



# Farm productivity and social sustainability in formalized value chain governance: the case of the potato industry in Pakistan

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## Research Paper

**Cite this article:** Rasool A, Badar H, Blare TD, Ghafoor A, Mushtaq K (2023). Farm productivity and social sustainability in formalized value chain governance: the case of the potato industry in Pakistan. *Renewable Agriculture and Food Systems* **38**, e52, 1–10. <https://doi.org/10.1017/S174217052300042X>

Received: 8 April 2023

Revised: 6 August 2023

Accepted: 10 October 2023

### Keywords:

factor analysis; farms productivity; social sustainability; thematic content analysis; value chain governance

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### Abstract

Farm productivity and social sustainability are essential to realizing agro-based value chains' full potential. This paper aims to empirically conduct an analysis of the impact of formal value chain governance practices on farm productivity and social sustainability in Pakistan's potato industry. A multi-stage sampling method was employed from 10 villages to examine growers' motivations to adopt the contract and its effect on their income and farm employment. The main findings of this study stipulate that buyers' technical assistance and provision of quality inputs are the growers' primary motives for contracting, non-contracted farms earned 40% less than contracted farms from each unit invested, contracted farms employed more labor with better wages, and welfare arrangements than the non-contracting farms. The study concluded that formal value chain governance practices significantly affect farm productivity and social sustainability and can spur growth in the agricultural sector in developing countries. The results reveal that any governmental initiative aiming to support formal value chain governance should consider the role that intermediaries play in the value chain and accordingly minimize their risks and food losses and improve social outcomes.

## Introduction

Agricultural growth is critical to ending poverty and a major barrier to rural development, particularly in developing countries (Xhoxhi et al., 2014). Poor farm productivity is frequently linked to inaccessible high-quality inputs (Fischer and Hartmann, 2010), seasonal patterns of output (Xhoxhi et al., 2020), insufficient production techniques, logistical challenges, and inconsistent market orientation (Grunert et al., 2004). Also, institutional constraints hinder smallholders' capacity to use improved production and marketing choices (Trienekens, 2011). Subsequently, these challenges result in fluctuating produce quality and a relative bargaining disadvantage to growers (Van Tilburg et al., 2007). Previous studies revealed that inadequate value chain governance (VCG) is the primary cause of inefficient agri-food systems, affecting farm productivity (Um and Kim, 2019; Xhoxhi et al., 2020; ADB, 2022). Formalized VCG has been key to increasing farm productivity, which may aid in the eradication of rural poverty and promote socially sustainable rural agriculture economies (Key and Runsten, 1999; Warning and Key, 2002; World Bank, 2023). Thus, this study ascertained how VCG affected rural people's social sustainability and farm productivity based on an analysis of the VCG structures of the potato value chain in Pakistan.

Pakistan has an agrarian economy; its agriculture, food, and related industries contributed roughly 22% to the nation's gross domestic product in 2022. The sector provides food to more than 220 million residents and is allied with high-value processing sectors like textiles and leather. Potato (*Solanum tuberosum* L.) is the cheapest source of human nourishment and one of the principal horticultural commercial global food crops. The average yield in Pakistan (26 tons per ha) is comparable to that in China but lower than that (about 40 tons per ha) in Europe, North America, and Australia (FAO, 2019).

Landholdings in Pakistan are small (an average of 2.27 hectares). Private firms handle the complex potato industry, while the public sector is limited to research, regulation, and extension activities (Ghafoor, Basher and Badar, 2022). Input providers, farm household/growers, village buyers, commission agents, wholesalers, processors, exporters, retailers, and consumers compose its value chains (Fig. 1). Potatoes are mostly grown in red and white skin variants and consumed both fresh and processed (14.4 kg per capita). *Frito Lays*, a large food processor owned by PepsiCo, purchases potatoes under (formal) VCG production contracts (SBP, 2015).

Potato value chains in Pakistan are long and have several inefficiencies (Badar et al., 2020). Growers' relationships with chain buyers are informal; they mostly sell through middlemen

