Regoverning Markets

Small-scale producers in modern agrifood markets

Innovative Practice

Jordan
Participation and decision making of small-scale producers in new sheep cheese market channels in the Badia

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Regoverning Markets

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1 Abstract

Based on field research, this paper provides analysis of sheep cheese market channels in the Badia of Jordan. The goal is to inform policymakers, researchers and development programmes about this commodity's market in that area. It also addresses market impact on Badia development and the challenges that face small-scale producers in accessing the market. Specifically, it investigates farmers' channel choices, and determinants of market choices after the introduction of the Badia Research and Development Centre (BRDC)'s innovation. The data were elicited from 118 subjects through a survey carried out in March-June 2007. Additional data were collected through interviews with key informants and PRA with farmers. This paper examines farmers' choices of market channel and technology choice as factors of farmers' characteristics such as capital, quasi-capital, risk controllers, incentives, farm size and village location.

Findings indicate that the sheep cheese market is still a decentralized, mixed procurement system. The Badia innovation gradually evolved along with the supply chain and in response to the varying conditions imposed by the four pillars of inclusion[1]; at the same time it had poor executive governance. Farmers' decisions regarding channel choice and technology choice are a trade-off between losses (or risks of losses) and gains. The attributes that affect a farmer's choices of channels are: farm labour, provision of technical assistance, use of contract, disease control, and feed requirements. Differences of attributes among the channels show the importance of increase in household income and village location. Association of attributes among the different channels shows a significant relation with a farmer's additional job, contractual relations, and bank deposits. A farmer's decision of channel is not affected by technology choice. However, a farmer's choice of technology is affected by increase in production costs, land ownership, and feed requirements. Differences among the channels indicate that technology choice is important in relation to increase in production costs, product price, profit, and household income. Association with technology choice indicates a relation with disease control, feed requirement, landownership, and farm labour.

Conclusions show that farmers who access traditional and wholesale markets have a better economic status. It is crucial for farmers who participate in the cheese factory channel to be able to produce quality and quantity, but choice of produce quality is more a function of human capital, risks control and incentives than of equipment. Benefits from the innovation included: sustainability, better product quality, better prices, increased livestock activity and size, ability to buy animal feed, job opportunities, income increase, farmers marketing choices and sales increase. The factory has to provide price premiums, cash, technical assistance and supervision, and maintain

[1] Centralized procurement; specialized wholesalers; preferred suppliers; private standards.

quality and reliability in cheese produce, in order to compensate farmers for the additional risk and cost they incur in supplying the cheese factory with quality milk.

2 Background

Jordan has recently become a member of the World Trade Organization (WTO). This has led to changes in some regulations in the agricultural sector. The Agricultural Marketing Organization has taken its first steps towards setting up quality standards for fresh fruits and vegetables. Most indicators show poor competitiveness of the majority of Jordanian agricultural products due to the following: small size of production and marketing enterprises; absence of organizations to assist producers to use technologies needed to improve produce quality, lower costs, and ameliorate marketing activities; government failure to provide the needed environment to encourage the private sector to invest in the marketing infrastructure; and government failure to provide effective support services (MoA 2007).

The retail sector has undergone internal changes raising consumer expectations of product standards and specifications. This has prompted some local retailers to reinvent themselves. Supermarkets have spread in Amman suburbs and in some other cities of Jordan; in small cities and villages, however, grocery and convenience stores still play an important role in the retail business. Research is still limited on changes in market structure, their effect on new technology adoption by farmers and on domestic channels to supermarkets in Jordan, and in particular on how private standards and other product and transaction requirements of local supermarkets are transmitted to, and affect, producers (Chaudhry 2006).

The selection of sheep cheese for this research is based on the fact that this commodity is affected by changes in the food industry found to be critical for small-scale farmers in the Badia of Jordan. People of the Badia (Bedouins) are considered Jordan's top producers of sheep's milk for cheese. Although many consumers in Jordan and in the region are more familiar with cheeses from cow's milk, such as Cheddar and Swiss, there is an important growing market for sheep cheeses. Livestock dairy product quantity for unorganized sheep and goats and cow holdings in Jordan is 2,060 M.T., valued at 9,688,910JD ($13,758,252)[2] (2005 statistics). With an output of 165,000 tons of fresh milk, Jordan produces 35 litres per capita, while individual milk consumption is equivalent to 50 litres. The country imports about 8,000 tons of powdered milk each year. Due to expansion in Jordanian dairies, production of cheese in Jordan averaged 7,250 tons per year in 2002-2004, compared with only 2,950 tons in 1999-2001. Jordan's production of sheep cheese is estimated at about 60kg/head annually. Most recent figures of cheese imports rose from 7,130 tons in 1999 to 10,533 in 2003. Figures show that Jordan imports about $19.7 million worth of cheese annually (Parker 2005).

[2] Note: 1 JD = 1.42 US$, 1 JD = 1.10 EUR.

The present study's geographical location is the north east Badia[3], an area that has been neglected in the development process in Jordan. Development there has been restricted by scarcity of water, land tenure, and shortage of adequate agrifood transportation. About 80 per cent of Jordan's land is Badia, but about 74 per cent of Jordan's livestock is found in it. The number of sheep in Jordan is 2,024,810, of which 967,790 are in the north Badia (2005 statistics). Livestock holders in the north east Badia number 845 and are categorized according to flock size: livestock holders of 1-100 heads represent 50.8 per cent; 101-200 represent 20.5 per cent; 201-300 represent 9.5 per cent; 301-400 represent 5.3 per cent; and 401+ holders represent 13.9 per cent. Average farm size is 203 heads; only a few farmers have as many as 3,000 heads (Al-Oun 1997; 1998).

North Badia is located in the Mafraq governorate and compromises 25,930km^2. With a birth rate of 2.26 per cent, the north Badia population stands at 263,200 (2006 statistics), making up about 4.7 per cent of Jordan's total population. Most of the people in the area depend on livestock for their livelihoods, as 22 per cent of households consider livestock as their main source of income and 35 per cent consider livestock production as their major activity. Milk is considered the most important source of income from livestock after meat (Al-Oun 1997; 1998).

People in the area were able to adjust their sheep management systems and cope with severe droughts and feed subsidy suspension in 1996. Grain subsidy removal in mid-1996 led to an increase of 100 per cent in feed costs compared with prices in early 1980s. This increased the overall cost of livestock by nearly 70 per cent. It is estimated that livestock numbers have dropped by 25 per cent since the mid-1990s. Better opportunities encouraged many Bedouin families to shift from animal production to a settled agricultural life (Al-Oun 1997; 1998).

