

Environmental Factors That Influence the Agricultural Innovation: Evidence from Thailand

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Agriculture developments have revolutionized the overall agricultural practices however, the small farmers are still suffering as they were not able to cope with the fast-paced changes. Thus, it still poses a threat to their survival. The study has attempted to explore how the environment can motivate a small farmer to adopt the agriculture extension. The study also examined how environment stimulates the intrapreneurship of a small farmer. For this purpose, data was collected from the farmers of Thailand and Smart-PLS was used for data analysis. The results of the study depicted a significant positive association between environmental hostility and agriculture extension. Further results also showed a significant relationship between dynamisms and agriculture extension. More importantly, the study results revealed that intrapreneurship acts as a positive mediator between the relationship of environment and agriculture extension. All the hypotheses are accepted. The discussion and future direction are provided at the end of the study.

Key words: *Agriculture, extension services, farming, innovativeness, risk-taking.*

Introduction

Agriculture development and adoption of new methods has become a prime topic. Assisting the farmers to become more effective and efficient in their farming is an emerging concern. Regardless of the development stage of any country many efforts are especially devoted to

the agriculture development to assist the farmers. Agriculture is a major economic source of the majority of the population around the globe making it extremely important (Cerdán-Infantes, Maffioli, & Ubfal, 2008). Agriculture has proved to be a significant factor across the globe with its influence on the growth of economy, alleviation of poverty, secured food, livelihoods, advancement of rural areas and environmental sustainability (World Bank, 2007). Furthermore, the green revolution in Asia has modernized the practices of farmers in the 20th century. Consequently, it resulted in better yields of agriculture, sustainability and finally saved the nations from the fear of food shortage (IFAD, 2001). Even though work has been done to advance the agriculture still there are some loopholes which need to be addressed.

Previously Van den Ban and Samanta (2006), identified challenges associated with the green revolution and argued the small farmers are left behind as they were unable to cope with the rapid pace of the developments. It was also argued that there is a serious attempt to make sure enough food and poverty were alleviated through agriculture thus, there is a urgent need to take serious steps and provide the farmers with the agriculture extension services for improved agricultural practices. Agriculture extension programmes are regarded as the major policy instruments to be utilized to up scale the effectiveness and efficiency in various countries (Chimota, 2014).

There are similar situations in the Thailand agricultural sector. It has served to be the core aspect of the economy of Thailand (Jermsittiparsert, Sriyakul, & Rodoonsong, 2013). Previously only human resources were applied in agriculture, but now the trend has shifted towards the application of the latest technologies in the Thai agricultural sector. Various latest technologies, machines and tools are being used, yet it has to be known there are factors hindering the way to agricultural extension (Bhandhubanyong & Sirirangsi, 2019). Another study has contended that the agricultural productivity is low especially in the low-income countries. It is the scenario even in the middle-income countries which is due to the less prevalence of agriculture extension. In general agricultural extension is aimed to reduce the gap between the estimated and actual production which serves as the parameter of its success as well (Suranovic, 2015).

