GOVERNANCE AND SUSTAINABLE DEVELOPMENT

By

INAYAT ULLAH

THESIS

Submitted to

KDI School of Public Policy and Management

in partial fulfillment of the requirements

for the degree of

DOCTOR OF PHILOSOPHY

IN PUBLIC POLICY

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ABSTRACT

Chapter 1: Does Community Inclusion in Protected Areas' Governance Reduce Threat to Biodiversity? A Cross Country Analysis

To what extent community inclusion in protected areas' governance affect biodiversity outcomes is the main question that we attempt to answer in chapter 1 using the extra-ordinary datasets of the World Database on Protected Areas (WDPAs) and the Redlist of International Union for the Conservation of Nature (IUCN). We exploit variation in cumulative size of designated protected areas differentiated by IUCN governance types and estimate the threat to mammals and birds in Sub-Saharan African countries. We find stronger effect of community inclusion in protected areas' decision making on the reduction of threat to mammals while no significant effect on the threat level to birds. Our findings provide evidence in support of positive response of community participation towards common goods that carry potential economic incentives. This chapter contributes to the idea of inclusive environmental policies that yield environmental gains not at the cost of social exclusion.

Chapter 2: A Model of Collaborative Governance for Community-based Trophy-Hunting Programs in Developing Countries

We frame the governance structure of community-based trophy hunting(CBTH) programs as a form of collaborative governance that involve multiple stakeholders in the management of common pool resources. By conducting a mata-analysis on 80 published case studies, we develop contingency propositions that help practitioners and governments to understand and implement programs that seek environmental conservation in collaboration with local communities. We identify factors that may interplay to affect the incentive to participate in community based conservation programs particularly CBTH. We also argue that, despite the uncertainty of effectiveness of community-based conservation from

the beginning, due to the pre-history of conflicts, governments tend to rely upon bottom-up approach that utilize the effort of local communities in conserving wildlife rather than ineffective command-and-control policies. On the other hand, local communities cooperate and participate in CBTH due to power-imbalance between strong governments and weak communities who live closely with wildlife. We finally elaborate the process of CBTH and identify factors that determine the outcomes of CBTH programs in developing countries.

Chapter 3: Teachers' Monitoring and Schools' Performance: Evidence from Public Schools in Pakistan

We examine the effect of a large scale innovative smart-phone-aided monitoring program implemented in over 28000 government schools for improving teacher's attendance and school performance in the Khyber Pakhtunkhwa (KP) province, Pakistan. We find ideal conditions for a natural experiment by utilizing nationally representative survey that enables us to create treatment and control areas. Our findings suggest that the program has improved teacher's attendance by nearly 8% in the year immediately following the program. However, this effect decreases by nearly half after two years of the program introduction. We also find the program's direct effect on the enrolled children's test performance at home. Enrolled children's standardized Reading, Math and English ability in monitored schools has improved significantly by 0.07, 0.13 and 0.11 standard deviation points respectively at the lower (0-5) grades. There is slight improvement in the standardized test performance of higher grade children. The program also increases the probability of children enrollment into government schools. Our results are robust on different specifications and sub-samples of schools and districts clusters.

To those who struggle against the cult of ignorance

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CHAPTER 1

DOES COMMUNITY INCLUSION IN PROTECTED AREAS' GOVERNANCE REDUCE THREAT TO BIODIVERSITY? A CROSS COUNTRY ANALYSIS

1.1 Introduction

The trade-off between economic growth, social well-being and ecological viability has been a challenge in achieving sustainable development goals (SDGs) adopted by the member states of the United Nations(UN) (Barrett, Bulte, Ferraro, & Wunder, 2013; Bromley & Paavola, 2008; Mills & Waite, 2009). Proponents of sustainable development suggest 'win–win' strategies that generate both economic and environmental benefits, preventing environmental damage through inclusion of local communities and adjustment of economic policies that help avoid environmental loss (Baldus, 2009; Gupta & Vegelin, 2016; McIntosh & Renard, 2010; Munasinghe, 1993; Munasinghe et al., 2009; Sachs et al., 2009; UNEP, 2011). Sustainable development is therefore seen as achieving environmental, social and economic objectives not at the cost of each other.

One of the key sustainable development goals is the conservation of biological diversity that seeks to protect, restore and promote sustainable use of ecosystem services and reduce threat to biodiversity. On one hand, the expanding global economy coupled with increased human population pose a continuous threat to biodiversity (Cohen, 1995), on the other hand, countries facing poor governance find it a challenge to conserve natural resource stock particularly

wildlife and forests (Gibson, McKean, & Ostrom, 2000; Smith, Muir, Walpole, Balmford, & Leader-Williams, 2003).

Given the important of biodiversity, there have been growing efforts in building conservation capacity of developing countries that inhabit most of the world's biodiversity. One of these efforts is the designation of Protected Areas(PAs) by the International Union for the Conservation of Nature (IUCN) through various donor support programs. However, there are rising concerns in developing countries that increasing protected areas lead to the exclusion of local communities from natural resource use and corruption in the use of natural resources that in turn results into the failure of conservation projects (Smith et al., 2003). We attempt to address this concern by analyzing the effectiveness of community involvement in (rather than exclusion from) protected areas in less developed countries. In this paper, we investigate the relationship between governance of designated protected areas and threat to biodiversity using panel data for 32 Sub-Saharan African countries. We exploit the difference in governance systems of designated protected areas to estimate the effect on Redlist threat level reported by the International Union for the Conservation of Nature (IUCN).

The following section underlines the key findings in the previous literature and linking it with the basic research questions in the third section followed by a short description of the need for research in this area. The fifth section describes methods, specification and data respectively. Section 6 reports the mains findings while the last section concludes.

1.2 Review of Existing Literature

The concept of sustainability demands maintenance of the stock of both human-made and natural capital over time. B. Adams (2008) further divides sustainability into two types; strong sustainability and weak sustainability. Strong sustainability emphasizes more on the conservation of natural capital while requiring

enough stock of both natural and human capital. However, practically, achievement of strong sustainability is difficult given the diverse nature of societies, their standards of living and geographic conditions. As evident by recent studies, the overwhelming emphasis on ecological or environmental goals has marginalized the less privileged communities in terms of their livelihood sources (Baldus, 2009; Gibson et al., 2000; Hayes, 2006; A. Hoole & Berkes, 2010). For example the designation of conservation areas in developing countries has resulted into significant concerns of communities living near or inside protected areas due to their dependency on the local natural resource (W. B. Adams, 2013). On the other hand, weak sustainability allows a trade-off between natural and human-mad capital. Economists however, are increasingly concerned about imbalance in priorities of sustainable development objectives suggesting more careful investigation of environmental policies.

One of the key environmental strategies to overcome the environmental degradation is the establishment of protected areas and reserves around biodiversity hotspots that can help protect the ecosystem services. In the following texts, we explain the history and system of protected areas and its relationship with conservation outcomes in the light of previous studies.

1.2.1 Establishment of Protected Areas and Conservation

The uncontrolled degradation of biodiversity and ecosystem services in the nineteenth century resulted into the establishment of protected areas (PAs) (Andrade & Rhodes, 2012). Since then, the designation of protected areas has been increasing exponentially with a current total of 161,000 protected sites, over a 32 million km^2 area, or nearly 13% of the earth's land area (See Appendix figure A.1). The purpose of PAs designation generally depends on various objectives and criteria, at the heart of which is the preservation of constituent species and ecosystem services (Child, 2013; Dudley, 2008; Hayes, 2006). Understanding of the conditions under which protected areas are designated and how they

deliver their conservation outcomes is therefore important for policy makers and conservation specialists to adopt sustainable courses of actions.

Despite being considered a key conservation strategy for forests and wildlife conservation (Brooks et al., 2004), a recent meta-analytical study on 76 papers evaluating impact of protected areas on habitat cover and 42 studies evaluating impact on species population finds positive impact of PAs on habitat cover with inconclusive evidence on PAs effectiveness in species conservation (Geldmann et al., 2013). The World Database on Protected Areas[1] (WDPAs) is the organization that collects, compiles and reports data on marine and terrestrial protected areas in collaboration with various governmental and non-governmental organizations, academia and industry. Its aim is to develop and maintain an accurate and freely available up-to-date database on protected areas status around the world to be used as a global standard by all relevant stakeholders (Brooks et al., 2004).

Protected areas are further divided into many categories by WDPAs. These include protected areas established by governments, areas established under the regional and international conventions, privately owned conservation areas and areas conserved by indigenous people and local communities. The IUCN officially defines protected area as "a clearly defined geographical space, recognized, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values" (Dudley, 2008)[p.30].