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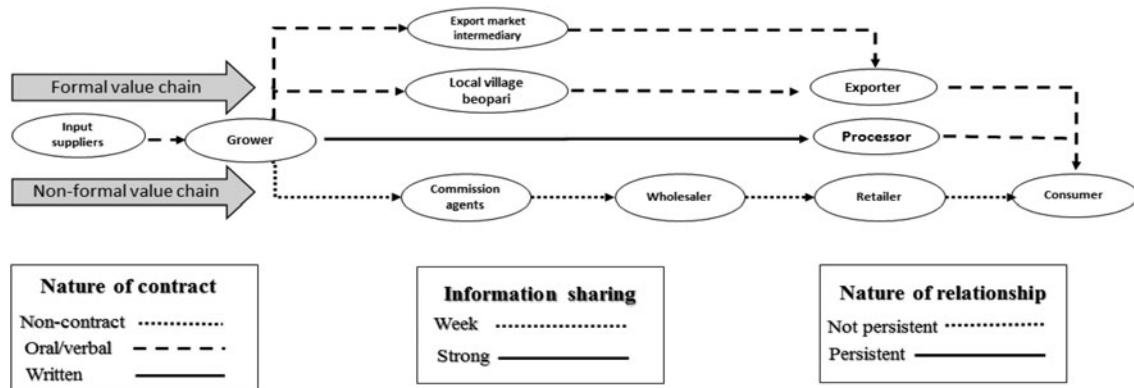


Figure 1. Potato value chain in Pakistan.

(SBP, 2015). Delayed payments, negotiation of the agreed-upon harvest price, withdrawal from the agreement at harvest, and other factors have a detrimental influence on farm productivity (Badar, 2015) and on the social sustainability of rural communities (Warning and Key, 2002; Brennan et al., 2023). Potato growers are mostly smallholders, and their productivity is below the optimal level due to traditional production and marketing systems. In addition, they face unnecessarily high transaction costs such as warehousing, transportation and storage, and so on. These costs can be lowered, as Badar (2015) pointed out through closer coordination among value chain actors, which ultimately affects growers' returns and the number of employments.

This article adds to a wide range of literature on the effects of formal VCG or contract farming on farm productivity and the social sustainability of rural people. It also complements studies on improving farm profits, farm employment, and rural development. The study aims to: (1) understand the VCG in the potato industry of Pakistan; (2) predict growers' primary motivations for production contracts; (3) analyze the impact of production contracts on farm productivity; and (4) examine the effect of contract schemes on-farm employment. The next section explores the extensive literature that highlights the positive aspects of formal VCG that affect farm productivity, farm employment, and rural people's social sustainability.

### Formal value chain governance in developing countries: a conceptual framework

The growing concept of formal VCG between growers and food processors originated in the 1930s in the United States and by the late 1960s had become a significant component of agribusiness industrialization. It was introduced as a contract or out-grower scheme (Weatherspoon, Cacho and Christy, 2001). Minot (1986) and Miyata, Minot and Hu (2009) explored growers' motivation and reasons for participation into three, not mutually exclusive, categories, resource provision contracts, production contracts, and marketing contracts. In resource provision contracts, the produce buyers provided the growers with quality inputs, extension programs, or credit. While in production contracts, growers committed to following buyers' precise production practices (Key and Runsten, 1999). Marketing contracts are formal VCG created on pre-harvest agreements to meet middle-class food consumers' customized ('ready-to-cook' and 'ready-to-eat') requirements. As the middle class grows, these contracts are becoming more popular. Marketing contracts

include quality, variety, quantity, and just-in-time (JIT) and bind firms under a particular set of conditions (*what is to be produced, how is to be produced, and when and why?*) (Gereffi, Humphrey and Sturgeon, 2005; Gereffi and Fernandez-Stark, 2011).

An impetus for the formalization of VCG is because agri-food value chains have become more complex. They are now exposed to more dynamic environments, caused by globalization, rapid advancements in technology, and changing consumer market requirements (Soosay and Hyland, 2015). The shift exerts a rivalry among food processing and retailing Multinational Corporations (MNC). To confront these governing challenges, MNCs have gradually evolved spot-market relationships into formal VCGs with food suppliers/growers, striving to meet the requirements of an emerging global middle class (USAID, 2022). Some research implies that formal VCG can provide organizations with a competitive edge (Fischer and Hartmann, 2010). The adoption of formal VCG by MNCs considerably expands their resources and capabilities beyond their borders (Um and Kim, 2019) and assists growers in meeting market requirements. Thus, it eventually results in more productive farms (Cao and Zhang, 2011) and reduces unnecessary costs (Chen et al., 2017). Globally, expanding MNCs have relied heavily on formal VCG with growers to sustain their competitive advantage (Um and Kim, 2019). They impose quality and safety standards, narrowing the gap in reaching the United Nations' Sustainable Development Goals (SDGs) (Gyau and Spiller, 2008; Um and Kim, 2019).

