Gender and Innovation: Experience
Of South Asian Firms

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This paper examines the impact of women representation in ownership of firms on innovation. Three types of innovation are considered: (1) product, (2) process and (3) management innovation. The current study is based on World Bank Enterprise Survey data for the year 2013-14 and countries included in analysis are Afghanistan, Bangladesh, Bhutan, India, Nepal and Pakistan. Results suggest that in these regions, the women's participation in ownership increases the probability of innovation. The innovation is high in manufacturing as compared to service sector, especially among female-headed firms. Researcher's estimates also indicate that being in big city, human capital in firms, firm size and competing in international markets increase the innovation prospects.

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1. INTRODUCTION

Globalization, competitiveness and rapid industrialization during 21 century increased the focus of businesses toward innovation. Continuous improvement in products, services, management processes and methods are now inevitable to remain in competition or even in market. The process of innovation is complex and dynamic phenomena. According to Schumpeter (1942) the innovation shapes the big and continuous small changes in the world. Schumpeter (1942) also developed a relationship between entrepreneurship and innovation; his work identifies particularly new product innovation, process innovation, new markets, developing new sources of supply chain and changes in industrial process.

Many factors can influence innovation process including individual knowledge and skill level, market competition, the firm characteristics, geographic location of the firm etc. (Burke, 1990; zanne et al., 1992; Harari, 1994; Nonaka, 1994; West et al., 1992). There is, however, little evidence on innovation in relation with gender. Ramadani et al. (2015) recommended strong guidelines for policy to improve the women's participation in labor market as entrepreneurs for Albania, Macedonia and Kosovo. The recommendations are for supporting micro-enterprises, financial support and training programs for female entrepreneurs. A similar argument is supported by Marlow (2013) that women's performance is not lower than their male counterpart rather it's better with

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little socio-economic support. Another dimension that male-owned firms have strong negative relationship to employment growth is consistent with national employment trends (Conroy, 2016).

South Asian countries' innovation system suffers from many institutional problems (Dahlman, 2007). After 1980s, there are upward trends in economic growth but still the innovation system is marginal in this region and traditional processes still predominantly prevail in businesses and production processes (Collin, 2007). South Asian countries included in this study are also mostly patriarchal and traditional societies. Gender norms are strong in these countries on one hand but on another hand, these countries are facing completion in era of globalization and also going through transition toward modernization. Trade liberalization increases female labor force participation but women's participation is usually concentrated in informal and traditional/ agro-based sectors of the economy (Hyder & Behrman, 2012). In this scenario, a very few firms have female managers and those headed by women, are mostly in agro-based sector.

Thapa (2004) reports that women set up almost one-third of new small enterprises, and these businesses are creating employment more than the countries' domestic average. Thus, there are some changing trends in terms of women ownership in businesses. Munoz and Saran (2012) revealed with help of US data that gendered diversity and women's representation bring more innovation as compared to large businesses. This paper contributes in existing literature in two important aspects. Firstly, this study examines the change in firms' behavior toward innovation (product, process and procedures and overall innovation), where a female manager heads the firm. Secondly, the study is carried out for developing, transitional and mostly patriarchal societies, where women are rarely at decision-making positions.

There is varied empirical evidence of foreign competition on local market. For example, Sakakibara and Porter (2001) report that in case of Japanese firms. Export competitiveness has upward pressure on local market competition and it also increases the efficiency through innovation. The argument of positive impact of competition on efficiency is also supported by (Djankov & Murrell, 2002; Schmidt, 1997).

On the other hand, the counter evidence has been found in case of developing countries that pressure of competition is shifted to consumers in the form of high prices rather than increasing the efficiency (Collins & Preston, 1969; Alokesh, Chakraborty & Hariprasad, 2010). While exploring this phenomenon, Blanchflower and Machin (1996) and Januszewski et al. (2002) found that for British and German firms, there is no effect of competition on efficiency.However, the competition may indirectly affect the innovation.