The IUCN has further two broad types of classifications; (1) Management Categories and; (2) Governance Types. The Protected Area Management Categories help us classify protected areas based on their primary management objectives (Dudley, 2008), while the IUCN Governance Types classify protected areas according to who holds authority, responsibility and accountability for them

[1]WDPA is a joint initiative between the United Nations Environment Programme (UNEP), the World Conservation Monitoring Centre (UNEP-WCMC), the IUCN and the World Commission on Protected Areas (WCPA). The latest version is available at https://www.protectedplanet.net/

(Borrini-Feyerabend & Hill, 2015) . Currently about 65% of protected areas in the WDPA have IUCN Management categorization, and 88% have governance types (Juffe-Bignoli et al., 2014). In this paper, we use the latter classification because it sufficiently tells us the extent to which authority, responsibility and accountability is devolved to the lower level in terms of resource use.

1.2.2 Governance of Protected Areas

Governance refers to the process of decision making and exercising of authority in an organization. Graham, Amos, and Plumptre (2003) define governance of protected areas as an interactions among structures, processes and traditions that determine the extent to which power is exercised, responsibility is shared, the way decisions are taken and how citizens or other stakeholders participate in the process. Achievement of protected areas' objectives is closely associated with the extent of power and decision-making capacity, responsibility sharing, rights to use and the way financial, political or communal support is generated around protect areas (Andrade & Rhodes, 2012).

Ever since protected areas and conservation existed, decisions about how to protect, conserve and use the natural resource inside or around the protected areas have been done by either the state (central or local government), international organizations, private owner or local communities. Recently, there has been increasing attention on understanding the nature of governance in terms of appropriateness to the specific context, effectiveness in delivering lasting results and livelihood benefits under different governance regimes (Borrini-Feyerabend & Hill, 2015; Smith et al., 2003). Although, an ideal governance setting does not exist for all protected areas, however, IUCN suggests a set of "good governance" principles(indicators) that can provide insights about the way different governance settings contribute in protecting livelihood, rights and values of the indigenous people in or around these areas (Graham et al., 2003). The key components of IUCN governance categorization include, participation, innovation,

benefits sharing, respect and informed approval of the stakeholders. The purpose of this categorization is to measure the extent to which full and effective participation of relevant stakeholders including local people are ensured, and the proportion of benefits shared equitably.

There are diverse forms of governance regimes for protected areas around the world. However, IUCN (and CBD) has grouped them into four broad governance types, on the basis of who holds authority, responsibility and management decisions. For example, who establish the protected area and who determine its management objectives and demarcating plans etc. These four types are: governance by states, joint governance, governance by private sector organizations; and governance by local communities(figure-1) (Borrini-Feyerabend & Hill, 2015). In the following text, the main types of governance are discussed.

Figure 1.1: Protected Areas'Governance: A Continuum(Borrini-Feyerabend & Hill, 2015)

A. State Protected Areas and Conservation

The state protected areas are characterized by strict government control over designated areas in terms of authority, responsibility and accountability in decisions and determination of its conservation objectives (Dudley, 2008) . Usually a ministry or protected areas agency under the national or sub-national governments is responsible for the management and development of enforcement plans for the

protected areas. In most of the cases, the central governments take overall control of the protected area and take all major decisions with a little or no say from the local people in or around protected areas (Andrade & Rhodes, 2012; Geldmann et al., 2013). Historically, state-protected areas were the dominant type of governance, however, recently, there have been increasing efforts in delegating authority to the sub-national level or local level (Andrade & Rhodes, 2012; Li, 2002; Nelson & Agrawal, 2008).

Although the establishment of PAs is considered a great achievement per se, many environmentalists and social scientists believe that only state PAs alone cannot safeguard preservation of biodiversity due to multiple reasons (Borrini-Feyerabend & Hill, 2015; Hayes, 2006; A. Hoole & Berkes, 2010; Virtanen, 2005). For example, many state protected areas have been established under the top-down approach of the nineteenth century (Gibson et al., 2000; Hayes, 2006). Such protected areas have failed to consider social, cultural, and political values that are important for indigenous communities (Hayes, 2006). Governments frequently deprive communities from extracting resources that are essential for their livelihoods, and in some cases, local people are pushed out from their lands with no consultation or appropriate compensation (Vodouhê, Coulibaly, Adégbidi, & Sinsin, 2010). This often results into adverse social impact on local communities that include disruption of their traditional way of living, lack of cooperation with PAs authorities and hostile attitude towards nature (Abidi-Habib & Lawrence, 2007; W. M. Adams & Hulme, 2001; Baldus, 2009). Also, conflicts emerge between state authorities and local people that reduce the effectiveness of protected areas in conservation outcomes (Gupta & Vegelin, 2016; A. F. Hoole, 2010; Khan, 2012). For example, in Uganda, local people burnt 5% of forest after the national park was gazetted (Hamilton, Cunningham, Byarugaba, & Kayanja, 2000). Similarly, in retaliation to the strictly top-down policies, illegal activities including hunting and poaching were started in South Africa (Watts & Faasen, 2009). Moreover, no cooperation with park authorities in conserva-

tion is an inevitable outcome of strictly controlled protected areas (B. Adams, 2008; W. B. Adams, 2013). Recently, there has been increasing focus on finding alternative governance forms in which governance of protected areas could be delegated to the local authorities and local people might be involved in decision making (Abidi-Habib & Lawrence, 2007; W. M. Adams & Hulme, 2001; Bunge-Vivier & Martínez-Ballesté, 2017; Frost & Bond, 2008; Goldman, 2003; Hayes, 2006; A. Hoole & Berkes, 2010). These include collaborative governance, delegated governance and governance by local communities. Since, the second largest type of governance in the WDPA database is governance by local communities, therefore the next section discusses this type in more details.

B. Community-Governed PAs and Conservation Outcomes

The effect of inappropriate protected area's management on the livelihood of local people is well documented (W. M. Adams & Hulme, 2001; Bouwen & Taillieu, 2004; Child, 2013; Hayes, 2006; Ostrom, 1999; Rosser Jr & Rosser, 2006). The main concern of local communities about strictly protected areas is their deprivation from getting benefits of the local natural resources such as forests, wildlife and vegetation etc (Abidi-Habib & Lawrence, 2007; Frost & Bond, 2008; Khan, 2012; Marshall, 2008).

Local communities in many countries particularly developing ones depend on the natural resources that protected areas seek to preserve, as part of their livelihoods. For example, people living in or around a forest reserve might depend on forests use for fuel, plants and vegetation for their livestock and agriculture and wildlife for proteins etc. Therefore, their interest in protected areas' management and negotiating their share of the cost and benefits related with conservation policies is understandable (Child, 2013; Hayes, 2006; Rai, Neupane, & Dhakal, 2016). In most cases, local communities seek access to local resources, overcome human-wildlife conflicts and share in financial benefits arising from the natural resources such as trophy payments, employment,

tourism ventures and market for local products (Abidi-Habib & Lawrence, 2007; Leader Williams, Kayera, & Overton, 1996; Virtanen, 2005). Besides livelihood-attachment, , local people also possess knowledge and practical traditions about biodiversity conservation that they have developed historically (Imran, Alam, & Beaumont, 2014). As a result, the recent decades have seen increasing interventions in developing countries that encourage governments to devolve authority to local communities and adopt inclusive strategies in identifying priorities for natural resource management particularly in protected areas.

Local communities' compliance with conservation policies in protected areas is closely associated with their involvement in decision making (Baldus, 2009; Bassi & Carestiato, 2016; Bunge-Vivier & Martínez-Ballesté, 2017; Di Minin et al., 2013; A. Hoole & Berkes, 2010). However, what motivates local communities to cooperate and comply with conservation policies, is not clear. Although community preferences vary across countries, the so-far literature on Sub-Saharan African countries show two main drivers of community compliance with conservation policies that include, economic incentives for the local people (e.g through community-based trophy hunting (CBTH) or ecotourism benefits etc) and reduced conflicts between state authorities and local people.

The simple theory behind CBTH success is that the perceived future economic benefits from trophy hunting will incentivize local communities to be engaged as key partners with policymakers and practitioners to make efforts to conserve endangered species. Thus community members will do better than government due to their proximity to and knowledge of wildlife and their ability to detect, report, and help preventing illegal wildlife trafficking (Baldus, 2009; Li, 2002; Shackleton, 2001). In this context, the expectations to reap tangible benefits from collaboration in CBTH may strongly affect the incentive to participate in collaboration.

