Exploring Linkages between Women Empowerment and Resilience to Natural Disasters in Pakistan

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Contents

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Abstract

This study attempts to measure and analyse linkages between women empowerment and resilience to floods through a pilot survey in rural Khyber Pakhtunkhwa, Pakistan. I first derive a measure of resilience and women empowerment using indices. Next, econometric regression models are run and potential interlinkages between the two are tested. Results appear to indicate that the proportion of literate women in a household and education of the household head plays a significant role in empowering women whereas access to basic amenities, occupation and health status of the household head significantly contribute in increasing resilience of the household. Lastly, the extent of women empowerment seems to enhance resilience of a household but not conversely.

Keywords: resilience, women empowerment, Pakistan, floods, climatic hazards

Statement of candidate

I certify that the work in this thesis entitled "Exploring linkages between women empowerment and resilience to natural disasters in Pakistan" has not previously been submitted for a degree nor has it been submitted as part of requirements for a degree to any other university or institution other than Macquarie University.

I also certify that the thesis is an original piece of research and it has been written by me. Any help and assistance that I have received in my research work and the preparation of the thesis itself have been appropriately acknowledged.

In addition, I certify that all information sources and literature used are indicated in the thesis.

The research presented in this thesis was approved by Macquarie University Ethics Review Committee, reference number: 5201500062 on 31 March 2015

Signature

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1   Introduction

Natural disasters pose serious threats, especially to communities that are already made vulnerable owing to their inferior socio-economic or geographic conditions. Natural disasters are classified into six groups (Emergency events database (EM-DAT)). They are geophysical (earth quake, mass movement and volcanic activity), meteorological (extreme temperature, storm and fog), hydrological (flood, landslide and wave action), climatological (drought, wildfire and glacial lake outburst), biological (epidemic, insect infestation and animal accident) and extra-terrestrial (space weather, for example, hazards caused by asteroids or meteorites) (EM-DAT).

Natural disasters have been reported to be on the rise in the past few decades (EM-DAT). However, the only real increase has been observed in case of climatic disasters (Centre for Research on the Epidemiology of Disasters (CRED), 2013). For example, EM-DAT statistics show an increase of 100 to over 300 such disasters per year from 1980 to 2000s. Of the overall fatalities caused by climatic disasters (meteorological, climatological and hydrological) recently, over 95% were attributed to developing countries (United Nations Environment Programme (UNEP), 2012b). Continent wise, Asia is particularly prone to natural disasters. For instance, in the past decade Asia was hit by the highest number of recorded disasters globally. The recorded disasters were predominantly floods (CRED, 2013). From the year 1980 to 2011, 3,445 floods were reported worldwide (United Nations Office for Disaster Risk Reduction (UNISDR), 2012). In fact, in the last three decades, the recurrent floods have made them the top most climate related calamity.

Current rise in intensity and frequency of climatic hazards has led the humanitarian agencies to merge their development and relief agendas (Barret and Constas, 2013). More recently, these integrated objectives have been captured by resilience based frameworks in the policy making circles. Resilience approach serves as a holistic tool in analysing situations where shocks are becoming increasingly covariant and thus interfering with development goals (Béné et al., 2012). Covariate shocks include shocks such as climatic hazards and economic shocks (Carter et al., 2007). Resilience is a proactive rather than reactive approach in minimizing risk related to idiosyncratic and covariate shocks. Building resilient communities can thus help countries avoid considerable economic, environmental and human losses (Turnbull et al., 2013). For instance, in Bangladesh a cyclone in 2008 (similar in

scale to the one in 1970) claimed 3000 human lives compared to nearly half a million in 1970, primarily due to country's better disaster readiness (Ashdown, 2011). Similarly, increased disaster resilience has helped in promoting pasture and water conservation between the borders of Kenya, Ethiopia and Somalia (Standley, 2012) and in lowering down forest destruction in Honduras (McSweeney and Coomes, 2011). In a nutshell, resilient individuals, households or communities tend to cope better when hit by economic or environmental shocks.

Resilience has been defined as "the ability of countries, communities and households to manage change, by maintaining or transforming living standards in the face of shocks or stresses - such as earthquakes, drought or violent conflict - without compromising their long-term prospects" (DFID, 2011). In other words, the resilient individuals, households or communities recover and bounce back to their pre-shock stage. Shock is defined as "an event that can trigger decline in well-being, which can affect individuals (illness, death), a community, a region, or even a nation (natural disaster, macro-economic crisis)" (World Bank, 2000-01).

How well a household or a community withstands a shock depends on its capability, assets and livelihood strategies (Dercon and Krishnan, 1996; Ellis, 1998). Livelihood strategies, in particular, play an important role in resilience building. For example, Alinovi et al (2010) found that in Kenya, wage employees and entrepreneurs were the most resilient whereas small farmers the least. In terms of assets ownership, large land owners in Nicaragua had the highest resilience while small ones had the least.

There is considerable literature available on theoretical aspect of resilience (Barret and Constas, 2013; Béné et al., 2012; Briguglio et al., 2009; Armitage et al., 2012; Bahadur et al., 2010, Moser et al., 2010). However, only few studies have estimated resilience quantitatively (Alinovi et al., 2010; Brownie et al., 2014; Ciani and Romano, 2013; Alfani et al., 2015). So far there is no accord yet on how best to quantify it, partly because of the lack of clarity and understanding of the term (Béné et al., 2012) and partly because of lack of a suitable dataset. Resilience is a dynamic rather than static approach which requires multiple years of data.

Quantitative resilience has been estimated using multivariate techniques such as, factor analysis and principal component analysis (Alinovi et al., 2010; Brownie et al., 2014; Ciani and Romano, 2013; Alfani et al., 2015). The latest paper estimated resilience using Oaxaca Blinder framework (commonly used to study mean outcomes between treated and control groups) (Alfani et al., 2015). A major limitation of most of these studies is their static nature, that is, they only test household's resilience at a certain point in time. How long a household takes to come back to its pre-shock stage is generally unexplored. All of the studies mentioned above have used physical capital (assets possession) in estimating resilience. While assets serve an important tool in determining poverty or vulnerability of households, they could be misleading in estimating resilience to climatic shocks. A real life example is the case of some households in my research area (in rural Pakistan) who owned quite a few productive and consumptive assets before floods. These households would be classified as resilient on the basis of above studies. They, however, reported as non-resilient due to extensive losses and thus not being able to come to their pre-shock stage. In some instances, poorer households on the other hand recovered faster because they only had a few assets to begin with. Therefore, it is important to take into account the dynamic change associated with shocks. In the current study, households took on average 3.86 years to recover. The exact dynamics of recovery are not known however. They could be influenced by larger societal economic growth processes.

Another important determinant of resilience, which has been given less attention in quantitative resilience, is women empowerment and its potential role. Women are an important human capital which plays an important role in promoting a household's overall wellbeing. Educating women, for instance, not only helps them but also with the next generation's educational attainment (World Bank, 2001) which, in turn, helps improve the overall welfare of the society. Economically empowering women also helps diversify households' livelihood strategies thus making them more resilient to shocks. In a nutshell, women are an important human capital whose empowerment is considered a pre-requisite for sustainable development (DFID, 2000). Figure 1.1 depicts the relationship between five types of capital (human ("the productive capacities of an individual, both inherited and acquired through education and training" (Goodwin, 2003)), physical (produced assets such as housing, businesses or industries (Mayunga, 2007)), financial (for instance, savings and investments), natural (refers to natural resources and ecosystem (Goodwin, 2003)) and social (includes trust, norms and

networks (Mayunga, 2007)), women empowerment and resilience.

Figure 1.1 Relationship between capital, women empowerment and resilience
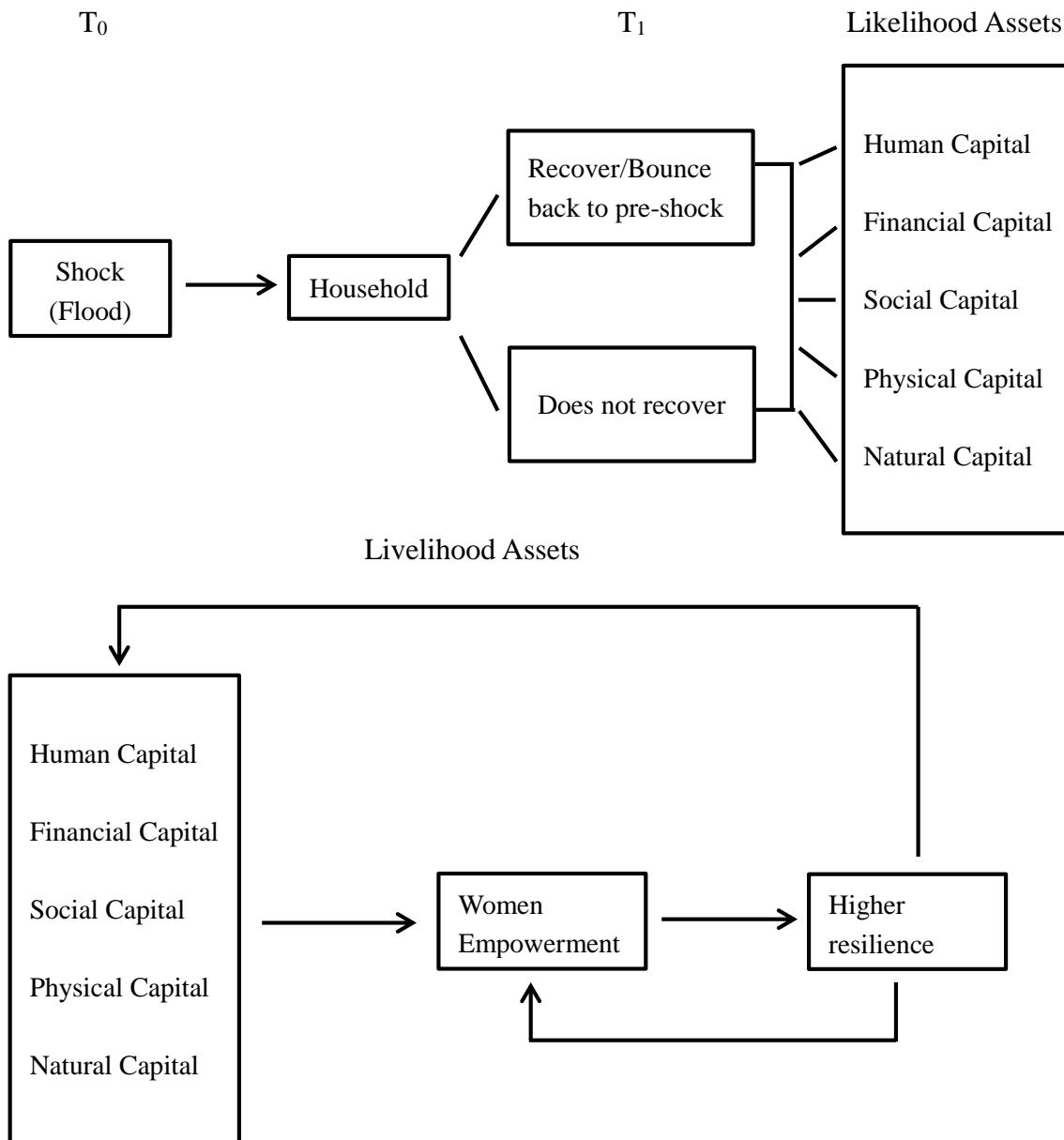
The concepts of women empowerment and resilience are potentially interconnected. That is, households, individuals or regions with more empowered women should be more resilient and vice versa (This is a key hypothesis that I test in my thesis - only household level investigation is conducted here). Livelihood capitals contribute in enhancing resilience and in empowering women. For example, access and control over natural and physical capital provide a mean to economic empowerment which improves investment in human capital such as education, training, and skills (Duflo 2003; Thomas 1990). Women's education and labour force participation not only results in their own well-being but

also their children's. For instance, literate women were more likely to oppose female circumcision in Egypt (El-Gibaly 2002) and had lower infant mortality in India and Egypt (Kishor, 1997; Dreze and Sen, 1995) than their counterparts. However, educational attainment alone does not guarantee gender equity, it also dependents on the socio-cultural setting of the region (Mitra and Singh, 2007; International Center for Research on Women (ICRW), 2005). Jejeebhoy (1998) reported that education resulted in more pronounced reduction of domestic violence in Tamil Nadu as compared to Uttar Pradesh (more male dominant state than the former). Similarly, money transfers such as microcredit has been reported to have varying effects on women's well-being. That is, some studies report improvement in decision making power of women (Hashemi et al, 1996; Murthy et al, 2002; Holvoet, 2005) and decrease in domestic violence (Hashemi et al, 1996; Kabeer, 2005). While others report increase in domestic violence in some instances (Rahman, 1999). However, such instances are small and positive effects outweigh the adverse ones. Overall, livelihood capitals are deemed essential in a holistic approach towards building resilient communities and empowering women.

