



Association between Innovation Types and Agriculture SME firm Performance

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Abstract: *Innovation is one of the hallmark of entrepreneurial endeavors. Literature assumes innovation to be beneficial for various organization performance parameters. Agricultural SME firms have various challenges to innovation such as market factors, ability, and resource constraints among others. However, the consumption of agricultural products depend on socio cultural and geographic factors thus, limiting the relationship between innovation and performance of agricultural SMEs. This research investigated the association of different innovation types (product, process, market, service, technology, and supply) with the firm performance parameters (profit, sales growth, asset growth, employment growth, customer satisfaction, and product/service quality) of agricultural SMEs in Odisha, India.*

Results indicate that all types of innovations are not equally important for different organizational performance. Product innovation is associated with asset growth, employee growth, and customer satisfaction. Process innovation is associated with product or service quality. New market influence employee growth, customer satisfaction, and quality. New technology is associated with product/service quality. New source of supply influence customer satisfaction and quality. The profit growth is not associated with any innovation type, and the innovation in services, is not associated with any performance parameter in the context of agricultural SMEs. A nuanced understanding is essential in the context of agricultural SMEs. Results are explained through profit and innovation theory, and the exogenous and endogenous firm growth models. The findings are expected to help policymakers, entrepreneurs, and other stakeholders to design appropriate interventions.

Keywords: *Innovation, Performance, Agriculture, SME, Odisha*

Introduction

Innovation is the hallmark of entrepreneurs and is generally expected to influence organizational performance positively. However, innovation is associated with risk. In case of agriculture, the food consumption pattern depends on sociocultural and demographic boundaries. Therefore, the taste and preferences in a sociocultural milieu and geography remains sticky. The entrepreneurial tendency for innovation, need for the firm growth, risk associated with innovation, and the sticky nature of consumption of the agricultural produce create a complex maze for decision making. The high failure rates of entrepreneurial firms also remain a concern.

The agriculture as a broad sector has different subsectors such as fertilizers, seeds, equipment manufacturer, food-processing, trading, and agricultural waste process. Some subsectors can have diversified incomes beyond agriculture but their major revenue is derived from agriculture

based activities. The firm operations are dependent on agriculture and they inherit the characteristics of agriculture business. Further, the agricultural sector is subjected to changes in market, demand and supply, policies, and institutional environment (Diederer et al., 2002). Though, the commodity prices do not generally increase, niche products command higher prices. The government policies and support mechanisms are emphasizing on market forces rather than support in form of subsidy.

Innovation is generally understood as newness. However, it is not singular. Innovation literature has extended innovation types beyond the Schumpeterian types (product, method of production/ process, market, source of supply, new way of organizing) such as expertise-field innovation, external-relational, formalization, and adhoc types (Drejer, 2004). Open and closed innovation makes a distinction between the locations or people side of innovation, where the closed innovation occurs within the organization

and open innovation occurs with collaboration. Innovation is also classified as incremental or disruptive based on the degree of change. *Jugad* is an Indian version for frugal, flexible, and inclusive innovation (Prabhu & Jain, 2015).

With different variation of agriculture as broad sector and innovation as archetype, the innovation literature or studies in agriculture sector-specific literature is scarce. The subsequent section presents a purposive literature review around innovation and firm performance, not limited to agriculture sector. Recursive search around themes and subthemes and follow through of the bibliography were carried out for the review.

Literature review

The objective of the literature review was to understand the relationship and dynamics of firm performance and innovation.

Competitiveness and survival are two fundamental parameters. In manufacturing SMEs companies, the product, process, and market innovation influenced firm competitive advantage and profitability (Rosli & Sidek, 2013). A Chile based research found that innovative manufacturing organizations have lower risk of exit. It also claimed that single product innovators have increased risk of exit and higher profits (Fernandes & Paunov, 2015). In case of SMEs, product, process, and market innovations were found to be associated with firm growth but no innovation type was associated with the profitability of firms (Varis & Littunen, 2010). However, the external sourcing of administrative innovations in SMEs were claimed as the most important factor in explaining sales rather than technological innovations (Yeh-Yun Lin & Yi-Ching Chen, 2007). The SME growth was found influenced by dynamic capabilities with external sourcing, which influenced product and process innovations. Interestingly this study reported employee involvement influenced process innovation positively but negatively influenced sales growth (Uhlaner et al., 2013).