A bunch of studies examine the effect if foreign competition on labor productivity while considering industry and firm characteristics. For instance, McDonald (1994) examined the effects of import competition of U.S manufacturing industry's labor productivity and the paper concluded that productivity growth is high in concentrated industry. Thus, the paradox regarding innovation, labor productivity, competition and gender mix in ownership at firm level is still an empirical question. Further, the literature on this topic in south Asian context is nascent and research scope of the subject for South Asian countries has been marginalized.

Before the presentation of the empirical specification of the analysis, fundamental question of empirical testing is formulated. With the evolution of innovation literature

across sectors and economies, certain dimensions are identified. In this regard, Schumpeter Mark I (*The Theory of Economic Development,* 1911) and Schumpeter Mark II (*Capitalism, Socialism and Democracy)* [1]is of significant importance. The Schumpeter Mark I industries hypothesize the creative destruction in certain sectors and new entrepreneurs enter the market and thus, in high competitive environment innovation generate. In Mark I industries, the firms are small and it is easy to enter the market. The analysis here is of developing economies, where new entrants are emerging with better proportion of mix gender. These new nascent entrepreneurial small firms have to innovate for their survival. On the other hand, Schumpeter Mark II industries operated in more stable environment and innovation took place as a result of technological accumulation. Based on these fundamental ideas and in light of most of the empirical literature following hypotheses were tested:

> *H1:* Representation of women in ownership increases the probability of three different types of innovation: product innovation, process innovation and innovation in management practices.
>
> *H 2:* The innovation is high in presence of women's participation in ownership particularly in manufacturing sector.

2. MODEL SPECIFICATION, ESTIMATION METHOD AND SAMPLE

This section briefly describes the variables construction methodology along with modeling approach, estimation method and the sample used in the empirical part of the paper. Firstly, the modeling approach and variable construction are discussed in section 2.1. Secondly, the estimation method is presented in section 2.2. Finally, section 2.3 presents the features and sources of the data used to carry out the empirical analysis.

2.1. Model Specification and Variable

According to Joseph Schumpeter (1939), the major determinants of industrial change are introduction of new products (product innovation), production processes (process innovation) and management methods (organisational innovation) in an economic system. Following this, three variables are used for innovation[2]; (1) product innovation, (2) process innovation and (3) innovation in management practices. Thus, three questions are used in the survey i.e., First, '*During the last three years, has this establishment introduced new or significantly improved products or services*?', second, '*During the last three years, has this establishment introduced any new or significantly improved methods of manufacturing products or offering services?*' and third,'*During the*

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[1]Schumpeter, Joseph A. (2011). *Economic doctrine and method: an historical sketch.* Translated by Aris, Reinhold. Whitefish Montana: Literary Licensing, LLC.

[2] There are some other measures of innovation, for instance, innovation in marketing, inventing new markets, new methods of logistics etc. are also mentioned in questionnaire of World Bank Enterprise Survey however,in our selected sample for south Asian countries the data is very insufficient for most of questions on innovation for an analysis.

last three years, has this establishment introduced any new or significantly improved organizational structures or management practices?'.These variables are categorical in nature and replies are in yes/no options.

The major independent variable of our interest is the ownership structure particularly in terms of gender mix. The impact of ownership is analysed in two distinct ways. First, the ownership structure is categorized in three broad groups, private national individual and companies, foreign ownership and government/public ownership. The impact of these investors is evaluated by the percentage of total outstanding shares held by private/foreign investors and public institutions respectively. Second, the ownership structure is classified from gender perspective. To investigate the impact of gender diversity, following question is used: 'Amongst the owners of the firm, is there any female' A dummy variable, which is equal to zero for the former while equal to one for the latter category, is used in the empirical analysis to evaluate the impact of gender specific classification of the ownership structure.

In order to test the hypothesis, the relationship between the various categories of innovation and ultimate ownership is broadly focused. However, it is necessary to take into account the other control variables that might affect the innovation process of firms in order to avoid the specification error in the econometric model.