C. Other forms of PAs Governance

The other two forms of PAs governance are collaborative or joint governance and the governance by private owners. The terms Joint governance, shared governance, co-management and collaborative management are sometimes used interchangeably. Collaborative governance is usually characterized by a form of governance in which decision-making authority and responsibility is vested to one agency which is required to inform or consult other stakeholders when planning or implementing a specific plan (Borrini-Feyerabend & Hill, 2015). The Private governance of protected areas includes protected areas governed by individuals, NGOs or corporate entities called "private protected areas" such as private ranches etc. This form of governance is more common in developed countries. Since this study's main focus is the Sub-Saharan African countries (more discussion in methodology section), therefore, private owners' governance is not discussed in much detail here.

1.2.3 Economic Incentives and Community Involvement in PAs

A large number of country-specific case studies have individually attempted to find major factors that lead to community participation in conservation plans (Damm, 2008; Frost & Bond, 2008; A. F. Hoole, 2010; Jachmann, 2008; Klein, Reau, Kalland, & Edwards, 2007; Natcher & Hickey, 2002; Newig & Fritsch, 2009; Seixas & Berkes, 2010). Community-based conservation programs are based on the premise of perceived financial incentives from regulated hunting of endangered animals for local communities who are committed to conserve those animals in developing countries particularly Sub-Sahran Africa (W. M. Adams & Hulme, 2001; Mayaka, Hendricks, Wesseler, & Prins, 2005; Rosser Jr & Rosser, 2006). The expectations of direct and indirect benefits (e.g, hunting, ecotourism), can make them interested in being engaged in conservation pro-

grams. Studies show high motivation and interest in participation in community-based conservation programs in general where the potential for these incentives is higher (Frost & Bond, 2008; S. IUCN, 2012; Khan, 2012)

Conventional conservation policies, such as establishing national parks, often lead to conflicts between government and local communities by restricting local communities from using natural resources including wildlife animals in protected areas and even displacing them forcibly out of the protected areas (A. Hoole & Berkes, 2010; Khan, 2012; Murombedzi, 1999; Watts & Faasen, 2009) . Such conflicts might arise because economically poor local communities who live on subsistence agriculture in their traditional lands perceive wildlife mainly as a threat to their livelihoods. For example, in Uganda, stampedes of active wild animals on farmlands at the edge of the Kibale National Park reduced crop production dramatically (Naughton-Treves, 1997). Thus, they tend to poach wild animals illegally and harm their habitats for their survival and are often tempted to illegal wildlife trafficking for economic reason, which have limited the effectiveness of conservation policies. In Mozambique for example, the colonial rules prevented local communities in reserved forests from using natural resources; consequently, local communities were united against the government and consumed all local forest resources (Virtanen, 2005).

Various studies have documented the effect of community-based natural resource conservation on income (Andam, Ferraro, Sims, Healy, & Holland, 2010; Lewis, Hunt, & Plantinga, 2003). An empirical study on a large-scale household survey using an index of village associational life in Tanzania finds a positive correlation between social inclusiveness and household income (Narayan & Pritchett, 2000). Lewis et al. (2003) observe no significant negative effect of land preservation and share in different regimes in the northern US regions on the growth rate and further suggest the possibility of positive shift in employment due to conservation policy. Also,community involvement is often associated with reduced inequality in rural areas that positively affect the local institutions

for natural resource management (Hayes, 2006; Holland, Peterson, & Gonzalez, 2009). A study for example on community forestry in Mexico finds that a village with an unequal economic structure was associated with poor forest management due to small groups of power elites who manipulated the logging industry for their own benefits (Klooster, 2000). In villages with effective community institutions, forest management was better with less biodiversity loss. There is also evidence that economic inequality in poor countries may hinder conservation efforts through avoiding collective actions (Chabwela & Haller, 2010; Hwang, Chi, & Lee, 2016; Hwang et al., 2016).

Literature on the common property management also highlight the role of group actions in solving problems associated with local "commons" property that ultimately lead to higher productivity and income generation (Gibson et al., 2000). The Elinor Ostrom's work on common property management suggests that the cooperative ability of local groups(villages) plays important role in avoiding the adverse consequence of resource exploitation (Ostrom, 1999; Ostrom, Gardner, Walker, & Walker, 1994). In common property regimes cases, Ostrom argues cooperative actions' stronger effect on productivity and sustainable use of the property. In a comparative study on comparison of strictly exclusionary top-down approaches in developing countries, Narayan and Pritchett (2000) argue that greater associational activities reflected by community involvement may lead to less "imperfect information" and hence lower transaction costs which further lead to greater market transactions in output such as agriculture products, land use and labor related outcomes as well as other enhanced market activities. Other evidence suggest that local communities are more likely to commit to long-term conservation policies when they realize that their knowledge and opinions are incorporated into protected areas' decision-making process (Goldman, 2003; A. Hoole & Berkes, 2010; Marshall, 2008; Vodouhê et al., 2010). However, compliance with conservation strategies without potential economic incentives practically doesn't exist in developing countries owing to

higher dependency of local people on natural resource.

In Sub-Saharan Africa, leading sources of economic incentives for local communities include, natural resource extraction (e.g forest products, wildlife products such as trophy exports etc.), agriculture products (including livestock etc) and wildlife tourism. The following sections focuses on the role of wildlife (trophy hunting industry) and other factors affecting economic incentives vis-à-vis conservation policies.

A. The Role of Trophy Hunting Industry

A widely recognized area of revenue generation in Sub-Saharan Africa is the trophy hunting industry which has been promoted as an effective strategy for conservation of endangered animals since 1980s. Several studies attribute the effectiveness of trophy hunting industry in community participation and involvement in decision-making in and around protected areas (B. Adams, 2008; W. M. Adams & Hulme, 2001; Baldus, 2009; Gibson et al., 2000; Khan, 2012; Lindsey, Roulet, & Romanach, 2007; Mayaka et al., 2005; McIntosh & Renard, 2010; Shackleton, 2001).

Trophy hunting by early settlers to Africa was mainly uncontrolled and had negative impact on wildlife population especially large body species (Lindsey et al., 2007). Following this negative impact, in the late 19th century, some hunters recognized the need to protect the remaining game species (W. B. Adams, 2013). Consequently, in the early 20th century, hunters played a key role in establishing protected areas in various African countries. The tourist trophy hunting industry grew in those African countries where wealthy Europeans and Americans used to visit and guided by local farmers. Later this led to the development of trophy hunting industry which is generally run by operators who promote and sell trophies to their clients, purchase hunting sites, and employ the requisite staff (e.g hunting professionals, chasers, transporters, skinners and camp management staff etc.). In Kenya for example, tourism operators have signed agreements with

Group Ranch committees (organized by local communities), to set aside land as a conservancy in exchange for payments to local people, based on percentage of gross or net revenues (Roe, Nelson, & Sandbrook, 2009). The Kimana Group Ranch in Kajiado District which was established in 1996 resulted into other similar local conservancies in areas such as Laikipia, Samburu, Kajiado, and Narok Districts that have positively affected conservation of wildlife.

One argument is that the income from trophy hunting activities can empower local communities to protect biodiversity through employment of more anti-poaching rangers (Di Minin et al., 2013). If revenue cannot be generated from trophy hunting, the communities might transform the natural habitats to other forms of land use that provide higher returns on investment compared to conservation but will have negative impacts on biodiversity. Generally, trophy hunting involves low off-takes with high prices and is considered more sustainable where conservancies are community governed (Frost & Bond, 2008). Trophy hunters pay higher fee per trophy than conventional tourists which results in higher revenue generation from lower quantity of wildlife use (Lindsey et al., 2007).

Literature on the individual case studies of community-based trophy hunting programs reflect both successful and unsuccessful cases in developing countries (Baldus, 2009; Goldman, 2003). Most of the successful cases reflect a significantly positive effect on the livelihood of local community along with conservation outcomes. For example Di Minin et al. (2013) argue that hunting in Sub-Saharan Africa has strongly contributed to the conservation efforts in those conservancies of important terrestrial biodiversity where trophy hunting is practiced (Table 1.1). According to Lindsey et al. (2007), in parts of Zambia, Botswana, Namibia, Tanzania and Zimbabwe, improvement in conservation attitude among local communities has resulted in increasing revenues from trophy hunting. Also in these countries, communities are increasingly involved in community-based natural resource management programs and attempt to include their lands in wildlife management projects (Baldus, 2009; Child, 2013).

Similarly, in Namibia, revenues from trophy hunting are considered a primary stimulus for development of wildlife conservancies on more than 70,000 km^2 of communally owned areas (Weaver & Skyer, 2003). Also in Tanzania, incentives from trophy hunting have resulted into the creation of Wildlife Management Areas where sustainable wildlife utilization is the primary land use (Lindsey et al., 2007).