A banking service study showed significant and positive relationship of market, process, and product innovations with firm performance (YuSheng & Ibrahim, 2020). However, another research suggested that supporting industries should focus on the process, marketing, and organizational innovation, rather than product innovation activities to improve performance (Tuan et al., 2016).

Organizations focus on specific type of innovation over a period. However, a study suggested that consistent application of a particular type of innovation (among service, technological process,

and administrative process) can be counterproductive. Rather, the composition of innovation type should be changed to improve performance, divergence from industry practice seems to be the key (Damanpour et al., 2009). This suggested that the gain from innovation process is inconsistent.

Studies also used Balanced Score card approach in measuring manufacturing firm's performance and reported that the product innovation, process innovation and organizational innovation influence financial performance, customer performance, internal business processes performance and learning and growth performance positively. The marketing innovation influences financial performance, customer performance, and internal business processes performance positively but has a negative influence on growth performance. (Karabulut, 2015). Similarly, between the closed innovation strategy influenced the manufacturing firm's performance in a stronger way compared to the open innovation strategy (Park & Kwon, 2018).

At times innovation is considered for import substitution and export promotion which helps improving the growth of the in the food and agricultural industry, researchers attributed it to the presence of externalities (Manogna & Mishra, 2021). At the farm level the cropping innovations in farms were found to have positive impact on farm performance (Xayavong et al., 2016).

What triggers innovation in the context of small and medium sized firms, has been studied more extensively. For example, external relationships (Lasagni, 2012), network (Gronum et al., 2012), innovation capability, and management style (Otero-Neira et al., 2009). A farm's human capital, use of innovations, organizational management skills, business planning, and the unique environment were found to influence innovation (Xayavong et al., 2016).

Research gap

Product, process, organizational, and market innovations are major types of innovations considered by various researchers but their knowledge sources for different types and appropriate spatial levels for investigation are still debated (Tödting & Grillitsch, 2014). The innovation stream of research has focused on mostly large and non-agriculture firms. The performance dimension is also narrowly focused on few parameters. Innovation seems assumed to cause improved performance in many dimensions. Other dominant research stream has been to understand various causes and their interaction to cause innovation (Xayavong et al., 2016). In the context of India, as a developing country with large

employment in agriculture, low productivity, lower level of innovation/ mechanization, and high entrepreneurial failure, this research is significant to understand innovation and firm performance in this sector.

Methodology

A list of agriculture entrepreneurs was drawn from a well-known industrial directory of Odisha. Two hundred entrepreneurs were selected and were asked if any form of innovation has been practiced in their organization in the past 3 years, 100 entrepreneurs confirmed to some form of innovation and such entrepreneurs formed the sample of this study. The response form was sent to their mail ids and response was captured through a form. A maximum of 3 reminders were sent. Final 59 responses were collected and analyzed. This study is a part of a Ph.D. study on agricultural entrepreneurs. This article is an initial validation reporting on innovation practices and its effect on various firm performance measures.

The instrument had a demographic section with age, gender, marital status, and highest education as parameters. The firm performance measure included the perception of entrepreneurs on sales growth, asset growth, employee growth, increase in customer satisfaction, and improvement in product/service quality. The Likert scale very satisfied=5 to very dissatisfied=1, captured entrepreneurs'

Table 1 indicates that most of the respondents (90 percent) of the sample were graduates or post graduates, around 69 percent were up to the age group of 40 years. Of the total sample 22.0 percent were agricultural produce processing firms, 66.1 percent were equipment manufacturers, 5.1percent were fertilizers firms, 3.4 percent were seeds processing firms, and 3.4 percent classified themselves agricultural technology firms..