Sale and size of the firm are included in the model to take into account the impact of potential economies of scale and scope accruing to large firms. Regarding firm sale, two measures are included in the model to account for the product market competition that is domestic sale and exports sale. It is evident from the relevant literature that export oriented firms are more prone to market competition as compared to the counterpart firm that do not export because of competing in the international market. Therefore, firms with large exports shares will be more inclined to bring innovation in terms of production and management process to be cost competitive and unique in the market. Furthermore, firm with large market share in the domestic market will be less probable to be innovative in either aspect because of their dominant role and share in the domestic market.

Firm size may also be important source of the extent of innovation. To be innovative, it is largely dependent on the extent of competition in the market and economies of scale benefits. Larger firms are more diversified in terms of resources as well as in skills. They are capable to provide trainings and spare resources for the research and development and, hence, will be more innovative in all spheres than their counterpart smaller firms. On the other hand, smaller firms have small setup and it is convenient for them to adopt new technologies and production process. Since, both categories of firms have comparative advantage over one another to be innovative taking into account the above two aspects, i.e., easiness in adoptability and resources availability. However, we expect that larger firms will be more innovative than the smaller firms.

In order to take into account the main city impact, a dummy variable is included that is equal to zero if the firm has setup in main business city and one otherwise. Furthermore, the firms are classified in two broad industry groups, i.e., manufacturing and services sectors, and binary variable is included in the model to capture the industry specific effect. The industry dummy is equal to 1 for the services while zero for the manufacturing sector. Keeping in view the nature of business of these two sectors, the

manufacturing is expected to be more innovative in terms of production and process innovation, while the service sector will have an edge in the management practices based innovation. Therefore, we expect that industry specific dummy will have a negative sign in the production and process based innovation regression, whereas it will be positive if the dependent variable is management innovation.

In addition to the industry specific dummy, the interactive dummy of industry and no female ownership will also be of immense interest. It will be helpful to pinpoint that female ownership industry specific impact and provide guidance for the policy makers to facilitate the female owned business in a particular sector in terms of credit providence and etc. Overall, in South Asian like environment we expect that women owned business would be more innovative in the services sector as compared to the manufacturing sector. Therefore, the expected sign of the interactive dummy will be negative. Moreover, country specific dummy variables are included in the model to account for the countrywide heterogeneity and market size. The summary of statistics of selected variables used in the analysis is presented in Table 1.

Based on the above discussion, the following model is specified and estimated using the Maximum likelihood estimation method.

$$INOV_i = \beta_0 + \beta_1 PFPIC_i + \beta_2 GOVT_i + \beta_3 FOWNER_i + \beta_4 MSIZE_i$$
$$+\beta_5 LSIZE_i + \beta_6 SALE_i + \beta_7 EDUC_i + \beta_8 INDUS_i$$
$$+\beta_9(INDUS_i \times FOWNER_i) + \sum_{j=1}^{5} \delta_j COUNTRY_i + u_i \qquad \dots \quad (1)$$

According to equation (1) the depended variable $INOV_i$ represents the various measures of the innovation. The β, and δ are parameters to be estimated. the *PFIC* is a dummy variable representing the foreign individuals and institutional ownership, *GOVT* is binary variable denoting the government and public sector ownership, *FOWNER* is the dummy variable representing the male ownership (female ownership is the omitted category), *MSIZE* and *LSIZE* are the dummy variables for medium and large size firms respectively (small size firms are the omitted category), *SALE* is the domestic sale of the firm, *EDUC* is the education level of employees (proxy for skill labor), *INDUS* is the industry dummy and *COUNTRY* is the set of five dummy variables that accounts for the country specific effect (Pakistan is the omitted category). Moreover, $(INDUS_i \times FOWNER_i)$ is the interactive dummy that represents the female owner impact in service sector. The interactive term is of particular importance because it is general perception that women perform better than male in the service sector as compared to male owners in the service sector.

