzbekistan after 2018

| No | Authors | Year | Publication type | Data sources | Objectives | Sources |
|---|---|---|---|---|---|---|
| 1 | ILO | 2019 | Donor report | Visits to seven clusters, qualitative analysis | Rapid assessment of current cluster performance, recommendations for further reforms in the cotton sector | https://www.ilo.org/ipec/Informationresources/WCMS_681372/lang--en/index.htm |
| 2 | Synovitz and Ashur | 2019 | News report | Interviews with farmers, researchers and regional officials | Raise awareness for the situation of farmers and negative impacts of current clusters | https://www.rferl.org/a/uzbek-farmers-get-cluster-bombed-by-reforms/30328781.html |
| 3 | Yusupov | 2019 | News article | Official governmental data, research discussion paper, and several project reports | Review of agriculture, key problems and the need for reforms | https://cabar.asia/en/the-agricultural-sector-of-uzbekistan-features-key-problems-the-need-for-reforms. |
| 4 | Asfaw | 2019 | Policy Brief | Interviews with stakeholders and data from official governmental resolutions | Review of cotton industry reforms and implications of textile cluster formation | http://cpro.wiut.uz/pb-2019-04 |
| 5 | Zorya and Babaev | 2020 | Donor report | Official governmental resolutions, stakeholder consultations, data from Uztextile association | Review the progress achieved by cotton-textile clusters, discussion of their current and future role | https://documents1.worldbank.org/curated/en/305731601271791257/pdf/Policy-Dialogue-on-Agriculture-Modernization-in-Uzbekistan-Cotton-Textile-Clusters-in-Uzbekistan-Status-and-Outlook.pdf |
| 6 | Srokina | 2020 | Consultation report | Interviews with relevant actors and field visits | Environmental and Social Impact Assessment (ESIA) for the cotton farming project of Indorama cluster | https://www.indorama-agro.com/ESIA-disclosure/FE%20INDORAMA%20AGRO%20LLC_Volume%20II_Final%20ESIA%20Report_Eng_16-Dec-2020.pdf |
| 7 | Lasslett | 2020 | Research Brief | Open legal data bases, various websites | Analyse risks of clusters using corporate integrity scorecard (green, amber, red) | https://pure.ulster.ac.uk/en/publications/out-of-the-cauldron-into-the-fire-risk-and-privatisation-of-uzbek |
| 8 | Schweisfurth | 2021 | News article | Official governmental resolutions, various websites (Telegram channel, YouTube etc.), Uzbek Forum for Human Rights and other sources | Investigate land-grabs by clusters and their effects on rural livelihoods | https://apparelinsider.com/land-grabs-the-new-red-flag-for-uzbek-cotton-sector/ |
| 9 | Cotton Campaign | 2021 | News article | Field visits during cotton harvest 2020, interviews | Labour use monitoring during cotton harvest 2020 | http://www.cottoncampaign.org/a-changing-landscape-in-uzbek-cotton-production.html |

Source: author.

Table A 4. The definition of the cluster term by various scholars

| Scholars | Definition |
|---|---|
| Crouch and Farell (2001) | 'The more general concept of "cluster" suggests something looser: a tendency for firms in similar types of business to locate close together, through without having a particularly important presence in area'. |
| Rosenfeld (1997) | 'A cluster is very simply used to represent concentrations of firms that are able to produce synergy because of their geographical proximity and interdependence, even though their scale of employment may not be pronounced or prominent ' |
| Feser (1998) | 'Economic clusters are not just related and supporting industries and institutions, but rather related and supporting institutions that are more competitive by virtue of their relationships' |
| Swann and Preveser (1996) | 'Clusters are here defined as groups of firms within one industry based in one geographical area' |
| Swann and Preveser (1998) | 'A cluster means a large group of firms in related industries at a particular location' |
| Simmie and Sennet (1999) | 'we define an innovative cluster as a large number of interconnected industrial and/or service companies having high degree of collaboration, typically through a supply chain, and operating under the same market conditions' |
| Roelandt and den Hertag (1999) | 'Clusters can be characterised as networks of producers of strongly interdependent firms linked each other in a value – adding production chain' |
| Van den Berg et al, (2001) | 'The popular term cluster is most closely related to this local or regional dimensions of networks… Most definitions share the notion of clusters are localised networks of specialised organisations, whose production processes are closely linked through the exchange of goods, services. and/or knowledge.' |
| Enright (1996) | 'A regional cluster is an industrial cluster in which member firms are in close proximity to each other' |
| Porter (1998) | 'geographic concentrations of interconnected companies and institutions in a particular field' |

Source: author.

Table A 5. History of economic analysis of industrial policy

| History | Influential contributors | Period | Debate themes |
|---|---|---|---|
| Phase I | Antonio Serra, Giovanni Botero, James Stewart, Alexander Hamilton | XVIII - XIX centuries | Infant industry |
| Phase II | Celsa Furtado, Arthur Lewis, Raul Prebisch, Hans Singer | Early 1920s-1960s | Inter-sectoral and structural issues |
| Phase III | Ira Magaziner, Thomas Hout, Philip Trezise | 1970s-early 2000s | Competition and cooperation in local context, Coordination and implementation process |
| Phase IV | Ricardo Hausmann, Dani Rodrik | Mid-2000s | Information externality |

Source: author, adopted from Andreoni & Chang (2019).