2.1 Innovation

The innovation under investigation in this study is a combination of entrepreneurship and government policies created to increase farmers' benefits to above the average rates and to get rid of wholesalers' monopoly over farmers. It was launched through the only development agency present in the Badia, the Badia Development Research Centre (BRDC). The launching coincided with a set of legislations initiated by the Ministry of Planning (MoP), which supports development projects. BRDC objectives were to create jobs, provide support, enhance farmers' socio-economic status, increase cheese production, and provide marketing channels for product. The innovation emerged in the Jordanian Badia

[3] The arid and semi-arid land that is inhabited by the Bedouins (Badu); its annual rainfall does not exceed 200mm.

because there were barriers preventing Badia farmers from entering the market (Shahbaz et al. 2006).

The innovation was initiated in 1999 by establishing a sheep cheese factory (which, because of financial constraints, was not able to operate until 2004). Access to cash was at the beginning available through MoP, which granted 175,000JD ($248,500) in 2003 to establish the Tal Arrimah Cooperative Association (TACA) and infrastructure, and 20,000JD ($28,400) in 2004 to cover operation costs. Further, land was provided by local people and members of TACA in exchange for membership and stock shares (Gorman et al. 2007; Shahbaz et al. 2006). The development, through the innovation launched by the BRDC, of new marketing opportunities for farmers in the Badia, triggered new attributes required for competitiveness in the inaccessible cheese market in Jordan.

Farmers' risks included uncontrolled or new animal diseases, sudden price increases of animal feed, and dry seasons. Risks for small-scale farmers outside the innovation comprised overproduction during two spring months (March and April) and the inability to market their milk. Farmers' opportunities included continuous milk sales to the factory, especially when they were close to the factory, as well as better prices and sustainable sources of milk sales (Shahbaz et al. 2006).

The statement of the problem is that for producers with less capital, the level of inclusion of small-scale producers in quality requirements resulting from open marketing determinants that involve greater investments as compared with traditional systems may increase barriers.

3 Theoretical framework

Recognizing the boundaries of the innovation is an essential step for clarity and consistency of analysis, as Douthwaite and Ashby (2005) indicated. Organizational-institutional and economic analysis of the supply chain, and governance and coordination of the value chain using Kaplinsky and Morris (2001), will help to realize the imposed changes and farmers' inclusion. Inclusion is the capacity of small-scale producers to sustain their participation in a given supply chain and restructured market as they evolve. This capacity is the ability to undertake the technological, managerial and organizational changes required as a consequence of the continuous transformation of supply chains (Kaplinsky and Morris 2001; Berdegué et al. 2005). Inclusion can take different forms, from mere participation as individual suppliers, to collective action with other suppliers to meet basic demands for volume and consistency of supply, to becoming a specialized supplier on the basis of value-adding activities, or to becoming co-owner of a supply chain or one of its segments. Development agencies can change the set of incentives facing small-scale farmers and/or improve farmers' capacities to face these incentives (Berdegué et al. 2005).

Strategies evolve as procurement systems vary in their stage of development along the four pillars of inclusion. Changes undertaken by farmers are responses to changes in the incentives they face in a restructured market. The emergence and continuous evolution of the four pillars provide concrete incentives to small-scale farmers to undertake successive and never-ending changes in the areas of technology, management and inter-firm organization, all of which have significant financial implications (Berdegué et al. 2005).

Contracts emerge throughout these restructured markets and serve as incentives to the suppliers to stay with the buyer and, over time, to make investments in assets specific to retailers' specifications regarding products. Contracts are major agents of change, affecting tangible or intangible sanctions. A contract is not only the specific set of governance mechanisms agreed upon between a buyer and a supplier or between any segments of the chain (Reardon et al. 2004). The specification of prices, services and other transactional terms (whether written or not) between buyers and sellers constitute a contract, as Hueth et al. (1999) indicate. Contracts are insufficient because they are incomplete; they are secondary, serving only to assess quality and supply. Relationship, respect, openness, trust, mutual understanding, reputation and socially binding arrangements are more beneficiary for both parties (Hueth et al. 1999).

Finally, profit-maximization and risk-minimization choices of farmers to produce along the projected attributes of the innovation against the conventional non-complex attributes, may be recursive or simultaneous. The grower's first choice is to supply to a given market-channel, representing a choice between the new channel and the traditional market/wholesaler as determinant of technology adoption choices, as Sadoulet and de Janvry (1995) indicate. The model of choice is a function of prices, input prices, risks and attributes, quasi-fixed capital (human, organizational, physical, and land), and other shifters. The second choice is that of technology, which is embodied in input and capital investment, contingent on choice of marketing channel, and, therefore, as a relation of attributes required to participate in the channel and net returns and risks, as Sadoulet and de Janvry (1995) illustrate.

4 Methods

The aim of the present study is to empirically identify the strategies by which small-scale producers respond to sheep cheese market restructuring in ways that strengthen the resilience of their economies. The purpose is to analyze the access of cheese small-scale producers to the supply chain, and the effect of such access on small-scale producers' decisions. The research is based on a case study analysis in the Jordanian Badia region and its link to the supply chain of traditional and new markets in Jordan. Primary data was gathered using empirical research of semi-structured interviews, focus groups, and farmers' survey.

4.1 Hypotheses of the study

The first hypothesis states that a farmer's choice of supplying is a function of a set of farmer's attributes. Attributes include:

1. Human capital (education level, farm labour, and additional farmer's job). Education usually qualifies for additional jobs. Labour is proxied using permanent or temporary employment on farm.
2. Off-farm sources of income (bank savings and deposits, household enterprise, and land ownership). Sources of income serve as risk management to balance the initial risk of selling to a non-traditional market and to finance operations. Access to work and investment includes access to financing and sources of operational and investment capital.
3. Access to risk control factors (credit and loans, provision of technical assistance, and use of contracts).
4. Prices offered by buyers, individual farmers' shares (profit they get per head and increase in household income), and input costs.
5. Attributes and incentives like disease control and feed requirements. This model is based on that of Sadoulet and de Janvry (1995).

- The first sub-hypothesis assumes that these attributes are differently associated and affected among the different channels.
- The second sub-hypothesis assumes that the closer the farm is to the factory, the more probable it is that farmers will choose the factory channel; farm distance, as indicated by Staal et al. (1997), is an important determinant of channel choice.
- The third sub-hypothesis assumes that farm size affects the channel choice; attribute of yields is required differently by each channel as indicated by Cook (2004) and Berdegué et al. (2004).