Social sustainability is one of the cornerstones of sustainable development, which is defined as addressing the demands of current generations without risking future generations' ability to meet their own needs (NBS, 2023). The United Nations SDGs addressed a wide range of social sustainability concerns, including poverty, the well-being of resource-poor individuals, gender equality, and justice (UN, 2017). Social sustainability is important for individuals and society, although it receives less attention than environmental sustainability. In the agri-food sector, social sustainability focuses on rural communities whose incomes and nutritional security are affected by low farm productivity (Warning and Key, 2002; Brennan et al., 2023). A key component of this social sustainability is the treatment of hired labor, who are often among the poorest in rural communities (Cleaver, 2005). Enhancing workers' skills through training, providing appropriate wages, and ensuring workplace safety all impact farm productivity and hired labor's well-being (Soundararajan et al., 2021). Such investments are agents of sustainable agriculture and rural

development (Hurst, Termine and Karl, 2005) and long-term economic growth (USDA, 2023). In the next section, we describe the growers' primary motivations for participating in formal VCG; and its impact on the modernization of agriculture, farm productivity, and social sustainability in rural communities, which are well documented in different regional studies (Hurst, Termine and Karl, 2005; Trifković, 2016; Soundararajan et al., 2021; Li and Guo, 2023).

An understanding of what induces growers to choose contract farming over other strategies and an appreciation of large food processors' incentives to smallholders are important in designing policies to influence the outcome of contract farming schemes to better support smallholders and rural development. Key and Runsten (1999) stated that formal VCG ensures growers' access to financial resources, quality inputs, technical assistance, and better marketing channels in Latin America. In the case of India, it improved agri-food value chain efficiency (Singh, 2007), provided a successful model to modernize agriculture (Vicol, 2019), reduced unnecessary costs, enhanced growers' bargaining power, and helped link better market channels (Pingali et al., 2019).

Maertens and Swinnen (2009) explored, in Senegal, the enforcement of quality and safety standards in agri-food production practices contributed significantly to social sustainability by improving rural people's well-being and leading to poverty reduction, helping to come closer to achieving the SDGs. In Africa, Jaffee (1987) concluded that it successfully improved farm productivity and the ability to control leakages of money, inputs, and products. According to the study, an average contracted grower had access to better technical support and market information and earned 37% higher yield and 80% more net margins compared to non-contracted growers. The existing studies have found that formal VCG improves marketing activities (Trifković, 2016); enhances a farm's productivity (Li and Guo, 2023); increases farm employment (Weatherspoon, Cacho and Christy, 2001; Kessari et al., 2020); improves farm labor welfare (Maertens and Swinnen, 2009); increases social sustainability (Warning and Key, 2002); and provides growers a competitive advantage (Fischer and Hartmann, 2010). It may also serve as a catalyst for the adoption of best management practices and rural development (Key and Runsten, 1999; FAO, 2019; Xhoxhi et al., 2020; Borsellino, Schimmenti and El Bilali, 2020; USAID, 2022; World Bank, 2023). Therefore, it is widely believed that the formal VCG impacts growers' social sustainability and farm productivity. This study presents an in-depth comparison of both farm productivity and farm employment for contracted and non-contracted farms in order to perceive the impacts of these VCG schemes on social sustainability in rural communities (Fig. 2). This study contributes to the understanding of VCG theory demonstrating how different VCG can impact SDGs.

## Materials and methods

### Data sources and sample selection

Data were collected and processed in three stages from November 2021 to February 2022. First, a focus group discussion (FGD) was held with 15 potato growers who belonged to the Growers' Association of Pakistan (*Pakistan Kissan Ittehad*). In the second stage, 30 contracted growers were purposefully interviewed to determine their primary motivation for the contract. Thematic content analysis (TCA) was then used to examine textual and visual data to summarize the information gathered from the FGD and detailed interviews. In the third stage, a survey of 100 potato growers was conducted. A questionnaire was designed using the feedback from the FGD and interviews and insights from VCG literature (Trifković, 2016; Vicol, 2019; Um and Kim, 2019; Keco et al., 2019; Borsellino, Schimmenti and El Bilali, 2020; USAID, 2022; Xhoxhi et al., 2020; Kessari et al., 2020). The questionnaire was pretested with 10 growers and improved accordingly. A multistage sampling process was followed to select the respondents. As a result, 10 villages were selected from the three most productive (86% of total production) potato-producing areas in Punjab (Pakistan), including Sahiwal, Okara, and Depalpur (Fig. 3). These villages were purposively selected in consultation with the local government officials and the growers' association. From each village, 10 growers were randomly selected and interviewed. In total, 100 growers were interviewed for the study purpose. Later, the responses of 90 growers were retained for analysis; and 10 were discarded due to unclear and ambiguous responses. The growers' primary motivation was taken as independent variables, and the relative importance of each factor motivating contract production was captured on a five-point Likert scale (where 1 for strongly disagree and 5 for strongly agree). To find any underlying component and characterize these latent constructions into a logical sequence of subsets, the scale values were subjected to factor analysis. The factor loadings were subsequently subjected to a varimax rotation. The derived factor weightings for each of the respondents were then subjected to systematic differences analysis to determine the relative importance of the identified growers' primary motives.

