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Generation of farmers' contemporary innovations and re-inventions in Saurashtra region

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Abstract

Innovation is a crucial factor in driving agricultural development. Local innovations developed by farmers have significant contribution in enhancing agricultural productivity and protecting their rights. There are lots of innovative farming practices, including farm implements, plant varieties, and low-cost technologies for processing and packaging farm products made by the farmers. A study was conducted in Saurashtra region of Gujarat state. A total of 163 farmer innovators were considered as a sample. The research revealed that all the innovations and re-inventions went through the first two stages of the Innovation Development Process. However, more than half of them (52.76%) got stuck in the R&D stage, while only a small percentage (7.36%) made it to pass all the other stages. About one-third of the innovations (31.29%) reached stage IV without passing through stage III and also progressed to stage V. Moreover, 8.59% of the farmers' innovations and re-inventions directly reached stage V from the second stage. The characteristics of the respondents like research-extension contact, mass media exposure, creativity, scientific orientation, research orientation, achievement motivation, self confidence and progressivism had positive and highly significant relationship with their generation of contemporary innovations and re-inventions.

Keywords: Generation, farmer, innovation, re-invention

Introduction

In the realm of agriculture, innovation is a key driver of development at all levels. It is the creativity of individual farmers and farming communities that can make a significant difference in the sector. However, until recently, the emerging technologies, management practices, and institutions built over time by farmers and their communities have received little attention. These innovations are often developed in a local context that combines learning from previous generations' experiences and knowledge.

The Innovation Development Process consists of all the decisions and activities and their impacts that occurs from recognition of need or a problem through research, development and commercialization of an innovation (or) re-invention, through diffusion and adoption of the innovation (or) re-invention by users, to its consequences (Rogers, 1983)^[8]. As such there are six main stages in the innovation development process:

1. needs/problem identification,
2. research,
3. development,
4. commercialization,
5. diffusion and adoption and
6. consequences.

Innovation in farming is also a way of life for poor farmers

who are threatened by the country's ever-changing environmental, political and market circumstances. For them, innovation is not academic work or an extracurricular activity. Rather, it is an inherent characteristic of those who are striving to make a living out of the difficult situation they are in. Almost every single farmer who is living in such challenging circumstances has to innovate in order to survive (Chambers *et al.*, 1989)^[1].

Objectives

- To study the generation of farmers' contemporary innovations and re-inventions
- To unearth the relationship between the profile characteristics of farmers and their generation of contemporary innovations and re-inventions

Methodology

In the present study ex-post facto research design was used. According to Kerlinger (1973)^[6] ex-post facto research is a systematic empirical enquiry in which the scientists do not have direct control of influencing independent variables, because manifestations have already occurred. The research took place in the Saurashtra region, which is comprised of 11 districts in the state of Gujarat. The list of total 163 innovative farmers was created in collaboration with the Department of Agriculture, ATMA, KVK officials, and internet searches to identify and farmer innovations and re-

inventions. Telephonic interviews were conducted with all the listed farmers. To understand the different stages involved in the generation of farmers' contemporary innovations and re-inventions, a set of open-ended questions was formulated. The data collection process involved conducting personal interviews using a well-structured, pretested interview schedule. Once the data was collected, it was organized, tabulated, analyzed and interpreted to extract meaningful findings. The statistical measures of frequency, percentages, mean, standard deviation, correlation

coefficient and multiple linear regression were utilized in the study.

Results and Discussion

1) Generation of farmers' innovations and re-inventions

For the purpose of presenting the findings of research, the process of generation of innovations and re-inventions consisting of six stages was combined in the following groups as shown in Table 1.