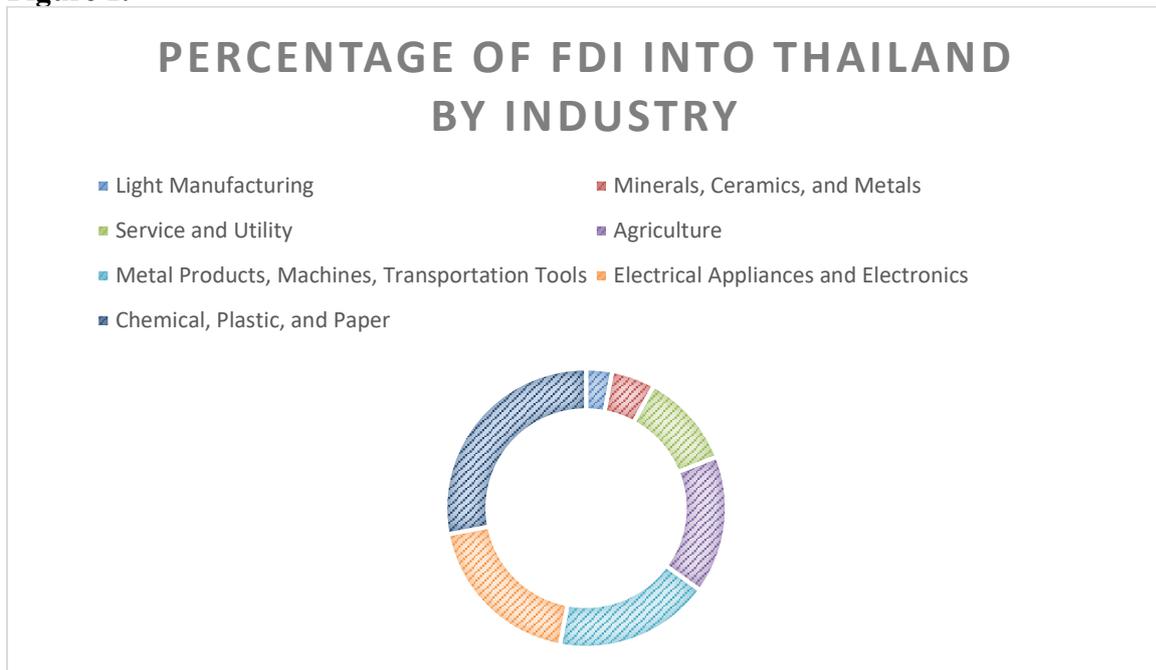
Agriculture extensions' prevalence in the emerging economies such as Thailand is low and there are several factors which can be claimed as the potential factor which increases or decreases the likelihood of the intrapreneurship. Dynamism and environmental hostility are one of them. Continuous changes happening in the ongoing industry and business environment creates a sense of the uncertainty which serves as a potential hurdle to the risk taking and doing something new. Similarly, the environment also plays a vital role in the agricultural development. Natural disasters and lack of natural resources may also dampen the progress in agriculture. Thus, bearing in mind the importance of the external factors current study has adopted these two. Considering the importance mentioned above of agriculture and problems associated with it; the study has a primary aim to identify the external factors that allow a farmer to go for the agriculture extension. The study will address the following research questions:

RQ1. Does the environment hostility influence the intrapreneurship behaviours?

- RQ2. Does the dynamism influence the intrapreneurship behaviours?
RQ3. Do the intrapreneurship behaviours influence the agriculture extension?

The study is significant for the farmers as it will provide them with the evidence of factors that can potentially influence their behaviours towards the agriculture extension. The research paper begins with the introduction which explains the background and problem statement and later literature review consisting of the detailed description. Furthermore, section 3 describes the methods adopted for the present study. The results are presented in section 4 and the discussion, conclusion and limitations are provided at the end of the research paper.

Figure 1.



Source : Handley (2017)

Figure 1 shows that a percentage of foreign direct investment in agriculture sector is 16% which is more than service and utility, minerals, ceramics and metals and light manufacturing. There is more investment needed in the agricultural sector for development of economy and reducing the poverty ratio. The highest foreign direct investment is on chemicals, plastics and paper industry of Thailand.

Literature review

Agriculture Extension

Agriculture extension is made up of two words “agriculture” and “extension” where extension denotes to the informal education which can be applied to any institution which transfers information and guidelines with the primary purpose to promote the knowledge, skills and attitude. Based on this concept a new term is being studied which is agriculture

extension. It is also aimed to disseminate the new knowledge to the farmers so they can apply it to one of their farming practices. In doing so it will ultimately develop the agriculture, resolve the issue of food security and uplift the livelihood of the farmers (Rivera & Qamar, 2003). It is generally accepted that agriculture extensions if appropriately designed and employed will ultimately improve the agriculture productivity. Services related to agriculture extensions provide the farmers with the vital information like new seeds, crop trends, changing weather, new managerial practices, marketing and training in new technologies as well. These services tend to strengthen and up scale the existing knowledge of farmers regarding the farming practices. Agriculture extension applied in its true sense improves the skill level of the farmers regarding the optimistic utilization of the resources available and finally resulting in improved crop yields (Baloch & Thapa, 2017; Chimota, 2014; Mahaliyanaarachchi & Bandara, 2006).