2.2. Estimation Method

Given the dichotomous nature of the innovation in all three categories, a qualitative response model seems to be appropriate. The qualitative response models relate the probability of an event to the set of independent variables that include the vector of control variables as well as variables of interest. These types of models are useful when assessing firm characteristics associated with dependent variable. Hence, the

binary choice probit model[3]is employed to assess the impact of various factors on the innovation using the firm level data in South Asia. In the binary probit model, innovation is presented as 1 if the firm had adopted some sort of innovation and 0 otherwise (no innovative idea is implemented). The Probit model is expressed as:

$$P(y_i = 1| x_i) = F(z) = F(x_i'\beta) \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (2)$$

Where, P denotes the probability of outcome of the dependent variable for the $i = 1,2,\ldots,N$, F is the standard cumulative density of standard normal, x_i is the $(K \times 1)$ vector of explanatory variables and β is the $(K \times 1)$ vector of coefficients to be estimated.

Provided that the observed responses are independent, the likelihood is a product of $F(x_i'\beta)$ and $\left(1 - F(x_i'\beta)\right)$. For each $y_i = 1$ the probability $F(x_i'\beta)$ appears in the product. Similarly, for each $y_i = 0$ the probability $\left(1 - F(x_i'\beta)\right)$ appears in the product. The general form of the likelihood for binary data is

$$L(y_i,\beta| x_i) = \prod_{i=1}^{N}[F(x_i'\beta)^{y_i}]\left[\left(1 - F(x_i'\beta)\right)^{1-y_i}\right] \quad \ldots \quad \ldots \quad \ldots \quad (3)$$

For $y_i = 1, 0$. The log likelihood is

$$\log L(y_i,\beta| x_i) = \sum_{i=1}^{N} y_i \log F(x_i'\beta) + \sum_{i=1}^{N}(1 - y_i)\log\left(1 - F(x_i'\beta)\right) \quad \ldots \quad (4)$$

Maximizing the $\log L(y_i,\beta| x_i)$ yields the MLE estimates of β. However, there is no closed form solution for $\hat{\beta}$ as the log likelihood is non-linear in β and will be computed numerically. The asymptotic covariance matrix is computed as the inverse of information matrix. The estimates are not directly interpretable in the normal way and can be interpreted in terms of probability. However, marginal effects for continuous variables can be calculated (at the mean) as:

$$\frac{\partial f(x_i'\beta)}{\partial x_k} = f(\bar{x}'\beta)\beta_k \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (5)$$

Where, X_k is the kth element of vector of independent variables. For dummy variables, the discrete change in probability when the dummy variable switches from zero to one is calculated as $F(X_1\beta_1) - F(\bar{x}'\beta)$ where, $X_1 = X_0 = X_k\bar{x}$ β except that the ith elements of X_1 and X_0 are set to 1 and 0 respectively (StataCorp, 1997).

2.3. Data

This paper exploits the cross-section (year 2013-14)[4] data from seven south Asian countries including Afghanistan, Bangladesh, Bhutan, India, Nepal and Pakistan. The study exploits Enterprise Surveys of World Bank Group[5]. Within these countries, the analysis is carried out on almost 975 firms headed by female entrepreneurs and 11,411 headed by male managers. According to World Bank estimates, female labor force participation is low in Afghanistan (16%), Pakistan (25%) and India (27%) and high in

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[3] *See D.S Maddala (1986). Limited-Dependent and Qualitative Variables in Econometrics.Cambridge University Press.*

[4] This is latest data set available. However, the time period of 4/5 years is not enough for any structural or behavioral change.

[5]Enterprise Surveys (http://www.enterprisesurveys.org), The World Bank.