Table 1: Demography of the sample

		Female		Male		Total	
Demography		n	%	n	%	N	%
Education	No formal schooling	0	0.0	1	1.7	1	1.7
	Upto+2	1	1.7	4	6.8	5	8.5
	Graduate	1	1.7	20	33.9	21	35.6
	PostGraduate	5	8.5	27	45.8	32	54.2
Total		7	11.9	52	88.1	59	100.0
Marital Status	Married	5	8.5	45	76.3	50	84.7
	Unmarried	2	3.4	7	11.9	9	15.3
Total		7	11.9	52	88.1	59	100.0
AgeGroup	26-33	5	8.5	11	18.6	16	27.1
	34-41	1	1.7	23	39.0	24	40.7
	42-49	1	1.7	15	25.4	16	27.1
	50 and above	0	0.0	3	5.1	3	5.1
Total		7	11.9	52	88.1	59	100.0

Table 2 indicates the association between new product innovation and performance parameters. Product innovation was found significantly associated with asset growth, employment growth, and customer satisfaction.

perception about the firm performance. The dimensions of innovation included introduced/ improved new product, introduced/ improved new production process, identified new market, introduced/ improved new service, introduced/ improved new technology, and identified new source of supply. The responses to innovation dimensions varied from strongly agree= 5 to strongly disagree = 1 in a 5 point Likert scale.

Non-parametric data analysis was considered appropriate due to the categorical data and low sample size. Beyond the descriptive analysis, the Pearson's Chi-square test was conducted to understand the association between responses for various dimensions. Further, the response distribution with a five point scale was converted to 2 categories to improve understanding and comply with minimum observation requirement of the Chi-square test. For example, the satisfaction score very dissatisfied to neutral was grouped into one and satisfied and above was another group. Similarly, 'strongly disagree' to 'neutral' responses were considered one group, and 'agree' and 'strongly agree' was grouped to another.

The inter item reliability statistics (Cronbach's Alpha) of the 5 item performance measures was 0.790 and for the innovation dimensions was 0.788 for 6 items.

Analysis

Table 2: Association between New Product vs Performance parameters

Performance	NewProduct						Pearson Chi-Square Value	
	A		B		Total			
	n	%	n	%	N	%		
Profit	1	1	9.1	10	90.9	11	100.0	$\chi^2= 0.450, df=1, p=.503$
	2	2	4.2	46	95.8	48	100.0	
Total	3	5.1	56	94.9	59	100.0		
Sales Growth	1	1	8.3	11	91.7	12	100.0	$\chi^2= 0.329, df=1, p=.566$
	2	2	4.3	45	95.7	47	100.0	
Total	3	5.1	56	94.9	59	100.0		
Asset Growth	1	2	16.7	10	83.3	12	100.0	$\chi^2= 4.187, df=1, p=.041$
	2	1	2.1	46	97.9	47	100.0	
Total	3	5.1	56	94.9	59	100.0		
Employment Growth	1	3	27.3	8	72.7	11	100.0	$\chi^2= 13.792, df=1, p=.000$
	2	0	0.0	48	100.0	48	100.0	
Total	3	5.1	56	94.9	59	100.0		
Customer Satisfaction	1	1	33.3	2	66.7	3	100.0	$\chi^2= 5.226, df=1, p=.022$
	2	2	3.6	54	96.4	56	100.0	
Total	3	5.1	56	94.9	59	100.0		
Product/Service Quality	1	1	25.0	3	75.0	4	100.0	$\chi^2= 3.526, df=1, p=.060$
	2	2	3.6	53	96.4	55	100.0	
Total	3	5.1	56	94.9	59	100.0		

A: Strongly disagree to neutral, B: Strongly agree and agree, 1: Very dissatisfied to neutral, and 2: satisfied and very satisfied

Table 3 indicates that the new process innovation has significant association with customer satisfaction.