The second hypothesis states that choice of technology is affected by a set of farmer's attributes, based on the Sadoulet and de Janvry (1995) model mentioned above. The technology variable is modelled as dichotomous, in that a farmer either has or does not have any applied technology in relation to quality of animal feed required to get the appropriate pH and fat levels, and to quantity of milk through increased livestock size.

- The first sub-hypothesis states that these attributes are differently associated and affected by technology choice.
- The second sub-hypothesis states that the closer the farm is to the factory and the bigger it is, the more probable it is that farmers will choose technology.
- The third sub-hypothesis states that technology choice is a function of channel participation. It further states that farmers who use technologies apply their embodied technologies differently in terms of value-added quantity and quality, measured on a scale of 1-5.

4.2 Data collection

Semi-structured interviews were conducted during the months of April and May 2007 with nine key actors that included: corporation procurement officers, 'Safeway' supermarket managers, administrators, procurement coordinators, two wholesale agents, the factory manager, the president of the cooperative society, and local small-scale farmers and producers

4.2.1 Focused group discussion

The Participatory Rapid Appraisal (PRA) approach was used during the months of March and April 2007. The PRA included three focus group meetings of the different cluster villages. Meetings were led by research assistants and lasted 1-2 hours.

4.2.2 Surveys

The sample was randomly selected using stratification by flock size: (1-100 heads) 46.5 per cent, (101-200 heads) 14.9 per cent, (201-300 heads) 12.3 per cent, and (301-400 heads) 7.9 per cent. Subjects were randomly selected from the different cluster villages; they represented small-scale producers with relations to the three marketing channels available in the Badia: traditional, wholesalers, and factory (the innovation). The final sample was 114 small-scale producers, of which 70 subjects chose the traditional channel, 28 the factory channel, and 16 the wholesaler channel.

The questionnaire examined producer's (head of the household) socio-economic characteristics, marketing accessibility, and adaptation. The major variables of the survey were based on the household survey of Reardon and Glewwe (2000) and included:

1. Market channel choice.
2. Production and embodied technologies choice.
3. Attributes and incentives.
4. Input and output prices.
5. Household characteristics.
6. Risk control and quasi-fixed capital.

The study included a multi-dimensional model as a function of different factors that affected inclusion and exclusion (choice of market) and, later, adaptation to restructured market requirements (choice of technology). Thus the quantitative model of analysis included two major steps: a multinominal logit model for choice of market and technology which affected the interactive attributes; and test of difference among the three channels' attributes using the Analysis of Variance (ANOVA), and of degree of association using chi-square tests.

5 Results, analysis, and discussion

This section presents the major findings of the case study and a normative analysis, both merged with the discussion for the purposes of clarity.

5.1. Market channels characteristics and context

The Badia cheese market is open to other cities of Jordan; therefore competition in prices and product quality has remained stable and limited. Survey findings showed that about 61 per cent of the subjects chose traditional intermediaries, about 14 per cent direct wholesalers' relation, and about 25 per cent direct factory relation. As depicted in Figure 1, milk is produced and brought into the factory by farmers and the NGO. Traditional intermediaries and wholesalers collect milk directly from farmers and sell to different retailers after processing the cheese. They occasionally visit farmers, provide loans, and negotiate transactions. The factory sales to key buyers include 30 per cent to BRDC, AABU (Al al-Bayt University), armed forces at Safawi, Azraq and Mafraq, and HCST (the Higher Council for Science and Technology), and 70 per cent to wholesalers (see Figure 1). Factory input of milk from farmers was 24,362kg in 2006 at a cost of 0.4JD ($0.57) per kg, decreasing from 37,547kg in 2005, and the cost rising from 0.39JD ($0.55) per kg in 2005. The output of cheese in 2006 was 3,285 kg with a cost of 2.3JD ($3.27) per kg, but was 4,216kg in 2005 with less cost (1.45JD ($2.06) per kg).