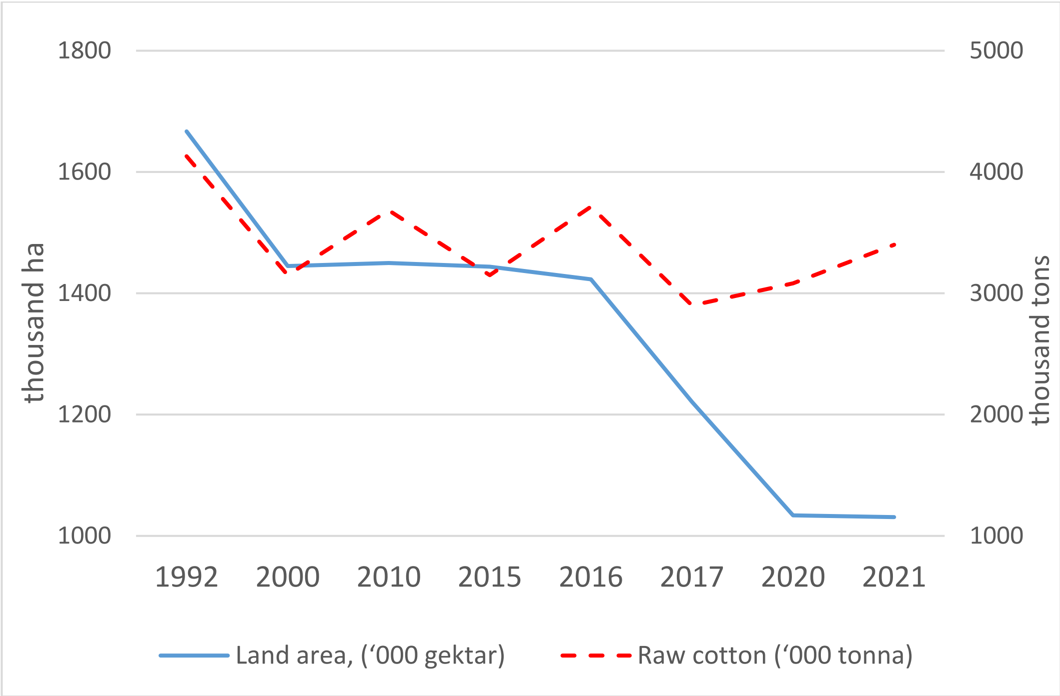



Figure A 1. The change in cotton production and cotton land allocation in Uzbekistan
Source: author based on Governmental resolutions & ILO report.

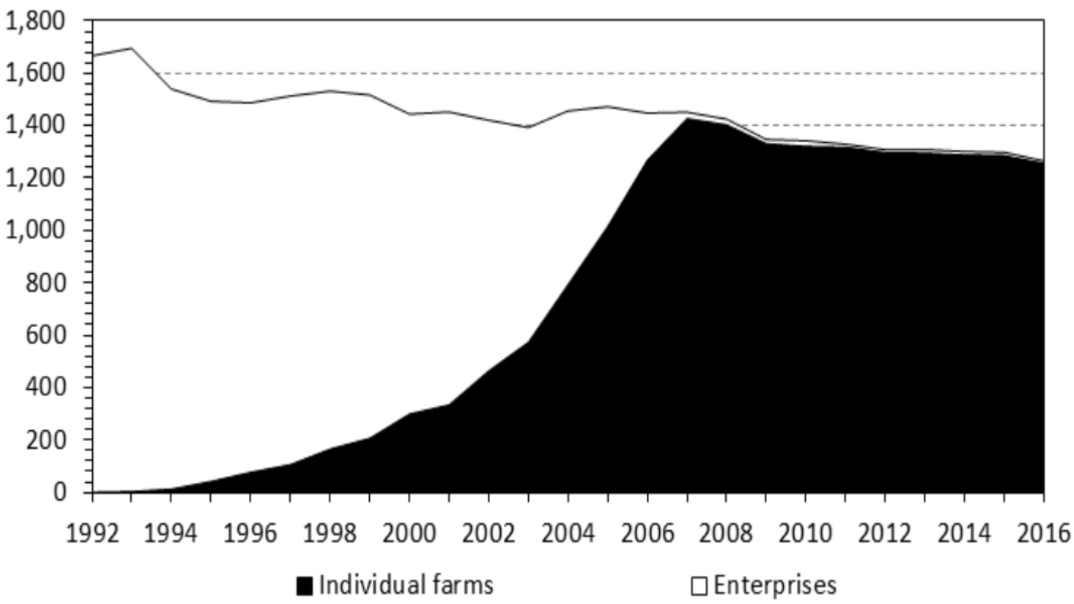



Figure A 2. Cotton sown area by producer category, thousand ha
Source: Zorya et al. (2019).

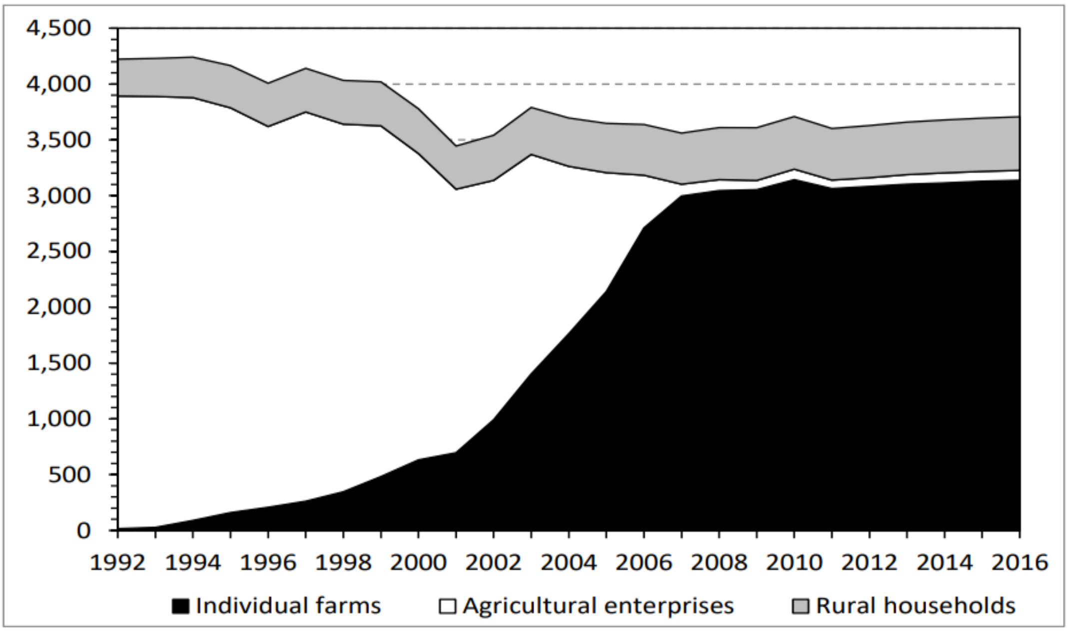



Figure A 3. Cotton sown area by producer category, thousand ha
Source: Zorya et al. (2019).