Nepal (80%), Bangladesh (58%) and Bhutan (67%).[6] Further to these statistics, female participation in ownership is highest in Bhutan (43.8%) and lowest in Afghanistan with only 3%.[7] Table 1 presents description of variables and their construction in model specification. The data statistics show that about 42% and 44% of the firms of the entire

Table 1

Definition of Variables and Percentages

Variables	Description	Construction	Percentage
PTINV	Product Innovation	Dummy variable: 1 if a certain firm has product innovation and 0 otherwise	42
PSINV	Process Innovation	Dummy variable: 1 if a certain firm has process innovation and 0 otherwise	44
MGTINV	Management Innovation	Dummy variable: 1 if a certain firm has management innovation and 0 otherwise	35
DPIC	Domestic Private Individuals and Companies	Dummy variable: 1 if highest percentage is owned by private domestic individuals/ companies and 0 if highest percentage is owned by some other category, such as foreigners and government	98
FPIC	Foreign Private Individuals and Companies	Dummy variable: 1 if highest percentage is owned by Private foreign individuals/ companies and 0 if highest percentage is owned by some other category, such as domestic private individuals/companies and government	1.5
GOVT	Government Ownership	Dummy variable: 1 if highest percentage is owned by government and other public institutions and 0 if highest percentage is owned by other two category, i.e., domestic and foreign as domestic private individuals/companies	0.5
FOWNER	Female Ownership	Dummy variable: 1 if the firm is owned solely by male owners and 0 if firm is owned by male and female jointly or solely by female	85
SALE	Proxy for market competitiveness	Dummy variable: 1 if national sales is >70% and 0 if direct or indirect exports percentage is >70%	91
BCITY	Not in main business city	Dummy variable: 1 if a firm operates in main business city and 0 otherwise	20
MSIZE	Proxy for medium size firms	Dummy variable: 1 if a firm belongs to the medium class (having >=20 &<=99 employees) and 0 if firm belong to small (having <20 employees) or large size category (having >100 employees)	40
LSIZE	Proxy for large size firms	Dummy variable: 1 if a firm belongs to the large size firms class (having >100 employees) and 0 if firm belong to small or medium size categories	22
EDUC	Proxy for Skilled Labours	Proportion of workers with high school or more	47
INDUS	Industry	Dummy variable: 1 if a firm belongs to the service sector and 0 if firm belongs to manufacturing sector	22
BANG	Bangladesh	Dummy variable: 1 if a firm operates in Bangladesh and 0 otherwise	11
PAK	Pakistan	Dummy variable: 1 if a firm operates in Pakistan and 0 otherwise	9.70
AFG	Afghanistan	Dummy variable: 1 if a firm operates in Afghanistan and 0 otherwise	3.3
NPL	Nepal	Dummy variable: 1 if a firm operates in Nepal and 0 otherwise	3.8
INDIA	India	Dummy variable: 1 if a firm operates in India and 0	72.2

[6] Source: World Bank, web link: data.worldbank.org/indicator/IC.FRM.FEMO.ZS/countries retrieved on May 26, 2016.

[7] The situation in our sample is slightly different because we are only focusing on service and manufacturing sector.

		otherwise
N		12862

sample have reported product and process innovation respectively, whereas about 35% of the firms have adopted management innovation in their setups. Within the group of South Asian countries, Afghanistan, India, Nepal and Bhutan have almost equal level of innovation in the categories of product and process innovation, whereas Pakistan have the lowest level of innovation. The level of management innovation is highest in Nepal and lowest in Pakistan. The remaining four countries have the modest level in management innovation. Next section provides more detailed analysis.

3. RESULTS AND DISCUSSION

Table 2 in annexure presents the results of three types of innovation. The discussion on results is in order.

Table 2

Probit Estimates for Product, Process and Management Innovation

	PTINV Est. Coeff. (S.E)	PSINV Est. Coeff. (S.E)	MGINVT Est. Coeff. (S.E)
FPIC	0.517***	0.735***	0.352**
	0.172	0.189	0.171
GOVT	-0.715**	-0.909**	-0.086
	0.351	0.372	0.344
SALE	-0.066+	-0.337***	-0.274***
	0.041	0.041	0.043
BCITY	-0.357***	-0.256***	-0.241***
	0.031	0.03	0.03
MSIZE	0.220***	0.204***	0.169***
	0.028	0.028	0.028
LSIZE	0.339***	0.327***	0.306***
	0.034	0.034	0.034
Proportion of workers with high school or more	0.005***	0.004***	0.005***
	0.001	0.001	0.001
INDUS	-0.107	-0.243+	-0.504***
	0.156	0.156	0.156
FOWNER	-0.075**	-0.251***	-0.101***
	0.037	0.037	0.037
INDUS FOWNER*	0.007	0.204**	0.264***
	0.082	0.082	0.082
BANG	0.195***	0.353***	0.581***
	0.061	0.062	0.064
AFG	0.606***	0.673***	1.00***
	0.134	0.135	0.136
NPL	0.441***	0.433***	0.916***
	0.077	0.078	0.079
INDIA	0.297***	0.467***	0.679***