Agriculture development is becoming the major concern in the developing countries. In this regard it was argued that the agriculture extension is the bedrock for the agriculture development. It serves as a tool to improve the farming by improving the farmers' skills and abilities. Additionally, it is the cultivation of organizations related to farmers which are primarily aimed to enhance the production of the agricultural sector which will ultimately improve the livelihood of the farmers (Abdullah, Gillani, Naveed, Amanullah, & Kashif, 2005; Chimota, 2014; Omar, Hassan, & Bakar, 2012; Van den Ban & Samanta, 2006). From this perspective it can be seen that the agriculture extension contains the broad benefits for the farmers and society.

Intrapreneurship

Intrapreneurship denotes exemplifying the risk taking, proactive behaviours and dynamic innovativeness in products. The intrapreneurship activities can potentially develop and advance the growth and success of an organization. It also improves the organizational dependence on the environment. Intrapreneurship activities are argued to be the broad conceptualization of organizational renewal (Lee, Wong, Der Foo, & Leung, 2011; Lekmat & Chelliah, 2014). It is not a new concept but nowadays it is gaining more attention from the researchers and organizations due its proven impact on the organizations (Hadad, 2015; van der Zwan, Zuurhout, & Hessels, 2013). It is not only getting attention of the corporate leaders but it is also becoming more popular among the academicians and they are finding ways through which they can incorporate human creativity in the business (Farrukh, Ying, & Mansori, 2016a, 2016b).

In a broad context it can be defined as entrepreneurship within an organization. Looking at the argument, intrapreneurship can be said as the means to act like as an entrepreneur within an organization and by using the resources of that organization. Intrapreneurship has been defined as “the pursuit of creative or new solutions to challenges confronting the firm, including the development or enhancement of old and new products and services, markets, administrative techniques and technologies for performing organizational functions, as well as changes in strategy, organizing, and dealing with competitors” (B. Antoncic & Hisrich, 2003). The present study has considered the risk taking and innovation to assess the intrapreneurship.

From an organizational perspective, risk taking denotes the willingness of an organization to welcome the unknown, take risky initiative or invest the resources into latest technologies which are not primarily tested and which also ask for huge capital expenditure with high chances of failure as well (Mohamad, Ramayah, Puspowarsito, Natalisa, & Saerang, 2011). Previously it has been argued a tendency to look for the new opportunities which are risky as well (Omar et al., 2012; Pitt, Berthon, Morris, & Nel, 2015). It is also represented an extent to which decisions are made regarding the allocation of assets, selection of products and markets (Nasution, Mavondo, Matanda, & Ndubisi, 2011).

Innovation is the other dimension of intrapreneurship which has been considered in the study. It serves as a potential source for growth and advancement. It is also more closely related with the adoption and application of new technologies which can give a competitive advantage to an organization. This argument has been supported by a previous study which argued that innovativeness is inclusive of developing the new product, adopting the latest tech available, techniques and services to get better performance and competitiveness in the market (Ahmadpour & Karimi, 2017). It represents the organization's ability to develop and produce new products, go for the new markets and refine the supply chain which is the core concept of the entrepreneurship. Based on this it is argued that the innovation in agriculture denotes to the adoption of the new farming practices which are followed anywhere in the world. It also denotes adopting the new ways of farming and new techniques to increase the production as well.