Considering the importance of women empowerment and climate resilient communities in developing economies like Pakistan's, I conducted a pilot survey in rural Khyber Pakhtunkhwa (KP) province of Pakistan in April 2015. KP was hit by catastrophic floods in 2010. This calamity resulted in huge economic losses and many fatalities, making it one of the worst disasters in the history of Pakistan. More than a thousand people lost their lives and about 180,000 houses were damaged in KP alone (Disaster Emergency Committee, 2010). A single big shock, such as these floods, leaves the developing economies shattered for years to come. It also hampers the whole development process. It is, hence, important to build climate resilient communities. Understanding resilience and its determinants are inevitable to serve this purpose.

To fill the gaps (discussed in preceding paragraphs) in existing resilience literature, I use a dynamic approach to estimate resilience. That is, I address data related issues by collecting information regarding households' financial and physical capital for a year before (2009) shock (floods), a year after (2010) and for the year 2015. Resilience is thus measured directly by change in capital over time. This research also contributes to the literature by exploring aspects of the speed of recovery (that is, the number of year a household takes to come back to its pre-shock stage). The third contribution is

being made by testing the role of women empowerment in enhancing resilience of a household (and vice versa). The overall objective of this study is to determine resilience and women empowerment levels of a household and explore interlinkages between the two. Specifically, this research asks the following key questions:

How resilient are households to climatic shocks, that is, how well does a household cope when it is hit by an unpredictable negative event?

Do women play any role in increasing household's resilience to climatic shocks? Further, do resilient households contribute in empowering women?

These questions are answered by constructing resilience and empowerment indices and empirically testing the two models through linear regression models. The regression results appear to indicate that the ratio of literate women and education of the household head are contributing in improving women empowerment score while access to basic amenities, occupation and health status of the household head significantly contribute in increasing resilience of the household. Moreover, the extent of women empowerment seems to enhance resilience of a household but not conversely.

The remainder of this research is as follows. Section 2 attempts to provide brief review of theoretical and quantitative resilience and women empowerment. Section 3 explains the methodology followed by section 4 (Data and background of the floods). Section 5 interprets and discusses the results. Section 6 concludes the thesis.

2   Literature Review

The concepts of resilience and women empowerment are very broad, context specific and difficult to quantify with precision and without ambiguity. The detailed review of the existing theories behind such definitions is beyond the scope of this research. The following sub-sections provide a brief review the theoretical and empirical literature related to the concepts.

2.1 History, definition and explanation of resilience

Resilience is a multidisciplinary concept with its roots in engineering, ecology, psychology and other disciplines. The use of resilience in engineering dates back to 1858 "when the eminent Scottish engineer William J. M. Rankine employed it to describe the strength and ductility of steel beams" (Alexander, 2013). In the Psychology literature, resilience refers to the ability of individuals to withstand traumatic situations (Luthar *et al*., 2000). The idea of ecological resilience was first introduced by the Canadian ecologist Crawford Stanley Holling. It was defined as the ability of an ecosystem to reorganise itself after absorbing disturbances (Walker *et al*., 1969; Holling, 1973). Holling (1996) later contrasted between ecological resilience and engineering resilience. He defined engineering resilience as the ability of a system to come to its equilibrium state after temporary disturbance. Basically, the idea of ecological resilience relates to the ability of the system to absorb a certain amount of shock, whereas engineering resilience relates to how quickly an object or a system can bounce back after receiving a shock.

There is a growing trend in usage of the resilience term (for economic development) among humanitarian agencies, donor agencies, and governments. Previous studies have been reported using the resilience idea in areas of climate change adaptation and disaster risk reduction (Klein et al., 2003; Allison and Hobbs, 2004; Adger et al., 2005; Moser et al., 2010). Although the term resilience in development area is relatively new, it has been implicitly used before. For instance, previous literature shows that some households are unable to use effective measures to recover in the wake of a tragedy (such as a natural disaster or other economic shocks) and thus demonstrate lack of resilience. That is, the households tend to cope by selling their productive assets, reducing expenditure and increasing borrowing (Umetsu, 2010; World Bank, 2005).

Resilience has three dimensions; absorptive capacity, adaptive capacity and transformative capacity (Béné et al., 2012). Absorptive capacity refers to 'the ability of the community to absorb event impacts using predetermined coping responses' (Cutter *et al*, 2008). Adaptive capacity refers to the capacity of individuals to adjust without making major changes in their structural identity whereas in transformative stage changes occur in individual or community's structure and functions (Béné et al.,

2012).

Resilience is also relevant (and closely tied) to the concept of vulnerability (widely used in disaster risk and development literature) (Gallopin 2006; Morduch 1994; Moser 1998). There are differing views over the relationship between the two concepts. Some scholars view an inverse relationship between the two, that is, high vulnerability means low levels of resilience and vice versa (Cannon, 2008). However, another school of thought considers the two conceptually different (Cutter et al., 2008a; Gallopi'n, 2006; Sapountzaki, 2012). Other authors differentiate the two terms on the basis of time dynamics. For example, Barret and Constas (2013) explain that while an individual, household or community is exposed to shocks in both cases, vulnerability only measures short term (immediate) effects whereas resilience measures long term disturbances.

Sustainability too is closely related to the concept of resilience. However, the two are not equal. Ciani and Romano (2013) describe the difference as, "While sustainability deals with the ability of a socio-ecological system to maintain its own flow of goods and services over time, system resilience is its ability to absorb shocks without changing its structure and functions".

Essentially the idea of resilience can be expressed as the ability of a country, community, household or individual to come back to its pre-shock stage. There are four possible states; bounce back better, bounce back to pre-shock condition, recover but worse-off and lastly collapse (DFID, 2011). What state is observed depends on capital stock (human, physical, financial, natural and social) owned and the intensity of the shock.

To sum up, resilience is a multi-disciplinary approach which borrowed its roots from ecology. This framework is being used extensively nowadays. In fact, it has grown to become main policy objective among international and humanitarian agencies.

The theory of resilience has been broadly explored. However, not many papers have quantified the concept. So far there is no accord yet on how best to quantify it, partly because of the lack of clarity and understanding of the term (Béné et al., 2012) and partly because of lack of suitable dataset. A few

papers have (reviewed below in detail) used a static approach to estimate resilience. However, it's a dynamic framework which needs panel data.

The major part of my work in this thesis is dedicated towards constructing resilience indices through the use of improved dataset. Key emphasis is placed on understanding the relevance and implications of resilience to natural hazards when variables that comprise the resilience indicator are changed. A detailed review of relevant empirical literature is provided in the next sub-section.

2.1.1   Previous studies on measurement of resilience

The most recent paper proposing new ways to measure resilience is a World Bank's publication (Alfani et al., 2015). The authors estimated rates of resilience using welfare indicators (consumption and child malnutrition) for the Sahel countries. According to their paper, the dataset for target countries is only repeated cross-sections, that is, same households are not observed every year and thus post-shock data are not available to estimate resilience. In order to address data limitation, the authors made use of Oaxaca-Blinder framework to construct counterfactuals. Using this framework, the sample (households) was divided into two halves according to shock observance. Shock was determined on the basis of rain threshold. Rain being less than a certain benchmark meant that households were hit by a shock (treated). If it was greater than or equal to the threshold, then no shock (controlled) was recorded. In order to know how households would behave if they observed a different state of the world, counterfactuals were made using characteristics of the households of the opposite state. That is, parameters (households' covariates) of the controlled equation were used in treated case to obtain ex-post data. Counterfactuals for controlled state were produced in the same manner. Those counterfactuals were then compared to the permanent welfare model (welfare was a function of various household characteristics and an error term).   Households having permanent welfare less than one were categorized as chronically poor, those with permanent welfare less than or equal to their counterfactual values were classified as resilient, similarly non-resilience was observed if permanent welfare was higher than counterfactual welfare. Based on consumption indicator, Senegal was the least poor, only 4% households were chronically poor. Niger, on the other hand, had the highest chronical poverty (48%) followed by Burkina Faso 34% and Northern Nigeria 27%. Senegal

had around 70% non-resilient households, whereas in other countries this percentage ranged between 34 and 38 percent. Niger had 18% resilient households whereas the rest of the countries had 33%. Analysis of the other indicator (child malnutrition) showed that Burkina Faso had the highest number of chronically poor children whereas Senegal got the lowest (same as consumption indicator results). Northern Ghana had more resilient children than Burkina Faso and Mali.

Another major contribution in quantitative resilience is that of the use of latent variable approach for Palestinian households (Alinovi et al., 2009). In this paper, resilience to food insecurity is approached as an unobservable variable which is a function of income and food access, stability, adaptive capacity, social safety nets, assets and access to public services. Since these independent variables too are thought of as latent variables, multivariate techniques (factor analysis, principal component analysis, optimal scaling (for ordinal variables)) are used to estimate them through observed variables. Some of the observed variables include income, health, education, employment ratio, coping strategies, financial assistance, basic amenities, et cetera. Resilience index for five Palestinian regions shows that Jerusalem is the most resilient, Gaza Strip and South West Bank have low resilience and North and Mid-West Bank has more stable levels. In order to investigate the role of resilience in food security and vulnerability of households, log of food consumption is regressed on resilience index, household size, household head gender and location dummies. Regression results indicate that resilience is the most important determinant in explaining food security situation.

Another paper (by Alinovi et al. (2010)) looked at livelihood strategies to measure household resilience to food insecurity in Kenya. Households were classified into different clusters on the basis of their livelihood strategies. Hierarchical cluster analysis (using Euclidean distance and Ward method) was used to do the grouping. Analysis discovered six groups among Kenyan population, that is, pastoralists 6%, agro-pastoralists 14%, small-holder farmers 34%, large-holder farmers 3%, entrepreneurs 19% and wage employees 24%. The authors also updated resilience function (defined previously in Alinovi et al., 2009) by adding another latent variable called agricultural practice and technology and by breaking down assets into non-agricultural and agricultural assets. Two-stage factor analysis was used to quantify resilience index. Livelihood based resilience indicated that large farmers were the most resilient whereas pastoralists and small farmers the least. Location wise,

Nairobi province (with high dependence on income generation capacity) was the most resilient and North Eastern Province the least (mainly due to low adaptive capacity). Gender related analysis showed that male headed households were more resilient than female ones and gender bias was more pronounced in urban-based groups (entrepreneurs and wage employees) than agrarian groups.

Browne et al. (2014) used simple sum of assets (SSA) in addition to categorical principal component (CPC) method to measure resilience (to food insecurity) index for five African countries. Two time periods (using demographic health and surveys) were analysed to compare resilience trends over time. The two indices, SSA and CPC did not produce consistent results across countries and time period. For instance, in four out of five countries (Tanzania, Uganda, Egypt and Kenya), SSA index showed decrease in resilience over time whereas CPC indicated increased resilience in these countries. Only Mali had consistent results across both indices. However, SSA results were consistent with national statistics (that is, Millennium Development Goals report).

Ciani and Romano (2014) estimated resilience to food insecurity for agricultural households of Nicaragua. The households were surveyed before (1998) and after (1999, 2001) the shock (hurricane Mitch hit the country between Oct and Nov 1998). In 1999, only hurricane affected sub-sample (540 households) was re-surveyed. Resilience index was estimated using two stage factor analysis which showed that large land owners were the most resilient while small ones the least. Resilience index was then validated to check its relevance for future welfare indicators (food security). Logit results indicated a positive relationship between resilience and food security in future, that is, more resilience in time period t (1998) resulted in high probability of being food secure at time period t+1 (2001). Similar relationship was observed between resilience and vulnerability; being food poor in 1998 increased the chance of future food poverty (2001) by 28.7% and thus probability of transition from non-poor to poor also increased.

2.1.2   Summary of resilience index literature

Above studies have attempted to estimate resilience by using the following techniques:

- Oaxaca Blinder framework to obtain counterfactuals (since the dataset is cross-sectional and thus no records of post shock state are available) (Alfani et al., 2015).

- Factor Analysis (FA) and (PCA) Principal Component Analysis (resilience is a latent variable, the factors which it depends on are also unobservable. Multivariate techniques (FA and PCA) are used to estimate these factors through observed variables. Resilience is thus reduced to a single variable (Alinovi et al., 2010; Brownie et al., 2014; Ciani and Romano, 2013; Alfani et al., 2015).

- Simple Sum of Assets method (Brownie et al., 2014)

None of these papers answer the question of speed of recovery or the role of (empowered) women in resilience building which my research attempts to do. The role played by empowered women towards ensuring resilience to natural disasters, especially in poor and emerging economies, can be substantial. There is a significant body of literature measuring and recognizing the importance of women empowerment towards ensuring better livelihoods for households. Yet, the (possibly two way) linkage between empowered women and resilience to natural disasters has been left unexplored thus far.

Resilience part has been reviewed above. Women empowerment related literature is reviewed in the next sub-section. Women empowerment issues have been researched extensively. I will provide short review of the concept and then focus on the measurement side literature.