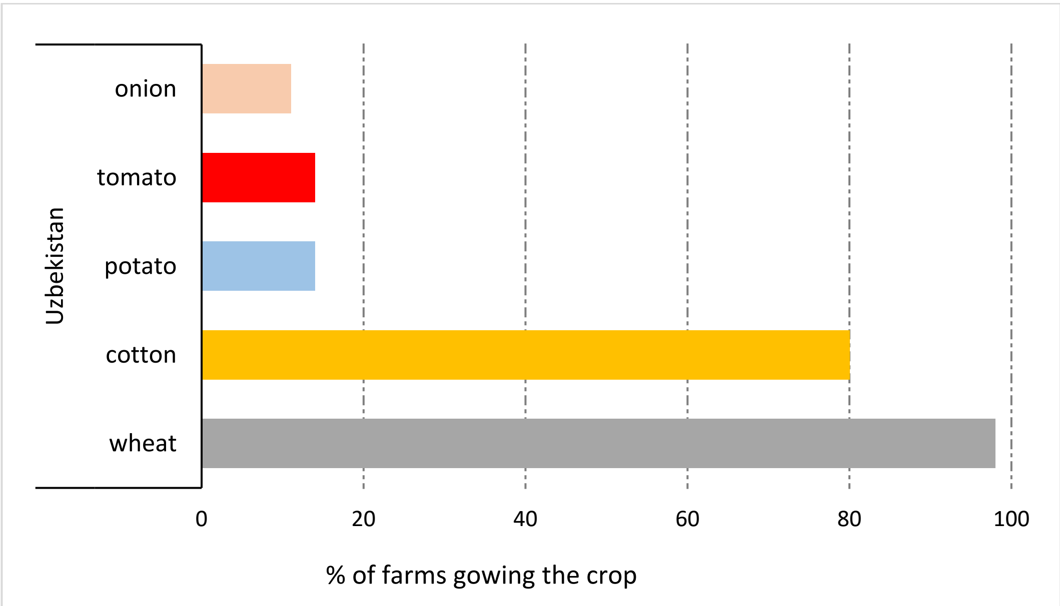



Figure A 4. The share of farms surveyed, which cultivate major crops
Source: author based on Agrichange II.

Table A 6. The survey question: I use it for grouping farms into different pay systems.
What is the main system that you practice for payments to your permanent workers involved in crop production? (If Practice = 1; If does not practice = 0)

| | Permanent workers |
|---|---|
| ***Fixed salary and in cash payments*** | |
| 1.1. Each month a fixed salary irrespective of the total harvest | |
| 1.2. Each month a fixed salary combined with extra bonus in cash proportional to the total harvest | |
| 1.3. Only payment in cash based on a provided field service irrespective of the total harvest | |
| ***Payment as part of harvest*** | |
| 2.1. Payment in cash mixed with part of a crop harvest based on a provided field service | |
| 2.2. Only part of earlier agreed quantity of harvest | |
| 2.3. Only part of harvest proportional to the total harvest | |
| 2.4. Extra bonus in part of harvest proportional to total harvest | |
| ***Payment as allocation of a plot of farmland to your farm workers*** | |
| 3.1. Only plot of farm land for cultivation | |
| 3.2. Plot of farm land for cultivation combined with payment in cash | |
| 3.3. Plot of farm land for cultivation combined with payment in part of harvest from other fields | |
| 3.4. Plot of farm land for cultivation combined with payment in cash and in part of harvest other fields | |

Table A 7. The survey question: I use it for revenue variable

In this Table, we will ask information about income produced by the four most important crop for your farm in 2018?

| **Indicator** | **Units** | | | | |
|---|---|---|---|---|---|
| Ranking | | Most important | 2nd important | 3rd important | 4th important |
| Crop name | | | | | |
| Total area | ha | | | | |
| Total harvest | ton | | | | |
| Yield | t/ha | | | | |
| Quantity sold last year (tons) | tons | | | | |
| Average sale price | UZS/kg | | | | |

Table A 8. The survey question: I use it to calculate total family and hired labour FTE

What was the structure of your labor force (including administrative staff) in the last 12 months?

| | Number of persons | From this, female workers | Total number of months | Total number of days |
|---|---|---|---|---|
| **Permanent** | | | | |
| 1. Members of household and relatives | | | | XXXX |
| 2. Hired workers (who are not household members and relatives) | | | | XXXX |
| **Seasonal** | | | | |
| 1. Members of household and relatives | | | XXXX | |
| 2. Hired workers (who are not household members and relatives) | | | XXXX | |

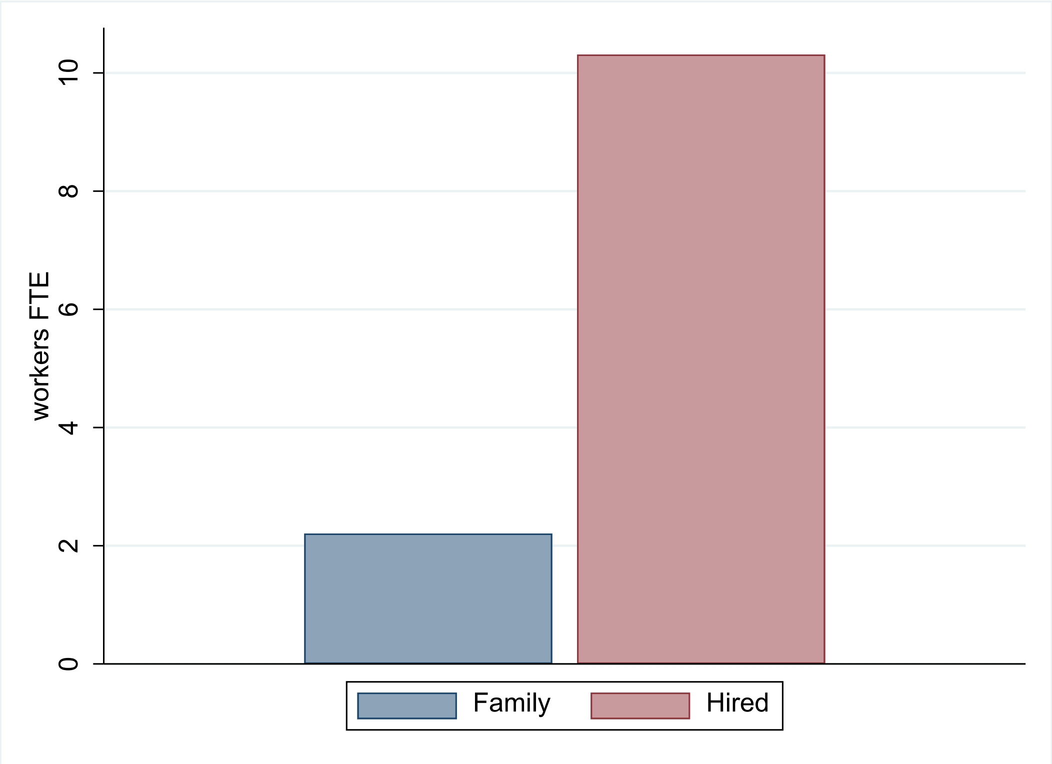



Figure A 5. The average labour force in farms and its components
Source: the author based on Agrichange II.