Intrapreneurship and Agriculture extension

Following the rationale of corporate intrapreneurship, it can be argued that agriculture intrapreneurship is also going for the unknown and adoption of new farming practices which are not applied yet. The new farming practices come with the high-risk high return philosophy. Risk taking in farming signifies farmers willingness to go for new tools and practice of farming such as a trend to covert the conventional farming. Green farming and drip irrigation are some of the examples of new horizon of farming (Akbari, Danesh, Dolatshah, & Khosravani, 2019). Agriculture is the application of new technologies, tools and education in the agriculture. Thus, it can be argued that the farmers with the high risk taking ability will be more oriented towards the agriculture extension as compared to the farmers with less risk taking ability. Previously it has been argued that the risk taking has positive influence over the performance of an organization. The risk taking may end up in the loss if it exceeds the demands of the environment. A study has reported that the risk taking significantly improves the overall performance, growth and sale (Otieno, Bwisa, & Kihoro, 2012). Therefore, it is contended that when the farmers take risks, they ultimately go for the agriculture extension as the application of new domain into their routine agricultural practices. The more the risk a farmer takes the greater his or her likelihood is to adopt the new agricultural practices. As it is previously argued that creating new things falls under the domain of intrapreneurship, which is a similar case to agriculture as well. In the agriculture the farmers' innovation is to create new methods of farming, creating more productive seeds and more. The farmers with more innovative personality attributes will strive hard to go for

the agriculture extension which is the application of new tools and techniques in agriculture. Thus, it is hypothesized that:

H1: Innovation is significantly associated with the agriculture extension.

H2: Risk taking is significantly associated with the agriculture extension.

Environment Hostility and Intrapreneurship

There are different factors have been identified for the intrapreneurship such as external environment, organization and its strategies, research and development activities, managerial activities and organizational culture (Karimi, Malekmohamadi, Ahmadpour Daryani, & Rezvanfar, 2011; Taştan & Güçel, 2014). Intrapreneurship is basically a process which happens and is a result of the intersection between the environment and work settings. Environment is a significant driver of the intrapreneurship. So, it can be argued that the different aspects of the environment will also act as a stimulus for the intrapreneurship of farmers to go for the application of innovative and new ideas. The external environment influence the behaviours and therefore, it is argued the aspects of the environment also play a vital role in determination of the intrapreneurship behaviours (B. Antoncic & Hisrich, 2003; Taştan & Güçel, 2014). Environment hostility and dynamism has been selected as a potential predictor for the intrapreneurship.

Environment hostility potentially stimulates the intrapreneurship behaviours among the farmers. This generally poses a threat to the organization which ultimately serves as a stimulus to go to the intrapreneurship, think beyond the box and do something extra to overcome the threat. There are two kinds of environment hostility which can potentially activate the intrapreneurship thinking; one is the unfavorability and competitive rivalry (Taştan & Güçel, 2014). Previously it has been contended that when the organization faces a hostile environment it puts the efforts into being more entrepreneur oriented as compared to the normal situations (Mohamad et al., 2011). From the business corporation's aspect, it was also reported that the entrepreneurship is the strategic tool which acts as a potential variable for the organizational endurance in highly hostile environments. The entrepreneurial activities are performed and preferred as a potential remedy to the hostile environment (Akbari et al., 2019). Intrapreneurship is narrow in scope as the person must rely on the organizational resources to go extra mile. Therefore, it can be argued that the increasing environmental concerns and challenges force a farmer to put in extra effort and go for innovative tools for his or her survival.