### Estimation procedures

The FGD demonstrated growers' primary 11 motives for participating in contracts and described if they perceived contracts as an improvement from the available VCG continuum as described by Xhoxhi et al. (2020). The continuum is modified to reflect the local industry characteristics. To create measures, all the items were placed into exploratory factor analysis (EFA), a frequently used method for extracting a few factors from many core features (Hair et al., 2013). The principal component analysis (PCA)



Figure 2. Conceptual framework of the study.



**Figure 3.** Potato production sites in (Punjab) Pakistan.  
Source: Government of Pakistan (2022).

groups highly correlated variables together and, thus, simplifies the analysis. It combines a large number of variables into a smaller set of underlying components and summarizes the basics (Leech, Barrett and Morgan, 2014). Varimax rotation transforms the components into factors that are more clearly interpretable. The identified factors were labeled according to the characteristics of growers' primary motives. The SPSS software was used for the descriptive analysis.

The recommended sample size for a PCA varies considerably, with at least five respondents per item in a construct, as suggested by Malhotra and Birks (2007). Since the motives of 11 growers from a sample of 55 respondents were sufficient to fulfill the requirement, the study sample of 90 respondents was more than sufficient to meet the PCA requirement. The obtained data were used for per-acre microeconomic estimations, cost of production (COP), input-output analysis (I-O), and benefit-cost ratio (BCR) to compare farm productivity and employment for contracted and non-contracted farms. The method of microeconomic estimation was adapted from Noonari et al. (2016), with a small modification to reflect the local industry characteristics.

### Results and discussions

The results of TCA identified two themes at stage 1, contracted and non-contracted growers' farms. The findings showed that more than half (57.4% of those surveyed respondents) adopted traditional marketing channels to sell their farm produce at the nearest fruit and vegetable wholesale markets without engaging in any kind of contractual agreement. Wholesaling intermediaries (commission agents) facilitated produce sales through an open and closed (*hatha*) auction between growers and end users, wholesalers, processors, exporters, and vendors (street, town, and supermarkets). Agents negotiated purchases, sales, or both but did not take ownership of the product. They earned a commission on the total sales. About 42.6% of respondents reported having a formal VCG or contract with buyers that was written, verbal, or not disclosed.

In terms of socioeconomic characteristics, the study sample comprised all male respondents. Women are almost entirely excluded from farm post-harvest management (PHM) and marketing of produce in Pakistan (Badar, 2015). Table 1 outlines most of the contracted growers belonged to either between 51 and 60 years old or 31 and 40 years old, with medium-sized (3–4 members) families than the non-contracted growers. The majority (55% of overall respondents) possessed secondary and intermediate-level education, while only 19.5% of contracted respondents held a university degree.

Regarding farm characteristics, the majority (56.6%) of contracted growers had more than 25 acres and non-contracted had less than 12.5 acres). As shown in Table 1, the majority (74.5%) of respondents were sole proprietors and had access to canal water for irrigation. A variety of irrigation systems were employed by around half of the respondents. Newer technologies such as drip and sprinkling were used by 26.1% of contracted growers. Half of the respondents rented farm-specific equipment. According to the study, farm food sold at the closest collection location (less than 20 kilometers) was more likely to stay in business (more than 60%), although 38.3% of contracted growers were more than 20 kilometers away.

Moreover, the majority of respondents (71.9%) were engaged in full-time farming (Table 1). According to the survey, 49.3% of non-contracted growers had less than 10 years of experience, particularly in potato cultivation. Yet, 45.1% of contracted growers had been farming for more than 20 years. Approximately, 35.2% of those surveyed stated that they had obtained no formal agricultural training. The majority (74.5%) were trained from private sources such as produce buyers and input merchants. Just 4.5% were trained by government extensionists. Despite this lack of access to agricultural training, 24.9% of contracted growers reported having received more than four formal pieces of training each year. In Pakistan, MNCs frequently sell farm supplies such as pesticides, seeds, and fertilizer, and their sales team organizes field days to teach growers and fulfill their sales targets.