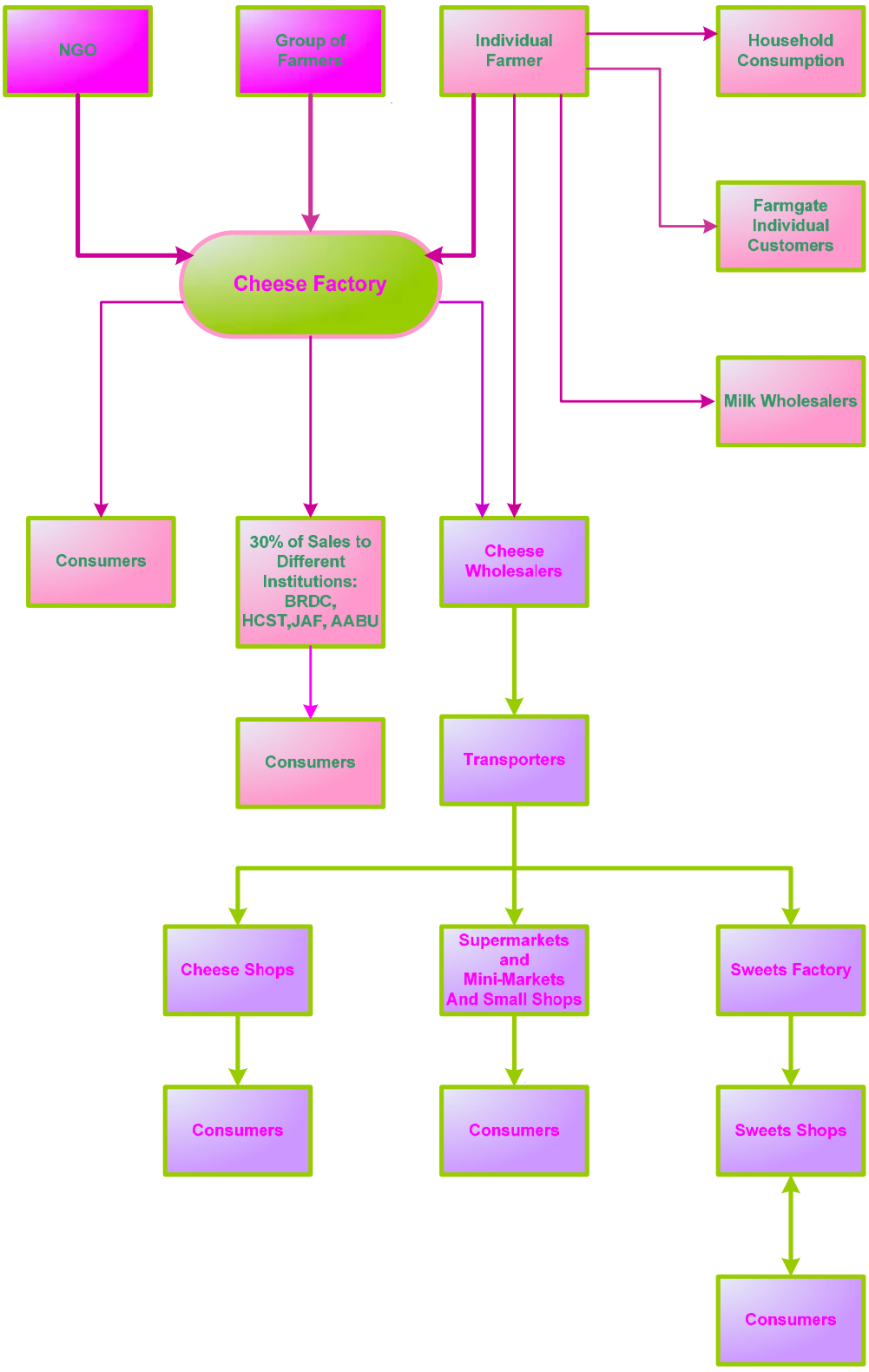

Figure 1: Market channels for sheep cheese. Source: the author.

5.1.1. The evolution of the factory supply chain

Farmers' inclusion and participation has been achieved both as individual suppliers since 2006, and as a collective action with other suppliers since 2004. Small-scale producers accessed the supply chain through membership of the association, which made direct communication with the farmers. Farmers who did not conform to milk quality nor had less than ten heads were excluded from participation.

Drivers of inclusion: procurement systems based on four pillars
The factory works with dual objectives: qualitative, to increase quality and safety of cheese; and quantitative, to increase volume and reduce costs. Different market strategies evolve along the procurement systems that vary in stage of development along the four pillars of inclusion, as Berdegué et al. (2005) indicate. The present procurement system of cheese products available in the market includes:

1. Organizational - specialized procurement agents – "dedicated wholesalers" – who deliver to chain supermarkets around Jordan (but not found in the Badia). This shift happens because additional wholesalers lack quality or consistency standards. However, Badia farmers, including those who travel in spring seasons for rangelands and who live away from the factory, rely on traditional wholesalers.

2. Organizational - preferred suppliers to ensure consistent supply: chain supermarkets in Jordan are also switching to lists of preferred suppliers using new commercial practices that reward high performance in delivery (not found in the Badia either). However, the cheese chain in general is still a decentralized, mixed procurement system. Many regular supermarkets are sourcing directly from individual producers or preferred wholesalers.

3. Organizational - centralization of procurement through distribution centres: there is a shift to centralized procurement through distribution centres to major chain supermarkets. The innovation represents a centralized proactive procurement system.

4. Institutional - private grades, standards, and conditions improved by the factory. Institutional issues of standards are related to benchmarks of performance and practices (Kaplinsky et al. 2001). Changes in incentives faced by farmers in innovation of sheep cheese markets include:

- In terms of transaction attributes required in the factory chain: price is to be fixed and to be the best price available in the local market (0.1JD ($0.14) more than what the wholesalers set for each kg); payment mode is cash from wholesalers, and monthly from the factory; minimum volume is open; and shipment required is fresh early morning daily delivery.

- In terms of technologies: the factory has requirements related to Ministry of Health safety and health regulations: fresh milk delivery, animal disease control, low pH level, and fat level not to exceed 27-30 per cent, all expressed using verbalized informal accords (contract). The accords stipulate that the factory take all the supply the farmers can provide (if the farmers choose to) provided that they are offered the best competitive market price. They informally specify that NGO members will be provided with technical assistance in issues like animal disease control, vaccinations, feed and insemination, in addition to farmer training and loans.

5.1.2. Changes of inclusion

Management was shared with the local community and based on kinship distribution at both the factory and TACA. The innovation was based on collective action and team work and not launched until the local people became members of an NGO that had managerial and financial capacities. Incentives were available, but financial support was not sustainable. Incentives included loans, membership in TACA, better prices, better quality milk, raw material (milk) or its output (cheese), and marketing.

Changes requested from farmers included providing quality feed and increasing livestock size. This required getting loans, something new to the farmers in the Badia area. Small-scale producers managed to comply with product and transaction requirements by: (1) conforming to new standards using deals and agreements; (2) organizing the feeding system by using feed concentration; (3) developing farm management and financial management skills; (4) getting training by BRDC; and (5) establishing milk collection centres with cooling tanks through TACA.

5.1.3. Costs and benefits of inclusion

Costs were the responsibility of the BRDC, so whenever the innovation struggled farmers blamed it on the BRDC. On the other hand, the experience gained in the creation of the NGO allowed communities to work together, transcending tribal differences. Innovation benefits included improvement in rangeland feed and water supply. For smallholders, this inclusion improved farm income and created more jobs.

Income benefits for the small-scale producers were as follows: about half of the subjects (51 per cent) faced changes in production costs, with an average increase of 5.5JD ($7.81) per sheep head. About 42 per cent of the sample had yields with a range of 4-70JD ($5.68-99.4) per head, the average amount of yield per head being 8.3JD ($11.79). About 41 per cent of the sample reported an increase in product value, with an average of 6JD ($8.52) per head. About 47 per cent reported an increase in profit, with an average of 7.1JD ($10.08) per head.

At the household level, benefits were the following: about half of the subjects (49 per cent) reported an increase of income at an average of 1,762.1JD ($2,502.18) annually. About 21 per cent of the subjects reported change in income security, but they provided no specific information about it. Only 12 per cent of the subjects reported an increase in required external labour to meet new demands from the innovation, but they provided no information about it either. One-third of the subjects (27 per cent) reported use of added income, spent mostly on buying forage and more sheep.

5.2. Analysis of the empirical model and hypothesis testing

5.2.1. Market channel choice

Farmers' decisions regarding channel choice and technology choice were a trade-off between losses (or risks of losses) and gains. Attributes that are hypothesized to affect farmers' choice of channels and technology included: input prices (costs); revenues (increase in profit); human and quasi-fixed capital (increase in income, additional job, education, farm labour, bank savings, household enterprise, and land ownership); and incentives and risks controls (price offered, provision of technical assistance and loans, use of contract, disease control, and feed requirements) as suggested by Sadoulet and de Janvry (1995); in addition to farm distance, as indicated by Staal et al. (1997) and farm size, as suggested by Cook (2004) and Berdegué et al. (2004). The following test the hypotheses stated above.

a. Market choice: multinominal logistic regression test

The interactive relationship of the set of farmer's attributes with channel choice was reported significant in Table 1, suggesting that a farmer's decision to choose between the three channels is a trade-off between losses and gains related to input and output prices, risk control, quasi-fixed capital, attributes, and incentives, as indicated by Sadoulet and de Janvry (1995).