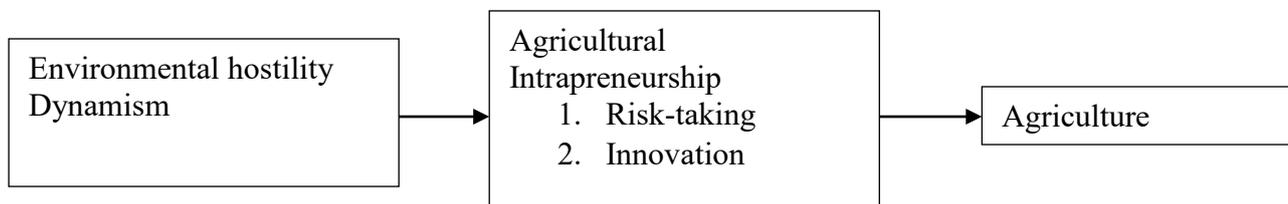
The other dimension of environment hostility is the dynamism. It denotes to the uncertain conditions, unpredictability, instability and continuous change in the market where an organization is dealing, which serves as a potential stimulus for the intrapreneurship. According to Bostjan Antoncic (2001), dynamisms denote to the perceived unpredictability and continuous changes in market. Karimi et al. (2011) states in their study that the dynamism has influence on the intrapreneurship. Based on the arguments it is stated that the farmers dealing in the dynamic agriculture market will be forced to go for something new or in a new way which will stimulate their intrapreneurship. Based on the literature mentioned above it is hypothesized that:

- H3:** Environmental hostility is significantly and positively associated with the risk-taking.
H3a: Environmental hostility is significantly and positively associated with the innovation.
H3b: Risk-taking is a significant mediator between relationships of environmental hostility and agriculture extension.
H3c: Innovation is a significant mediator between relationships of environmental hostility and agriculture extension.
H4: Environmental dynamism is significantly and positively associated with risk-taking.
H4a: Environmental dynamism is significantly and positively associated with innovation.
H4b: Risk-taking is a significant mediator between relationships of environment dynamism and agriculture extension.
H4b: Innovation is a significant mediator between relationships of environment dynamism and agriculture extension.

Research Framework

The study has a primary aim to explore the impact of the environmental factors on the agriculture extension. The following is the research framework for the study. Environmental hostility and dynamisms have been considered as potential predictors of the intrapreneurship which also do predicts the agriculture extension through mediation, this is shown in Figure 2 below:

Figure 2.



Methodology

The following section of the present study will elaborate the research methods adopted to conduct the study. The purpose of the study is to explore the influence of the environmental factors on the agriculture extension. Further the study has also considered the role of the intrapreneurship in a sense of how it can contribute towards the agriculture extension.

The nature of the study is quantitative and descriptive. Initially population of the research study was determined for data collection. The population of the present study is the farmers, who are involved in farming at small scale. The reason to choose them is they have not been able to cope with the rapidly changing agricultural practices in Thailand. The exact number of farmers was not known so the thumb rule has been used to select the sample size.

According to Hair et al. (2010), the number of questions in a questionnaire should be multiplied with 10 to get the sample size for the study. There were 30 questions in the questionnaire and after the multiplication the result was 300 respondents. According to Oke, Ogunsami, and Ogunlana (2012), the sample size should range from 200 to 400 respondents. According to Krejcie and Morgan (1970) table the maximum sample size in case of

population is 100000 will be 384. Thus, it's established that the proposed sample size for the present study falls under the acceptable range according to the previously proposed sampling techniques.

After the sample size was determined the next step was to design the questionnaire which contained the information from two perspectives. One perspective focused on the demography of the respondents such as age, education, farming experience, and adopted extension services or not. While the other perspective of questions was purely related to the variables under study. The measures were adapted from the previous studies. The agriculture extension was measured by six items; risk taking and innovation (Hashemi & Nadi, 2012) was measured by seven and six items respectively (Aktan & Bulut, 2008), environmental hostility and dynamism were measured by using five and six items respectively (Akbari et al., 2019). Smart-PLS was used to analyse the data collected. The next section of the present study will explain the results of the study in detail.