Table 1: Classification of innovations/re-inventions passed through different stages of Innovation Development Process (n = 163)

Sr. No.	Stages of IDP	Frequency	Percentage
1	Need/problem identification	163	100.00
2	Research and development	163	100.00
3	Need/problem identification + Research and development	86	52.76
4	Need/problem identification + Research and development + Commercialization + Diffusion and adoption + Consequences	12	7.36
5	Diffusion and adoption and consequences	51	31.29
6	Consequences only	14	8.59

Table 1 showed that all 163 farmer innovations and re-inventions went through the first two stages of need/problem identification and research and development. However, over half (52.76%) were stuck at the R&D stage. Only 7.36% of the innovations passed through the third stage of commercialization, while 31.29% passed through the fourth stage of diffusion and adoption, and 8.59% passed through the fifth stage of consequences without going through the diffusion and adoption stage. Overall, it was concluded that only 7.36% of the farmer innovations or re-inventions successfully passed through all five stages of the Innovation Development Process.

1. Need/problem identification

According to Table 1, all of the innovations and re-inventions were created in response to identified needs or problems. This suggests that the farmers have a strong ability to develop solutions for the challenges they face. Based on this information, it can be concluded that the

farmer innovators in the selected sample area possess excellent knowledge and skills in identifying needs and problems related to their farming practices and methods.

2. Research and development

Table 1 revealed that all of the farmers' documented innovations and re-inventions underwent a research and development phase. However, the study found that the R&D phase was not conducted as formal research, but rather through informal experimentation based on the farmers' wisdom and experience. The final product was deemed suitable for addressing their problems. In terms of development, the innovations and re-inventions were developed to a level that allowed for their use or adoption in the farmers' fields, but not for commercialization purposes. Here, under the Table 2, all 86 (52.76 per cent) farmers' innovations and re-inventions which remained or stuck up at R&D stage without passing other stages are presented.

Table 2: Innovations and re-inventions stuck up at research and development stage

Sr. No.	Title of innovation/re-invention	Sr. No.	Title of innovation/re-invention
1	Bullock operated sprayer	44	Control of caterpillar in field crops
2	Weed control in field crops	45	Increased fodder yield in lucerne
3	Control of spodoptera and heliothis in field crops	46	Aphid and heliothis control in field crops
4	Controlling striga in sugarcane	47	Seed treatment for field crops
5	Controlling blight in cumin	48	Heliothis control in Bengal gram
6	Nut grass control in field crops	49	Pest control in field crops
7	Controlling heliothis in cotton	50	Seed preservation
8	Preservation of grains	51	Soil reclamation
9	Increasing yield of cumin	52	Seed treatment for cumin seeds
10	Insecticide for cotton	53	Control of pest in groundnut
11	Herbal protection for cotton	54	Seed preservation
12	Herbal pesticide for cotton	55	Seed preservation
13	Control of caterpillar in cotton	56	Pest control in cotton
14	Increasing castor production	57	Seed preservation
15	Aphid control in groundnut	58	Pesticide to control pest
16	Controlling white ants in groundnut	59	Herbal pesticide for cotton
17	Aphid control in cotton	60	Inoculation of microbes in FYM
18	Cricket control in field	61	Organic fungicide
19	Herbal spray for aphid control	62	Method for insect trapping in cotton
20	Aphid control in field crops	63	Pesticide to control sucking pests

21	White grub control in groundnut and cotton	64	Pesticide to control spodoptera and helicoverpa
22	Insect-pest control in field crops	65	Increase in the yield of pulse crop
23	Storage of sesame seeds	66	Organic pesticide
24	Herbal pesticide	67	Organic pesticide
25	Control of grub infestation in pearl millet	68	Fungicide to control powdery mildew
26	Aphid control in field crops	69	Organic pesticide
27	Insect-pest control in cotton	70	Controlling white grub infestation
28	Pest control in cotton	71	Seed treatment for groundnut
29	Effective storage of grains	72	Controlling leaf curl disease
30	Insect control in sesame	73	Seed treatment for controlling rust
31	Pest control in field crops	74	Insect pest control in field crops
32	Increase in groundnut production	75	Organic pesticide for field crops
33	Control of crawling insects	76	Insect pest control in maize
34	Caterpillar control in field crops	77	Seed treatment for cotton
35	Controlling wilt disease in maize	78	Seed preservation
36	Controlling heliothis in cotton	79	Seed preservation of sesame
37	Ants and larval control in sugarcane	80	Seed preservation of pigeon pea
38	Controlling whitefly in cotton	81	Seed preservation
39	Aphid control in field crops	82	Seed treatment for cotton
40	Aphid control in lucerne	83	Seed preservation
41	Increase in the yield of groundnut	84	Seed preservation
42	Caterpillar control in groundnut	85	Herbal insecticide
43	Control of capsule borer in castor	86	Organic pesticide