Table 1: Model fitting information of market channel choice.

Model	-2 log likelihood	Chi-square	df	Sig.
Intercept only	206.965			
Final	2.774	204.191	140	**0.000**

Factors (attributes) that significantly contributed to the regression model in the order of their strong effect are (see Table 2): (1) farmer's additional job as a quasi-fixed capital; and (2) contractual relationship, (3) provision of technical assistance, (4) disease control, and (5) feed requirements as attribute and incentive.

This indicates that it is more likely that farmers' choice among the three channels is affected by quasi-fixed capital variables such as having an additional secure job, which is another fixed source of income since they have low income profiles (as indicated earlier). The sample's additional fixed sources of income (which are: 13 per cent civil servants, 12 per cent retirees, 11 per cent traders, and 7 per cent drivers) are low-paid, but give security to the farmer. Access to work includes having access to financing and sources of operational and investment capital. Contracts, though informal, specified competitive prices, payment needs, shipment, and sustainability in supply. Contractual relationship, as a risk controller, contributed to the farmers' channel choice decision, which supports Hueth et al. (1999) and Reardon et al. (2004). Further, availability of technical assistance was a risk controller that also contributed to farmers' decisions. Technical assistance was needed for diseases control, milk inspection, general advice, husbandry, forage quality and mixes, and farm visits and observation. About 33 per cent of farmers reported their need for technical assistance, and about 63 per cent reported their need for livestock vaccination. Risk management was to balance initial risk of selling to a non-traditional market and also to provide finance for operations.

Moreover, the Badia farmers' most available risk was animal disease as indicated by Al-Oun (1998). More than half of the interviewed farmers used disease control, but farmers who participated in the traditional market and the wholesaler channels were more frequent users of it. However, most farmers had low use of animal feed, which may be due to lack of cash needed to meet the high costs of quality feed. The most costly requirement was animal feed because farmers lacked rangelands and because feed subsidies were removed by the government in 1996, as indicated by Al-Oun (1998) and Shahbaz et al. (2006).

Factors that marginally affected the interactive relationship included household enterprise and bank savings and deposits (see Table 2). Both factors were risk controllers and quasi-fixed capital that affected farmers' sense of security. Household enterprise was an additional source of income that provided more cash flow to farmers to undertake additional economic activities. However, only about 14 per cent of the subjects reported the existence of non-farm enterprises. The average transactions from this enterprise were about 346JD ($491.32) during the last 12 months. Meanwhile, bank savings and deposits were a source of capital for farmers.

Table 2: Multinominal logistic regression of channel choice likelihood ratio tests.

Effect		-2 log likelihood of reduced model	Chi-square	df	Sig.
Intercept		3.020	0.000	0	0.0
Input costs	**Increase in production costs per head**	8.319	5.545	12	0.937
Output revenues	**Increase in product profit per head**	5.270	2.496	6	0.869
	Increase in household income	11.141	8.367	48	1.000
Risk control and quasi-fixed capital	**Farmer's additional job**	53.262	50.488	18	0.000
	Education level	10.045	7.271	4	0.122
	Farm labour	2.773	-0.001	2	1.000
	Bank savings and deposits	13.818	11.044	6	0.087
	Household enterprise	8.375	5.601	2	0.061
	Land ownership	2.773	-0.001	2	1.000
Incentives and attributes	**Increase in product price**	2.773	-0.001	10	1.000
	Provision of technical assistance	24.030	21.255	6	0.002
	Availability of chain credit and loans	4.500	1.726	2	0.422
	Contractual relationship	20.474	17.700	2	0.000
	Disease control	14.234	11.460	2	0.003
	Feed requirements	9.282	6.508	2	0.039

Finally, other variables such as increase in production costs, profit, household income, and product prices, as well as educational level, farm labour, land ownership, availability of loans were reported with no significant effect (see Table 2). This suggests that farmers were basically motivated by risk controllers, incentives, capacity, and attributes more than financial issues.

b. ANOVA test

An ANOVA analysis was conducted in order to study the difference between the averages of each attribute across the three available cheese channels (see Table 3). The results indicated that farm distance and amount of increase in household income were significant. The highest amounts of income increase were gained by farmers who sold to wholesalers, and the lowest to the factory. Further, farm location was significant, which supports Staal et al. (1997). Farmers from villages far from the factory tended to use the wholesaler channel due to lack of direct milk transportation to the factory. Farm location is significant because it reflected additional transport costs.

Table 3: ANOVA results of channel choice.

Attributes	Channel choice	N	Mean	Std. deviation	F	P-value
Increase in production costs per head	**Traditional market**	70	5.29	5.65	0.285	0.752
	Cheese factory	28	5.36	10.53		
	Wholesalers	16	6.81	7.74		
	Total	114	5.52	7.36		
Increase in product price	**Traditional market**	70	5.56	7.05	0.723	0.487
	Cheese factory	28	5.96	7.99		
	Wholesalers	16	8.13	9.81		
	Total	114	6.02	7.69		
Increase in product profit per head	**Traditional market**	70	7.16	7.48	0.476	0.622
	Cheese factory	28	6.14	7.93		
	Wholesalers	16	8.63	10.94		
	Total	114	7.11	8.10		
Increase in household income	**Traditional market**	70	1771.07	2695.13	3.752	0.027
	Cheese factory	28	898.57	1884.52		
	Wholesalers	16	3234.38	3872.41		
	Total	114	1762.15	2786.80		
Farm location	**Traditional market**	70	9.31	6.12	17.700	0.000
	Cheese factory	28	3.29	3.16		
	Wholesalers	16	12.31	5.10		
	Total	114	8.25	6.15		
Flock size (farm size)	**Traditional market**	70	224.86	225.69	2.688	0.072
	Cheese factory	28	186.14	311.22		
	Wholesalers	16	368.75	295.29		
	Total	114	235.54	262.69		

In addition, flock size (indicating farm size) was marginally significant, which supports the Cook (2004) and Berdegué et al. (2005) findings. The sample's livestock holdings range was 5-1,500 heads with an average size of 236 heads. Farmers who participated in the factory channel had larger flock size. However, farmers who had large flock size and travelled longer distances in order to find natural feed for their flocks tended to choose the wholesaler's channel. Owners of larger flock sizes liked to limit risks; therefore if they were situated a distance away from the factory, they prearranged things with wholesalers, who were flexible in terms of logistics. Farmers looked for accessible alternatives to market their milk if they travelled more than 70 km west of the factory location. This mobility impacted the innovation by making it difficult for the factory to get sustained milk supplies. Findings suggest that traditional and wholesale cheesemakers have better opportunities to source from the Badia farmers. Finally, other variables such as increase in production costs, product price, and profit showed no significant difference among the different channels.

c. Chi-square test

Association of the nominal attributes with the three channels was tested using a chi-square test (see Table 4). The results indicated that additional farmer's job, bank deposits, and contractual relationship were significant with the three channels. Most farmers who chose the factory had additional jobs (82.1 per cent), about half of the wholesale channel farmers (51.8 per cent) had additional jobs, but only 38.6 per cent of the traditional channel farmers had additional jobs. This is potentially because most farmers who supplied to the factory lived in the cluster villages and had initial low-paid jobs and low income profiles.