Results

Table 1: Confirmatory Factor Analysis

Constructs	Items	Loadings	Alpha	CR	AVE
Agriculture Extension	AE1	0.734	0.798	0.868	0.622
	AE3	0.747			
	AE4	0.843			
	AE5	0.826			
Dynamism	DY1	0.736	0.858	0.894	0.587
	DY2	0.797			
	DY3	0.838			
	DY4	0.743			
	DY5	0.814			
	DY6	0.654			
Environmental Hostility	EH1	0.825	0.773	0.859	0.611
	EH2	0.838			
	EH3	0.538			
	EH4	0.878			
Innovation	IN2	0.845	0.847	0.898	0.689
	IN3	0.732			
	IN4	0.851			
	IN6	0.885			
Risk Taking	RT1	0.867	0.851	0.896	0.639
	RT2	0.698			
	RT4	0.891			
	RT5	0.908			
	RT7	0.583			

Table 1 above is depicting the results of CFA. It is carried out to establish the convergent validity of the scale which allows for the next step in data analysis. The values for the factor loadings must be greater than 0.5 or 0.7 (Hair et al., 2010). All the items with the low factor loadings must be deleted. According to the table all the values for the factor loadings reported are more than 0.5 which satisfy the first parameter of the convergent validity. There are also the values of the composite reliability where average variance extracted the values of the both determinants must be greater than the 0.8 and 0.5. As per Table 1 the values of CR for the variables namely: agriculture extension, dynamism, environmental hostility, innovation and risk taking are 0.868, 0.894, 0.859, 0.898 and 0.896 respectively. Agriculture extension, dynamism, environmental hostility, innovation and risk taking are 0.622, 0.587, 0.611, 0.689 and 0.639 respectively. All the values are falling within the range which satisfies the criteria for the convergent validity. Therefore, it is concluded that the scale is cover-gently valid.

Discriminant Validity

Table 2: Fornell and Larckers Criterion

	AE	DY	EH	INN	RT
AE	0.789				
DY	0.612	0.766			
EH	0.596	0.489	0.781		
INN	0.625	0.539	0.626	0.830	
RT	0.717	0.717	0.550	0.532	0.799

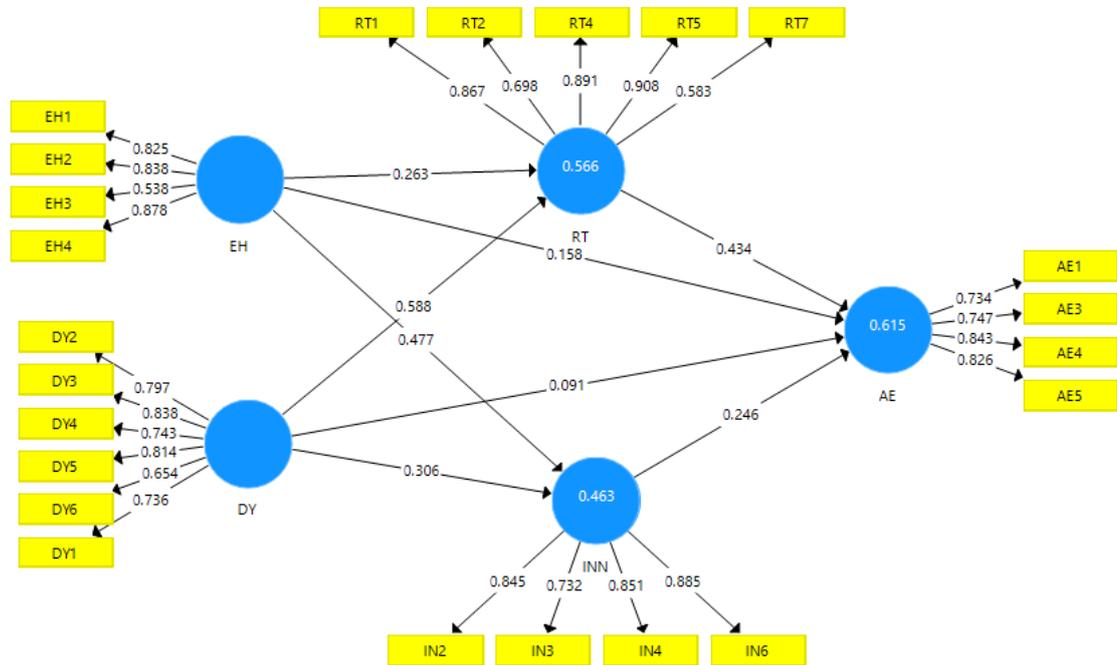
Fornell & Larckers Criterion is used to establish or determine the discriminant validity of the scale. According to which the values of the correlation of all other variables should be less than the self-correlation of a particular variable. As per the Table 2 all the values of the correlation are less than the self-correlation of the variable which affirms the discriminant validity.