Table 1.1: Trophy Hunting Contribution to National Economies in SS Countries

Country	Area Covered by Game Ranches (% of Total Land Area)	Protected Areas (% of Total Land Area)	Top 3 Most Exported Trophies	Revenue (US$ million)
South Africa	13.1	6.2	impala, warthog, kudu	68.0
Tanzania	26.4	32.2	leopard, hippopotamus, elephant	56.3
Botswana	23.0	37.2	elephant, leopard, lechwe	40.0
Namibia	11.4	43.2	zebra, chacma baboon, leopard	28.5
Zimbabwe	16.6	27.2	elephant, leopard, chacma baboon	15.8
Mozambique	10.5	17.6	Nile crocodile, elephant, hippopo	5.0
Zambia	21.3	37.8	lechwe, hippopotamus, leopard	3.6
Total	-	-	-	217.2

Source: (Di Minin et al., 2016)

B. Other Sources of Revenues from Protected Areas

Other than trophy hunting, tourism to conservancies and game reserves have significant impact on the national economies in Sub-Saharan African countries. According to the World Travel and Tourism Council, in 2016, the direct and induced contribution of travel and tourism to these countries was US $108 billion (7.1% of GDP) and is forecasted to rise by over 4.8% to US $ 178.5 billion (7.3% of GDP) in the next ten years (WTTC, 2016). Similarly, the total contribution of travel and tourism to employment, including indirect jobs by industries (such as hotels, construction and services etc.) was estimated to be 6% of the total employment in Sub-Saharan Africa and is expected to rise by 3.2% p.a in the next ten years. Figure 1.2 shows the link between community participation and conservation vis-a-vis economic benefits.

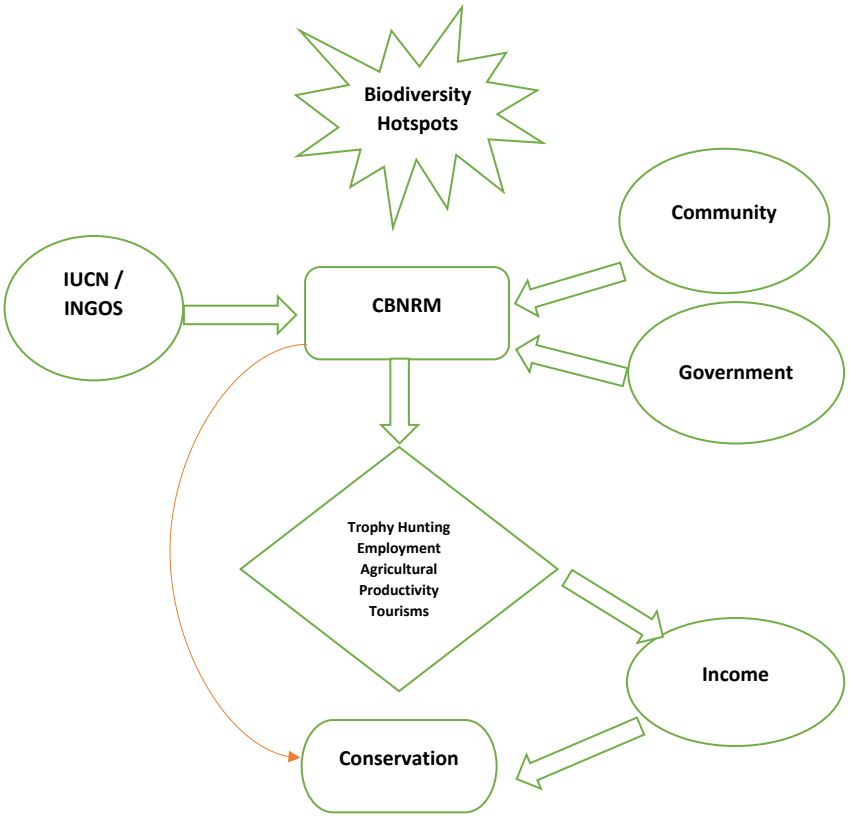

Figure 1.2: CBNRM, Income and Conservation Relationship

1.3 Basic Research Questions

From the literature on governance of protected areas, the central question arises that to what extent the holding of authority, responsibility and accountability in making key decisions for protected areas affect the conservation outcomes. To understand this, it is important to identify the channel through which such an effect might take place. Considering the number of studies that find economic incentives as a tool for conservation of threatened species specially mammals (Di Minin et al., 2016; Heinmiller, 2009; S. IUCN, 2012; Lindsey et al., 2007; McIntosh & Renard, 2010; Sethi & Khan, 2001; Shackleton, 2001), two assumptions are important to be held before hypothesizing any effect of community participation on conservation outcomes. First, people in poor countries are primarily not concerned with conservation objectives that global forces such IUCN seek, owing to their livelihood constraints, dependencies on local resources and

lack of education. Secondly, in the past two decades, the market value of wildlife products has increased significantly due to regulations and limitations imposed by the Convention on International Trade in Endangered Species (CITES). In other words, if there is no potential economic benefit of the target resource, local people are less likely to affect conservation outcomes. Moreover, a recent meta-analysis on 42 studies from 35 papers by by Geldmann et al. (2013) measuring the effectiveness of protected areas on species population, finds no direct impact of protected areas establishment on species population. Thus, we hypothesize that:

Community inclusion in environmental decision making positively affect conservation outcomes if the common good within protected areas provide economic incentives for local people

More specifically, we divided this hypothesis into two questions:

1. Does community involvement in protected areas' decision making affect the population of threatened species?

2. Whether impact of community involvement in protected areas' decision making vary by the type of common good(mammals and birds)?

1.4 Methodology

Three features make this research distinct from previous studies. First, we use IUCN Redlist (the outcome variable) as a measure of environmental degradation to examine the effect of protected areas 'governance on the population of threatened species. We do this because IUCN Redlist is the most comprehensive, complete and globally recognized measure of threat to biodiversity. Second, we utilize the World Database on Protected Areas (WDPAs) to separate protected areas based on their governance across Sub-Saharan countries. WDPA governance specify governance characteristics within designated areas (not outside) and therefore community governed PAs are clearly separable from the state gov-

ernance PAs-something missing in current empirical literature on conservation. We use this difference in the governance system within these designated areas as a key variable to estimate the effect on threatened species. Third, we use strongly balanced panel data from 2000 to 2016 that enables us to apply country FE and year fixed effect to overcome any omitted time invariant country-specific bias.

1.4.1 Data and Variables Description

The IUCN Red List is globally recognized approach for assessing and monitoring the status of biodiversity (Baillie, Hilton-Taylor, & Stuart, 2004). The scientific objectivity of the IUCN Red List is assessed through the Red List Categories and Criteria developed in 1994 and revised in 2001 (IUCN, 2001). According to this criterion, there are nine categories: Extinct, Extinct in the Wild, Critically Endangered, Endangered, Vulnerable, Near Threatened, Least Concern, Data Deficient, and Not Evaluated. Every surveyed species falls into one of these categories. So far, the IUCN has developed quantitative criteria for three categories; Critically Endangered, Endangered and Vulnerable. Species listed within each of these categories are believed to share a similar probability of extinction risk (Baillie et al., 2004). Species falling into the categories of Critically Endangered, Endangered and Vulnerable are collectively described as 'threatened' and are generally used as a measure of threat to biodiversity. Consistent with IUCN classification, our measure of biodiversity loss in a country is the number of mammals and bird's species known to be threatened from 2000 to 2016. These two taxonomic groups have been comprehensively assessed since 2000. Previous studies that have used this measure include Mikkelson, Gonzalez, and Peterson (2007) and Naidoo and Adamowicz (2001).

To measure each country's biodiversity related governance policy, the World Database on Protected Areas (WDPA-IUCN), offers a range of variables that cover the nature of governance and management objectives within protected areas in each country around the world. The management objective categorization

helps us classify PAs based on primary management objectives (such as wilderness area, habitat reserve, natural parks etc), while governance category segregate PAs according to "who holds authority, responsibility and accountability for the PAs resources" (Borrini-Feyerabend & Hill, 2015).

We use the "IUCN Protected Area Management Category and Governance Type Matrix" developed by Borrini-Feyerabend and Hill (2015) to classify PAs categories that qualify two broad governance criteria; State-governed PA and Community-governed PA. We use variables on the reported size of the conserved area, governance type and year of designation to measure the difference between state-protected conserved areas and community-based conserved areas. Since the focus of this study is terrestrial protected areas, therefore we exclude marine protected areas from our data. Further we also exclude designated areas which come under the category of natural monuments. We assume the ownership of protected areas to be independent of the relationship of government and management structures of protected areas. Due to the long history of PAs establishment and multiple designation in each year, we collapse (sum) the size of designated protected areas (in km^2) by year and cumulate since 1980s. To match each country's protected areas' status with IUCN Redlist, we keep the cumulative protected areas (in three different governance types i.e state-governed, community governed and not-reported) from 2000 to 2016. The cumulated status of PAs in each country in a year captures the size of the protected areas separated with different governance levels. Due to increased interventions in most of the Sub-Saharan African countries, there is considerable variation in the size of designated areas in each subsequent year since 2000. We utilize this variation to measure the country's ability to devolve power, authority and accountability of PAs to the local community.