It was found that the majority of these innovations were organic ways of controlling pests and diseases in crops, but due to the availability of chemical pesticides and fungicides, most farmers prefer chemical control over organic methods. Additionally, some innovative practices, such as those related to controlling weeds and increasing crop yield, are not popular among farmers due to their reliance on chemical methods. The study also found that innovations related to storing and preserving seeds did not pass the diffusion and adoption stage, as farmers prefer to experiment and find their own effective ways of seed storage. Similar results were obtained by Chidananda (2008) [2].

3. Need/problem identification + Research and development + Commercialization + Diffusion and adoption + Consequences

According to Table 1, only 7.36 percent of the innovations/re-inventions passed through the commercialization stage. It is not accurate to say that this stage was neglected by the farmer innovators, as it appears that they may have been unaware of its potential benefits. In such cases, scientific organizations, extension agencies, and private firms could play a role in identifying suitable farmer innovations and re-inventions for commercial and agripreneurship purposes. The innovations and re-inventions which passed through the commercialization stage are presented in the Table 3.

Table 3: Innovations and re-inventions passed from the commercialization stage

Sr. No.	Title of innovation/re-invention	Sr. No.	Title of innovation/re-invention
1	Low cost tractor-Vanraj	7	Unique type of <i>santi</i>
2	Tilting bullock cart-Aaruni	8	Wheat sowing plate
3	Zatka machine	9	Modified sickle
4	Bullet driven <i>santi-Sanedo</i>	10	Groundnut harvesting implement
5	Modified groundnut huller	11	Mini power tiller
6	Low cost mini tractor	12	Farm implement - groundnut digger

These innovations and reinventions shown in Table 3 were focused on farm mechanization to minimize the effort, time, cost, and labor required for various farming operations. The majority of these innovations and reinventions were commercialized with the support of NGOs or other assisting agencies. These farmer innovations and reinventions have had a clear and positive impact on crop production, and as a result, they have been adopted and implemented by many farmers in the community.

4. Diffusion and adoption and consequences

Table 1 indicates that 51 farmer innovations and re-

inventions passed through the fourth stage, which is diffusion and adoption. Based on this information, it can be concluded that farmers tend to adopt new ideas or practices after learning about them from their peers and relatives. Once they have successfully adopted a new practice, they also tend to share it with other farmers. Many of these innovations and re-inventions are also diffused by progressive farmers and extension agents. The innovations and re-inventions which passed through diffusion and adoption stage are presented in the Table 4.

Table 4: Innovations and re-inventions passed from the diffusion and adoption and consequences stage