2.2   Concept and importance of Women Empowerment

Empowerment has been defined as the process of enabling an individual to make choices to obtain desired outcomes (Alsop et al., 2006; Kabeer, 2005). Empowerment has three dimensions; resources (social, material, human, economic), agency and achievements (Kabeer, 2005). According to Kabeer, agency is referred to as a process where goal-oriented actions are taken. It could have positive or negative connotations, positive being having power to do something independently whereas negative aspect means that someone else has power over someones' decisions. Previously resources and agency has been grasped by the term capabilities and negative and positive agency by negative and positive freedom respectively (Sen, 1985). The third dimension, achievements, refers to outcomes (realization of first two dimensions). Failure to achieve depends on personal preferences or traits

(incompetence or laziness) and underlying inequalities in capabilities. Only the latter is related to power dimension (Kabeer, 2005). The other conceptual model is composed of two factors, agency and opportunity structure. The two factors together influence degrees of empowerment which in turn affect development outcomes (Alsop and Heinsohn, 2005). The authors describe agency as resources (human, financial, social, material, psychological and informational) and opportunity structure as formal and informal institutions where individuals participate.

Empowerment serves an important tool for addressing gender inequality issues. Women empowerment is a transformative process where women gain rights to make choices and direct resources to help challenge and eliminate their subordination (Keller and Mbwewe, 1999). Women empowerment is an important policy focus among development agencies. For instance, one of the 8 Millennium Development Goals is "promote gender equality and empower women"; in fact, it has been included as a development objective in over 1800 World Bank funded projects (World Bank, 2006). The idea of women empowerment has been promoted to achieve economic growth, development and health related policy outcomes (Eyben, 2008). For example, microcredit program in Bangladesh resulted in an increased use of contraceptives among women, in addition to their economic and social empowerment (Schuler and Hashemi, 1994). Similarly, women empowerment is considered a pre-requisite for poverty alleviation programs (DFID, 2000). Given the importance of women empowerment in development arena, many authors have attempted to measure it theoretically and quantitatively.

2.2.1 Review of Measurement Literature

Measuring women empowerment involves measuring its dimensions, that is, political, economic, psychological, legal, inter-personal and socio-cultural dimensions (Malhotra et al. 2002). One might not be empowered in all dimensions at a time and disempowerment in one sphere might affect the empowerment in other area (Kabeer 2005), which makes the measurement increasingly difficult. Another challenge in the measurement process is the context specific nature of women empowerment (Malhotra et al. 2002). An indicator determining level of empowerment in one cultural setting might be meaningless in the other. Universal measures, therefore, fail to measure cross-country

empowerment levels. Empowerment is thought of as a process rather than "condition or state of being" (Malhotra et al. 2002) and measuring a process is only possible through proxies such as education (Ackerly 1995) whereas the outcome of the process through direct indicators (Kishor 2000). Malhotra et al suggests measuring process across multiple time periods. Yet another challenge is measuring characteristics which are subjective, context specific and dynamic in nature, such as behaviour or norm. Due to the inherent complexities in concept of women empowerment, it is virtually impossible to measure it fully. However, qualitative dynamic framework combined with quantitative approach could provide an in-depth investigation of the empowerment process.

Women empowerment has been empirically measured at the household level, aggregate, macro or country level and intermediate level (Malhotra et al. 2002). At the household level, most commonly used indicators are domestic decision making, freedom to move about and access to resources. Less frequent ones are freedom from domestic violence, public space, marriage or social support and couple interaction.

The aggregate level indicators mostly use proxy or indirect indicators. The dimensions used at this level are labour market (labour force participation), education (school enrolments of males and females), marriage (age at marriage or spousal age differences) and political and legal (ratio of women holding seats in parliament) (Malhotra et al. 2002).   Cross-country comparisons are usually made through indices (combination of categorised indicators). For instance, United Nations Development programme (UNDP) developed two indices to measure gender equality and women empowerment in mid 1990s (Charmes and Wieringa 2003). The two indices are Gender related Development Index (GDI) (measures Human Development Index (HDI) for males and females separately - HDI measures human development in three dimensions; health assessed by life expectancy at birth, education and standard of living by gross national income per capita) and Gender Empowerment Measure (GEM) (covers economic and political dimensions). Among their many uses, indices were criticized for failing to adequately measure gender inequality dimensions (Schüler, 2006). To address some of the short comings, a new index called Gender Inequality Index (which covers reproductive health, empowerment assessed by proportion of male to female education and seats occupied by women in parliament and economic status assessed by ratio of male to female labour force participation) was

proposed (Klasen and Schuler, 2011). Many authors have been reported proposing their own indices based on the dimensions they are testing. The most frequent dimensions are women's education, employment and legal rights (Malhotra et al., 2002).

Recently a new index called Women's Empowerment in Agriculture Index (WEAI) is proposed (Alkire et al. 2013). It is specifically designed for rural regions. It makes use of both qualitative and quantitative indicators to test women empowerment through five dimensions (for more details see methodology section). The construction of index in this research is based on the model of WEAI which, in turn, is used to test the hypothesis; empowered women contribute in household's resilience. It is explained in detail in the following methodology section.

To sum up this section, resilience is a multidisciplinary approach which borrowed its roots from ecology. It is the ability of an individual, household or region to bounce back to its pre-shock stage. It had been quantitatively measured using Oaxaca Blinder framework, Simple Sum of Assets method, Factor and Principal Component Analysis. Women empowerment is the process of enabling women to make choices to obtain desired outcomes. Indices like GDI, GII and GEM measure country level empowerment ratios whereas WEAI is used for agricultural based rural communities. The most frequently tested dimensions of women empowerment are labour force participation, education, political, legal, economic and domestic violence.

3 Methodology

3.1 Women Empowerment Index

This section introduces the key concepts necessary for constructing the women empowerment index followed by the methodology for index construction.

3.1.1 Key concepts
3.1.1.1 Indicators

Women empowerment is empirically measured through indicators. They are particularly important in

determining the progress of a policy intervention. Canadian International Development Agency (CIDA) defines an indicator as a pointer which "can be a measurement, a number, a fact, an opinion or a perception that points at a specific condition or situation, and measures changes in that condition or situation over time" (CIDA, 1997).

Gender based indicators are capable of capturing quantitative and qualitative changes over time. Quantitative (gender related) indicators rely on quantitative data such as, share of men and women in labour force or percentage of girls and boys enrolled in schools. These indicators are perceived to be rather straightforward in measuring and comparing cross-country changes. Nevertheless, they fail in capturing factors behind such changes. For example, is increase in women's literacy due to a government intervention or women's own struggle?

Qualitative indicators fill such gaps and thus complement quantitative indicators in the measurement process. They use qualitative data to measure opinions, perceptions or attitude of a group or an individual towards the problem at hand (Moser, 2007). Indicators are also classified on the basis of their direct and indirect measurement approaches. As the name suggests, direct measurement involves using indicators which directly measure empowerment. For instance, reports of decision making power or domestic violence. Whereas indirect measurement uses proxy indicators, that is, educational or age difference between spouses.

3.1.1.2 Dimensions and Categories

Selection of indicators depends on the dimensions (of women empowerment) being tested. The most common dimensions are economic, educational, legal, political and health (Malhotra et al., 2002). Since these dimensions are very broad in nature, they are subdivided into categories. Categories and dimensions tend to vary quite a lot within different contexts (for example, cultural and political environments of different regions). In fact, one review paper reported 581 indicators being used by international and national agencies (Kantachote et al, 2013) (see table 3.1).

Table 3.1 Indicator count of dimensions and categories

Dimension	Category	Number of indicators
Economic	Market Participation	90
Contribution	Resource Equity	122
	Characteristics of Population	9
Education	Educational System	7
	Others	2
	Representation	16
Governance	Electoral System and Processes	11
	Justice	19
	Access and Utilization of Health Services	14
	Disease and Prevention	16
	Environmental Health	4
	Fertility and Population Growth	12
	Health-Care Management	5
Health	Health Expenditures	6
	Maternal and Infant Health	12
	Mental Health and Risk Behaviours	5
	Nutrition	9
	Reproductive Health	9
	Violence against Women	6
	Equal Treatment of Media Employees	48
Media	Equal Coverage in News Reporting	37
	Equal Expression of Freedom of Speech	122
	Total	581

Source: Kantachote et al, 2013

3.1.1.3 Indices

Women empowerment indices are typically constructed by aggregating weighted indicators. Weights vary in different contexts. They are usually decided by the researchers who take into account the importance of indicators in a cultural setting. Higher weightage is given to more important indicators whereas lower to less important.

International organisations develop their own indices to measure and compare cross-country results. The most commonly used indices are human development index (HDI), gender empowerment measure, gender inequality index and gender equity index. These indices, while effective in measuring country level comparisons, fail to capture individual level heterogeneity. These indices are

also limited to using only proxy indicators. In order to address these limitations, Alkire et al (2013) introduced a new survey based index called Women's Empowerment in Agriculture Index (WEAI). This index is of high significance in agricultural rural economies where women empowerment is deemed essential in the development process.

3.1.1.4   WEAI

WEAI is composed of two sub-indices. The first one measures women empowerment in five dimensions namely; agricultural production, productive resources, income, leadership in the community and time allocation. The indicators used for production domain are women's input in production decisions and autonomy in production. For productive resources dimension, ownership, purchase and sale decisions of assets and credit decisions are used as indicators. Similarly for income, control over use of income is used; for leadership in the community, group membership and public speaking and for time allocation, leisure and work load (that is, time spent fulfilling productive or domestic tasks) in used. Each indicator has been weighted. A person is considered empowered if she has achieved 80% adequacy in weighted indicators. The second sub-index of WEAI (called gender parity index (GPI)) reflects the gender gap and the percentage of women who have the same achievements as men in indicators. WEAI is a multidimensional index. It does not only shed light on overall empowerment level but it also breaks down the overall score into sub-indices. The empowerment levels are thereby also determined on the dimensions level, which makes it easy for the policy makers to target the problem areas. It is a coherent framework which is suitable for rural economies such as Pakistan's. The aforementioned uses, thereby, motivate me to use WEAI's structural model for measuring women empowerment in this study. The next sub-section explains the methodology for construction of index for my research area.

3.1.2   Procedure

Alkire et al. used both qualitative and quantitative indicators in their paper. Their qualitative approach primarily included questions about defining women empowerment in womens' own words. I, however, didn't cover the conceptual part (defining empowerment) in my research. Instead, I focused

on measuring the determinants of women empowerment. I also didn't measure the second sub-index of WEAI due to time constraints and data limitations. For measuring GPI (the second sub-index), WEAI requires selecting only those households which has both primary male and female adults. Whereas, my sample households were selected on the basis of flood hit criterion rather than sex composition. Similarly, (agricultural) production dimension has not been included in this study. The reason being is, women don't actively participate in farm activities in the sample area and agriculture is considered predominantly a male profession. I, however, did interview women about their contribution in decision making in agriculture. None of the women respondents reported having any say in agricultural decisions, the reason being mentioned was "I don't know much about agriculture, males take care of it and they know what is best to do". Nevertheless, this study largely covers most of WEAI's dimensions. However some new dimensions, which are of high cultural significance in my sample research area, are also added.

This research primarily focuses on intra-household level empowerment. That is, have women been given due power by their male counterparts in a household? Community level empowerment has also been explored through social status indicator (explained in the next section). Moreover, I used both direct and indirect indicators for measurement procedures. This study attempts to measure women empowerment in seven dimensions; economic empowerment, freedom of movement, political empowerment, community level empowerment, asset ownership, marriage decisions and leadership. These dimensions are investigated through a small set of indicators. Hundreds of indicators are being used by researchers. A thorough investigation into each dimension and indicator is beyond the scope of this study. Nonetheless, a modest attempt has been made to cover the most important factors in current cultural setting. Each dimension is explained below. Survey questions related to each indicator are attached in the appendix.

A. Economic empowerment

The first dimension is measured by women respondents' input in major purchase decisions, freedom to spend partner's money or own earned money and if they have acquired education or training to enhance income of the household. A woman is considered to have adequate (I am using the same term

as Alkire et al's, that is, adequacy) achievements in this domain if she has some say in major economic decisions, has acquired education or if she has not and she wants to, then she is not restricted by partner or other male members of a household and she has some control over her partner's money or her own money in case she is working. Adequacy is categorised as indicator variable, adequate achievements being 1 and no adequacy being 0.

B. Freedom of movement

In this dimension, a woman has achieved adequacy if her movement (going outside for chores) is not restricted by males in the household. The respondent receives a value of 1 if she is free to do so, otherwise 0.

C. Political Empowerment

The women receives a category of 1 if she has been given the power to vote by her male peers and she is aware of political situation of the region or participates in political discussions. Otherwise, she receives the value of 0.

D. Community-level Empowerment

In addition to investigating intra-household empowerment level, this research also captures whether women have been denied their rights culturally. It is explored by asking how important social status is to women. This question has also been validated by finding if they are willing to take up a job even if it impaired their social image in the community. A women is classified as empowered in this domain if she does not care about her social status being negatively affected as a result of exercising her power. Same as other domains, adequacy take a value of 1 and 0 otherwise.

E. Asset ownership

I use mobile phone ownership as an indicator to test this dimension. Since there is no clear distinction

of sole ownership of major assets in the sampled households, mobile phone is a small but yet powerful tool in determining the level of empowerment. For instance, a gender gap study by GSMA (Groupe Speciale Mobile Association) reported women being more independent, connected and safe as a result of using a mobile phone. Similarly literacy through mobile phones showed a significant improvement in the literacy levels of young women (aged 15 to 24) in southern Punjab Pakistan (GSMA, 2010). As women empowerment is measured within the household, it is useful to investigate if women have been given the right to own a mobile phone by male members of the house. A woman is considered less empowered if she is not allowed to keep a mobile phone, provided that she can operate and afford to own one.