Table 3: Association between New Process vs Performance parameters

Performance	NewProcess						Pearson Chi-Square Value	
	A		B		Total			
	n	%	n	%	n	%		
Profit	1	1	8.3	11	91.7	12	100.0	$\chi^2= 1.124, df=1, p=.289$
	2	1	2.1	46	97.9	47	100.0	
Total	2	3.4	57	96.6	59	100.0		
Sales Growth	1	0	0.0	12	100.0	12	100.0	$\chi^2= 0.529, df=1, p=.467$
	2	2	4.3	45	95.7	47	100.0	
Total	2	3.4	57	96.6	59	100.0		
Asset Growth	1	0	0.0	11	100.0	11	100.0	$\chi^2= 0.474, df=1, p=.491$
	2	2	4.2	46	95.8	48	100.0	
Total	2	3.4	57	96.6	59	100.0		
Employment Growth	1	0	0.0	3	100.0	3	100.0	$\chi^2= 0.111, df=1, p=.739$
	2	2	3.6	54	96.4	56	100.0	
Total	2	3.4	57	96.6	59	100.0		
Customer Satisfaction	1	1	25.0	3	75.0	4	100.0	$\chi^2= 6.119, df=1, p=.013$
	2	1	1.8	54	98.2	55	100.0	
Total	2	3.4	57	96.6	59	100.0		

A: Strongly disagree to neutral, B: Strongly agree and agree, 1: Very dissatisfied to neutral, and 2: satisfied and very satisfied

Finding a new market as an innovation has significant association with growth in employees, customer satisfaction, and the product and service quality (table 4).

Table 4: Association between New Market vs Performance parameters

Performance	NewMarket						Pearson Chi-Square Value	
	A		B		Total			
	n	%	n	%	n	%		
Profit	1	0	0.0	11	100.0	11	100.0	$\chi^2= 0.233, df=1, p=.629$
	2	1	2.1	47	97.9	48	100.0	
Total		1	1.7	58	98.3	59	100.0	
Sales Growth	1	0	0.0	12	100.0	12	100.0	$\chi^2= 0.260, df=1, p=.610$
	2	1	2.1	46	97.9	47	100.0	
Total		1	1.7	58	98.3	59	100.0	
Asset Growth	1	0	0.0	12	100.0	12	100.0	$\chi^2= 0.260, df=1, p=.610$
	2	1	2.1	46	97.9	47	100.0	
Total		1	1.7	58	98.3	59	100.0	
Employment Growth	1	1	9.1	10	90.9	11	100.0	$\chi^2= 4.439, df=1, p=.035$
	2	0	0.0	48	100.0	48	100.0	
Total		1	1.7	58	98.3	59	100.0	
Customer Satisfaction	1	1	33.3	2	66.7	3	100.0	$\chi^2= 18.989, df=1, p=.000$
	2	0	0.0	56	100.0	56	100.0	
Total		1	1.7	58	98.3	59	100.0	
Product/Service Quality	1	1	25.0	3	75.0	4	100.0	$\chi^2= 13.987, df=1, p=.000$
	2	0	0.0	55	100.0	55	100.0	
Total		1	1.7	58	98.3	59	100.0	

A: Strongly disagree to neutral, B: Strongly agree and agree, 1: Very dissatisfied to neutral, and 2: satisfied and very satisfied

Service innovation or new service does not have significant association with any performance measures (table 5)

Table 5: Association between New Product vs Performance parameters

Performance	NewService						Pearson Chi-Square Value	
	A		B		Total			
	n	%	n	%	n	%		
Profit	1	0	0.0	11	100.0	11	100.0	$\chi^2= 0.233, df=1, p=.629$
	2	1	2.1	47	97.9	48	100.0	
Total		1	1.7	58	98.3	59	100.0	
Sales Growth	1	0	0.0	12	100.0	12	100.0	$\chi^2= 0.260, df=1, p=.610$
	2	1	2.1	46	97.9	47	100.0	
Total		1	1.7	58	98.3	59	100.0	
Asset Growth	1	0	0.0	12	100.0	12	100.0	$\chi^2= 0.260, df=1, p=.610$
	2	1	2.1	46	97.9	47	100.0	
Total		1	1.7	58	98.3	59	100.0	
Employment Growth	1	0	0.0	11	100.0	11	100.0	$\chi^2= 0.233, df=1, p=.629$
	2	1	2.1	47	97.9	48	100.0	
Total		1	1.7	58	98.3	59	100.0	
Customer Satisfaction	1	0	0.0	3	100.0	3	100.0	$\chi^2= 0.054, df=1, p=.815$
	2	1	1.8	55	98.2	56	100.0	
Total		1	1.7	58	98.3	59	100.0	
Product/Service Quality	1	0	0.0	4	100.0	4	100.0	$\chi^2= 0.074, df=1, p=.786$
	2	1	1.8	54	98.2	55	100.0	
Total		1	1.7	58	98.3	59	100.0	