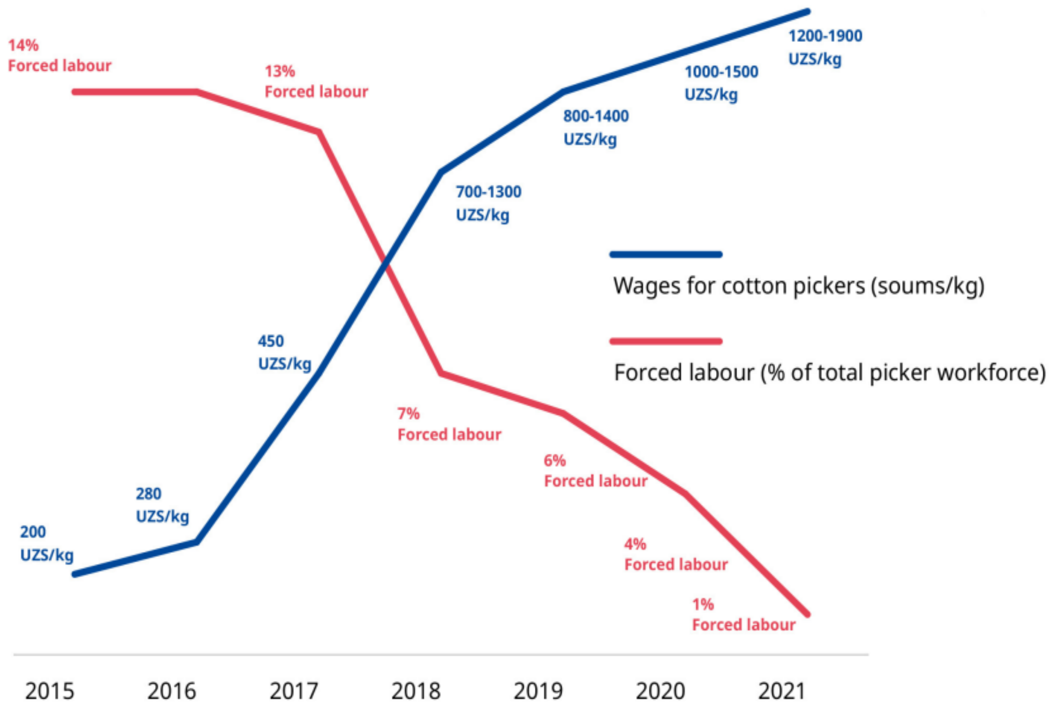
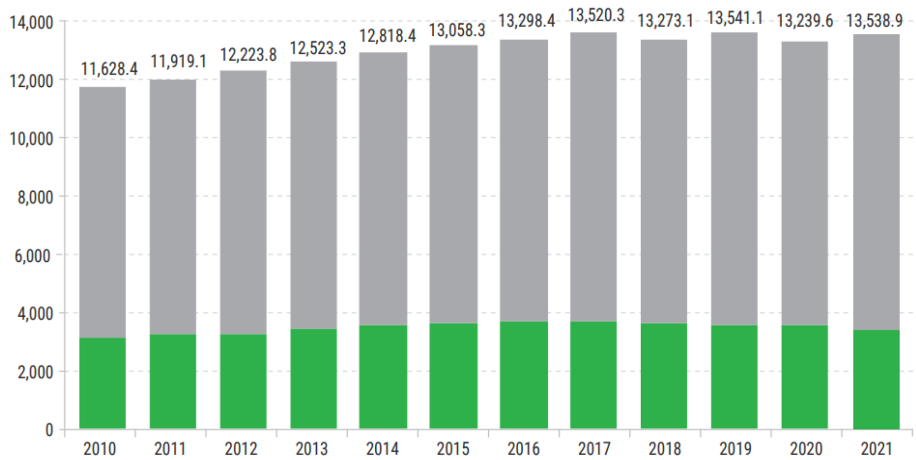
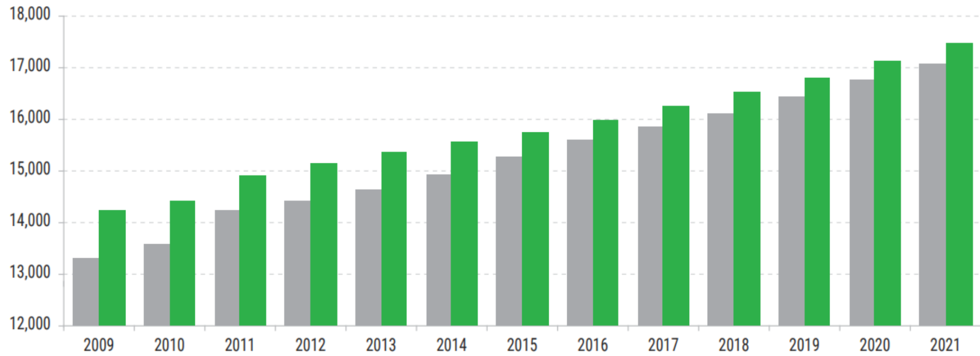



Figure A 6. Wages and forced labour percentages (2015-2021)
Source: ILO (2022).




| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Rest of economy | 8,510.3 | 8,689.7 | 8,972.1 | 9,121.2 | 9,289.5 | 9,456.6 | 9,651.7 | 9,878.9 | 9,700.1 | 9,996.5 | 9,679.6 | 10,036.8 |
| Agriculture, forestry and fisheries | 3,118.1 | 3,229.4 | 3,251.7 | 3,402.1 | 3,528.9 | 3,601.7 | 3,646.7 | 3,641.4 | 3,573.1 | 3,544.6 | 3,560.0 | 3,502.1 |

Figure A 7. Employment in agriculture, forestry and fishing, thousand people
Source: Shukurov et al. (2022).




| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Rural population | 13,297 | 13,576 | 14,226 | 14,412 | 14,623 | 14,938 | 15,275 | 15,611 | 15,870 | 16,124 | 16,449 | 16,761 | 17,049 |
| Urban population | 14,236 | 14,426 | 14,897 | 15,143 | 15,370 | 15,555 | 15,748 | 15,964 | 16,251 | 16,533 | 16,807 | 17,144 | 17,510 |

Figure A 8. Rural and urban population
Source: Shukurov et al. (2022).