**Table 1.** Respondents' characteristics (percent)

Variables		Category	Non-contracted farms	Contracted farms	Mean	
Socioeconomic	Age (years)	Up to 30	7.5	11.3	9.4	
		31–40	17.2	17.3	17.2	
		41–50	29.1	12.8	21.0	
		51–60	41.0	50.4	45.7	
		Above 60	5.2	8.3	6.7	
	Education	No education	8.2	1.5	4.9	
		Primary <sup>1</sup>	24.4	24.8	26.6	
		Secondary <sup>2</sup>	33.6	14.3	24.0	
		Intermediate <sup>3</sup>	22.4	39.8	31.1	
		Graduation <sup>4</sup>	7.5	19.5	13.5	
	Family size (Nos.)	1–2	10.4	3.0	6.7	
		3–4	27.6	42.9	35.2	
		5–6	54.5	37.6	46.1	
		>6	7.5	16.5	12.0	
Farm	Farm size (hectares)	Up to 5	41.0	16.5	28.8	
		Between 5 and 10	26.1	27.8	27.0	
		Above 10	32.8	56.6	44.2	
	Farm legal status	Sole proprietorship	76.1	72.9	74.5	
		Partnership	20.9	23.3	22.1	
		Others/sharing	3.0	3.8	3.4	
	Irrigation source	Canal water	70.9	77.4	74.2	
		Tube well	25.4	18.8	22.1	
		Mixed	3.7	3.8	3.7	
	Irrigation technology	Traditional	24.6	33.1	28.8	
		Modern	19.5	26.1	22.8	
		Mixed	49.3	47.4	48.3	
	Farming equipment's	Owned	33.6	36.1	34.8	
		Rented	52.2	50.4	51.3	
		Others/shared	14.2	13.5	13.9	
	Distance to wholesale market (KM)	Up to 10	30.6	26.3	28.5	
		Between 11 and 20	41.0	35.3	38.2	
		Above 20	28.4	38.3	33.3	
	Business	Off-farm employment	Part-time	33.6	22.6	28.7
			Full-time	66.4	77.4	71.9
Farming experience (years)		Up to 10	32.8	18.0	25.5	
		Between 11 and 20	28.4	36.8	32.6	
		Above 20	38.8	45.1	41.9	
Exp. as potato grower (years)		Up to 10	49.3	37.6	43.4	
		Between 11 and 20	38.8	33.8	36.3	
		Above 20	11.9	28.6	20.2	
Agriculture trainings/year (Nos.)		Not at all	40.3	30.1	35.2	
		1–2	37.3	21.8	29.6	
		3–4	20.1	23.3	21.7	

(Continued)

Table 1. (Continued.)

Variables	Category	Non-contracted farms	Contracted farms	Mean
Source of training	4–6	2.2	22.6	12.4
	Above 6	0.0	2.3	1.1
	Govt. source	3.4	6.3	4.5
	Private source	73.1	71.7	74.5
	Others/mixed	23.5	22.0	21.0

Note: <sup>1</sup>Grade 5 equivalent, <sup>2</sup>grade 10 equivalent, <sup>3</sup>grade 12 equivalent, <sup>4</sup>university degree.

In terms of respondents' motivation for contracting practices, the results of direct interviews highlighted 11 primary reasons for contract production. These include access to farm inputs, technical training and lab testing (soil, water, and food), and transportation assistance, among other things. Due to the prevalence of traditional marketing structures, there are numerous additional motives. Access to market information, a price-fixing system, and the market intermediaries' unnecessary transaction charges, as well as their mode of payment, were among these market-related motivations. These results demonstrate the ineffective role of market committees in the fruits and vegetables wholesale marketplace. The following statements depict these motivations. A 39-year-old grower, who had a two-year contract, explained: 'Buyer's provision of seed, packaging bag, transport, extension advice and farm level mobile testing lab assistance motivated contract participation [production contract scheme]'.

A 34-year-old grower with a one-year contract revealed: 'Buyers' resource provision [seeds, bags, and transportation] lowers our risk. Otherwise, it is difficult for us to make the arrangements before, even the transport workers poorly handle the produce that damages the quality of produce'. These findings indicated that buyers provide growers with inputs under the production contracts. Growers also had access to market information as well as training in production and post-harvest technology, as cited in previous studies (Xhoxhi et al., 2020). These services had to be provided because of the inadequacies in the government extension services to provide this information.