Table 4: Chi-square of nominal attributes with channel choice.

	Farmer's additional job	**Contractual relationship**	Household enterprise	Availability of chain credit and Loans	Land ownership	**Bank savings and deposits**	Farm labour	Education level	Provision of technical assistance	Disease control	Feed requirements
Pearson Chi-square	**32.452**	**6.345**	2.153	1.624	3.563	**13.865**	1.992	12.151	7.562	2.622	1.427
df	**18**	**2**	2	2	2	**6**	2	6	6	2	2
Asymp. Sig. (2-sided)	**0.019**	**0.042**	0.341	0.444	0.168	**0.031**	0.369	0.059	0.272	0.270	0.490
No. of valid cases	**114**										

Many of the sample used contract relationships, but they mostly belonged to the traditional channel (see Table 5). The limited use of formal contractual relationships was due to existing trust relations, given that all partners of the innovation were from the same Badia area and had respect for each other. Regarding bank deposits, about 30 per cent of the subjects had cheque accounts, and about 11 per cent had savings accounts. Meanwhile, most bank deposits and cheque accounts belonged to traditional channel participants, but most saving accounts belonged to factory channel participants. However, it is important to note that bank accounts were not a pre-condition for accessing the channel or the innovation.

Table 5: Cross tabulation results of channel choice with contractual relationship and bank deposits.

Channel choice		Contractual relationship			Type of bank deposits				
		Yes	No	Total	None	Cheque account	Savings account	Post Office accounts	Total
Traditional market	**Count**	50	20	70	46	19	4	1	70
	Within%	71.4	28.6	100	65.7	27.1	5.7	1.4	100
	Total%	**43.9**	**17.5**	**61.4**	**40.4**	**16.7**	**3.5**	**0.9**	**61.4**
Cheese factory	**Count**	26	2	28	9	12	7		28
	Within%	92.9	7.1	100.0	32.1	42.9	25.0		100
	Total%	**22.8**	**1.8**	**24.6**	**7.9**	**10.5**	**6.1**		**24.6**
Wholesalers	**Count**	14	2	16	11	3	2		16
	Within%	87.5	12.5	100	68.8	18.8	12.5		100
	Total%	**12.3**	**1.8**	**14.0**	**9.6**	**2.6**	**1.8**		**14.0**
Total	**Count**	90	24	114	66	34	13	1	114
	Within%	78.9	21.1	100	57.9	29.8	11.4	0.9	100
	Total%	**78.9**	**21.1**	**100**	**57.9**	**29.8**	**11.4**	**0.9**	**100**

Further, educational level was marginally associated with channel choice (see Table 4), suggesting that educated farmers chose the factory channel most because they were aware of its importance and its potential impact on their economic status. The variables of household enterprise, availability of credit and loans, land ownership, and additional farm labour, provision of technical assistance, disease control, and feed requirements (components of embodied technologies) showed no significant differences among the three channels, as indicated in Table 4. Farmers in general tended to seek technical assistance, as 33 per cent reported their need for technical assistance and about 63 per cent for livestock vaccination. More than half of the interviewed farmers used disease control. However, most farmers have low use of animal feed, which may be due to lack of cash needed to meet the high costs of quality feed.

5.2.2. Choice of production technology

The emergence of cheese attributes through the innovation of sheep cheese factory included determinants of the capacities to meet requirements of milk quality (low pH and fat levels), which required investing in quality animal feed and animal disease resistance, and of quantity (yields), which required investing in increasing livestock size. These factors necessitated technological choices implied by the required attributes of quality and safety, as Reardon et al. (2001) suggested. Farmers saw their role in these technological requirements through different forms of participation: open discussions, decision-sharing, and experience presentation.

a. Technology choice: multinominal logistic regression test

The hypothesis that technology choice is affected by a set of farmer's attributes (shares, costs, prices, incentives and risk controls, attributes, and human and quasi-fixed capital) was reported significant in Table 6, suggesting that farmers' use of production technology choice was affected by the interaction of a set of factors that made up the farmer's decision to supply a certain channel.

Table 6: Model fitting information of production technology choice.

Model	-2 log likelihood	Chi-square	df	Sig.
Intercept only	153.999			
Final	48.091	105.908	70	**0.004**

Factors that contributed to the regression model in the order of their strong effect are (see Table 7): (1) land ownership (a risk control and quasi-fixed capital variable); (2) feed requirements (an incentive signalled by the channel); and (3) increase in product costs per head (an input variable). This supports some of the attributes suggested by Sadoulet and de Janvry (1995). Further, feed requirements are costly, and as a result affect the decision of technology use.

Land ownership was the most affecting factor of farmers' choice of technology. It was a quasi-fixed capital that was available when needed – representing a sense of security working as a source of investment in technology when needed. About 61 per cent of the interviewed farmers or members of their family owned land areas varying from 20-5,215 donums[4] with an average land size of 301 donums.

Contractual relationship, educational level, and increase in product price were reported with marginal significance in Table 7. Contracts are incentives and sources of risk control as indicated earlier when farmers used them as determinants of channel choice. They provide specific terms of technological requirements and specifications as indicated by Reardon et al. (2004). Therefore, farmers were becoming aware of their importance in making their technology choice. Further, education level makes farmers aware of technology impact on increasing their chances of competition and getting better price. Variables like increase in product profit per head and increase in household income, farmer's additional job, required farm labour, bank savings and deposits, household enterprise, provision of technical assistance, availability of credit and loans, and disease control were not significant in their effect.

[4] One donum = 1,000 square metres.

Table 7: Multinominal logistic regression of technology choice likelihood ratio tests.