We implicitly control for the gross wildlife exports value by using the CITES data on the exports of endangered species from Sub-Saharan African countries. The CITES database offers data on the number and size of wildlife products

including trophies, live and dead bodies, skins and others with clear geneses and taxonomic classifications. We use the data on CITES reported by importing countries. We do this because of the weak reporting standards of the exporting countries mostly in Sub-Saharan Africa. The variable of gross exports is expected to be positively correlated with the IUCN threat level due to the trade sanctions on endangered mammals and birds listed by CITES.

To measure the level of economic development, we use GDP per capita (constant 2010 US$) from the World Bank Archives (2000-2016). Previous studies have used GDP per capita as an important determinant of threat to biodiversity (Asafu-Adjaye, 2003; Naidoo & Adamowicz, 2001). To account for the country-specific differences in habitat we use forest area as a percentage of total land area that may have a direct effect on the number of species threatened. We also control for other observable characteristics that might affect biodiversity including rule of law and political stability. Data on forest cover, income, rule of law and political stability are obtained from World Bank Tables Archives. Table 1.2 shows the summary statistics of the variables used in this work.

Table 1.2: Summary Statistics of the Main Variables

VARIABLES	N	Mean	SD	Min	Max
Number of Mammals Threatened	543	18.24	14.35	2	120
Number of Birds Threatened	543	14.54	10.83	0	50
Community Governed Protected Area(km^2)	544	18164.34	37609.64	0	195062
State Governed Protected Area (km^2)	544	51435.37	62440.15	0	257734
Protected Area Not-Reported(km^2)	544	19237.89	45541.91	0	251281
Total Protected Area (km^2)	544	88837.60	99286.12	108	468819
CG ratio to Total Protected Area	544	0.21	0.24	0	1
SG ratio to Total Protected Area	544	0.59	0.32	0	1
NR ratio to Total Protected Area	544	0.20	0.28	0	1
Forest Area(% of Land Area)	512	30.91	23.47	1	89
Forest area (sq. km)	512	155271.75	282226.16	382	1572490
GDP Per Capita(constant 2010 US$)	544	2124.97	3388.72	194	20334
Population Density(People/km2)	448	84.91	118.20	2	622
Government Effectiveness(WB ets)	512	-0.71	0.61	-2	1
Political Stability(WB ets)	512	-0.51	0.90	-3	1
Rule of Law(WB est)	512	-0.66	0.64	-2	1
Total Natural Resource Rents (% of GDP)	508	14.01	11.96	0	89
Illegal Export Quantity	562	47.22	183.53	0	2090
Illegal Export Value	562	14700447.90	79861348.51	0	1.09e+09

Notes: Table A shows the panel data on 32 Sub-Saharan Countries from year 2000 to 2016. Data on the *number of mammals and birds threatened* are obtained from the IUCN Redlist. Data on the governance of protected areas are taken from the IUCN World Database on Protected Areas-*the only database that record the statistics of IUCN designated protected areas*. Data on the number of trophies exported (or imported) are obtained from the Conventional on International Trade in Endangered Species (CITES) Database. Corresponding prices of each genus of exported trophies are obtained from each country concerned ministries. Data on all other variables are taken from the World Bank Tables archives

1.4.2 Identification

We estimate the effect of protected areas' governance on the proportion of threatened mammals and birds using Ordinary Least Square(OLS) regressions. We

apply country fixed effect that loosen up the assumption of commonality across countries by estimating a separate constant for each country (Koop & Tole, 1999). We also add year fixed effect to control for any potential time trend. To capture the inclusion of local communities in PAs governance, we use the IUCN World Database on Protected Areas (WDPA) to differentiate between community-based conserved areas and state protected areas for a panel of Sub-Saharan African Countries over the period 2000-2016. In doing so, we divide total protected areas into three types; state strictly governed, community-governed and protected areas-not-reported. Since habitat size may directly affect biodiversity as suggested by previous studies e.g Asafu-Adjaye (2003), we take into account the size of strictly state protected areas as control variable to isolate the only variation in the size of protected areas governed by local communities. We further assume that protected areas about which the governance structure is not reported, are randomly distributed across countries, and that there is no systematic relationship with the outcome variables.

We adopt the following model to estimate the effect of protected areas governance on the population of threatened species.

$$\begin{aligned} Threat_{it} &= \alpha_0 + \alpha_1 CG_{it} + \alpha_2 SG_{it} + \alpha_3 GDP_{it} + \alpha_4 lnTE_{it} + \alpha_5 lnFRit + \alpha_6 RL_{it} \\ &\quad + \alpha_7 PSit + \pi_i + \gamma_t + \epsilon_{it} \end{aligned} \tag{1.1}$$

Where

$$(a)\ Threat = \frac{(Threatened\ X\ in\ year_t - Threatened\ X\ in\ year\ 2000)}{Threatened\ X\ in\ year\ 2000}$$

The threat rate is calculated as percentage change in the number of X (taxonomic group e.g. Mammals and Birds) relative to base year 2000 in country i in year t. The threshold is 0 which means that if a country' endangered mammals

population remains the same, it's the least positive indication. The negative sign of threat signifies country's positive performance towards biodiversity conservation. We also adopt first difference specification for measuring the threat to biodiversity over time in the following form:

$$(b)\ \ Threat = \frac{(Threatened\ X\ in\ year_t - Threatened\ X\ in\ year_{t-1})}{Threatened\ X\ in\ year_{t-1}}$$

Variables CG and SG represent a country's protected areas' governance by community and state respectively measured as cumulative size (in km^2). The log of GDP per capita represents income per capita in country i in year t. Variables TE is the gross value of trophy exports from country i in year t, FR is the forest area as a percent of total land area in country i in year t, RL and PS are a country's score on rule of law and political stability respectively measured in units of standard deviations (- 2.5 to 2.5) in year t. Country fixed effect and year fixed effects are represented by π and γ respectively while ϵ is standard errors clustered at country level.

1.4.3 Sample Selection

We choose the sample of 32 countries(see Appendix table A.1) in Sub-Saharan Africa for three reasons. First, potential biodiversity loss (specially mammals and birds) coincides with higher poverty rate in Sub-Saharan countries (Sachs et al., 2009). Second, over the last twenty years, community-based natural resource management (CBNRM) has been adopted widely in Sub-Saharan Africa as a mechanism to combine rural development and conservation efforts (Lindsey et al., 2007; Nelson & Agrawal, 2008; Roe et al., 2009). Third, Sub-Saharan African countries share similar characteristics in terms biodiversity richness and species diversity.

1.5 Findings

Table A.1 shows results of OLS panel fixed effect estimates on equations (1) using panel data from 2000 to 2016. A negative relationship can be observed between the ratio of community-governed protected areas and threat to mammals measured using specification (a). After controlling for all observed factors affecting biodiversity and country and time fixed effects, the effect is significant at 10%. Increasing community-governed PAs by one more percent of the total protected areas, would roughly increase the proportion of threatened mammals in Sub-Saharan countries by 37% after controlling for state-governed PAs ratio.

Table 1.3: Community-Governed Protected Areas(Ratio) and Threat to Mammals

Dep. Var: Threat to Mammals	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Community-Governed PAs	-0.117	-0.225	-0.242	-0.249	-0.235	-0.378*	-0.369*
	(0.0946)	(0.200)	(0.207)	(0.202)	(0.195)	(0.198)	(0.194)
State-Governed PAs	0.0327	0.0936	0.0550	0.0417	0.132	0.146	0.137
	(0.110)	(0.168)	(0.153)	(0.145)	(0.185)	(0.176)	(0.176)
Log of GDP Per Capita			-0.256	-0.247	-0.218	-0.213	-0.212
			(0.195)	(0.193)	(0.198)	(0.203)	(0.202)
Log of Illegal Trophy Exports				0.00502**	0.00504*	0.00549**	0.00545**
				(0.00242)	(0.00252)	(0.00238)	(0.00238)
Log of Forest Area					-0.228	-0.209	-0.197
					(0.337)	(0.316)	(0.314)
Rule of Law						-0.0682	-0.0419
						(0.130)	(0.147)
Political Stability							-0.0242
							(0.0434)
Country FE	NO	YES	YES	YES	YES	YES	YES
Year FE	NO	YES	YES	YES	YES	YES	YES
Constant	0.0360	-0.0608	1.683	1.605	2.043	2.038	1.997
	(0.0668)	(0.136)	(1.325)	(1.317)	(1.673)	(1.771)	(1.738)
Observations	543	543	543	543	511	479	479
Adj. R-squared	0.013	0.155	0.172	0.178	0.134	0.145	0.146
Number of countries		32	32	32	32	32	32

Notes: The outcome variable is the percentage of threatened mammals to the base years 2000 calculated as Threat Rate = $[(T_t - T_{2000})/T_{2000}]$. Community-Governed PAs and State-Protected Areas are the ratio of the size (in km^2) of protected area governed by community and state to the total protected area respectively in each country. The reference is the protected areas not reported. Column (1) reports the pooled OLS while country and year fixed effect applied in the remaining columns. Log of illegal trophy exports represents exports in current USD from the sub-Saharan countries. Log of forest area is the log of the forest area as a percent of total land area. Controls for rule of law and political stability are included in column (6) and (7) respectively.