A: Strongly disagree to neutral, B: Strongly agree and agree, 1: Very dissatisfied to neutral, and 2: satisfied and very satisfied

New technology or technological innovation has significant association with the quality of the product or service (table 6).

Table 6: Association between New Technology vs Performance parameters

Performance	NewTechnology						Pearson Chi-Square Value	
	A		B		Total			
	n	%	n	%	n	%		
Profit	1	0	0.0	11	100.0	11	100.0	$\chi^2= 0.474, df=1, p=.491$
	2	2	4.2	46	95.8	48	100.0	
Total	2	3.4	57	96.6	59	100.0		
Sales Growth	1	1	8.3	11	91.7	12	100.0	$\chi^2= 1.124, df=1, p=.289$
	2	1	2.1	46	97.9	47	100.0	
Total	2	3.4	57	96.6	59	100.0		
Asset Growth	1	0	0.0	12	100.0	12	100.0	$\chi^2= 0.529, df=1, p=.467$
	2	2	4.3	45	95.7	47	100.0	
Total	2	3.4	57	96.6	59	100.0		
Employment Growth	1	0	0.0	11	100.0	11	100.0	$\chi^2= 0.474, df=1, p=.491$
	2	2	4.2	46	95.8	48	100.0	
Total	2	3.4	57	96.6	59	100.0		
Customer Satisfaction	1	0	0.0	3	100.0	3	100.0	$\chi^2= 0.111, df=1, p=.739$
	2	2	3.6	54	96.4	56	100.0	
Total	2	3.4	57	96.6	59	100.0		
Product/Service Quality	1	1	25.0	3	75.0	4	100.0	$\chi^2= 6.119, df=1, p=.013$
	2	1	1.8	54	98.2	55	100.0	
Total	2	3.4	57	96.6	59	100.0		

A: Strongly disagree to neutral, B: Strongly agree and agree, 1: Very dissatisfied to neutral, and 2: satisfied and very satisfied

New sources of supply has significant association with customer satisfaction and the product or service quality (table 7).

Table 7: Association between New Source of supply vs Performance parameters

Performance	New Source of Supply						Pearson Chi-Square Value	
	A		B		Total			
	n	%	n	%	n	%		
Profit	1	0	0.0	11	100.0	11	100.0	$\chi^2= 0.724, df=1, p=.395$
	2	3	6.3	45	93.8	48	100.0	
Total	3	5.1	56	94.9	59	100.0		
Sales Growth	1	1	8.3	11	91.7	12	100.0	$\chi^2= 0.329, df=1, p=.566$
	2	2	4.3	45	95.7	47	100.0	
Total	3	5.1	56	94.9	59	100.0		
Asset Growth	1	0	0.0	12	100.0	12	100.0	$\chi^2= 0.807, df=1, p=.369$
	2	3	6.4	44	93.6	47	100.0	
Total	3	5.1	56	94.9	59	100.0		
Employment Growth	1	1	9.1	10	90.9	11	100.0	$\chi^2= 0.450, df=1, p=.503$
	2	2	4.2	46	95.8	48	100.0	
Total	3	5.1	56	94.9	59	100.0		
Customer Satisfaction	1	1	33.3	2	66.7	3	100.0	$\chi^2= 5.226, df=1, p=.022$
	2	2	3.6	54	96.4	56	100.0	
Total	3	5.1	56	94.9	59	100.0		
Product/Service Quality	1	2	50.0	2	50.0	4	100.0	$\chi^2= 17.936, df=1, p=.000$
	2	1	1.8	54	98.2	55	100.0	
Total	3	5.1	56	94.9	59	100.0		

A: Strongly disagree to neutral, B: Strongly agree and agree, 1: Very dissatisfied to neutral, and 2: satisfied and very satisfied

The summary of findings are presented in the table 8.