F. Marriage Decisions

The adequacy in this dimension is measured by discovering if women have a say while the marriage decisions (for children) are being made by household head (typically male in the sample area).

G. Leadership in the community

Alkire et al used group membership and leadership to measure this domain. I am only using group membership. Public speaking among rural women in the sample area is almost non-existent and thus ignored for analysis purposes. Women are, therefore, defined empowered in this dimension if they have joined any women's organisation or self-help group.

3.1.2.1 Weights

Following Alkire's methodology, I also use symmetric weights for each domain. See table 3.2 for summary of indicators and weightage given to each dimension.

Table 3.2   Domains, indicators and weights in Women Empowerment Index

Categories	Weights	Domains	Indicators	
A	1/7	Economic Empowerment	Labour	force

			participation, Acquired education or training, Freedom to spend partner's or own earned money
B	1/7	Freedom of movement	Ability to go outside without being controlled
C	1/7	Political Empowerment	Participation in voting/political decisions
D	1/7	Community level empowerment	Social status
E	1/7	Asset ownership	Ownership of mobile phone
F	1/7	Marital decisions	Say in marriage decisions (for children)
G	1/7	Leadership in the community	Group membership

3.1.2.2 Adequacy Score

The following model has been borrowed from Alkire et al's paper. In order to compute empowerment in selected dimensions, adequacy score (c_i) is computed as follows.

$$c_i \ = \ w_1 D_1 \ + \ w_2 D_2 \ + \ . \ . \ . \ + \ w_7 D_7 \qquad (3.1)$$

Where w_1 refers to weight associated with domain D_1 and D_1 refers to domain A, similarly w_2 is the weight for second domain (B) and so on (see table 3.2). All weights sum up to one.

The adequacy score varies between 0 and 1. It increases with increase in adequacies across dimensions. The score of 1 means that the respondent woman has no inadequate achievements in many domain whereas a zero implies that the respondent has no adequacy in any dimension. That is, a higher score implies higher empowerment while a lower one means lower empowerment.

Alkire and her co-authors made use of threshold to identify non-empowered women. They recommended the cut-off of 20%, which means the individual is less-empowered if she has an inadequacy score of 20% or higher. The threshold conversely implies that empowered women has an

adequacy score of 80% or more. This cut-off is a bit high for my sample area. I use the threshold of 30% or higher to categorise the less-empowered. In other words, a woman is empowered if she has adequate achievements in five of the seven dimensions, or has an adequacy score of 70 percent or more.

3.1.3 Empowered/less-empowered headcount ratio, its intensity and overall empowerment score

Alkire's paper used the term dis-empowered to refer to women who are less empowered. I avoid using this, since it's misleading and often implies that women are denied the power what they have been given previously. In order to compute the headcount ratios, intensity and overall empowerment score, I use Alkires' formulae.

The empowered head count ratio is calculated via dividing the total number of empowered women (q) by the total sample size (n).

$$H_e = q/n \qquad (3.2)$$

The intensity is determined by dividing aggregated adequacies score (c_i) by the total number of empowered women (q);

$$A_a = \sum_{i=1}^{n} ci \, /q \qquad (3.3)$$

Lastly, the extent of women empowerment in the sampled dimensions (WE) is given by;
$$WE = [H_e + (H_n * A_a)] \qquad (3.4)$$

Where, H_n (1- H_e) is less-empowered head count ratio, H_e empowered head count ratio and A_n(1-A_a) average inadequacy score. WE increases if number of empowered women increases or when adequacy scores of less-empowered women go up.

3.1.4 Indicators affecting empowerment levels

This survey collects information regarding both direct and indirect indicators for measurement purposes. The adequacy scores (defined above) are measured through direct indicators. This study also measures the effect of proxy or indirect variables on adequacy scores.

The following regression model is used to measure such effect:

$$c_i = \alpha + \beta X + \epsilon \qquad\qquad (3.5)$$

Where c_i is adequacy score of household i in seven dimensions, α is the intercept, β is a vector of coefficients associated with vector X , ϵ is the error term and X is a vector of covariates; education and age of household head, proportion of literate women in the household, resilience index of households and total annual expenses incurred by the household. Expenses (in Pakistani rupees) are used as a proxy for income here.

In this model, the education is captured by higher qualification (bachelors or above). It takes the value of 1 if household head has graduate level literacy, otherwise it takes 0. Resilience indices are four in number. Each one is continuous and varies from 0 to 1. The extent of resilience is captured through variation in the scores. Higher value means high resilience and vice versa. Inclusion of these indices helps determine if resilience is playing any role in empowering sampled women. Above regression model is run four times with each different resilience index each time. The next section explains the methodology for construction of resilience indices.

3.2 Resilience Indices

This research aims to measure resilience of a household through dynamic changes in major production and consumption assets, income, state of recovery and years of recovery. Productive assets include livestock, agricultural implements and machinery, and tubewell. Consumption assets include fridge, car, motor bike, push bike, television, sewing machine, gold jewellery, air conditioner, motor

pump, washing machine and computer. Speed of recovery is captured by exploring how long the sample household took to come back to its pre-floods state.

The following models of resilience index are constructed using a combination of measures (assets, income, state and years of recovery):

$$\textit{Model 1} \quad R_1 = w_1 r_1 + w_2 r_2 + w_3 r_3 + w_4 r_4 + w_5 r_5 + w_6 r_6$$

Where r_i refers to indicators of resilience, w_i refers to weights, i varies from 1 to 6. Assets are divided into three categories, productive, consumption and gold jewellery. Although gold jewellery is a consumption asset, yet it is introduced separately into the model since it is used as a means of saving and a coping strategy in uncertain shocks. Here the amount of gold is represented by its weight in grams. Refer to table 3.3 for indicators and their weights.

In the case of assets, the recovery from floods is measured by exploring if the lost assets are replaced. This is done by comparing the current (2015) asset stock with pre-floods (2009) stock. If the difference in asset stock between 2015 and 2009 is positive or zero, then it implies that the household has bounced back to its pre-shock stage and is resilient. A positive value here means that the household bounces back better and zero means that it has full recovered.

Similarly, recovery is also measured by changes in income of the household due to floods. This change is important where households switch from agricultural to non-agricultural occupations as a consequence of floods (for example, in the case of sample households). The household is resilient if households' earnings are same or better than pre-floods stage. This change is measured by taking the difference between current (2015) and pre-floods (2009) yearly income. Here the income is adjusted for inflation.

The third determinant of resilience is current condition of the household after floods. Here the recovery of the household is directly measured by asking the household heads if their households have bounced back to pre-shock stage.

The fourth measure is the number of years taken by the household to come back to its pre-shock condition. The responses to this question (in the pilot survey) showed that households took four or less years to fully recover from the floods. Therefore, the benchmark is set to 4 years. The household is considered resilient if it took less than or equal to four years to recover, otherwise not resilient.

Table 3.3   Resilience indicators and their weights for model 1

	Resilience indicators	Weights
1	Change in amount of gold	1/6
2	Condition after floods	1/6
3	Change in real income	1/6
4	Change in quantity of consumption assets	1/6
5	Change in number of production assets	1/6
6	Years of recovery (>4 years)	1/6

r_1 takes the value of 1 if amount (in grams) of gold possessed currently has increased or stayed the same as pre-shock stage,   0 otherwise.

r_2 takes the value of 1 if current condition of the household (in respondent's perception) is better than or same as pre-floods condition, that is, if the household has bounced back   to its pre-shock stage, 0 otherwise.

r_3 takes the value of 1 if current real income has stayed the same or increased in comparison to pre-flood year , 0 otherwise.

r_4 and r_5 take the value of 1 if lost consumption and production assets of the household have been replaced and/ increased, 0 otherwise.

r_6 takes the value of 1 if a household takes less than four years to come back to its pre-shock stage, 0 otherwise.

$$\textit{Model 2} \quad R_2 = w_1r_1 + w_2r_2 + w_3r_3 + w_4r_4$$

Table 3.4   Resilience indicators and their weights for model 2

	Resilience indicators	Weights
1	Change in value of assets	1/4
2	Condition after floods	1/4
3	Change in income	1/4
4	Years of recovery (>4 years)	1/4

In this model, monetary value of assets is taken into account rather than the number of assets. r_1 takes the value of 1 if combined value of replaced assets is the same or more than pre-shock value. Here the assets are combined into consumption and production assets (defined in previous model 1). Also, nominal income is replaced by real income. The rest of the methodology is the same as previous model's.

$$Model\ 3 \quad R_3 = w_1r_1 + w_2r_2 + w_3r_3 + w_4r_4 + w_5r_5 + w_6r_6$$

In this model, all the indicators and weights are the same as model 1 except r_3 where nominal income is used.

$$Model\ 4 \quad R_4 = w_1r_1 + w_2r_2$$

In this model, r_1 (same as r_2 in previous models) takes the value of 1 if condition (of the household) after floods is the same or better than before and r_2 (same as last indicator in previous in models) takes the value of 1 if a household takes less than four years to come back to its pre-shock stage, 0 otherwise. Here 0.5 weightage is given to each indicator and then summed up to get resilience index. The next step is to explore what factors are contributing in increasing resilience of a household.

3.2.1 Regression Model

The extent of resilience of a household is influenced by a number of factors such as livelihood strategies, access to basic necessities, and other individual and household characteristics. For instance, Alfani et al (2015) found out that the resilient group in the Sahel countries had higher literacy and smaller family size than the non-resilient group. Similarly other studies have looked into livelihood strategies and asset stock to explain the resilience levels (Alinovi et al., 2009; Ciani and Romano, 2014).

This study, too, investigates the effects of a few such factors through the following regression equation:

$$R_i = \alpha + \beta X + \epsilon \qquad (3.6)$$

Where, R_i refers to resilience index i and i=1....i=4, whereas numbers 1 to 4 refer to resilience model 1 to 4 respectively. X is a vector of covariates such as access to natural gas supply for cooking, family size, occupation (agricultural/non-agricultural), other shocks, women empowerment adequacy scores, current value of house in rupees and general health status of the household head.

In this model, access to basic amenities is measured by including natural gas access only. Information regarding electricity and water access was also collected but not included in the model since more than 95% of the sampled population had access to those facilities and thus irrelevant in resilience determination. Here access to gas is a dummy, 1 being accessible and 0 otherwise. Occupation variable takes the categorical value of 1 if it is non-agricultural, whereas, the agricultural takes the value of 0.

Other shocks is again a categorical variable based on the occurrence or non-occurrence of such shocks. Other shocks include shocks such as death of main earner or any other member of the household, death of livestock, business failure and loss of productive assets. Such shocks are only included if they occurred after the floods and before fully recovering from the floods. Health status is determined by general fitness of the household head. In this survey, a person is considered fit if he is able to work in the field for a day or so. In this model, a fit person takes the value of 1 and un-fit 0.

4   Data and background of the floods
4.1   Background of 2010 floods

In July 2010, North and North-Western areas of Pakistan were struck by flash flooding due to heavy monsoon rains.   It was the worst flooding event recorded in Pakistan's history.   The areas affected were parts of Khyber Pakhtunkhwa (KP), Gilgit Baltistan, Azad Jammu and Kashmir (AJK), and Baluchistan.   The severe riverine and flash flooding throughout these regions   combined to create a southward flowing body of water approximately the size of the United Kingdom land mass

(Provincial Disaster Management Authority (PDMA), 2010).

The high-intensity rainfall in the KP area (Table 4.1 compares average annual rainfall with catastrophic rainfalls) caused unprecedented flood peaks in Swat River. The floods tore apart two major irrigation structures, damaging the Amandara Headworks extensively and washing away the Munda Headworks.   The merged flow of the Swat and Kabul Rivers produced an unparalleled flood peak at Nowshera town. The flood waters moved downstream through the barrages in Punjab and Sindh until reaching the Arabian Sea (PDMA, 2010).

Table 4.1 Comparison of average rainfall

Area	Annual Rain	Rain from 28th July to 3rd August 2010
Peshawar District	400 mm	333 mm
Khyber Pakhtunkhwa	962 mm	3,462 mm

Source: PDMA 2012

These floods were amongst the worst natural disasters recorded in the history of Pakistan in terms of geographical coverage and the numbers of affected population.   The losses caused by the Pakistan 2010 floods resulted more than double the destruction caused by the Pakistan Earthquake 2005, Cyclone Katrina 2005, Indian Ocean Tsunami 2004, Cyclone Nargis 2008 and Haiti Earthquake 2010 (National Disaster Management Authority (NDMA), 2010). Table 4.2 compares the flood statistics with other natural disasters' statistics.