According to a 49-year-old grower, who signed a two-year contract: 'Our prior farming [production and irrigation] practices were unproductive. Government extensionists never visited nor directed efficient and profitable technology. Now, buyers guided and demonstrated the modern technology at our farms'. According to the findings generated from the growers' in-depth interviews, growers were also not getting extension advice and demonstrations on the use of advanced production technology. The respondents also highlighted the relevance of the price of produce and the period of cash receivables for their participation in contract farming. For example, a 51-year-old grower, who signed a one-year contract, mentioned: 'Buyers' given selling price before seeding in written [formal production contract] decreases our marketing risk. Their [buyers'] in-time payment [growers' cash receivables after selling of produce] improve our living conditions'. The study found that the buyers' fixed price in production contracts minimized the growers' uncertainty and marketing risk.

In terms of these 11 motives, collected using a Likert scale, the mean values were estimated for lab testing assistance (4.76), agricultural training (4.58), production technology assistance (4.42), market information (4.13), getting better prices/price fixing

mechanism (3.50), receivables/buyers' payments risk (3.27), accessibility of quality inputs (2.18), provision of packaging bags (1.18), and transportation (1.16). These scores indicate a considerably higher level of motivation than the costs associated with meeting farming requirements. Growers who participated in formal contract practices have some favorable advantages, i.e., 'pull' factors, as well as mitigating against negative circumstances of local markets, i.e., 'push' ones. The overall Cronbach  $\alpha$  value of the growers' primary reasons was 0.713, which was greater than the minimum value needed for the significance of 0.60, and supported the scale's internal consistency (Hair et al., 2013).

The study uses an EFA to derive meaningful growers' primary motives for adopting formal contracts. To check the factorability of data, the Kaiser–Meyer–Olkin (KMO) test of sample adequacy and Barlett's test of sphericity ( $\chi^2 = 6960.71$ ;  $DF = 351$ ;  $P < 0.00$ ) were applied to all 11 growers' primary motives (Pallant, 2007). The KMO value was found to be 0.75, greater than the minimum value of 0.60 recommended by Kaiser (1970) for applying the factor analysis. Barlett's test  $\chi^2$  value of 6960.71 was also found significant, which indicated that data were suitable for running the EFA. The study discovered four components with eigenvalues greater than one that account for 75% of the variation in the sample (Hair et al., 2013). The EFA found four broad growers' motivations for contracting, through the analysis of their statements (Table 2).

The first factor comprised three statements and explained 27.4% variance and was labeled buyers' technical assistance (BTA). This factor revealed that growers preferred contracts due to lab testing assistance, agricultural training, and technology support. The  $\alpha$  value of  $F_1$  was 0.941, which is greater than the minimum needed value of 0.60 and confirms the internal consistency of the scale utilized (Hair et al., 2013). According to the survey, growers had limited access to lab (soil, water, and crop) testing. This assistance would lead to lower food loss and higher returns.

Conferring the analysis, BTA had positively affected growers' motivations to contract. The greater the BTA, the greater the return to growers, such as improved PHM practices (i.e., sorting, grading, packing, and delivery method), and it reduces food losses. Benmehaia and Brabez (2018) stated that consistent technical assistance would improve farms' productivity.

The second factor named 'buyer provides market information' embraced two statements relating to market uncertainty and explained a total of 18.6% variance. The results point out that growers are likely to choose contract production due to the availability of market information, such as market requirements and how to acquire higher pricing. Its  $\alpha$  value is 0.913 > 0.60 and validated the scale's internal coherence (Hair et al., 2013). The study discovered that contracted growers were provided with up-to-date market requirements, resulting in better prices. Yet, the public

**Table 2.** Results of the exploratory factors analysis (EFA)

Statements	F <sub>1</sub>	F <sub>2</sub>	F <sub>3</sub>	F <sub>4</sub>
<b>(F<sub>1</sub>) Buyers' technical assistance (BTA)</b>				
<b>Explained variance = 27.4%, Cronbach's (<math>\alpha</math>) = 0.941</b>	0.932			
Buyer provides me lab testing (soil, water, produce) support.				
Buyer provides me training for better PHM practices.	0.904			
Buyer assists me with the production technology (land preparation, sowing, harvesting, etc.).	0.886			
<b>(F<sub>2</sub>) Buyer provides market information (BMI)</b>				
<b>Explained variance = 18.6%, Cronbach's (<math>\alpha</math>) = 0.913</b>		0.928		
Buyer provides me market information/requirements like variety, quality, and grade, etc.				
The buyer provides me with the necessary info., how to get better prices.		0.926		
<b>(F<sub>3</sub>) Buyers' mode of payment (BMOP)</b>				
<b>Explained variance = 8.6%, Cronbach's (<math>\alpha</math>) = 0.853</b>			0.771	
Buyer price fixing mechanism of my produce better and provides better prices than the market.			0.725	
My receivables/buyers' payments are trustworthy?			0.709	
Buyer provides my receivables within a short duration or season.				
<b>(F<sub>4</sub>) Buyer provides farm inputs (BPFI)</b>				
<b>Explained variance = 7.3%, Cronbach's (<math>\alpha</math>) = 0.714</b>				0.859
Buyer provides me the quality inputs (seed, fertilizer, urea, etc.)?				0.739
Buyer provides me the packaging bag for the produce?				0.718
Buyers assist with transport to deliver the produce from farm to market.				