Sr. No.	Title of innovation/re-invention	Sr. No.	Title of innovation/re-invention
1	Pesticide for field crops	27	Preventing blight in cumin
2	Motor mounted sprayer	28	Control of green caterpillar in cotton
3	New groundnut variety-Moralo	29	New variety of sesame- 'Adarsh-8'
4	New groundnut variety-Dhiraj 101	30	Automatic spraying pump
5	Round moving tractor	31	Bullock spraying pump
6	New variety of groundnut	32	Technique to prevent soil erosion
7	Multipurpose thresher	33	Remedy for sugarcane red rot
8	Thresher that also washes	34	Herbicide to control blight in cumin
9	Manure made from castor shells	35	Modified pump for spraying
10	Larval pest control in cotton	36	Organic seed treatment
11	Modified farm implement	37	Farm implement
12	An improvisation for drawing water from well	38	New design of check dam for water harvesting
13	Improved toothed iron tool for weed removal	39	Storage tank for liquid fertilizer and pesticide
14	Insect-pest control in cotton	40	Farm implement for earthing up
15	White grub control in groundnut	41	Farm implement
16	Modified sowing plough	42	Hand seed drill
17	New variety of groundnut	43	Farm implement for weeding
18	Remedy for yellowing of groundnut	44	Modified sprayer
19	Remedy for tikka disease in groundnut	45	Mobile groundnut thresher cum collector
20	Remedy for blight in cumin	46	Power sprayer
21	Controlling caterpillar in cotton	47	Farm implement
22	Blade for groundnut harvesting	48	Auto compression sprayer
23	Modified <i>santi</i>	49	Cotton boll picking machine
24	Modified farm implement- <i>Jinsali</i>	50	Farm implement
25	Farm implement	51	Insect pest control in field crops
26	Innovative method of groundnut sowing		

Table 4 included the innovations and re-inventions related to multiple farming tools, crop production practices, varietal selection techniques, plant protection aspects, organic manure making practices, and soil erosion control methods that were successfully diffused and adopted by the farming community. These innovations and practices were found to have positive consequences on the farming community in terms of increased productivity, ease of operation, time and labor saving and protection from various agricultural challenges. It was revealed that the success stories of innovative farmers influenced many other farmers to adopt the same practices, leading to widespread adoption and

positive impact on the farming community.

5. Consequences only

Table 1 reveals that 14 innovations and re-inventions passed through the stages of need identification, research, and development, and reached directly to stage V, which is consequences. In this stage, the identification of a problem and the development of a solution through research and development can lead to consequences in the society, even if the diffusion and adoption of the innovation or re-invention has not taken place and these innovations and re-inventions were mentioned in the Table 5.

Table 5: Innovations and re-inventions passed from the consequences stage only

Sr. No.	Title of innovation/re-invention	Sr. No.	Title of innovation/re-invention
1	Groundnut picker	8	Rat control in field
2	Control of sucking pest in cotton	9	Increase in the yield of pulse crop
3	Protecting sorghum from grasshopper and aphid	10	Control of argot disease in pearl millet
4	Improved quality and yield in cotton	11	Farm implement
5	Bullock driven spraying pump	12	LPG operated tractor
6	Control of insect-pest in field crops	13	Alternative of urea
7	Farm implement	14	Hand seed cum fertilizer drill

From Table 5, it can be concluded that modifications of farm tools have been found to be effective for farming practices but have not been widely adopted due to the technical work required while, Organic farming practices were developed to address soil fertility depletion caused by chemical usage but have not been widely adopted due to their laborious and time-consuming nature. However, these practices have positive impacts on human and animal health by leaving no chemical residue on the crop. Crop production practices were also developed by farmer innovators and increased crop yields but were not widely adopted due to

low observability.

2) Relationship between profile characteristics of farmers and their generation of contemporary innovations and re-inventions

To investigate the link between farmers' profile characteristics (independent variable) and the generation of contemporary innovations and re-inventions (dependent variables), the correlation coefficient ('r') was computed. (Garrett, 1967) ^[4] The study formulated empirical hypotheses to test the significance of the relationship, and

the results of the zero-order correlation analysis can be found in Table 6.