Although not statistically significant, the variable for state-governed protected areas size reflect a continuously positive coefficient indicating harmful effect for biodiversity outcomes. Since variables of community and state governance in table 1.3 represent the ratio to the total protected area in each country, therefore the coefficients of these variables are interpreted as marginal change in the fraction of the total protected area. It is however difficult to clearly specify the magnitude of change in the size of protected areas due to disproportionate

size of protected areas across different countries.

Table 1.4 shows the same regression model using the absolute variation in the size of community-governed protected areas and the proportion of threat to mammals. Our interest in table 1.4 is to see the direct effect of community-governed protected areas size on threatened mammals that appears to be significant at 10 percent indicating a negative impact of community-inclusion in governance on threat to mammals. This is in line with studies that finds evidence on positive effect of community participation on the conservation of species population and suggest further institutional understanding of the conditions under which PAs succeed or fail to deliver conservation outcomes (Geldmann et al., 2013).

Table 1.4: Community-Governed Protected Areas(size in km^2) and Threat to Mammals

Dep. Var: Threat to Mammals	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Community-Governed PAs	0.00584*	-0.0195**	-0.0161*	-0.0164**	-0.0180**	-0.0178**	-0.0171*
	(0.00338)	(0.00749)	(0.00798)	(0.00786)	(0.00767)	(0.00804)	(0.00856)
State-Governed PAs	-0.00109	-0.0108	-0.0112	-0.0114	-0.0111	-0.00978	-0.0106
	(0.00436)	(0.0101)	(0.00966)	(0.00953)	(0.0102)	(0.00943)	(0.00933)
Log of GDP Per Capita			-0.217	-0.205	-0.173	-0.167	-0.167
			(0.206)	(0.204)	(0.208)	(0.214)	(0.214)
Log of Illegal Trophy Exports				0.00528**	0.00555**	0.00633**	0.00628**
				(0.00256)	(0.00259)	(0.00252)	(0.00253)
Log of Forest Area					-0.0729	-0.0629	-0.0566
					(0.298)	(0.282)	(0.281)
Rule of Law						-0.0850	-0.0585
						(0.133)	(0.150)
Political Stability							-0.0242
							(0.0468)
Country FE	NO	YES	YES	YES	YES	YES	YES
Year FE	NO	YES	YES	YES	YES	YES	YES
Constant	0.0256	0.0390	1.494	1.389	1.395	1.255	1.246
	(0.0556)	(0.0492)	(1.367)	(1.361)	(1.830)	(1.910)	(1.898)
Observations	543	543	543	543	511	479	479
Adj. R-squared	0.005	0.166	0.178	0.185	0.141	0.151	0.152
Number of country1		32	32	32	32	32	32

Notes: The outcome variable is the percentage of threatened mammals to the base years 2000 calculated as Threat Rate = $[(T_t - T_{2000})/T_{2000}]$. Community-and State-Governed PAs are the size of protected area (per 10,000 km^2) governed by community and the state respectively in each country. Column (1) reports pooled OLS while Country FE and Year FE is applied in all remaining columns. Log of illegal trophy exports represent exports in current USD from the sub-Saharan countries. Log of forest area is the log of the forest area as a percent of total land area. Controls for rule of law and political stability give the country's score on the aggregate indicator, in units of a standard normal distribution, i.e. ranging from approximately -2.5 to 2.5.

Table 1.4 suggests that increase in the size of community-governed protected area by 10,000 km^2 would decrease the threat to mammals by .017 percentage points. In other words, given the small mean value of the outcome variable(.030), an increase of 10,000 km^2 in the community-governed protected areas will decrease the proportion of threat to mammals by nearly 10% compared to base year 2000. Relevant tests[2] (Hausman, and wald test) were conducted

[2]Hausman test was conducted without clustering the standard errors both for mammals and birds threat level

to decide whether to use country fixed effect, random effect and year fixed effect. These tests favored using country fixed effect and year fixed effect estimations. To be more conservative in determining the statistical significance of the effects,standard errors in all regressions are clustered at country level. We use xtreg command from column (2) to (7) which automatically deals with both heteroskedasticity and autocorrelation using clustered standard errors.

Both table 1.3 and 1.4 show positive association (at 5% significance) between the log of the trophy exports value[3] and the IUCN threat level. The positive coefficient of trophy exports value suggests weak implementation of CITES regulation in exporting countries. Moreover, this is in line with previous studies e.g Dietz and Adger (2003), that report correlation of country's government enforcement level of CITES and threat to biodiversity.

Table 1.5: Protected Areas Governance and Conservation[Comparison of effect]

	Mammals			*Birds*		
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: *Ratio of the Total Protected Area*						
Community-Governed PAs	-0.117	-0.225	-0.378*	0.355	0.167	0.139
	(0.0946)	(0.200)	(0.198)	(0.239)	(0.321)	(0.319)
State-Governed PAs	0.0327	0.0936	0.146	-0.149	0.192	0.530
	(0.110)	(0.168)	(0.176)	(0.225)	(0.395)	(0.387)
Controls	NO	NO	YES	NO	NO	YES
Country FE	NO	YES	YES	NO	YES	YES
Year FE	NO	YES	YES	NO	YES	YES
Observations	543	543	479	543	543	479
Adj. R-squared	0.013	0.155	0.145	0.037	0.472	0.517
No. of Countries		32	32		32	32
Panel B: *Cum. Size in 10K km^2*						
Community-Governed PAs	0.00584*	-0.0195**	-0.0178**	0.0131	-0.00528	-0.00348
	(0.00338)	(0.00749)	(0.00804)	(0.0113)	(0.0141)	(0.0120)
State-Governed PAs	-0.00109	-0.0108	-0.00978	-0.00857	-0.0183	-0.0173
	(0.00436)	(0.0101)	(0.00943)	(0.00926)	(0.0167)	(0.0131)
Controls	NO	NO	YES	NO	NO	YES
Country FE	NO	YES	YES	NO	YES	YES
Year FE	NO	YES	YES	NO	YES	YES
Observations	543	543	479	543	543	479
Adj. R-squared	0.005	0.166	0.151	0.011	0.473	0.510
No. of Countries		32	32		32	32
Mean of the Dep. Variable:	.0306	.0306	.0306	.065	.065	.065

Notes: The outcome variable is the percentage of threatened mammals and birds to the base years 2000 calculated as Threat Rate = $[(T_t - T_{2000})/T_{2000}]$. Panel A use Community-Governed PAs and State-Governed PAs size as a ratio of the total protected areas in each country while Panel B use the variation in the cumulative size of Community-Governed PAs and State-Governed PAs (in 10,000 km^2). The reference is Areas Not-Reported for governance. Column (1) and (4) use pooled OLS regression while column (2) and (5) applies Country and Year FE respectively. Controls added in column (3) and (6) include the log of GDP per capita, log of Illegal trophy exports(in USD), Forest Area as a percentage of total land area, and the Rule of Law.

Table 1.5 compares the effect of community and state governed protected areas using the same regression on two different outcome variables; threat to mammals and threat to birds. After controlling for factors affecting threat to mammals and birds in Sub-Saharan countries and country fixed and year fixed effect, the coefficient of community-governed PAs is negative and significant

[3] Data taken on this variable is reported by importing countries rather than exporting countries

for mammals in both panel A and Panel B. On the other hand, the effect of the community-governed protected areas on the threat to birds is not significant rather positive, indicating no effect of governance type on the threatened birds proportion in Sub-Saharan African countries. This *no-effect* has interesting implications. First, as expected, community does not respond to the conservation of birds due to lack potential economic incentives as compared to mammals. Secondly, there is possibility of increasing threat to bird's species due to increased community involvement. Other unobserved factors such as pollution or other human factors might cause extinction of birds from protected areas. The state-governed protected areas' effect is not significant both for mammals and birds indicating less effectiveness of strictly state-protected areas compared to community-governed protected areas. In both panel A and Panel B, the reference PAs' governance type is the ratio and size(in km^2) of protected areas not reported respectively. These results are suggestive of the importance of protected areas governance mechanism in achieving biodiversity outcomes, consistent with previous country-specific studies that find different results of community-based conservation programs (Lindsey et al., 2007; Mayaka et al., 2005; Murombedzi, 1999; Stone, 2015; Taylor, 2009).