	0.05	0.051	0.054
CONSTANT	-0.212***	0.252***	-0.402***
	0.09	0.094	0.095

Discussion is started from the central variable that is women representation in ownership of the firm. In all three models; product innovation, process innovation and innovation in management practices, the representation of women in ownership increases the probability of innovation significant. Afghanistan, India, Nepal are quite high in innovation followed by Bhutan. However, Pakistan and Bangladesh are still much behind in innovation among their peer countries. The female participation in ownership is very low in all countries though Bhutan is an exception. Below is presented some comments along with discussion on these estimates. The discussion below revolves around the impact of gender variable in table 2.

According to Frobes (2016) a few Indian companies like Asian Paints, Hindustan Unilever, Tata Consultancy Services, Sun Pharma, Tata Swatch and Larsen and Toubro are ranked among the list of "*The World's Most Innovative Companies*".[8] Arora (2012) found with the help of survey that Indian firms are very successful in bringing product and process innovation. The drivers of innovation in Indian firms are mostly high skilled labor and spillover effect of technology and knowledge. According to Global Innovation Index report (2015), India is mentioned as an innovator achiever in Central and Southern Asia in the group of lower-middle-income countries.

Almost 44 to 49 percent firms in Nepal report that they opted different types of innovation in their products, processes and in their management practices. The literacy rate in Nepal increased from 45% in 2000 to 60% in 2010 (UNESCO, 2015). According to overall findings of World Bank Enterprise Survey (2013), the female participation in ownership of the firms in Nepal is 22% whereas this percentage is 15% in south Asian region. Thus, Nepal is low in innovation but it can be grouped into high tier innovative group of countries within our sample countries. As far as female participation is concerned it is mostly in agriculture sector. However, recently women are participating in service sector as an employee role or in entrepreneurial role as well as both in manufacturing and service sector, for instance, tailoring, knitting, weaving, handicraft production, food processing, travel agencies, beauty parlors, and advertisement firms (Shrestha et al. 2017). There are new women entrepreneurs who entered the market particularly in floriculture, tissue culture, alternative energy, medical herbs and computer services (Bajracharya et al. 2006).

Another important point to mention here is that Nepal remained a traditional economy for a long period of time and it stepped toward modern education during last two decades of twentieth century thus, marginal effects of innovation and change are highly visible in our data. Culturally, there are a few communities, for instance, Newar, Sherpa, and Gyrung communities, where women ownership in businesses is more common as compared to rest of the country.

A few recent institutional steps like Federation of Women Entrepreneurs Association of Nepal (FWEAN), and Business Professional Women Nepal (BPWN) are

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[8]"Five Indian Companies Ranked Among World's 100 Most Innovative", Frobes India, August 24, 2016.

exemplary association for encouragement and training of women business owners. The third country, which is grouped in top innovative countries, is Afghanistan whilst with lowest level of participation of women in ownership among all selected countries. The fact of the matter is; although social environment improved in early this century but to enter into a business, as an owner for women is still immensely different in Afghanistan. A very small number of firms with women representation (4.22%) showed very high level of innovation in their businesses. International NGOs or national progressive institutions or schemes mostly support these few women in ownership. Thus, with guidance of these supporting organizations, the women business owners are showing an innovation and progress. The marginal impact of cultural change and modernization is also evident in case of Nepal and Afghanistan.