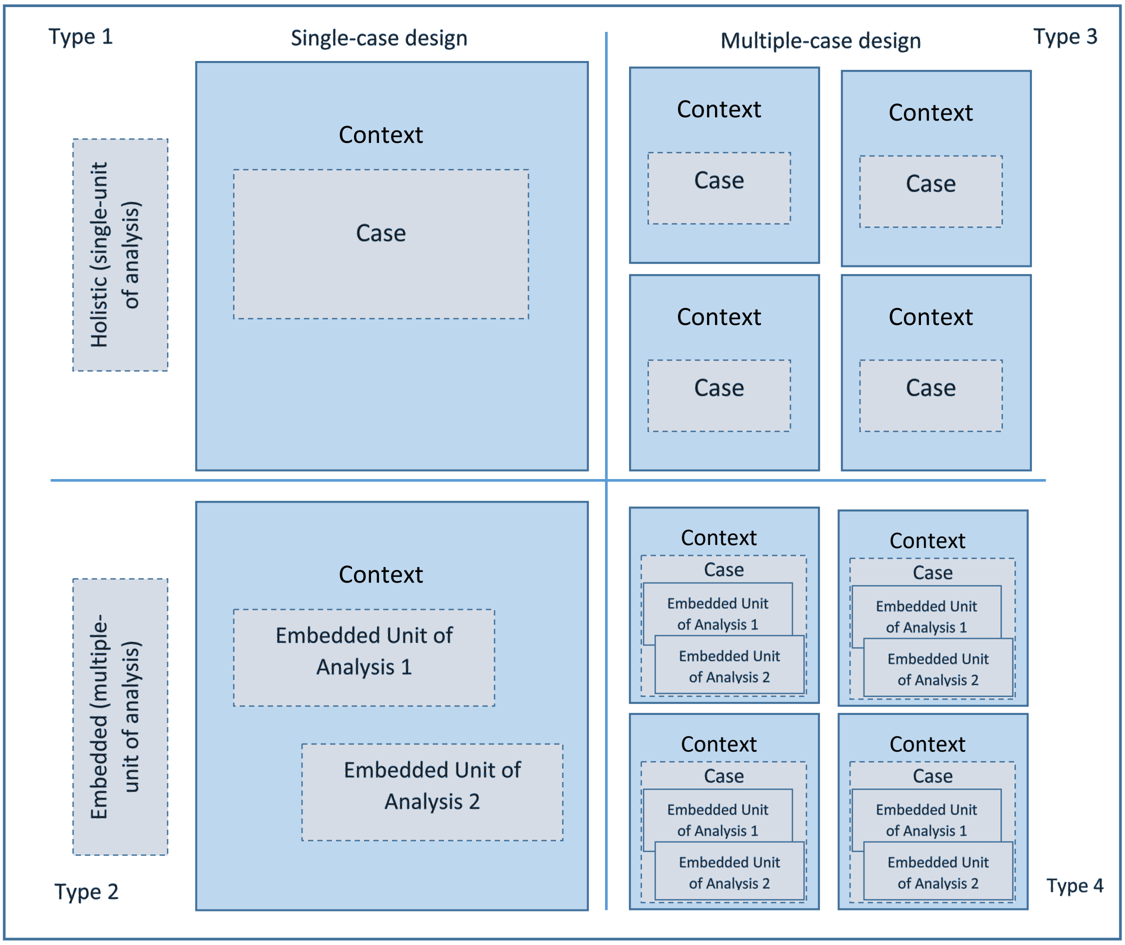



Figure A 9. Basic types of designs for case studies
Source: Yin (2014).

Table A 9. Comparison of the different settings

| Area | Centralised regime | Liberalisation |
|---|---|---|
| Production | Target volumes determined by the state | Allow free decision for producers |
| Prices | State controls the prices | Market determines the prices |
| Finances | State support | Hard budget constraints |
| Inputs, sales processing | State monopoly | Privatization, demonopolize |
| Ownership of resources | State, collective | Private |
| Farming structure | Large size, collective and state organizations | Downsize, Individualize |

Source: Lerman et al. (2004)