Table 6: Correlation between profile characteristics of farmers and generation of contemporary innovations and re-inventions (n = 163)

Sr. No.	Characteristics	'r' value
1	Age	-0.1703*
2	Education	0.1847*
3	Farming Experience	-0.1540*
4	Size of land holding	-0.1031 ^{NS}
5	Annual income	0.1125 ^{NS}
6	Research-extension contact	0.2095**
7	Mass media exposure	0.3821**
8	Creativity	0.2925**
9	Risk bearing ability	0.1755*
10	Scientific orientation	0.4928**
11	Fatalism	-0.2128**
12	Research orientation	0.1923**
13	Achievement motivation	0.1652**
14	Self confidence	0.2651**
15	Progressivism	0.4237**
16	Equipment possession	0.1372 ^{NS}

*= Significant at 0.05 level

** =Significant at 0.01 level

NS = Not significant

The characteristics of the respondents like research-extension contact, mass media exposure, creativity, scientific orientation, research orientation, achievement motivation, self confidence and progressivism had positive and highly significant relationship with their generation of contemporary innovations and re-inventions. The characteristics of the respondents viz., education and risk bearing ability had positive and significant relationship with the participation in agricultural activities.

Fatalism of the respondents had negative and highly significant relationship with the generation of contemporary innovations and re-inventions. The characteristics of respondents like age and farming experience had negative and significant relationship with their generation of contemporary innovations and re-inventions.

The characteristics size of land holding, annual income and equipment possession had non-significant relationship with the generation of contemporary innovations and re-inventions.

The findings were in line with the findings of Neelaveni (2005) [7], Chinnam Naidu (2012) [3], Sreenivasa and Sireesha (2013) [9] and Justice and Tobias (2014) [5].

3) Functional relationship between generation of contemporary innovations and re-inventions and profile of farmers

In order to assess the amount of contribution (influence or predictive abilities) of all independent variable to the generation of farmers' contemporary innovations and re-inventions, the multiple regression analysis was carried out. It can be referred from the Table 7 that out of 16 independent variables, 6 variables viz., education, farming experience, creativity, research orientation, achievement motivation and progressivism were acquainting significant influence on the generation of contemporary innovations and re-inventions. All the variables together were

contributing 63.81 per cent variations indicated by R^2 value for the generation of contemporary innovations and re-inventions.

Majority of the independent variables considered in the study together exerted significant influence on the generation of farmers' contemporary innovations and re-inventions. The analysis of coefficient of total variation explained by independent variables ($R^2 = 63.81$) in generation of farmers' contemporary innovation and re-inventions.

Table 7: Regression coefficients between selected independent variables of the respondents with their generation of contemporary innovations and re-inventions (n = 163)

Sr. No.	Independent variables	Regression coefficient (bi)	S. E. of bi	't' value
1	Age	-0.587	0.657	-1.213
2	Education	0.058	0.248	2.297*
3	Farming experience	0.319	0.153	2.293*
4	Size of land holding	-0.024	0.108	-0.017
5	Annual income	0.015	0.019	0.851
6	Research-extension contact	0.007	0.015	0.314
7	Mass media exposure	0.147	0.567	0.241
8	Creativity	2.151	0.513	3.984**
9	Risk bearing ability	0.267	0.153	1.332
10	Scientific orientation	0.226	0.454	0.504
11	Fatalism	-0.112	0.410	-0.310
12	Research orientation	0.132	0.036	6.554**
13	Achievement motivation	0.116	0.068	1.681*
14	Self confidence	0.116	0.353	0.214
15	Progressivism	0.075	0.028	3.829**
16	Equipment possession	0.102	0.120	0.113

* = Significant at 0.05 level $R^2 = 63.81$

** = Significant at 0.01 level

The results presented in the Table 7 also pointed out that variables like creativity, research orientation and progressivism are crucial factors (highly significant) in deciding the generation of farmers' contemporary innovations and re-inventions. Other independent variables like education, farming experience and achievement motivation (significant) contributed largely with the generation of farmers' contemporary innovations and re-inventions. Remaining variables have failed to contribute significantly in generation of farmers' contemporary innovations and re-inventions.

Conclusion

It can be concluded that farmers tend to innovate and re-invent so many things they need in their day to day farming situation. This innovation generation do not always pass through all six stages, but they definitely become advantageous as they solve farmers' problems and difficulties which they often face in many agricultural practices. All of these start from felt or unfelt needs and results as consequences. Most farmers do not go for the commercialization of their final product after research and development but they get spread informally and show their consequences.

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