Table 1.6 shows results on the first-differenced variables of threatened taxonomic groups and protected areas' governance. We do this to take into account the one year lagged effect in variables of threatened taxonomic groups and size of protected areas' governance. The results show similar trend for mammals and birds. The coefficient of community-governed protected areas is negative and significant at 5% while positive (not significant) after controlling for country and year fixed effects. The coefficient of state-protected areas is not significant as expected, indicating the less effectiveness of any increase in state-strictly protected areas. Since any decrease in the threat level below threshold is considered substantially important for country's performance towards conservation of endangered species, therefore, the overall magnitude of these results is crucial for

sustainable development goals.

Table 1.6: Protected Areas Governance and Conservation[First-Differencing]

Dep. Variable: *Time Differenced Threat**	*Threat to Mammals*			*Threat to Birds*		
	(1)	(2)	(3)	(4)	(5)	(6)
Community-Governed PAs	-0.00560**	-0.00724**	-0.0223**	0.0106	0.0508*	0.00170
	(0.00206)	(0.00327)	(0.00966)	(0.00971)	(0.0278)	(0.0175)
State-Governed PAs	-0.00300	0.00443	-0.0218	-0.00288	0.0762**	-0.0206
	(0.00216)	(0.00439)	(0.0155)	(0.00667)	(0.0264)	(0.0387)
Controls	NO	NO	YES	NO	NO	YES
Country FE	NO	YES	YES	NO	YES	YES
Year FE	NO	YES	YES	NO	YES	YES
Observations	511	511	454	505	505	448
Adj. R-squared	0.051	0.035	0.072	0.042	0.035	0.300
No. of Countries		32	32		32	32
Mean of the Dependent Variable	.058	.058	.058	.153	.153	.153

*Notes: Time Differenced Threat and Size of Protected Areas Governance is calculated as the following.
Threat Rate = $[(T_t - T_{t-1})/T_{t-1}]$----(Threatened Taxonomic Group)
CG = $[(CG_t - CG_{t-1})/CG_{t-1}]$----(Community-Governed PAs in 10K km^2)
SG = $[(SG_t - SG_{t-1})/SG_{t-1}]$------(State-Governed Area in 10K km^2 ,)
The Reference group is the Size of Protected Areas Not-Reported. Standard errors clustered at country level. Column (1) and (4) use pooled OLS regression while column (2) and (5) applies Country and Year FE respectively. Controls added in column (3) and (6) include the log of GDP per capita, log of Illegal trophy exports(in USD), Forest Area as a percentage of total land area, and the Rule of Law. In constructing the time-differenced variables, those countries, where the number of threatened mammals or birds remain zero or where protected areas' governance size does not change for more than one consecutive years, the above formula assigns missing values which reduces the observations in column (3) and (4).

Three important implications can be derived from table 1.4, 1.5 and 1.6. First, governance of protected areas matter. As suggested by previous studies, we find variation in conservation outcomes of protected areas with different governance regimes. Several reasons can be associated for this difference. For example, the level of threat to species depends on the community-compliance with conservation policies of governments. In cases, where, protected areas are strictly protected by states, communities often do not cooperate with state-authorities due to the perception that they are excluded from exploiting natural resources. The closer the livelihood attachment with the protected areas resources is, the stronger would be the response of community-compliance.

Secondly, community-compliance also depends on the nature of the resource that is conserved. For common pool resources that carry potential economic incentives, community tends to conserve if they are given authority, responsibility and control over financial benefits. In community-governed PAs, generally, the governments and international organizations agree on the distribution of the share of economic benefits generated as a result of activities within or around protected areas to the local community. In Sub-Saharan Africa, mammals are the most dominant source of revenues for community (if given their fair share)

such as in trophy hunting industry. The flagship *Communal Areas Management Programme for Indigenous Resources* (CAMPFIRE) in Zimbabwe is the best example to explain how community involvement in protected areas management positively affect conservation outcomes. To establish this link between local community, income and mammals conservation, Taylor (2009) for example documents that between 1989 and 2006, the CAMPFIRE income from high valued safari hunting totaled nearly US$ 30 million of which 52% was allocated to sub-districts wards and villages for community projects and household benefits. The same study finds significant positive trend in mammals' conservation including elephants and buffalos' population. A number of other studies have documented the positive effect of devolving responsibility, authority and accountability of natural resource management on the attitude of local people towards conservation (Frost & Bond, 2008; Goldman, 2003; A. Hoole & Berkes, 2010; Lindsey et al., 2007; Mayaka et al., 2005).

Finally, state protected areas do not achieve conservation goals due to conflicts with local people. Conservation of endangered species needs a holistic approach in which local people play key role in protecting the resources. State machinery may not be capable of safeguarding a large biodiversity hotspot which is surrounded by people whose activities directly and indirectly affect the wildlife. For example, mammals are more vulnerable to illegal activities such as poaching and illegal hunting in areas where community compliance with conservation strategies is low. Previous studies have documented increase in endangerment of mammals in countries with relatively centralized management and governance structures (Jachmann, 2008; Mayaka et al., 2005; Shackleton, 2001). The positive coefficient of variable state-governed PAs in table 1.3 also shows the potential drawback of strictly state protected areas for mammal's conservation.

1.6 Conclusion

Community inclusion in the governance of protected areas can be considered an effective reforms initiative that enables countries to achieve conservation outcomes not at the cost of social exclusion. In this paper we provide empirical support for the argument that decentralization and devolution of authority, responsibility and accountability of natural resource management help reduce threat to biodiversity. This paper contributes to the existing literature on the dilemma of sustainability in the following ways:

(1) Community inclusion in the governance of protected areas strongly influence conservation outcomes of protected areas in Sub-Saharan African countries. Considering wildlife as a common good, community is more responsive in conservation of mammals than birds due to higher economic incentives.

(2) Our results suggest that governance policy that devolve authority, responsibility and accountability of natural resource management (particularly in Protected Areas) to the local communities can address the challenge of conservation as well as poverty by giving fair share of the benefits to local people. Merely establishment of (state) protected areas might negatively affect the conservation objectives if local communities are excluded from the benefits of natural resources in designated areas. Addressing social concerns of communities at risk can ameliorate the potential conflict between state authorities and local people.

In a broader context, achieving social and environmental (biodiversity) objectives is possible through inclusion of local communities in environmental decision making particularly in developing countries.

1.7 Limitations and Future Research Directions

This study is subject to some limitations that should be considered while interpreting its findings. First, the biodiversity measure adopted in this study is

the IUCN Redlist of threatened mammals and Birds. There are other genesis of species such as amphibians, etc which are also important in defining the overall status of biodiversity. Hence our results are only limited to mammals and birds identified as threatened from 2000 to 2016. Taking into consideration all species in measuring biodiversity might be more comprehensive in analyzing the effectiveness of protected areas' governance. Secondly, our sample is composed of 32 Sub-Saharan African countries for which the data on all variables was available. Our results only apply to countries in the Sub-Saharan Africa or those that share similar socio-economic characteristics. Thirdly, we aggregate the types of governance of protected areas into three broad categories; community-governed, state-governed and protected areas about which governance status is not reported. Our findings take a general classification of governance rather than each specific sub-classification of governance such as partially-devolved governance or governance by private owners. Protected areas in Sub-Saharan Africa do not have identical enforcement authorities, e.g. the range of community involvement varies, hence, further analysis of each sub-type of governance might be useful in explaining the extent of conservation success in protected areas. Lastly, although IUCN is the only organization around the world that records data on protected areas management and governance, there might still be protected areas which are not designated yet contributing to the national statistics on Redlist. Nevertheless, our assumption is that if such protected areas exist, they are normally distributed, and thus we rule out any systematic relationship with our estimates.