Table 4.2 Comparison of 2010 floods with other major disasters

	Pakistan Floods 2010	Pakistan Earthquake 2005	Katrina Cyclone USA 2005	Nargis Cyclone Myanmar 2008	Indian Ocean Tsunami 2004	Haiti Earthquake 2010
Population affected	20,251,550	3,500,000	500,000	2,420,000	2,273,723	3,200,000
Area Affected (Square Km)	132,000	30,000	n/a	23,500	n/a	13,226
Deaths	1,985	73,338	1,836	84,537	238,000	230,000
Injured	2,946	128,309	n/a	19,359	125,000	300,000
Household Damaged	1,894,530	600,152	200,000	450,000	n/a	250,000

Source: NDMA Annual Report 2010

One fifth of the country's land mass was covered by the floods, killing 1,985 people and injuring a further 2,946. Over ten thousand educational institutions and 511 health facilities were either damaged or totally destroyed. Similarly, over 2 million hectares of crops were destroyed and 450,000 livestock killed. Table 4.3 reports severely and moderately affected districts and associated losses incurred at a province level. Agriculture and livestock losses are provided in table 4.4; losses associated with schools and vocational colleges in table 4.5 and 4.6 respectively and health facilities damages in table 4.7. Tables 4.3 to 4.7 are attached in the appendix section.

4.2   Data

4.2.1   Overview

KP, geographically the smallest province, is located in northwestern part of Pakistan. The north and northeastern areas of the region are predominantly mountainous. The province shares its border with Afghanistan through Khyber Pass and nationally with Gilgit Baltistan, Federally Administered Tribal Areas (FATA), Azad Jammu and Kashmir (AJK) and Punjab. It has 25 districts which are subdivided into 69 tehsils and 986 union councils. Peshawar is the capital and largest city. Indus and Kabul Rivers are the major rivers in the province. Swat River joins Kabul River at Munda Headworks near Charsadda. The merged water flows through Peshawar Valley. In the event of heavy precipitation (in monsoon season-July to September), Swat and Kabul Rivers overflow thereby damaging Peshawar, Nowshera, Charsadda and Mardan. When combined with Indus River, the two inundated rivers cause flooding in DI Khan (PDMA, 2012).

KP is prone to landslides, avalanches, riverine and flash flooding. It has previously been hit by floods in 1976, 1982, 1988, 2005, 2006, 2007 and 2010 (PDMA, 2012). Apart from natural disasters, the region's economy has suffered immensely due to its war against terrorism and its aftermaths. KP also lags behind other provinces in terms of education and economic development. Its literacy rate stands at 53 percent compared to Punjab 61% and Sindh 56% (Pakistan Social and Living standards Measurement survey (PSLM), 2013-2014). Gender related literacy gap in KP is significantly higher than national average (36% compared to 25% nationally). Similarly, its average monthly income (7,709 Rupees) in the year 2010-2011 was the lowest in the country (Pakistan Integrated Economic

Surveys, 2010-2011). The region's poverty level is estimated at 39%, higher than national average (UNDP, 2011). In a nutshell, the region is "one of the least developed in the country" (World Bank, 2013).

In year 2010, the sources of catastrophic floods were Swat, Kabul and Indus rivers. The water levels in these rivers weren't detected on time and the peak levels reached at night, giving people no time to prepare. Poor preparation and lack of early warning system, therefore, increased the extent of potential damages. In terms of per capita losses, KP was affected the most. For instance, out of 1,985 human fatalities, 1,156 alone were reported to be from KP (see table 3). Other categories of flood losses are summarized in table 8. As shown in table 8, 121 thousand hectares of crops were destroyed, 72,500 large animals (cattle, buffaloes, donkey, and horse), 67,800 small animals (sheep, goat) and 6.2 million poultry perished. Similarly the infrastructure suffered extensive damage as well (see table 4.8 for more details).

Table 4.8   Summary of flood related losses in KP

	Category	Description of Damages	
1	Education	870 schools, 30 colleges	
2	Health	190 health facilities	
3	Governance	880 buildings	
4	Transportation	6511 km Road	
5	Irrigation	13 canal systems; 7 embankments	
6	Water & Sanitation	2812 WSS; 1,111 Sanitation schemes	
7	Housing	295, 684 houses	
8	Agriculture	Crop area:	121.5 thousand hactare
		Large animals:	72,500
		Small animals:	67,800
		Poultry:	6,213,000
		Water Courses:	1790
9	Business	89 industrial units,	
		17,702 shops and hotels	

Source: PDMA, 2012

All 25 districts of KP were affected, with some more severely affected than others.   The most affected districts were Peshawar, Charsadda, Nowshera, Upper and Lower Dir, Shangla, Swat, Kohistan, Tank and D I Khan (from table 3). Table 9 shows flood statistics for 9 of the 10 severely

affected districts (of KP).   Out of 25 districts, Nowshera was the worst hit. Parts of Nowshera are stretched along banks of Kabul River, which makes the district more vulnerable to riverine floods. As shown in table 9, human fatalities were the highest in Nowshera (167 people) followed by Shangla, 162 people; Swat 95 people and so forth. In terms of affected households, Swat takes the lead where the numbers nearly hit hundred thousand. Charsadda had the second highest number of affected households, that is, 71,819 households followed by Nowshera, 71,403 households.   Nowshera had the most extensive house damage followed by Charsadda and so on (see table 4.9 for detailed statistics).

Table 4.9   District level flood statistics in KP

District	HHs Affected	People Died	Pop Isolated	Villages Affected	Houses Destroyed	Livestock Damage
Nowshera	71,403	167		27	67,892	
Swat	90,665	95	350,000	42	14,460	34,470
Charsadda	71,819	66		34	33,000	
Kohistan	66,133	85	150,000	38	2,400	
Upper Dir	30,071	77	100,000	14	655	25,000
Shangla	11,950	162	60,000	7	13,000	
DI Khan	56,373	31		26	4,000	180,252
Tank	21,270	11		16		
Lower Dir	25,812	35		7	260	
Mansehra	3,267	36		12	4,092	89,232
Haripur	8,092	37		42	4,000	
Chitral	9,881	21		12	550	150
Total	546,003	1,068	660,000	544	191,215	507,423

Source: PDMA, 2012

4.2.2   Sample Households

In order to investigate resilience and women empowerment related questions, a pilot study was conducted in April 2015 in three of the ten severely (flood) affected districts in KP, that is, Peshawar, Nowshera and Charsadda. A semi-structured questionnaire was used to interview 51 households in 10 villages. Six villages were selected from Charsadda, namely Bhosa Khel, Painda Khel, Kande Malmale, Mastanabad, Kandare and Agra Payan. From Peshawar, the villages of Khazana Payan and Khazana Bala were selected. And in Nowshera, the Chowki Drab and Gujar Kas villages were

selected. In all villages, five households were selected with the exception of Gujar Kas where six households were selected. The sample villages were located with the help of a local NGO. First household (hh) in each village was selected randomly whereas the rest were selected using referral sampling. In this survey a household and household member is defined as 'A household is a group of people who live together and take food from the same pot, a person who has stayed in the house for at least 3 months in the past 6 months is considered a household member' (International Food Policy Research Institute (IFPRI), 2011-2012). This survey collected individuals' basic household information (age, number of children, education, marital status, income, consumption and health expenditures), agriculture (major crops, their cost of production and yield), women empowerment, marketing of crops, sustainable agriculture and resilience to climatic and economic shocks. Most knowledgeable female (in most cases wife of a household head) in the household was interviewed. Agriculture related questions were asked from informed males only since cultivation involves predominantly men in the sample areas and thus women have very limited knowledge about crops cost and yield. Whereas women empowerment related questions were asked solely from women in the absence of any male company to minimize any potential bias.

5   Findings

This section presents the results for models of women empowerment and resilience indices. Women empowerment models' results are discussed in the sub-section, 5.1 and resilience regression findings in section 5.2.

5.1   Women empowerment index

In this sub-section, I present WE (women empowerment) and its sub-indices, and categorisation of empowered and non-empowered women by age and education.

5.1.1   WE and sub-indices

WE and its decomposition is provided in table 5.1 As shown in the table 5.1, the overall WE score

for the sampled areas is 0.28 which is considerably lower than (Southwestern) Bangladesh's 0.747, (Western Highlands) Guatemala's 0.690 and (rural) Uganda's 0.789 (Alkire et al, 2013). Higher WE score shows higher level of empowerment whereas, lower indicates low levels of WE. It can be improved by either increasing the number of empowered women or increasing the adequacy scores of non-empowered women.

Table 5.1 Women empowerment indices

Index	Values
Disempowerment Headcount (H_n)	88%
Empowerment Headcount (H_e)	12%
Average Inadequacy Score (A_n)	82%
Average Adequacy Score (A_a)	19%
WE [$H_e + (H_n * A_a)$]	0.28

H_n shows the percentage of women who are not empowered. Pilot results show that a large majority, 88.24%, of the women in the sample areas are not empowered whereas in Bangladesh, Guatemala and Uganda, this ratio is 61%, 71.3% and 56.7% respectively (Alkire et al, 2013). Further breakdown shows that the non-empowerment women (88.25%) have inadequate achievements in 82.14% of the dimensions, whereas in the rest 17.86%, they have adequate achievements.

Figure 5.1 Contribution of individual domains to disempowerment of women
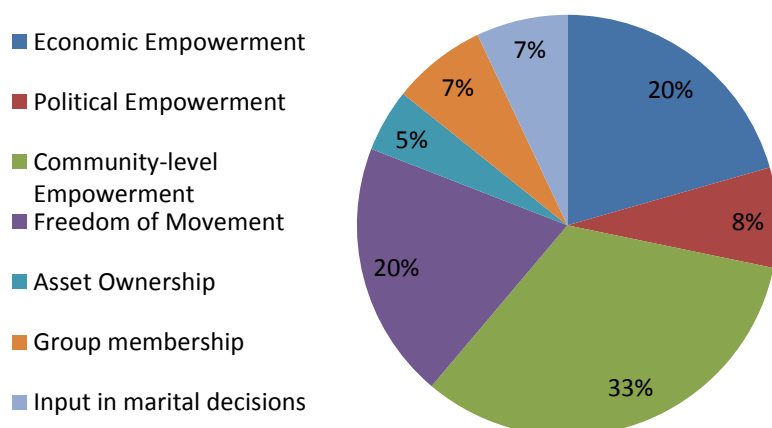

Figure 5.1 indicates the contribution of each domain in non-empowerment of women. Community

level empowerment is shown to be contributing the most which is 33% followed by freedom of movement and economic empowerment 20%, political empowerment 8%, group membership and input in marriage decisions 7% and lastly asset membership 5%. The decomposition of percentages of non-empowered women by dimensions is shown in figure 5.2.

Figure 5.2 Percent of women not empowered and who have inadequate achievements by indicator
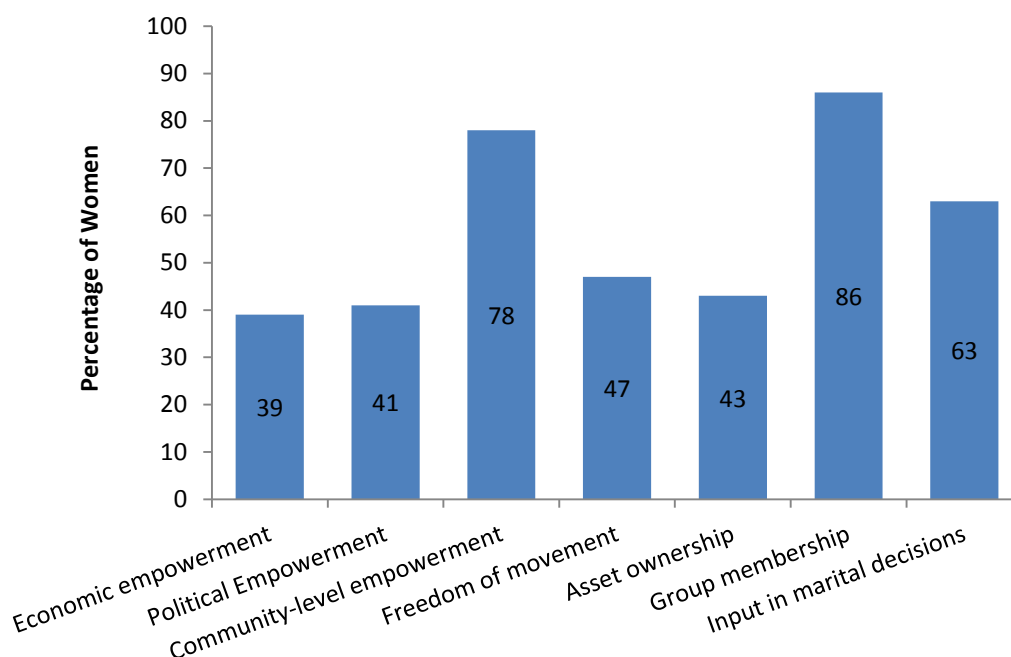
5.1.2 Categories of empowered and non-empowered women by education and age

From table 5.2, it is evident that, 4 out of 6 empowered women are literate. Out of these four, 2 have primary education (year 1 to 5), one has higher-secondary (year 9 and 10) and one has graduate level (year 13 and above) qualification. Among 46 non-empowered women, only three are literate out of which one has primary whereas the rest two have graduate degrees. The fact that majority of empowered women have some schooling implies that education plays an important role in empowerment of women.