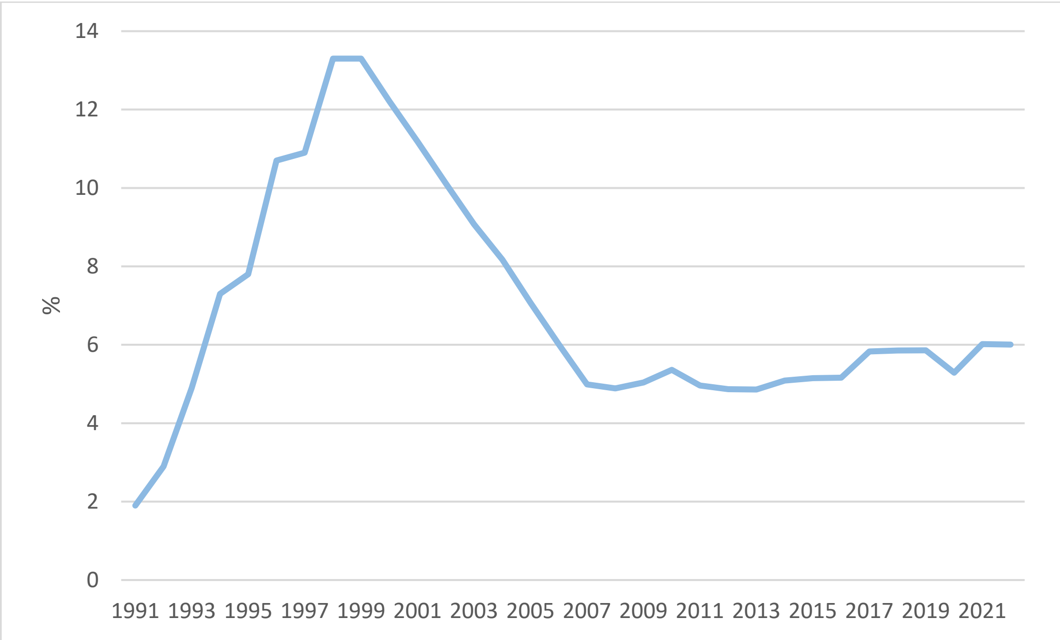



Figure A 10. Unemployment shares in total labour force in Uzbekistan

Source: www.data.worldbank.org

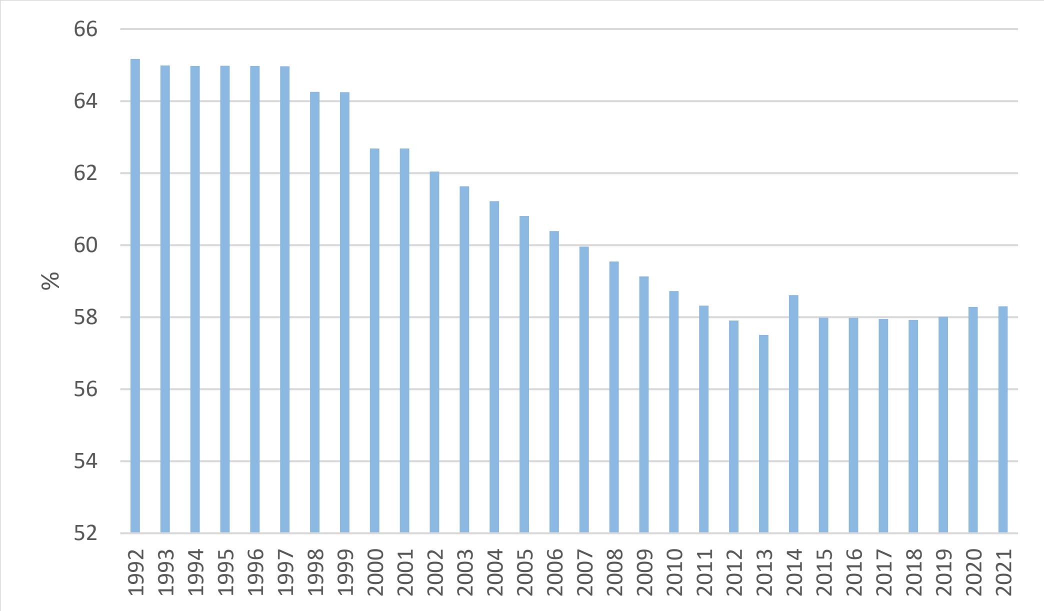



Figure A 11. Agricultural land (% of land area) in Uzbekistan over years

Source: [www.worldbank.org](http://www.worldbank.org)

Note: Agricultural land refers to the share of land area that is arable, under permanent crops, and under permanent pastures. Arable land includes land defined by the FAO as land under temporary crops (double-cropped areas are counted once), temporary meadows for mowing or for pasture, land under market or kitchen gardens, and land temporarily fallow. Land abandoned as a result of shifting cultivation is excluded. Land under permanent crops is land cultivated with crops that occupy the land for long periods and need not be replanted after each harvest, such as cocoa, coffee, and rubber. This category includes land under flowering shrubs, fruit trees, nut trees, and vines, but excludes land under trees grown for wood or timber. Permanent pasture is land used for five or more years for forage, including natural and cultivated crops.

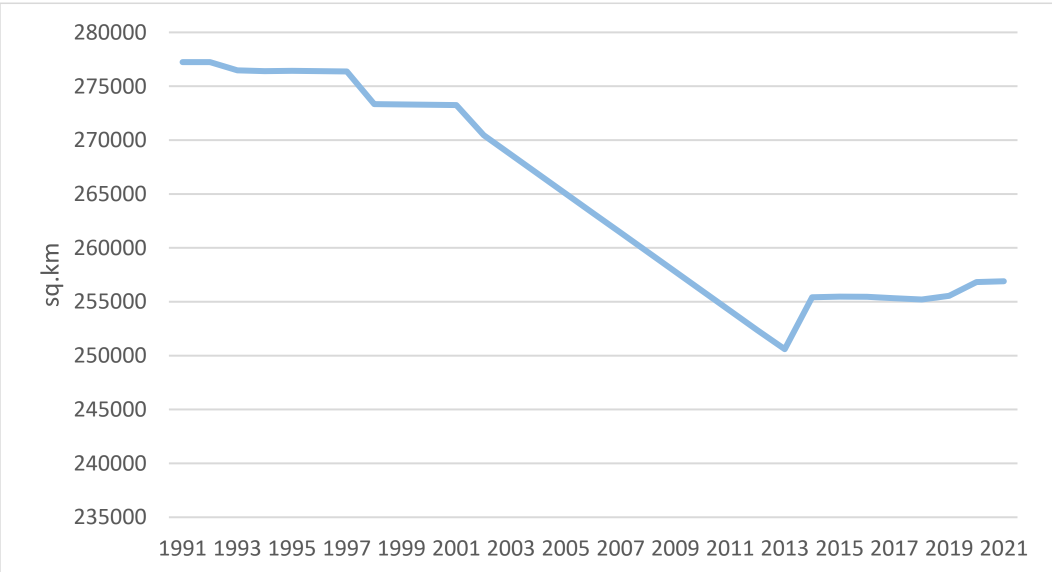



Figure A 12. Agricultural land (sq.km in Uzbekistan over years)

Source: [www.worldbank.org](http://www.worldbank.org)