Table 8: Summary of findings

	Profit	Sales growth	Asset Growth	Employee Growth	Customer Satisfaction	Product/ServiceQuality
NewProduct			*	**	*	
NewProcess						*
New Market				*	**	**
New Service						
New Technology						*
New Supply					*	**

* Significance at $p \leq 0.05$, ** Significance at $p \leq 0.01$

Discussion

A possible reason for the dearth of literature in agriculture innovation and firm performance literature is that the context does not lend adequate support for every innovation types. Though, various findings of prior studies are not convergent, and there are sectoral differences, this research supports some of the findings.

Findings of this research indicates (a) different types of innovation influence different performance parameters

This research confirms a prior study finding of no relationship between any type of innovation and profitability of firm but the growth relationship found with innovation types was not evidenced in this research (Varis & Littunen, 2010). Technological innovation did not explain the sales growth, giving a partial support to the prior study (Yeh-Yun Lin & Yi-Ching Chen, 2007). The lower importance of product innovation compared to other types was contradicted in this study (Tuan et al., 2016).

A fundamental assertion of innovation and profit theory is that innovation is directed by profitability and efficiency. Based on these characteristics authors have categorized farms into dependent (low profit low efficiency), efficient (low profit, high efficiency), imperfect (high profit, low efficiency), and innovative (high efficiency, high profit) farms and they argued that farms transition from one cell to another in the matrix of innovation environment (Menna & Walsh, 2021). The exogenous growth theory contend that technological progress determines the long-run economic growth and productivity differences. The endogenous growth models proposes investment for innovative purposes such as knowledge, human capital, and research and development are important and the efficiency of capital will determine the investment pattern. At a theoretical level there is still no convergence on the dominant theoretical economic growth model (Chirwa & Odhiambo, 2018). This study results can be explained on these bases. A

possibility where agriculture sector is in a transition mode or as a dichotomy between the exogenous vs. endogenous firm growth. The lack or the presence of association between the performance and innovation types indicate the presence of lesser innovative business context, as a state of transition, or as a lack of dominant growth paradigm.

Limitations

Survey research has known limitations. This research had to re-categorize responses from 5 point Likert scale to 2 categories due to paucity of responses however, such a regrouping enhanced understanding and complied with the requirements of the non-parametric test. As was indicated, this result is an initial observation from a large study and expected to help complex analysis subsequently. Literature is not convergent on the types of innovation and this research considered six types of innovation with reliability. The interaction possibilities of various innovations with each other and firm performance was not examined.

Future directions

Agriculture firms have several peculiarities with respect to innovation. For example, food habits, tastes, and preferences are determined by social preferences. Often, these preferences are sticky, not amenable to changes. Further, these preferences have distinct geographical boundaries, for example, the food preferences in different parts of India. The social preferences and geographical variations are likely to influence the innovation dynamics. Secondly, SMEs have several known limitations for innovation or adoption of innovations, including resource constraints. How does such limitations influence the propensity for innovation, is expected to enlighten the literature. Often, innovations are responses to problems and vice versa, the relationship is expected to be bidirectional. The influence of this bi-directionality on the innovation among agri-entrepreneurs and firms requires additional investigation. Finally, innovation explanations are dynamic and therefore,

need a longitudinal or qualitative study for improved explanation.

Conclusion

This research identifies that (a) different types of innovations are associated with different performance parameters of the organization, (b) organizational profit growth is not associated with any innovation type, (c) the innovation in services, is not associated with any performance parameter in the context of agricultural SMEs.

Implication

Understanding the market context for innovation is crucial for agri-entrepreneurs. Innovations in general, may not be beneficial for agricultural SMEs. The type of innovation and its organizational impact should be understood. The government, agencies, educators, and entrepreneurs should have nuanced understanding of the various innovations types and its influence on organizational growth aspects, and facilitate appropriate innovation through appropriate measures. A blanket policy may not produce desired impact.

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