The other two countries Pakistan and Bangladesh showed very low level of innovation in introducing new products, whilst Bangladesh is almost close to India and Nepal in women participation in ownership. Pakistan's position in women participation ownership is just ahead of Afghanistan. There are certain variations in case of Pakistan in introducing different types of innovation; for instance, Pakistan is better in process innovation and very low in product and management practices. One common phenomenon about these two countries is high demand due to high population growth. There is evidence that usually high demand results in high productivity rather than innovation (Pianta, 2001; Ross & Zimmermann, 1993).

Pakistan also remained stuck at the low end of technology ladder as compared to other Asian countries (Felipe, 2007). Slightly high position of process innovation might be result of government support for subsidizing the usage of solar energy. Thus, processes particularly in industrial sector are changing with the use of energy substitutes. The research and ideas presented by higher education institutions in Pakistan are not based on societal problems; the flow of ideas is not systematically linked with production processes to scale up; and thus, not leading to societal and industrial development as a natural process. The weak linkages between universities and industry are leading towards low level of innovation and thus, failed to solve entrepreneurial and industrial complexities. Bangladesh is another country, which shows low innovation in selected manufacturing and service sector firms.

The other ownership variable has three categories- firm is owned by national individuals, firm is owned by foreign individuals/companies completely or partiallyand'firm is owned by the government. As compared to firms owned by local individual or companies, the foreign owned companies are more innovating in product, process and government innovation. All the south Asian countries are consistently following the economic policies to enhance the foreign direct investment and to integrate them with rest of the world. These countries are following liberal policies and thus, FDI raised competitiveness, technological innovation and spillover effects (Chakrabati, 2001; Asiedu, 2002; Durham, 2004).

India introduced its second-generation reforms in 2002 with special emphasis on FDI in telecommunication, banking and civil aviation. Bangladesh implemented its structural adjustment program of World Bank and IMF in 1980s and 1990s with quite high momentum (Sahoo, 2006). Bangladesh remained the third largest recipient of foreign direct invest in the region after India and Iran (UNCTAD, 2012). During this

period, Pakistan also opted for liberal policies and signed a three year agreement with IMF for under Poverty Reduction and Growth Facility; however, the security remained a major hurdle in foreign direct investment. The performance of Nepal and Bhutan remained very low during recent and earlier years. Nevertheless, overall this region has chosen liberal policies and in general improved their share in global FDI (World Bank, 2013). The FDI in these countries is a major reason of innovation. First,these multinational companies introduced new methods, taste, goods and services according to local requirements. Second, the spills over effects of these MNCs are high. These foreign/ multinational companies brought knowledge, technology and modern methods. For instance, the multinationals in telecom sector in south Asia not only brought new technology but also influenced the living style of residents.

Many studies supported the argument that as firm size increases the degree of innovation also increases particularly due to economies of scale (Forre, 1997; Symeonidis, 1996; Majumdar, 2011; Keklik, 2018). On the other hand,huge amount of empirical literature arguethat smaller firms are more intend towards innovation because of their less hierarchical structure, small set of problems and close proximity between workers (Allen, 1977; Nelson, 1959). Results of this study are aligned with former view point on firm size and innovation practices. In other words, estimates of the current research are consistent with Schumpeter (1942) hypothesis that big firms in the economy possess the resources for innovation.

Firm's location also matters a lot in innovation process. Large cities with better institutions, infrastructure and human capital have much more capable for innovation as compared to smaller cities with fewer amenities. Large cities also have large markets and higher competition, which leads toward innovation in supply chain, management practices and also in product innovation. Historically, most of the innovations took place in large cities (Jacobs, 1969; Bairoch, 1991). Innovation in main cities is also driven by inter-firm relations and fierce industry competition (Doloreux, 2003). Thus, to capture this variable we include the dummy variable if firm is located in the main city or not. In our sample, 20% of the firms are not in the main city and being away from the main city reduces the probability of all three types of innovation significantly.