Note: Extraction method: principal component analysis. Rotation method: Varimax with Kaiser normalization. Factors are highlighted in bold and labeled.

information dissemination system was outdated and less successful. According to Xhoxhi et al. (2020), providing accurate market information could help boost growers' trust and lessen the possibility of contract defaults.

The third factor named 'buyers' mode of payment' explained 8.6% of the variance. It contained three statements, selling price or price-setting procedure, risk of growers' cash receivables/buyers' payments after selling of produce, and the duration of such cash receivables. The  $\alpha$  value was 0.853, greater than the level of significance of 0.60, and had confirmed internal consistency (Hair et al., 2013). According to the survey findings, growers evaluate their returns at the point where they are looking for a price for their farm produce. However, some of the contracted growers had raised their voices, which derived a relatively small proportion of income, during COVID-19. When the supply was abundant, contracted prices were higher than the market prices; and contract buyers were hesitant at the time to pay this price when receiving the product. This price differential, a risk associated with local and global markets, has rendered contracted growers insecure. However, they were more satisfied with the prices offered, terms of receivables, and returns than those growers who relied on the open market.

The study revealed that the market risk of non-contracted growers was also higher than contracted because they experienced uncertainty regarding their cash receivables from the buyers after selling their produce. According to the head of the Okara district wholesale market, many smallholders frequently sold through unknown outsider traders (export intermediaries from Afghanistan and Iran) in wholesale markets. They have tenancy agreements in markets and offer higher-than-market prices to smallholders and vanish after purchasing the farm food. Many smallholders who sold their produce on credit never got their receivables. Numerous offenses were reported to local law enforcement organizations, but the perpetrators were never found.

The fourth factor identified as 'buyer provides farm inputs' (BPFI) explained 7.3% of the variance and included three statements. This factor demonstrated that growers' preference for participating in contracts was because of buyers' provision of quality seed, packaging bags, and transportation. The cost and availability of imported farm inputs were impacted by inflation and fluctuating dollar exchange rates in the country. Having this price risk absorbed by the buyers was a great benefit to the growers. The study disclosed that BPFI had significantly impacted farm productivity, both for contracted and non-contracted farms. The  $\alpha$  value of 0.714 was greater than the 0.60 level of significance and confirmed the scale's internal consistency (Hair et al., 2013).

These factors reflected the current opportunities and restrictions confronting growers in determining the feasibility and sustainability of farm productivity. Certainly, the most important effect was the 'push' for the grower to overcome shortcomings in local input and output markets through contract production. Similarly, reflecting the scarcity of public extension services in potato-growing areas, growers were encouraged to participate in contracting to learn new skills and increase productivity. Growers appeared to have been willing or felt obligated to tolerate a loss of independence to ensure access to production resources.

Table 3 shows the results of the comparative farms' productivity, and it seems that the contracted farms per acre COP are higher than the average and that of non-contracted growers' farms. This could be attributed to contracted growers using high-quality or certified inputs including seed, soil nutrients, improved production practices, irrigation technology, and better PHM to fulfill the buyers' required quality standards. However, their yield was higher. They also received better selling prices than the non-contracted farms, resulting in higher incomes for the contracted farms.

Table 3 shows that the contracted farms' input-output ratio is 1:2.72, which indicates that one unit of a resource would yield 2.72 units of returns. Non-contracted farms obtained 2.22 returns

**Table 3.** Results of the farms' productivity analysis

Indicators	Unit of analysis	Non-contracted farms	Contracted farms	Mean
COP/acre*	PKR**	85,786.20	93,113.90	91,648.40
Yield/acre	KG	7856.00	10,458.80	9938.30
Farm income/acre	PKR	104,641.30	165,289.20	153,159.67
Input-output ratio	–	1:2.22	1:2.72	–
BCR analysis	–	1:1.22	1:1.71	–

\*1 hectare = 2.47 acres); \*\*(1 USD = 280 PKR).

for the same unit of resource. Additionally, the BCR showed that contracted farms earned 1.71 PKR by investing one rupee. Comparatively, non-contracted farm growers earned just 1.22 PKR by investing the same unit of resources.