Table 5.2 Number of empowered and non-empowered women by education

Education	Empowered	Non-empowered
Primary	2	0
Middle	0	1
Higher Secondary	1	0

Intermediate	0	0
Graduate	1	2
Total	**4**	**3**

Age decomposition in table 5.3 shows that majority (33 out of 51) of respondent women fall into the age group of 26-45. In this age group, 5 are empowered and 28 are not. In 18-25 age group, there is only one woman who is reported non-empowered. The age group of 46-55 reflects one respondent woman being empowered whereas the rest 13 not empowered. Lastly all the four women aged between 56 and 65 have been shown non-empowered. From this categorisation, no relationship can be deduced between age and empowerment. In Bangladesh and Guatemala, such association was significant whereas Uganda's survey showed no relationship between age and empowerment (Alkire et al, 2013).

Table 5.3 Number and percent of empowered and non-empowered women by age group

Age Group	Empowered	Percentage	Non-empowered	Percentage
18-25	0	0%	1	100%
26-45	5	15%	28	85%
46-55	1	8%	12	92%
56-65	0	0%	4	100%
Total	6		45	

5.1.3 Regression Results

Table 5.4 presents the results of women empowerment adequacy score being regressed on a set of covariates. These covariates are proportion of literate women in the sample household, household head's graduate level education (takes a categorical value of 0 or 1), age of household head, total annual expenses incurred by the household head and resilience indices (from model 1 to 4).

Table 5.4   Regression results for women empowerment models

	Model 1	Model 2	Model 3	Model 4
Proportion of literate women	.425***	.418***	.427***	.435***
	(.099)	(.099)	(.099)	(.099)
High qualification of household head	.31**	.301**	.306**	.31**
	(.154)	(.154)	(.155)	(.155)
Age of household head	.003	.003	.003	.003
	(.002)	(.002)	(.002)	(.002)
Annual expenses	-.015	-.016	-.016	-.0166

	(.012)	(.011)	(.012)	(.012)
Resilience index	.072	.088	.052	.009
	(.097)	(.089)	(.098)	(.063)
Adjusted R-square	0.326	0.332	0.322	0.318
F Statistic	5.85	5.98	5.76	5.67

Notes: standard errors are in parenthesis and estimated parameters with ***, ** and * indicate statistical significance at the 99%, 95% and 90% level respectively.

The results appear to suggest that only the ratio of literate women and education of the household head are contributing in improving women empowerment score. That is, the ratio of literate women is significant at 1% level of significance whereas education of the household at 5%. Holding all other independent variables constant, one unit increase in ratio of literate women increases the adequacy score by 0.4. Similarly, all else being equal, the household head's high qualification increases the score by 0.3 points compared to the household head that has no such qualification.

Adequacy scores have also been regressed on the same set of covariates except resilience indices (shown in table 5.7 in the appendix). Results do not vary much. The same covariates, ratio of literate women and education of the household head appear significant.

There could be potential endogeneity between women empowerment and ratio of literate women in a household. That is, the more the number of literate women in the household the higher would be the WE score. Also, the higher the WE score, the higher would be the emphasis on educating girl children in the household. However, from personal interviews with household heads during the survey, it was not clear whether the decision over sending the girl child to school primarily rested with women (or literate women) of the household. In households, where WE score was lower, girl children were still being sent to schools and it was mostly the decision of the male member(s) of the household. Given, these complexities and the small sample of the current study, a further test of endogeneity using the 2-sls (two stage least squares) was not conducted. However, this is planned in the future.

5.2   Speed of recovery and regression results of resilience models

Table 5.5 shows the time the sample households took to come back to their pre-floods stage. On

average, the households took 3.86 years to recover. Further breakdown shows that out of 51 households (hh), 14 hh didn't recover and 10 hh only just recovered (5 years). Five hh recovered in less than a year with one recovering in 2.4 months, three in 3 months and 1 in approximately eight and half a months.

Table 5.5 Speed of recovery

Time Period of Recovery (years)	Number of households
0	14
0.2	1
0.25	3
0.7	1
1	2
2	6
2.5	2
3	7
4	3
4.5	2
5	10

Table 5.6 compares the findings of ordinary least square regressions of four resilience models. The explanatory variables in the regression models are family size of the household, household's access to natural gas for cooking purposes, occupation (agricultural or non-agricultural), other shocks (takes a categorical value of 0 or 1), health of the household head, WE adequacy score and current value of the house (in log).

Table 5.6   Regression results for resilience models

	Model 1	Model 2	Model 3	Model 4
Access to basic amenities	.204***	.257**	.221**	.381**
	(.108)	(.115)	(.103)	(.172)
Family size	.009	.012	.007	.002
	(.013)	(.013)	(.012)	(.020)
Occupation (Agricultural/non-agricultural)	-.193***	-.157	-.222**	-.246
	(.104)	(.112)	(.099)	(.166)
Other shocks	-.169	-.121	-.180	-.108
	(.122)	(.129)	(.116)	(.193)
Women empowerment scores	.291***	.395**	.271***	.243
	(.171)	(.182)	(.163)	(.272)
Value of house (Rupees)	-.074	-.093	-.069	-.112
	(.064)	(.068)	(.061)	(.102)
Health Status	.078	.175***	.109	.113

	(.098)	(.104)	(.093)	(.155)
Adjusted R-square	0.144	0.163	0.206	0.194
F Statistic	2.05	2.22	2.62	2.65

Notes: standard errors are in parenthesis and estimated parameters with ***, ** and * indicate statistical significance at the 99%, 95% and 90% level respectively.

Model 1's results suggest that access to natural gas, occupation of the household head and WE adequacy score have significant effects at 10% level of significance. In model 2, access to natural gas and WE adequacy score are significant at 5% level of significance and health of the head is significant at 10%. The coefficients of access to natural gas and occupation are significantly contributing at 5% whereas adequacy score at 10% in model 3. In the last model, only access to natural gas is positively affecting resilience scores of the households. The signs of all the significant coefficients are as expected.

Access to natural gas is consistently significant in all four models. The significance of agricultural versus non-agricultural occupation in two models suggest that agriculture based households are more vulnerable to floods than their counterparts. This is evidenced by the fact that during the pilot survey many respondents reported that their agricultural land became barren for a few seasons after floods. On the other hand, although households relying on non-agricultural sources also reported their incomes being affected, they stated faster recovery than their peers. This result is also consistent with other papers' findings. In rural Nicaragua, small land owners and agricultural workers were the least resilient (Ciani and Romano, 2013). Similarly, in Kenya small farmers and pastoralists were least resilient whereas entrepreneurs were the most resilient.

Regression results without women empowerment scores are presented in table 5.8 (in appendix). Access to basic amenities appears significant in model 2, 3 and 4 and occupation in model 1 and model 3.

Women empowerment and household resilience is a two way process. Theoretically, high resilience contributes in empowering women and empowered women contribute towards increasing households' resilience. Current pilot findings didn't show any significant contribution of resilience towards

women empowerment. However, results from two resilience models in table 5.6 suggest a significant positive contribution of empowered women in enhancing households' resilience. It is possible that a much larger sample would show this two way inter-linkage between household resilience and women empowerment. That is, resilient households are more likely to have features that also contribute towards women empowerment over time. In order to explore this endogeneity a panel data set involving a larger sample collected over multiple time periods would be more suitable. Consequently, this endogeneity aspect has not been tested in this thesis.

6 Conclusion

This study attempts to measure women empowerment and resilience to floods through a pilot survey in rural villages of Khyber Pakhtunkhwa, Pakistan. It contributes to the existing literature in three ways; measuring resilience via a dynamic approach, exploring speed of recovery from the floods and lastly testing the role of empowered women in enhancing household's resilience and vice versa.

Women empowerment is measured in seven dimensions, that is, economic empowerment, freedom of movement, community level empowerment, leadership in the community, asset ownership, marriage decisions and political empowerment. An index is constructed by weighing each dimension and then aggregated.

Resilience is measured through dynamic changes in physical and financial capital due to floods, recovery of the respondents through their own perception and speed of recovery from the floods. Each indicator is weighted and summed to obtain the indices. Four such indices were constructed using a combination of different indicators. Both women empowerment and resilience indices are tested for potential inter-linkages using OLS.

Based on Alkire's method, the overall women empowerment score for the sample areas turned out to be 0.28. Moreover, further computation indicates that 88.24% of the women in the sampled areas are not empowered. The regression results from women empowerment model appear to indicate that the ratio of literate women and age of the household head are contributing in improving women

empowerment score. Resilience indices, however, do not appear to have any significant impact in empowering women.

The findings from (four) resilience models suggest that access to basic amenities such as natural gas is consistently significant in all four models. Occupation of the household, such as agricultural versus non-agricultural, appears to contribute positively in increasing household's resilience (based on two models' findings). This result resonates with other papers' findings, that is, agricultural workers are more vulnerable to shocks such as floods and are thus less resilient than their counterparts. General health status (being able to work in the field for a day or so) of the household is significant in one model only. Lastly women empowerment scores appear to be significant in the two models. It suggests that as women empowerment levels increase, resilience of the household also increases.

While the findings are along expected lines, further research is needed given some key constraints of this study. The results of this analysis are based on a small sample size and thus limited in their general applicability. Women empowerment has only been measured through seven dimensions, a thorough investigation of which will require a separate paper. Moreover, women empowerment is a process which is better understood using panel data for measurement. Women empowerment and resilience are interdependent and thus endogenous. In order to separately determine their roles, a panel investigation of both is desirable. A panel study will also help determine the recovery status of the households who have not recovered yet. Other future work could include investigating the role of social safety networks (aid, charity or family support) in augmenting household resilience. Addressing these and other potential issues will be part of my future research.

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Appendix

Table 4.3   Breakdown of countrywide damages

Province	Deaths	Injured	Houses Damaged	Population Affected	Severely affected districts	Moderately affected districts
Punjab	110	262	500,000	8,200,000	Muzzafargarh, Rajanpur, Mianwali, R.Y. Khan, Layyah, D.G. Khan, Bhakkar	Multan, Sargodha, Khushab, Jhang
Sindh	411	1,235	1,098,720	7,000,000	Kashmore, Shikarpur, Jacobabad, Larkana, Qambar-Shahdadkot, Thatta, Dadu, Jamshoro	S. Benazirabad, Hyderabad, Matiari, T.M. Khan, Tandu Allah Yar, Sukkur, Khairpur, Naushero Feroze, Ghotki
KPK	1,156	1,198	200,799	3,800,000	Tank, D.I. Khan, Kohistan, Peshawar, Charsada, Nowshera, Lower Dir, Upper Dir, Shangla, Swat	Lakki Marwat, Bannu, Abbottabad, Battagram, Mardan, Chitral, Karak, Kohat, Malakand, Mansehra, Swabi, Buner, Hangu, Haripur
Balochistan	54	104	75,261	130,000,011	Nasirabad, Jaffarabad	Sibi, Kachi, Killa Saifullah, Loralai, Mussakhail, Sherani, Hamai, Jhal Magsi, Kohlu, Barkhan
Other federating units	254	147	9,928	300,000	Neelum	Bagh, Bhimber, Kotli, Mirpur, Muzafarabad, Neelum, Rawlakot, Astor, Diamir, Ghanche, Ghizer, Gilgit, Hunza-Nagar, Skardu
Total	1,985	2,946	1,884,708	20,600,000		

Source: NDMA, 2010

Table 4.4   Flood Statistics - Agriculture and livestock

Descriptions	AJK	Balochistan	FATA	Gilgit-Baltistan	Khyber Pakhtunkhwa	Punjab	Sindh	National
Crop Area Damaged (thousand hactare)	33	133	7	8	122	747	1,044	2,093
Large Animals (thousand)	0	140	6	1	72	2	94	316
Small Animals (sheep, goat) (thousand)	0	1,037	8	11	68	3	82	1,208
Poultry Perished (thousand)	12	626	101	13	621	2,012	6,895	10,280
Fishery/Ponds lost (PKR million)	n/a	n/a	n/a	n/a	13	319	49	381
Water-courses Damaged	657	47	n/a	960	1,790	2,598	6,990	13,042
Household stocks of Food, Seed & Feed (PKR million)	75	1,509	n/a	19	6,722	35,805	10,488	54,699
Agriculture machinery, Tools (PKR million)	n/a	58	n/a	n/a	85	4,536	113	4,792
Govt, buildings, Infrastructure facilities (PKR million)	n/a	15	n/a	n/a	247	1,464	1	1,727

Notes: Large Animals = Cattle, Buffaloes, Camel, Horse, Donkey, PKR=Pakistani Rupee
  Fishery/Ponds Lost in FATA included estimates for Khyber Pakhtunkhwa
Source: Asian Development Bank (ADB), Preliminary Needs and Damage Assessment Report, 2010

Table 4.5   Flood Statistics – Schools

Categories	AJK	Balochistan	FATA	Gilgit-Baltistan	Khyber Pakhtun khwa	Punjab	Sindh	National
Higher Secondary Schools							20	20
Completely Destroyed							10	10
Partially Damaged							10	10
Secondary Schools	21	25	7	8	52	141	121	375
Completely Destroyed	2	2	3	1	9	19	54	90
Partially Damaged	19	23	4	7	43	122	67	285
Middle Schools	47	37	14	25	81	264	97	565
Completely Destroyed	16	1	2	6	20	34	43	122
Partially Damaged	31	36	12	19	61	230	54	443
Primary Schools	126	495	155	46	737	2,412	5,417	9,388
Completely Destroyed	20	25	30	12	197	604	2,627	3,515
Partially Damaged	106	470	125	34	540	1,808	2,790	5,873
Grand Total	194	557	176	79	870	2,817	5,655	10,348