Table 3: Hetrotrait-Monotrait Correlation Ratio

	AE	DY	EH	INN	RT
AE					
DY	0.727				
EH	0.741	0.596			
INN	0.756	0.627	0.769		
RT	0.866	0.820	0.686	0.644	

The latest technique to measure the discriminant validity is the “Hetrotrait-Monotrait Correlation Ratio”. According to this technique all the correlation values should be less than 0.85. Table 3 shows all the values for the correlations are less than 0.85 which establishes the discriminant validity of the scale. Scale has the convergent and discriminant validity thus it allows to proceed for the execution of SEM. Figure 3 is showing the output of the CFA:

Figure 3. Confirmatory Factor Analysis



Structural Equation Modelling

Table 4: Direct Effects

Relationships	Beta	SD	t value	p value
DY -> AE	0.091	0.050	1.846	p<0.05
DY -> INN	0.306	0.047	6.511	p<0.05
DY -> RT	0.588	0.037	15.926	p<0.05
EH -> AE	0.158	0.047	3.39	p<0.05
EH -> INN	0.477	0.046	10.351	p<0.05
EH -> RT	0.263	0.038	6.986	p<0.05
INN -> AE	0.246	0.048	5.164	p<0.05
RT -> AE	0.434	0.055	7.91	p<0.05

Table 4 is showing the direct relationships between the variables. Results have shown a positive relationship between DY and AE. The association is valued at 0.091 which is extremely weak. But due to the significant value it is acceptable and thus supported the hypothesis. Furthermore, the results depicted a positive link between DY and INN valued at 0.306. This means that a significant 1% change in dynamism will bring about 30% change in innovation. The more dynamic environment the more will be the innovation. Furthermore, DY and RT were also found to be a considerable link. The positive effect size is valued at 0.588. It is the strongest of all the relationships which assert that minor change in the dynamism will increase the risk taking. As per the results it can be said that the 58% variance has been explained by the dynamism in innovation. Thus, based on the results hypothesis H3 and H3a is accepted.

In addition, results of the study also revealed a positive influence of EH on INN. It establishes that EH has explained 0.477 variance in INN. Furthermore, EH is also found to be associated with RT and valued at 0.263. It means that EH has explained 0.263 variance in RT. However, the variance explained in innovation is much stronger as compared to the risk-taking. Therefore, it is stated that due to environmental hostility innovation increase more as compared to risk-taking. Thus, hypothesis H4 and H4a is accepted.