Effect		-2 log likelihood of reduced model	Chi-square	df	Sig.
Intercept		48.091	0.000	0	
Input costs	**Increase in production costs per head**	**61.064**	**12.973**	**6**	**0.043**
Output revenues	**Increase in product profit per head**	50.260	2.168	3	0.538
Risk control and quasi-fixed capital	**Increase in household income**	72.978	24.887	24	0.412
	Farmer's additional job	58.241	10.149	9	0.339
	Education level	53.308	5.216	2	0.074
	Farm labour	49.903	1.812	1	0.178
	Bank savings and deposits	49.484	1.393	3	0.707
	Household enterprise	48.214	o.122	1	0.726
	Land ownership	**53.159**	**5.067**	**1**	**0.024**
Incentives and attributes	**Increase in product price**	57.650	9.559	5	0.089
	Provision of technical assistance	50.342	2.251	3	0.522
	Availability of chain credit and loans	48.168	0.076	1	0.782
	Contractual relationship	51.309	3.217	1	0.073
	Disease control	49.083	0.992	1	0.319
	Feed requirements	**52.754**	**4.662**	**1**	**0.031**

b. ANOVA test

An ANOVA analysis was conducted in order to study the differences among the averages of each attribute in relation to technology choice (Table 8). The results indicated that increases in production costs, product price, profit, and household income were significantly different between those who used technology and those who did not. Farmers who chose technology had to put more investments in the production of milk in order to produce quality in relation to pH and fat levels and hygiene. They needed to take care of their animals in terms of disease control and quality feed, as well as other direct and indirect environmental risks. However, those farmers who used technology seemed to have had a greater increase in product price and profit, as well as household income. This suggests that profit increases when farmers invest more in technologies. Additionally, flock size was significant – those who used technology tended to have larger flock sizes. Those who had large flock size, reflecting large farms, had better income and better livestock management skills. They decreased risks by improving animal care and were more capable of implementing quality requirements in order to increase revenues and profits. Finally, village location was not significantly different in relation to technology use.

Table 8: ANOVA results of technology choice.

Attributes	Technologies choice	N	Mean	Std. deviation	F	Sig.
Increase in production costs per head	High technology	51	8.31	8.06	**14.952**	**0.000**
	No technology	63	3.25	5.90		
	Total	114	5.52	7.36		
Increase in product price	High technology	51	9.16	8.24	**17.647**	**0.000**
	No technology	63	3.48	6.20		
	Total	114	6.02	7.69		
Increase in product profit per head	High technology	51	10.84	8.38	**23.455**	**0.000**
	No technology	63	4.10	6.49		
	Total	114	7.11	8.10		
Increase in household income	High technology	51	2927.65	3137.17	**18.665**	**0.000**
	No technology	63	818.65	2048.34		
	Total	114	1762.15	2786.80		
Farm location	High technology	51	7.73	5.61	**0.681**	**0.411**
	No technology	63	8.68	6.56		
	Total	114	8.25	6.15		
Flock size (farm size)	High technology	51	322.20	298.45	**10.923**	**0.001**
	No technology	63	165.40	206.79		
	Total	114	235.54	262.69		

c. Chi-square test

A chi-square analysis was conducted to test for the association of the nominal attributes with technology choice (Table 9). The results indicated associations for those who used technology with the use of animal disease control, animal feed requirements, land ownership, and farm labour. Signalled by channels, disease control and feed requirements were associated with technology choice, and this required more labour.

Table 9: Chi-square tests of nominal attributes with technology choice.

	Farmer's additional job	Contractual relationship	Provision of technical assistance	**Disease control**	**Feed requirements**	Household enterprise	Availability of chain credit and loans	**Land ownership**	Bank savings and deposits	**Farm labour**	Education level
Pearson chi-square	7.690	0.341	1.844	**14.720**	**12.660**	1.369	1.721	**4.837**	2.847	**4.599**	1.511
df	9	1	3	**1**	**1**	1	1	**1**	3	**1**	3
Asymp. Sig. (2-sided)	0.566	0.559	0.605	**0.000**	**0.000**	0.242	0.190	**0.028**	0.416	**0.032**	0.680
No. of valid cases	**114**										

Animal disease control was reported more by those who used technologies. Animal feed requirements were reported more by those who used technologies, though about 78 per cent did not comply with animal feed requirements. Use of labour requirements were higher for those who implemented technologies, although most farmers did not hire labour, depending rather on family labour (Table 10). Further, land ownership was mostly reported by those who used high technology. It was a source of quasi-fixed capital that farmers used whenever they lacked money to invest in technologies. At the present time, extensive land development activities are taking place around Jordan, including the Badia, and this has suddenly raised land price, making land an important asset of quasi-fixed capital.

Table 10: Cross tabulation results of nominal attributes with technology choice.

		Animal disease control			Animal feed requirement			Land ownership			Farm labour		
		Yes	No	Total	Yes	No	Total	Yes	No	Total	Yes	No	Total
High technology	Count	40	11	51	19	32	51	37	14	51	10	41	51
	Within%	78.4	21.6	100	37.3	62.7	100	72.5	27.5	100	19.6	80.4	100
	Total%	35.1	9.6	44.7	16.7	28.1	44.7	32.5	12.3	44.7	8.8	36	44.7
No technology	Count	27	36	63	6	57	63	33	30	63	4	59	63
	Within%	42.9	57.1	100	9.5	90.5	100	52.4	47.6	100	6.3	93.7	100
	Total%	23.7	31.6	55.3	5.3	50	55.3	28.9	26.3	55.3	3.5	51.8	55.3
Total	Count	67	47	114	25	89	114	70	44	114	14	100	114
	Within%	58.8	41.2	100	21.9	78.1	100	61.4	38.6	100	12.3	87.7	100
	Total%	58.8	41.2	100	21.9	78.1	100	61.4	38.6	100	12.3	87.7	100

5.2.3. Production technology choice in relation to channel choice

The hypothesis that technology is affected by market channel chosen was found not to be significant, as shown in Table 11. This may be due to flexibility in the executive governance and lack of tangible sanctions that result from use of informal contracts based on trust relations. This limited quality level. Technology was used most by farmers who chose the factory channel and least by those who chose the traditional channel. Although it is important to use technologies to produce milk, it turns out not to be crucial for producers to possess them. The NGO facilitated farmers' access to the factory channel. Therefore, technology use was not fully monitored, which reflected a weak reach in the governance mechanism.

Table 11: Chi-square results of channel choice with technology choice.

					Production technology choice		
Pearson chi-square		Value	df	Asymp. Sig. (2-sided)	High technology	No technology	Total
		2.067	2	0.356			
Market choice	Traditional market	Count			31	39	70
		Within%			44.3	**55.7**	100
	Cheese factory	Count			15	13	28
		Within%			**53.6**	46.4	100
	Wholesalers	Count			5	11	16
		Within%			31.3	68.8	100
Total		Count			51	63	114
		Within%			44.7	55.3	100

Further, the hypothesis that farmers used technologies in terms of value-added quantity and value-added quality as an effect of channel choice was tested using comparative means (Table 12); it was reported as non-significant. Farmers from the factory channel had most tendencies to use quality and quantity value-added technologies, and those from the traditional channel had the least tendency. The explanation for this lack of significance for statistical difference in technology and embodied technology use lies in the structure of the chain itself.