Source: Asian Development Bank (ADB), Preliminary Needs and Damage Assessment Report, 2010

Table 4.6   Flood Statistics - Colleges and vocational institutions

Categories	AJK	Balochistan	FATA	Gilgit-Baltistan	Khyber Pakhtunkhwa	Punjab	Sindh	National
Colleges	4	0	0	2	13	4	0	23
Completely Destroyed	0	0	0	0	0	3	0	3
Partially Damaged	4	0	0	2	13	1	0	20
Technical/Vocational Institutions	0	0	0	0	17	4		21
Completely Destroyed	0	0	0	0	1	0	0	1
Partially Damaged	0	0	0	0	16	4	0	20

Source: Asian Development Bank (ADB), Preliminary Needs and Damage Assessment Report, 2010

Table 4.7   Flood Statistics - Health facilities

Province/Region	Total health facilities of all categories	Number of damaged health facilities			Affected facilities as % of province total
		Completely damaged	Partially Damaged	Total	
Azad J. Kashmir	616	6	33	39	6.3
Balochistan	2,075	26	19	45	2.10
FATA	364	0	30	30	8.24
Gilgit-Baltistan	731	2	1	3	0.41
Khyber Pakhtunkhwa	1,739	40	150	190	10.9
Punjab	2,891	9	48	57	2
Sindh	1,305	103	48	151	11.65
Pakistan	9,721	186	329	515	5.29

Source: Asian Development Bank (ADB), Preliminary Needs and Damage Assessment Report, 2010

Table 4.10   Summary Statistics

Independent Variable	Obs.	Mean	Std. Dev.	Min	Max
Characteristics of (household) hh head					
Gender	51	0.92	0.27	0.00	1.00
Age	51	50.31	13.02	18.00	90.00
Literacy	51	0.37	0.49	0.00	1.00
Years of education	51	3.63	5.02	0.00	16.00
Family size	51	8.31	3.67	2.00	21.00
fit	51	0.76	0.43	0.00	1.00
Education Categories for hh head					
Primary	51	0.02	0.14	0.00	1.00
Middle	51	0.08	0.27	0.00	1.00
High	51	0.20	0.40	0.00	1.00
Intermediate	51	0.04	0.20	0.00	1.00
Graduate	51	0.04	0.20	0.00	1.00
Occupation					
Agricultural/Animal Husbandry	51	0.22	0.42	0.00	1.00
Unemployed	51	0.16	0.37	0.00	1.00
Self-employment	51	0.27	0.45	0.00	1.00
Private/public service	51	0.12	0.33	0.00	1.00
Agricultural/Non-agricultural labour	51	0.24	0.43	0.00	1.00
HH composition					
Male children	51	1.63	1.22	0.00	4.00
Female children	51	1.69	1.77	0.00	8.00
Male adults	51	2.35	1.55	0.00	8.00
Female adults	51	2.33	1.41	0.00	6.00
Male elderly	51	0.14	0.35	0.00	1.00
Female elderly	51	0.10	0.30	0.00	1.00
Characteristics of female respondent					
Age	51	44.10	9.21	18.00	65.00
Literacy	51	0.14	0.35	0.00	1.00
Education categories					
Primary	51	0.04	0.20	0.00	1.00
Middle	51	0.02	0.14	0.00	1.00
High	51	0.02	0.14	0.00	1.00
Intermediate	51	0.00	0.00	0.00	0.00
Graduate	51	0.06	0.24	0.00	1.00

Independent Variable	Obs.	Mean	Std. Dev.	Min	Max
Occupation					
Housewife	51	0.82	0.39	0.00	1.00
Animal Husbandry	51	0.08	0.27	0.00	1.00
Self-employment	51	0.06	0.24	0.00	1.00
Public Service	51	0.04	0.20	0.00	1.00
Other Shocks	51	0.16	0.37	0.00	1.00
Basic amenities					
Electricity	51	1.96	0.20	1.00	2.00
Gas	51	0.35	0.48	0.00	1.00
Water	51	1.92	0.27	1.00	2.00
Income and expenses					
Current Income	51	292,853.30	236,616.10	49,500.00	1,116,000.00
Income after floods	51	180,864.70	188,840.50	0.00	900,000.00
Income before floods	51	209,760.80	177,069.70	0.00	800,000.00
Total expenses	51	349,630.40	273,853.40	50,500.00	1,218,000.00

Table 5.7   Regression results for women empowerment adequacy score (without resilience scores as covariates)

	WE model
Proportion of literate women	.437***
	(.098)
High qualification of household head	.31**
	(.153)
Age of household head	.003
	(.002)
Annual expenses	-.017
	(.011)
Adjusted R-square	0.333
F Statistic	7.24

Notes: standard errors are in parenthesis and estimated parameters with ***, ** and * indicate statistical significance at the 99%, 95% and 90% level, respectively.

Table 5.8   Regression results for resilience models (without women empowerment scores as covariate)

	Model 1	Model 2	Model 3	Model 4
Access to basic amenities	.174	.216*	.193*	.356**
	(.109)	(.119)	(.104)	(.169)
Family size	.007	.008	.004	.002
	(.013)	(.014)	(.012)	(.020)
Occupation (Agricultural/non-agricultural)	-.217**	-.188	-.243**	-.265
	(.106)	(.115)	(.101)	(.164)
Other shocks	-.167	-.117	-.178	-.106
	(.124)	(.135)	(.118)	(.193)
Value of house (Rupees)	-.043	-.041	-.069	-.086
	(.063)	(.060)	(.061)	(.098)
Health Status	.073	.105	.109	.109
	(.099)	(.108)	(.095)	(.155)
Adjusted R-square	0.106	0.091	0.173	0.116
F Statistic	1.85	0.131	0.030	0.098

Notes: standard errors are in parenthesis and estimated parameters with ***, ** and * indicate statistical significance at the 99%, 95% and 90% level, respectively.

Questionnaire

DEFINITION OF HOUSEHOLD: A household is a group of people who live together and take food from the same pot; a person who has stayed in the house for at least 3 months in the past 6 months is considered a household member (International Food Policy Research Institute, (IFPRI) 2011-2012)

Module A: Sample Household and Identification
1. Household Identification Number:
2. Village:
3. Union:
4. District:

Module B: Household Composition and Education
Module B1: Household Composition

Member ID	Sex		Age	Relationship to HH Head*	Marital Status*	Major Occupation**
	1=male	2=female				

Relationship to HH Head*: 1=HH Head, 2=Husband/wife, 3=son/daughter, 4=Daughter/son-in-law, 5=Grandson/daughter, 6=Father/mother, 7=Brother/sister, 8=Niece/Nephew, 9=HH head's cousin, 10=Partner's (of HH head) father/mother-in-law, 11=Partner's brother/sister-in-law, 12=Partner's niece/nephew, 13=Partner's cousin, 14=other relative, 15=permanent servant, 16=other non-relative/friends
Marital Status*: 1=Monogamous married, 2=Polygamous married, 3=Divorced, 4=Separated, 5=Widow or widower, 6=Never married
Major Occupation:**1=Cultivation,2=Agricultural Labour,3=Animal Husbandry,4=Non-agricultural wage labour,5=Village Artisan/Services,6=Skilled   Artisan,7=Self-employment,8=Service,9=Forestry,10=Fishing 11=Others

Module B2: Education

Member ID	Ever attended school?		Years of education	Type of school / college / university attended		Location of educational institution (local area, city or abroad)		
	a)yes	b)no		a)Private	b)Public	a)Local	b)city	c)Foreign country

Module C: Housing

Do you own or rent the house?		If own the house? What is its value?	If rented, how much is rent per month?	Type of construction; mud or concrete		Does this household have an electricity connection?		How often does the electricity supply go off? (hours per day)	Main source of cooking fuel**	Does the household have access to water supply	
a). yes	b) no			a)mud	b)concrete	a)yes	b)no			a)yes	b)no

Code:1=Electricity,2=Supply Gas,3=LPG,4=Kerosene,5=Firewood,6=Dried cow dung,7=Coal,8=Dried Leaves,9= Others

Module D: Assets

Description of Assets	Does your hh own the asset?		Quantity			Value of assets		
	a)yes	b)No	Year 2009	Year 2011	Year 2015			
Livestock								
Agricultural implements								
Agricultural machinery								
Fridge								
Car								
Motor bike								
Push bike								
Rickshaw								
Television								
Sewing machine								
Jewelry								
Air conditioner								
Hand Tube well								
Shallow Tube well								
Deep Tube well								
Electric motor pump								
Diesel pump								
Others								

Module E: Income

	Source of Income	Value (Rs./Annum)
1	Cultivation	
2	Livestock	
3	Other Sources (off-farm income)	

Module F: Land Holdings

	Type of land	Acres
1	Irrigated	
2	Unirrigated	
3	Own	
4	Rented-in	
5	Total Operational Land	

Module G: Major Crops Information

		Crop 1	Crop 2	Crop 3	Crop 4	Crop 5	Crop 6
Year (20)							
Name of crop							
Crop code*							
Acreage							
Yield (kg)							
Cost of production							
Source of water*							
Percentage of water usage from sources;	a. rain						
	b. own groundwater source						
	c. buy from other sources (farmers)						
	d. canals, rivers, pond. Lakes etc.						
Method of irrigation*							
Energy used for irrigation; 1=Electric, 2=diesel							

3=Manual						
Cause of inadequacy and insufficiency of water*						
Loss of yield is due to*						
If the issues were addressed, how much (%) would yield increase						
Is the produce sold to middlemen	a)yes					
	b)no					
If yes, how much (%) more profits can you make if the produce is sold directly in the city market						

Crop code*

Source of water*: 1=rainfed, 2=river, 3=canal, 4=pond, 5=canal irrigation, 6=groundwater

Method of irrigation*: 1=rainfed, 2=dug well, 3=hand tube well, 4=treadle pump, 5=rower pump, 6=shallow tube well, 7=deep tube well, 8=low lift pump, 9=canal irrigation, 10=other (specify)

Cause of inadequacy and insufficiency of water*:

Adequate water 1

Lack of rainfall 2

Lack of water in river 3

Lack of water in dam 4

Fall in groundwater level 5

Water too saline 6

(Electricity) Power outages 7

Electric failure............................. 8

Lack of diesel 9

Dispute with irrigation organization/supplier 10

Other(specify)............................. 11

Loss of yield is due to*: a=flood/rain, b=pest attack, c=infested by rats, d=drought, e=storm, f=other (specify)

Module H: Negative Shocks and coping mechanisms

code	Shocks	How many times did it occur in this hh in	year	What's your current condition after the shock? i.Worse	What was the total value of the loss?	How did you cope? *	How long did the impact of the event last	Please rank the worst shock; First worst,	How many years did it take you to come to your

		the past 5 years?		than before ii.Same as before iii.Better than before			(days)	1 Second worst, 2 Third worst, 3	pre-shock stage?
1	Death of main earner								
2	Death of other than main earner in the family								
3	Loss of income due to illness or injury of household member								
4	Medical expenses due to illness or injury								
5	Loss of a regular job of a household member								
6	Lost home due to river erosion								
7	Eviction from previous residence for any other reason								
8	Divorce or abandonment								
9	Major loss of crops due to floods								
10	Major loss of crops due to other reasons								

	(drought, storm, pest, diseases etc.)							
11	Loss of livestock due to flood							
12	Loss of livestock due to death							
13	Loss of livestock due to theft							
14	Loss of productive assets due to floods							
15	Loss of productive assets due to other reasons (theft, fire, river erosion, storms etc.)							
16	Loss or destruction of other consumption assets (personal) due to floods							
17	Loss of consumption assets due to factors other than floods							
18	Dowry payment							
19	Other costs of wedding							
20	Division of father's property							
21	Failure or bankruptcy							

	of business								
22	Family member put in prison								
23	Family member arrested by police								
24	Paid a big bribe								
25	Cost of court case								
26	Losses due to a court case								
27	Cut-off or decrease of regular remittances to household								
28	Withdrawal of NGO or government assistance								
29	Increase in food prices								
30	Increase in prices of inputs								
31	Price instability or uncertainty (in farming)								
32	Other – 1, specify								
33	Other- 2, specify								

How did you cope*: 1=None, 2= Sold land, 3= Mortgaged/leased land, 4= Sold productive asset (specify), 5=Mortgaged productive asset (specify), 6=Sold consumption asset (specify), 7=Mortgaged consumption asset (specify), 8=Took loan from NGO/institution, 9= Took loan from non-institutional sources (neighbours), 9= Ate less food to reduce expenses, 10=Ate lower quality food to reduce expenses, 11=Took male children out of school, 12=Took female children out of school, 13=Took both (male and female) children out of school, 14=Transferred male children to less expensive school, 15=Transferred female children to less expensive school,

16=Transferred both (sexes) children to less expensive school, 17=Adult hh member took job elsewhere temporarily, 18=Sent hh member away permanently, 19=Sent children to be fostered by relatives, 20=Sent children into domestic service, 21=Sent children to work somewhere other than domestic service, 22=Sent wife and children to her parental home, 23=Emergence receipt of remittance from migrant family member, 24=Forced to change occupation, 25=Moved to less expensive housing, 26=Took help from others, 27. Government, NGOs or other organisations helped, 28=Bought insurance, 29= crop diversification (to reduce your risks of crop failure and get more consumption stability) =Other (specify)

34. What was your income?
    a. A year before worst shock
    b. A year after worst shock
    c. And now?
35. Are you prepared for any of the worst shocks in future?
    a. Yes
    b. No

36. If yes, what actions (apart from farming) have you taken to enhance your income so far (specify)?

37. What are the key challenges in enhancing your income?

38. If no (to Q34), do you expect the government or other organisations to help you out in case of future catastrophes?
    a. Yes
    b. No
39. If no for Q34 and Q36, how do you plan to cope in future (specify)? (from cope codes above and/or others)

40. If there is a series of consecutive droughts/floods, how many years of such droughts/floods can you survive by maintaining minimum consumption with the current savings and wealth that you have?