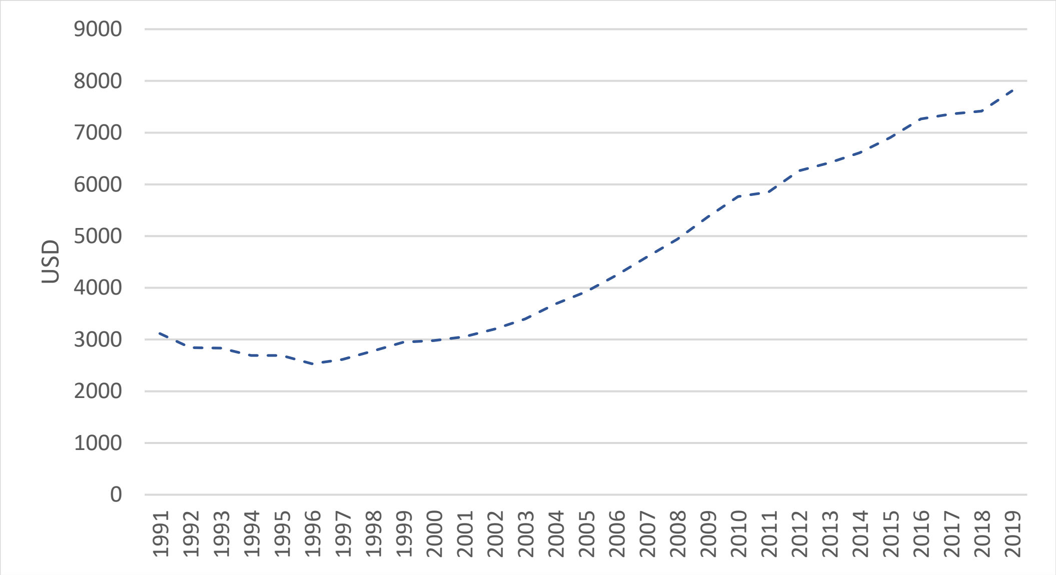



Figure A 13. Agricultural value added per worker (constant 2015 USD) in Uzbekistan

Source: www.worldbank.org

Note: The provided graph illustrates the trend in economic output per worker within the agriculture, forestry, and fishing industries of Uzbekistan, measured in the purchasing power equivalent of 2015 US dollars, from 1992 to 2019. The term "constant 2015 US$" indicates inflation-adjusted values to maintain consistent purchasing power over the period. The trend line shows an overall increase in productivity per worker, starting from about 3 thousand US dollars in 1992 and ascending to just over 7 thousand by 2019, suggesting a rise in the economic contribution of each worker in these sectors over the thirty-year span.

Table A 10. Overview of production forms

| Dimensions | State order | Commerical | Houshold |
|---|---|---|---|
| Main crops | Cotton and winter wheat | Rice, fruit and vegetables, fodder | Fruit vegetables |
| Cropping schedule | Cotton from March to October, Wheat from October to June | During the year | During the year |
| Land tenure | Insecure long term leaseholds | Insecure long term leaseholds. | Full ownership |
| Management decision | State control, no farm decision | Farmers, state and dekhans | Own decisions |
| Labour | Hired workers and sharecropping | Hired workers, renting out plots to people | Household labour |
| Economic rationale | no rational farm | Cash economy, sales in private markets | Own consumption |

Source: Veldwisch & Spoor (2008).

Table A 11. Short summary of the current development of agriculture

| Indicators | Value |
|---|---|
| Share of Agriculture in GDP | 25-26% |
| Number of individual farms | 91 thousand |
| Average sown area per individual farm | 39 ha |
| Major crops | Cotton and wheat |
| Farm models | Dekhkan farms, individual farms, agricultural enterprises |
| Average wage | 350 USD |
| Share of agriculture in employment | 26-27% |
| Highest land productivity | Dekhkan farms |
| Cotton clusters | 134 |

Source: author

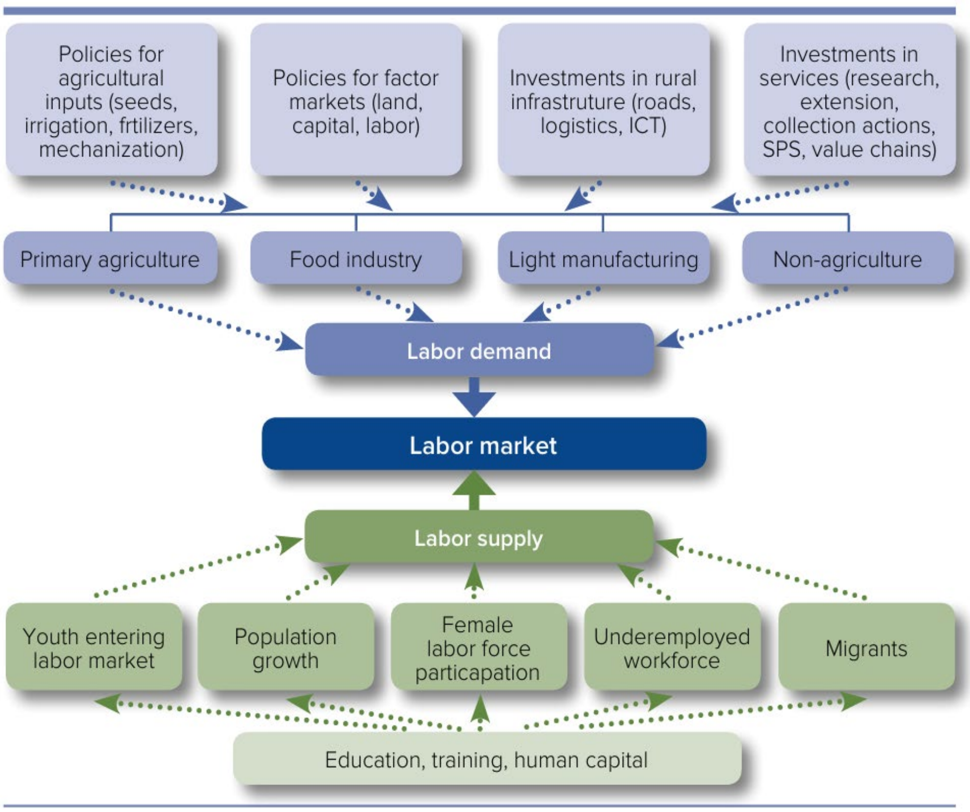



Figure A 14. Job creation in rural Uzbekistan
Source: World Bank (2020)