Table 4 shows the results of the estimation of farm employment. According to Table 4, an average contracted farm employed more farm labor per acre than a non-contracted farm. Their number of agricultural trainings of farm labor on PHM practices was likewise higher than it was for the non-contracted farms. In order to prevent food losses and retain the quality of produce, which also has an impact on growers' returns and farm productivity, the study looked into how contractual buyers provide PHM training. The growers engaged in contracts generated more profits and were able to pay higher wages to the employed farm labor. Just 17.2% of contracted farms paid their labor less than PKR 15,000 per month, while a sizable proportion (32.3%) paid them more than PKR 20000. Yet, not a single employee on a non-contracted farm earned more than PKR 20000; and 59.6% earned less than PKR 15000. The study also estimated the welfare and safety measures of employed labor at farms. Non-contracted farms possessed 36.0% of the safety measures and 63.2% of the welfare initiatives. In the same context, contracted farms had better figures, with 47.8 and 70.3%, respectively. The findings of the study have significant implications for developing countries in terms of supporting the design and implementation of production contract schemes that not only impact growers' profitability but also help to improve social outcomes. Such an approach can greatly contribute to rural poverty reduction and agricultural growth, particularly in developing countries.

## Conclusion

The study determined the impact of formal VCG on potato growers' farm productivity and social sustainability. The study

employed TCA, factor analysis, and microeconomic estimations to evaluate the data collected from 10 villages in potato production areas in Pakistan. This study confirmed that they were motivated to participate in contractual arrangements and give up some of their marketing independence for the provision of technical assistance and quality inputs that buyers provided them. The growers were particularly interested in these benefits because they had a substantial positive impact on farm productivity. The contracted farms had obtained yields and returns compared to non-contracted farms. The benefits of these contractual arrangements were also perceived in terms of the social sustainability of rural communities, as these farms hired more labor and paid higher wages. They provided the needed income source for many low-income or poor families and reduced the poverty rate of these communities. It seemed that the quality standards set by the contractual buyers were a deterrent to participation in the contractual system.

More formalized VCG through the adoption of formal production contracts improved farm productivity and employment and, consequently, has the potential to be a catalyst for the country's agricultural growth and social sustainability. The study's findings have substantial significance for developing countries to support the design and implementation of formalized VCG to reduce rural poverty and growth in the agricultural sector. Through collaboration, the government and private sector could develop a culture of contract production that includes an ICT-based information dissemination system, assures the accessibility of technical assistance, and provision of quality inputs. The next steps in supporting the sector to become more productive and profitable would include further reducing the risk faced by the contract growers in uncertain market conditions. For instance, an insurance scheme from a third party would likely improve farm productivity and minimize price ambiguity.

**Table 4.** Results of the farms' employment analysis

Indicators	Unit of analysis/category	Non-contracted farms	Contracted farms	Mean
Employed labor	Nos. per farm	1.6	2.9	2.6
Agri. training	Nos. per year	0.09	0.46	0.37
Salary/wages per month (PKR)	Less than 15,000 (percent)	59.6	17.23	–
	Between 16,000 and 20,000 (percent)	40.4	50.45	–
	Above 20,000 (percent)	0.0	32.32	–
Labor safety arrangements	Percentages of yes	36.0	47.8	–
Labor welfare arrangements	Percentages of yes	63.2	70.3	–



While this study provides key insights into the influence that formalized VCG on social sustainable and rural development, further research is needed to better understand the leverage points to bring about positive change. Additional research that examines the causality of these findings would strengthen the deductive conclusions made in this study. Further analysis of different VCG structures, beyond the contract and spot market value chains included in this study, is needed. Such research could include studying the nature of the grower–buyer relationship, and the level of satisfaction of both actors with the various arrangements. An in-depth comparative analysis of different VCG in the agri-food sector would provide key insights to those involved in value chain development (i.e., governmental agencies, NGOs, aid agencies, agroindustry, growers' organizations, research institutions) on what factors are key in developing profitable, sustainable, and efficient value chains to the benefit of all the actors along the chain.

**Acknowledgements.** The authors are thankful to Higher Education Commission, Pakistan for providing fellowship to A. R. (author) under the International Research Support Initiative Program (IRSP-HEC) program.

**Funding statement.** This research received no specific grant from any funding agency, commercial or not-for-profit sectors.

**Competing interests.** None.

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