Table 12: ANOVA results of channel choice with embodied technologies.

Market choice	Value-added technology for quality	Value-added technology for quantity
P-value	0.120	0.857
F	2.164	0.154

To summarize, it is crucial for farmers who participate in the factory channel to be able to produce quality and quantity, but results indicate that the ability to produce quality is more a function of human capital, risks control and incentives than of using equipment. This indicates that human capital and quasi-capital dimensions in determining farmer's access to the market were more attributable than technology holdings.

6 Conclusions

BRDC and MoP played a significant role in the emergence and evolution of the innovation. The innovation gradually evolved along with the supply chain and in response to the varying conditions imposed by the four pillars; however, it faced general financial, managerial, and marketing problems. Capacities required from farmers were basically financial, realized through TACA. In terms of technology, farmers were not required to have any expertise but were offered annual training workshops. However, the innovation had poor executive governance. In terms of organization, farmers were able to establish themselves as an NGO. In terms of management, farmers had no skills other than individual management skills gained at the farm level. Findings indicated that traditional and wholesale cheesemakers have better opportunities to source milk from the farmers than the innovation does.

This paper examined the relationship between farmers' choice of market channel and technology choice as factors of farmers' characteristics such as capital, quasi-fixed capital, risk controllers, incentives, farm size, and village location. A number of findings emerged throughout this study:

- First, selling choices are based on human capital (such as additional jobs) and incentives like product price, contractual relationship, animal disease control, and feed requirements.
- Second, village location was associated among the channels.
- Third, amount of income increase was significant among the three channels but was highest for those who sold to wholesalers.
- Fourth, additional farmer's job, bank deposits, and contractual relationships were differently associated with the three channels.
- Fifth, secured formal contracts were used most by those who sold to the traditional market and least by these who sold to wholesalers.
- Sixth, a farmer's decision about channel was not affected by technology choice.
- Seventh, the farmer's choice of technology was affected by increase in production costs, land ownership, and feed requirements.
- Eighth, differences among the channels indicated that technology choice was important in relation to increase in production costs, product price, profit, and household income.
- Ninth, association with technology choice indicated a relation with disease control, feed requirement, landownership, and farm labour.

The innovation presented a positive impact at that stage, but it needed time and more effort from the public and private sectors. It presented more choices to farmers as well as more consumers' awareness about, and trust in, the Badia products. Benefits from the innovation included sustainability, better product quality, better prices, increased livestock activities and numbers, ability to buy animal feed, job opportunities, income increase, farmers' marketing choices, and sales increase. These have led to a development of farmers' socio-economic status. The introduction of modern methods into production and marketing positively affected farmers, although they suffered to some extent from growing input costs of production that accompanied the restructured cheese market in the Badia.

Major obstacles included lack of advanced cash and qualified labour, and household characteristics such as family structure and consumption habits. The required changes and implications heavily impacted the availability of cash liquidity for household needs. Farmers were hindered in their marketing choices by environmental risk factors, animal diseases, and unstable government policies regarding feed subsidies.

Public and private policies can contribute to the up-scaling of the innovation by supporting farmers and producers with continuous technical training, supervision, and assistance in loans through the NGO, to help them maintain competitive product quality and reliability in delivery time. The contextual preconditions for up-scaling may include provision of rangelands or animal feeds, focus on product quality, positive attitudes of the local community, and marketing ability and networking.

Lessons learnt include development policies and interventions by the BRDC, which have proven successful, and the organization of farmers into collective actions. Intervention strategies and working methodologies used included: (a) establishing contact between smallholders and processor; (b) gaining diverse actors' trust and commitment; (c) developing required skills and capacities; (d) defining objectives and set-up of collaboration.

6.1 Recommendations

To become a better business model, the factory is required to reduce its operating costs. It has to provide price premiums – or other incentives such as revenues, lower risk through written contracts, and provision of technical assistance and credit and loans – that are advantageous compared with those that farmers could traditionally expect in terms of returns and risks. Specifically, farmers' channel choice can be enhanced by providing advance cash through the innovation in order to be able to buy feed, reduce costs, and eliminate disease risk. Further, it is important to realize the importance of both human capital and adoption of technology among producers. The factory drastically needs to improve the quality of milk received from the

farmers, especially in terms of hygiene and quality control, in order to free farmers from pre-contracts with the traditional and wholesale channels.

Key challenges that should be faced in order to facilitate inclusion of more small-scale farmers include:

1. Negative competition from wholesalers who camp in the vicinity of the factory; the number of farmers in the area is already insufficient to meet the supply demands of the factory alone.
2. Seasonality of product and low quantity of milk in dry seasons.
3. Lack of incentives for small-scale farmers such as cash flow , especially in winter seasons.
4. Low level of trust between the factory and the farmers.
5. Lack of written contracts.
6. Lack of use of modern technologies in production and packaging.
7. Lack of direct and forward marketing channels.
8. Lack of good management independent from the BRDC.

The innovation is a module that can be replicated in other poor agricommunities around Jordan, but on these conditions:

1. Establishing small-scale farmers' associations.
2. Focusing on developing human resources by training farmers.
3. Raising milk prices and monitoring wholesalers' prices.
4. Increasing size and volume of input milk by providing better rangelands and better income levels for farmers.
5. Providing efficient marketing channels.

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Regoverning Markets

Regoverning Markets is a multi-partner collaborative research programme analysing the growing concentration in the processing and retail sectors of national and regional agrifood systems and its impacts on rural livelihoods and communities in middle- and low-income countries. The aim of the programme is to provide strategic advice and guidance to the public sector, agrifood chain actors, civil society organizations and development agencies on approaches that can anticipate and manage the impacts of the dynamic changes in local and regional markets. The programme is funded by the UK Department for International Development (DFID), the International Development Research Centre (IDRC), ICCO, Cordaid, the Canadian International Development Agency (CIDA), and the US Agency for International Development (USAID).

Innovative Practice

Innovative Practice is a series of case studies from the Regoverning Markets programme providing examples of specific innovation in connecting small-scale producers with dynamic markets at local or regional level. Based on significant fieldwork activities, the studies focus on four drivers of innovation: public policy principles, private business models, collective action strategies by small-scale farmers, and intervention strategies and methods of development agencies. The studies highlight policy lessons and suggest working methods to guide public and private actors.

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