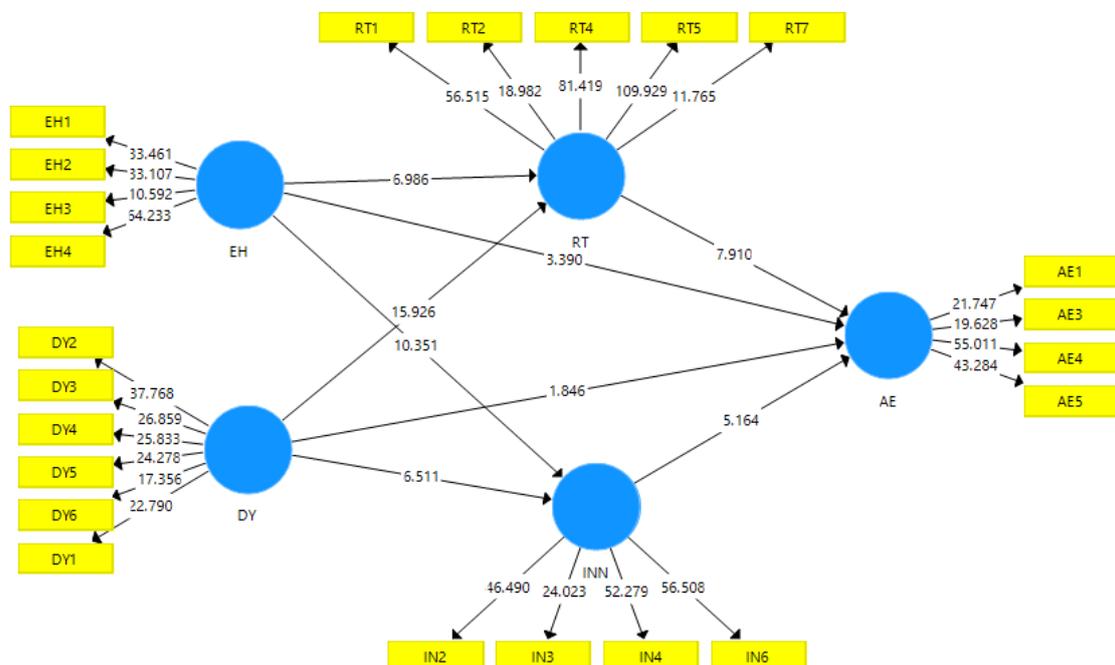
More importantly the results also reported that both the dimensions of intrapreneurship explained the variance in agriculture extension which is valued at 0.246 and 0.434 for innovation and risk taking respectively. The association is significant and thus the hypothesis H1 and H2 are accepted.

Table 5: Specific Indirect Effects

Relationship	Beta	SD	t value	p value
DY -> INN -> AE	0.075	0.018	4.080	p<0.05
EH -> INN -> AE	0.117	0.027	4.401	p<0.05
DY -> RT -> AE	0.255	0.034	7.514	p<0.05
EH -> RT -> AE	0.114	0.024	4.794	p<0.05

Table 5 above is showing the results for the mediation of the variables under study. Intrapreneurship as a multidimensional construct has been selected for the mediator in the study. From all above mediation relationships, the strongest is between the association of dynamism and agriculture extension. All other mediation results are significant, but the variance explained is less than as compared to previously mentioned variables. Based on the results all the mediation hypothesis H3b, H3c, H4b and H4c are accepted. Figure 4 below is showing the beta values for all the relationships between the variables in the study:

Figure 4. Structural Equation Modelling



Discussion

The study has attempted to elaborate the factors from environmental perspective which can predict the agriculture extension. Furthermore, the study also considered the intrapreneurship with two dimensions namely; risk-taking and innovation.

All the results are significant and all hypotheses are accepted. The study results showed that the environmental hostility has a significant influence on the agriculture extension. It also has significant influence on the risk-taking and innovation. Thus, it can be stated that when there is a challenging environment for the farmer it will increase his or her risk-taking ability and innovativeness. Further results also showed that the dynamism also predicts the agriculture extension. This means that the dynamic environment will force the farmers to go for the agriculture extension by increasing their risk taking and innovativeness ability. Thus, it is stated that the challenging environment acts as a significant antecedent for the adoption of agriculture extension.

Conclusion and Future Directions

Extension is more complex and beneficial to the agriculture sector. It is gaining attention and rapidly adopted by the farmers at every scale of their operations. This study has extended the existing knowledge of the agriculture extension by providing empirical evidence regarding how the different environmental factors can influence the agriculture extensions. The study will serve as a guideline to the policy makers regarding the promotion of the extension services. It will also serve as a guideline to design the interventions when going for the application of extension or continuation of the existing extension services in agriculture.

Even though all the hypothesis were accepted, results are significant and the model is successfully tested empirically, there still remains some limitations which need to be addressed to further strengthen the research in future. Firstly, the sample size did not include the medium and large scale farmers which can provide more valuable insights into this. Secondly, the research study is conducted in one state only, it is recommended that it should be done in multiple states to see the development of agriculture extension and problems associated with it.

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