Another important variable in the study is whether firm sells its products in local/ national market or in international market. This variable also reflects the competitiveness of the firm as international competition is driving force of industrialized economies (Kuhlmann & Edler, 2003). In our sample, 90 percent firms sell 70 percent of their products in national markets and only 10 percent compete in international market. This is also a major reason that the global competitiveness of south Asian countries is ranked very low. Results of the study suggest that firms competing in local market have significantly low probability to innovate their products, processes and management methods.

Information and knowledge serve as inputs of innovation and when newly trained university graduates join the labor market, the knowledge defuses and innovation takes place (Jensen & Thursby, 1998; Shartinger & Tammer, 2002). Empirical studies suggested mixed results (Schneider et al.2010; Romijn & Albaladejo (2002). It was found that impact of increase in proportion of high school graduates is significant and positive but coefficient was very small. Uden et al. (2014) showed that human capacity of the SMEs

has a significant impact on the innovation in case of Kenya, Tanzania and Uganda.

Many studies on innovation suggest that degree of innovation may vary between industries (Cohen, 1995). This analysis is limited to manufacturing and service sector. There are 22 percent service firms while the remaining are manufacturing firms. Female representation in ownership is 16% in manufacturing and 13% in service sector. Our estimates suggest that the probability of innovation reduces being in service or retail sector. Our model specification also includes the interaction between women participation in ownership and service sector showing that men in service sector increase the probability of all three types of innovation. On the other hand, women participation in ownership in manufacturing sector increases the innovation. There are few initiatives from government of Pakistan to encourage women to start their own businesses and also for balanced gender mixing in ownership. For instance, Small and Medium Enterprises Development Authority (SMEDA) has initiated Women Business Development Centers (WBDC), Capacity Building Programs for South Punjab, under this program SMEDA with few other organizations help women to exhibit and enhance their skills, and Opportunity in Exhibitions are few initiatives. Trade Development Authority (TDA) has established a Women Entrepreneurial Section to facilitate women. However, it is difficult to comment on outcomes of these initiatives due unavailability of evaluation of these programs.

In developing countries, innovation is also used as proxy for knowledge of new markets, exploring and importing new technology etc. In the current sample, Pakistan performed low in product and management/ organizational practices innovation. However, its performance is better in process innovation. Afghanistan, being in process of transformation and rebuilding of the economy, thus, going through innovation process in their context. A lot of technology is transferring along with FDI.

In case of Pakistan, the low female representation in firm ownership and limited number of women entrepreneurs also indicates the exclusion of women and other marginalized groups from financial access. To deal with this issue, State Bank of Pakistan prepared a framework for financial inclusion. According to the State Bank financial strategy paper, until 2015, the financial inclusion was very low, i.e., 16% adult population had bank accounts and only 11% women had account ownership. The framework provides few promising targets to be achieved by 2023; for instance, 20 mission accounts by women through enhanced usage of digital payments. The proposed financial inclusion strategy also aims to promote SME financing and will have special emphasis on women entrepreneurs.[9]These few initiatives are quite promising but it will take some time to evaluate the outcomes.

4. CONCLUSION AND IMPLICATION

The study provides an exploration of three types of innovation; product, process and managerial innovation in relation with female participation in ownership role. The analysis in this study reveals that female entrepreneurs are an untapped resource in all these societies and with the help of specialized policy, this potential can be utilized for societal development. Results encourage the argument that women being in ownership role increase the probability of innovation in

[9]http://www.finance.gov.pk/NFIS.pdf

manufacturing sector particularly, in south Asian countries. The current study also supports the argument that more human capital in firms, larger firms' size and being in larger or main city increases the probability of innovation. Thus, training and venues should be provided to women owners in rural areas so that they are exposed to new methods, procedures and products. Further, the study suggests that these patriarchal societies should encourage more women in leadership and ownership role. One possibility is provision of training and easy availability of resource and credit access. The paper also provides policy guidelines for Higher Education Commission of Pakistan through setting the research agenda of universities in strong collaboration with industry. Based on this study, an interesting research agenda would be the exploration based on qualitative data for further in depth analysis for a single country.

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