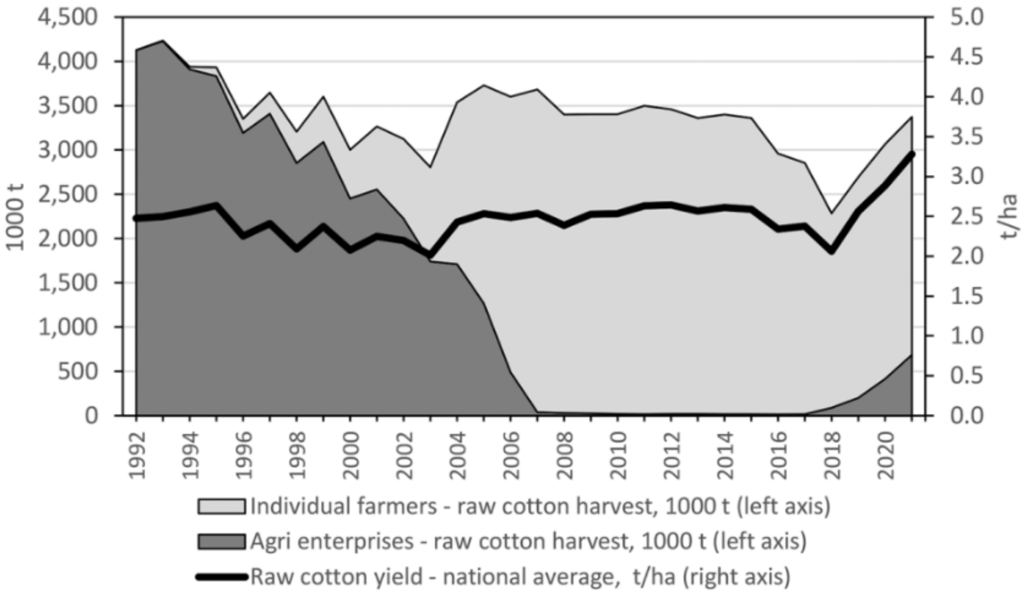



Figure A 15. Cotton cultivation dynamics in Uzbekistan

Source: Djanibekov et al. (2024).

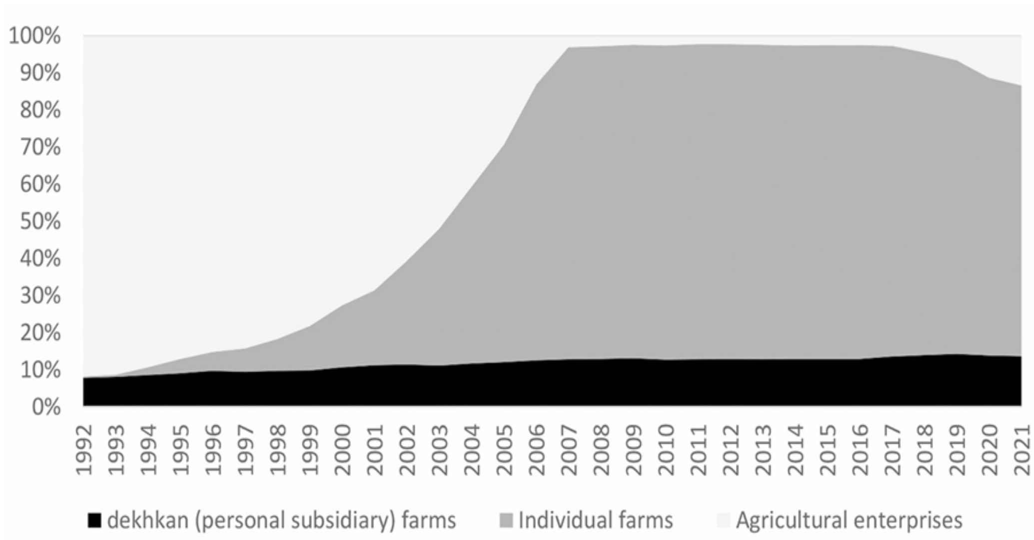



Figure A 16. Total sown area by farm types in Uzbekistan

Source: Ni et al. (2024).

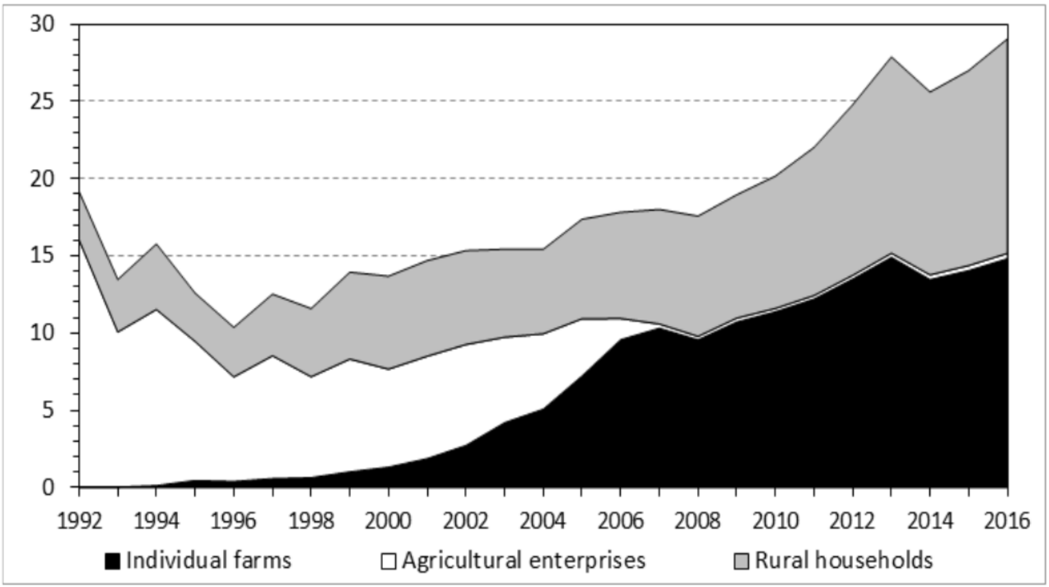


Figure A 17. Gross crop output by farm categories in Uzbekistan, in trillion constant 2016 UZS
Source: Zorya et al. (2019).