41. If there is a series of consecutive droughts/floods, how many years of such droughts/floods can you still manage to continue to pay for your children's education and not pull them back from school?

42. If you lose your current source of income, how many years can you still manage to continue to maintain sustenance consumption and survive (assuming you can use your savings, borrowings and all your assets)?

43. If you lose your current source of income, how many years can you still manage to continue to pay for your children's education and not pull them back from school?

Module I: Women's role in household decision making and household's progress (ask from women)

1. Do you have say in the decision over what crops to plant, crop rotation, animal health, new seeds, technology etc.?
   a) Yes   b) No
2. Do you ever have conflict with female/male members over certain decision making?
   a) Yes   b) No
3. Do you collectively decide (including other women in your household) over major decisions such as borrowing, monthly expenses, children's education (what school to send to public or private, cheap or costly), big purchasing decisions (cars, air conditioner, TV, livestock, farm equipment), etc.
4. If not who has the main say?
5. Do you have any money you can decide what to spend on?
   a) Yes   b) No
6. In comparison to your partner, do you?
   a. Earn more money than him
   b. Earn less money than him
   c. Earn about the same money as him
   d. Partner does not earn money
   e. I do not earn money
   f. Both partner and I do not earn money
   g. Do not know how much partner earns
   h. Not applicable
7. Is it okay if your spouse earned more than you?
   a) Yes   b) No
8. What is your current role in household sustenance**
   Code**: a=household work, b= agricultural related work, c=other sources of income, d=looking after children, e=livestock rearing)?
9. Are you now doing any work or business that brings in cash or additional food?
   a) Yes   b) No
10. If not, why?
    a. Husband / in-laws won't allow
    b. Society does not like it
    c. Taking care of children / household work
    d. I do not want to

e. I do not need to

f. Am unable to work

g. Lack of demand for the work that I have skill to do

h. Other

11. Why won't your husband or in-laws or any other male members or society let you work?

a. Believes women should not work

b. Household has enough income

c. Wants me to look after house work

d. Does not want me to mingle with other men

e. Other

12. Who usually decides how to spend the money you earn?

a. Yourself   b. your husband   c. self and husband

13. Have you or other female members in your household acquired education or training for enhancing household income?

a) Yes   b) No

14. Are females in this household encouraged to travel to augment income if opportunities arise?

a) Yes   b) No

15. Are females encouraged to acquire training that could lead to extra income?

a) Yes   b) No

16. What is preferred or not preferred profession/occupation for women?

	Profession/Occupation	Yes	No
a	Teacher (female school)		
b	Teacher at co-educational institution		
c	Nurse		
d	Midwife		
e	Home Tutor		
f	Distance Tutor (involves going to pupils' homes)		
g	NGO worker		
h	Doctor		
i	Engineer		
j	Artist		
k	Madrassa teacher		
l	Tailoring/Embroidery		
m	Lawyer		
n	Other		

17. Do you or other females in this household own cell phone?

a) Yes   b) No

18. Why not?

a. Cannot afford

b. Do not need

c. Not allowed

19. Do you go out without men accompanying you?

a) Yes   b) No

20. If no? why not

a. Don't feel safe

b. Not permitted

21. If the husband or other household member objects, in what circumstances would they allow you to go?

a. If I have company (children, relatives etc.)

b. If I can arrange my own expenses

c. If I follow purdah / dress acceptably

d. Other

e. Not applicable / would not object if I go alone

22. Do you or other women in this household vote (either in the local bodies or local elections)?

a) Yes   b) No

23. Do you or other women vote for someone else as compared to the head of household's vote?

a) Yes   b) No

24. Do you or other women participate in any kind of women's organization such as self-help groups (SHG)?

a) Yes   b) No

25. If yes, is there any income derived from it?

a) Yes   b) No

26. How much income is derived?

27. If you or other women bring in additional income from working outside of farm such as through local employment or SHG help, what proportion of that income you or they spend on themselves?

Value:

28. Do you/they have the freedom to spend it as you/they wish?

a) Yes   b) No

29. Are women aware of the political situation in the state/country?

a) Yes   b) No

30. Do they actively participate in voting and discussions?

a) Yes   b) No

31. How old were you when you got married?

32. What age do you plan to marry off your daughter(s)?

33. Who will decide their partner?

    a) You   b) your partner   c) girls themselves

34. Would you encourage your children (or is it acceptable for children) to select their own partners?

    a) Yes   b) No

35. Are there any restrictions on where or what sect they may not marry into?

    a) Yes   b) No

36. Are there any age restrictions? a) Yes   b) No

37. And would you marry them off sooner due to any kind of fear or risks involved?

    a) Yes   b) No

38. How important is social status with the community to you?

    a) very important   b) important   c)not important

39. Would you decide to take up a job outside of farming (either in the village or the city) even if it negatively affected your social status because it is generally not approved of by the local community?

    a) Yes   b) No

40. Would you take up a job even if it lowered your social status if it paid for providing better education and food to your children?

    a) Yes   b) No

Module J: Remittances

1. Do you have earning members in the family who are living far away (cities or abroad)?

    a) Yes   b) No

2. If yes, do they send money?

    a) Yes   b) No

3. How much do they send? Value per annum

4. Is it enough to sustain your annual consumption? a) Yes   b) No

Module K: Health Status

Member ID	Health Status a*= fit, b=unfit, c*=permanent disability)	Illness for a long time a=yes b=no	Do medical expenses constitute a major part of your monthly expenses? a=yes, b=no	If yes, what proportion is spent on health

a*= able to work in a field for a day
b*=unable to do so
c*=permanent disability (for instance, paralysis, dumb, blind etc.)

Module L: Consumption

	Category	Value/ Expense per annum (Rs.)
1	Food	
2	Education (of males)	
3	Education (of females)	
4	Health	
5	Non-food items	
6	Tobacco / others	
7	Total	

Module M: Marketing and Networking

1. What are the obstacles to ensuring better marketing of your produce?
   a. Lack of transportation facility
   b. Poor quality of product
   c. Role of middlemen (taking big share of farmers' profits)
   d. Lack of credit facilities
   e. Lack of storage facilities
   f. Market news (not aware of the latest market related information)
   g. Others
2. What kind of help you need to be able to take your produce to a place where prices offered are higher?

3. Are you willing to go if that help was provided?
   a. Yes
   b. No
4. Where do you get information related to crop price from;
   a. Neighbours
   b. Your networks,
   c. Papers
   d. TV
   e. Agricultural extension organisations / NGOs
   f. Others

5. Do you receive any help from NGOs, other agencies (for instance agricultural or livestock extension etc.) in terms of crop choice advice, crop marketing advice?
   a. Yes
   b. No
6. Have you received any technical help from NGOS or neighboring farmers?
   a. Yes
   b. No
7. Do you network with other farmers to acquire information over what crops to plant and where to sell your produce?
   a. Yes
   b. No
8. Do you network with outside people such as govt. officials, people from other areas in order to enhance your employability or in order to find better livelihood opportunities?
   a. Yes
   b. No
9. How well do you get along with your farming neighbours?
   a. Well
   b. Not very well
10. Do you ever have conflicts with them?
    a. Yes
    b. No
11. Do such conflicts affect your crop choices, income, directly or indirectly?
    a. Yes
    b. No

Module N: Common Property Resources

1. Do you rely on common property resources (cpr) (such as village commons or grazing lands or forests, tube wells etc.) for gathering food, fodder or generating income?
   a. Yes
   b. No
2. If yes, what proportion of your income/consumption comes from cpr?

3. Are you able to use enough common property water (such as through canal or groundwater) for irrigation?
   a. Yes
   b. No
4. If not, what are the constraints?
   a. Lack of tools (such as motors, wells)
   b. b. lack of access (land far from canals)
   c. c. other farmers appropriating all the water due to higher clout

Module O: Actions undertaken for sustainable Farming

1. Do you contribute labor time or money towards improving soil quality on your private land?
   a. Yes
   b. no
2. Do you contribute labor time or money towards improving soil quality on common land to plant trees, etc.?
   a. Yes
   b. no
3. Do you take any efforts/spend money to control salinity and drainage problem in irrigation?
   a. Yes
   b. No
4. If yes, please specify the targeted actions
5. Do you plant crops with the goal to;
   a. make high profit
   b. or for long term sustainability of farming?
6. Do you collectively work with other farmers;
   a. to improve productivity in farming
   b. or to get more price for your produce
7. List all actions that are taken collectively with other farmers;

8. Do you collectively decide any social justice issue or conflicts amongst farmers?
   a. Yes
   b. No
9. Would you or have you accepted collective decisions even if was against your interest?
   a. Yes
   b. No
10. Specify the decisions

Ethics Approval Letter

Dear Dr Ram Ranjan

RE: Ethics project entitled: "Pilot Study: Understanding Challenges to Women empowerment, Agricultural Sustainability and Household Resilience in the Wake of Climate Change Shocks in Rural Pakistan"

Ref number: 5201500062

The Faculty of Science Human Research Ethics Sub-Committee has reviewed your application and after considerable deliberation granted final approval, effective date 31 March 2015. You may now commence your research.

This research meets the requirements of the National Statement on Ethical Conduct in Human Research (2007). The National Statement is available at the following web site:
  http://www.nhmrc.gov.au/_files_nhmrc/publications/attachments/e72.pdf.

The following personnel are authorised to conduct this research:

   Dr Ram Ranjan
   Ms Aliya Gul

NB. STUDENTS: IT IS YOUR RESPONSIBILITY TO KEEP A COPY OF THIS APPROVAL EMAIL TO SUBMIT WITH YOUR THESIS.

Please note the following standard requirements of approval:

1.   The approval of this project is conditional upon your continuing compliance with the National Statement on Ethical Conduct in Human Research (2007).

2.   Approval will be for a period of five (5) years subject to the provision of annual reports.

Progress Report 1 Due: 31 March 2016
Progress Report 2 Due: 31 March 2017
Progress Report 3 Due: 31 March 2018
Progress Report 4 Due: 31 March 2019
Final Report Due: 31 March 2020

NB.   If you complete the work earlier than you had planned you must submit a Final Report as soon as the work is completed. If the project has been discontinued or not commenced for any

reason, you are also required to submit a Final Report for the project.

Progress reports and Final Reports are available at the following website:
http://www.research.mq.edu.au/for/researchers/how_to_obtain_ethics_approval/human_research_ethics/forms

3.   If the project has run for more than five (5) years you cannot renew approval for the project. You will need to complete and submit a Final Report and submit a new application for the project. (The five year limit on renewal of approvals allows the Committee to fully re-review research in an environment where legislation, guidelines and requirements are continually changing, for example, new child protection and privacy laws).

4.   All amendments to the project must be reviewed and approved by the Committee before implementation. Please complete and submit a Request for Amendment Form available at the following website:

http://www.research.mq.edu.au/for/researchers/how_to_obtain_ethics_approval/human_research_ethics/forms

5.   Please notify the Committee immediately in the event of any adverse effects on participants or of any unforeseen events that affect the continued ethical acceptability of the project.

6.   At all times you are responsible for the ethical conduct of your research in accordance with the guidelines established by the University. This information is available at the following websites:
http://www.mq.edu.au/policy/
http://www.research.mq.edu.au/for/researchers/how_to_obtain_ethics_approval/human_research_ethics/policy

If you will be applying for or have applied for internal or external funding for the above project it is your responsibility to provide the Macquarie University's Research Grants Management Assistant with a copy of this email as soon as possible. Internal and External funding agencies will not be informed that you have final approval for your project and funds will not be released until the Research Grants Management Assistant has received a copy of this email.

If you need to provide a hard copy letter of Final Approval to an external organisation as evidence that you have Final Approval, please do not hesitate to contact the Ethics Secretariat at the address below.

Please retain a copy of this email as this is your official notification of final ethics approval.

Yours sincerely,
Peter Busch, Chair
Faculty of Science and Engineering
Human Research Ethics Sub-Committee
Macquarie University
NSW 2109