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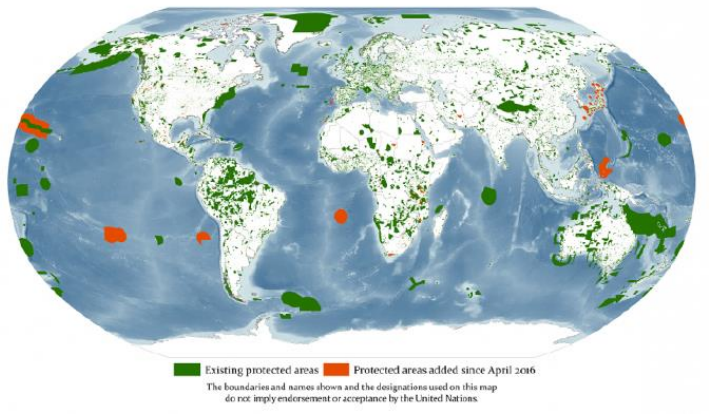
APPENDIX A

Figures



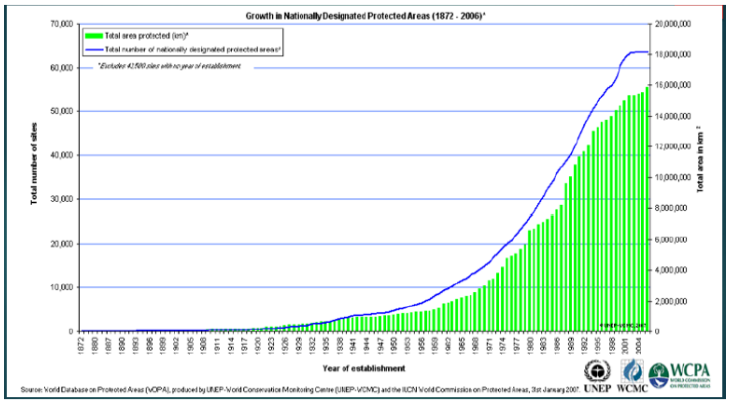


Figure A.1: Existing Protected Areas and growth

Table A.1: List of Sub-Saharan Countries Used in the Study

NO	Country Name	Income Category
1	Benin	L
2	Botswana	UM
3	Burkina Faso	L
4	Burundi	L
5	Cameroon	LM
6	Central African Republic	L
7	Chad	L
8	Congo, Dem. Rep.	L
9	Equatorial Guinea	UM
10	Ethiopia	L
11	Gabon	UM
12	Gambia, The	L
13	Ghana	LM
14	Guinea	L
15	Guinea-Bissau	L
16	Kenya	LM
17	Lesotho	LM
18	Liberia	L
19	Madagascar	L
20	Malawi	L
21	Mali	L
22	Mauritius	UM
23	Mozambique	L
24	Namibia	UM
25	Niger	L
26	Nigeria	LM
27	South Africa	UM
28	Tanzania	L
29	Togo	L
30	Uganda	L
31	Zambia	LM
32	Zimbabwe	L

L= Lower Income, LM= Lower Middle Income, UM=Upper Middle Income

CHAPTER 2

A MODEL OF COLLABORATIVE GOVERNANCE FOR COMMUNITY-BASED TROPHY-HUNTING PROGRAMS IN DEVELOPING COUNTRIES

2.1 Introduction

Community-Based Trophy Hunting (CBTH) has been promoted as an effective tool for conservation of endangered mammals in developing countries[4] since 1980s (B. Adams, 2008; W. M. Adams & Hulme, 2001; Baldus, 2009; Khan, 2012; Lichtenstein, 2010; Lindsey, Roulet, & Romanach, 2007; Mayaka, Hendricks, Wesseler, & Prins, 2005; McIntosh & Renard, 2010; Mir, 2006; Schumann, 2001; Shackleton, 2001; Twyman, 2000). Following successful experiments in African countries, Asian countries where some species were declared endangered due to overwhelming hunting practices in 1990, also adopted community-based conservation. These countries include Pakistan, Afghanistan, India and Tajikistan (R. M. Adams, Bergland, Musser, Johnson, & Musser, 1989; Damm, 2008; Shackleton, 2001). The simple theory behind CBTH is that economic benefits from trophy hunting will incentivize local communities to be engaged as key partners with policymakers and practitioners to make efforts to conserve endangered species, and community members will do better than government

[4]The Communal Areas Management Programme for Indigenous Resources (CAMPFIRE) in Zimbabwe was the first program that recognized wildlife as renewable natural resource, while addressing the allocation of its ownership to indigenous peoples in and around protected areas for conservation (Taylor, 2009). The Southern Luangwa Valley Integrated Resource Development Project (LIRDEP) in Zambia and the Selous Conservation Programme (SCP) in Tanzania are among those initiated in the late 80s. Similar programmese initiated in Namibia in the late 90s followed by multiple attempts in South Africa (Baldus, 2009)

since, by virtue of their proximity to and knowledge of wildlife, they are well placed to participate in conservation efforts by detecting, reporting on, and helping preventing illegal wildlife trafficking (Baldus, 2009; Biggs et al., 2017; Li, 2002; Shackleton, 2001; Twyman, 2000). Despite several successful cases of CBTH around the world[5], successful CBTH still remains more theory than reality in many countries (Baldus, 2009; Goldman, 2003; Shackleton, 2001).

Many commentators ascribe failures of CBTH to bad governance in and around protected areas and suggest better governance for successful CBTH (Balint & Mashinya, 2006; Bunge-Vivier & Martínez-Ballesté, 2017; Chabwela & Haller, 2010; Damm, 2008; Lichtenstein, 2010; Newig & Fritsch, 2009; Paudyal, Baral, Lowell, & Keenan, 2017). Factors related to bad governance include inadequate legislation in enforcing community participation (Baldus, 2009; Lichtenstein, 2010) , conflict among stakeholders on the level of participation (Balint & Mashinya, 2006), state's influence in selecting participants (Lebel, Daniel, Badenoch, Garden, & Imamura, 2008), power imbalance among community members (Twyman, 2000), lack of reliable information on the economic significance and ecological impact of the hunting industry (Lindsey et al., 2007), and corruption leading to inequitable distribution of revenues from trophies (Baldus, 2009; Khan, 2012; Lindsey et al., 2007; Nagendra & Ostrom, 2012).

Thus, good and collaborative governance matters for successful CBTH where power is transferred from state to local community and empowered community members participate actively and collaborate with various stakeholders including government agencies, donor institutions, private corporations and experts. Such a collaborative setting enables participants to build trust and own decision-making processes, and ultimately manage the stock of endangered wildlife in

[5]Some successful cases of CBTH are reported in African and Asian countries such as Zambia, Zimbabwe, Bostswana, Namibai, Tanzania, Pakistan and Tajikistan. In these countries, communities' participation in conservation related decision making and management of endangered mammals within their localities where trophy hunting with low off-take and high prices has been practiced, the number of target mammals has increased (Baldus, 2009; Damm, 2008; Frost & Bond, 2008; Lindsey et al., 2007; Mayaka et al., 2005; Shackleton, 2001; Zafar et al., 2014).

a sustainable way (W. M. Adams & Hulme, 2001; Bunge-Vivier & Martínez-Ballesté, 2017; Chabwela & Haller, 2010; Folke, Hahn, Olsson, & Norberg, 2005; Goldman, 2003; Mackenzie, 2010; Mayaka et al., 2005; Newig & Fritsch, 2009; Paudyal et al., 2017; Seixas & Berkes, 2010; Taylor, 2009).

Despite much literature on governance components of community-based programs, however, a clear comprehensive framework to guide, monitor, and assess CBTH is lacking. Such a framework is essential to facilitate appropriate preparation and implementation of CBTH on the ground. Thus, to address this gap, this paper intends to elaborate a general governance model of CBTH by framing CBTH as a form of collaborative governance and by conducting a meta-analytical study of the exiting literature on common-pool resource management (CPRM), community-based conservation (CPC), and CBTH programs. Ultimately, this study contributes the existing literature by developing a contingency approach to collaborative governance of CBTH that identify conditions for determining the effectiveness of CBTH programs.

In this study, we refer to Ansell and Gash (2008) model which defines collaborative governance as "a governing arrangement where one or more public agencies directly engage non-state stakeholders in a collective decision-making process that is formal, consensus-oriented, and deliberative and that aims to make or implement public policy or manage public programs or assets." Many characteristics of CBTH match with the components of collaborative governance defined above. In a CBTH, public agencies engage various non-state actors such as International Union for Conservation of Nature (IUCN), in formal and collective decision-making processes where participants deliberate and negotiate for consensus agreement to conserve endangered mammals through trophy hunting mechanism, and implement the agreement jointly.

The core system components of collaborative governance model by Ansell and Gash (2008) include starting conditions, institutional design, facilitative leadership, collaborative process and outcomes (figure 2.1). In the following

sections, we explain research method briefly, discuss what we found in literature on CPRM, CPC, and CBTH in conjunction with the model of Ansell and Gash (2008), and try to tailor the model to the context of CBTH.

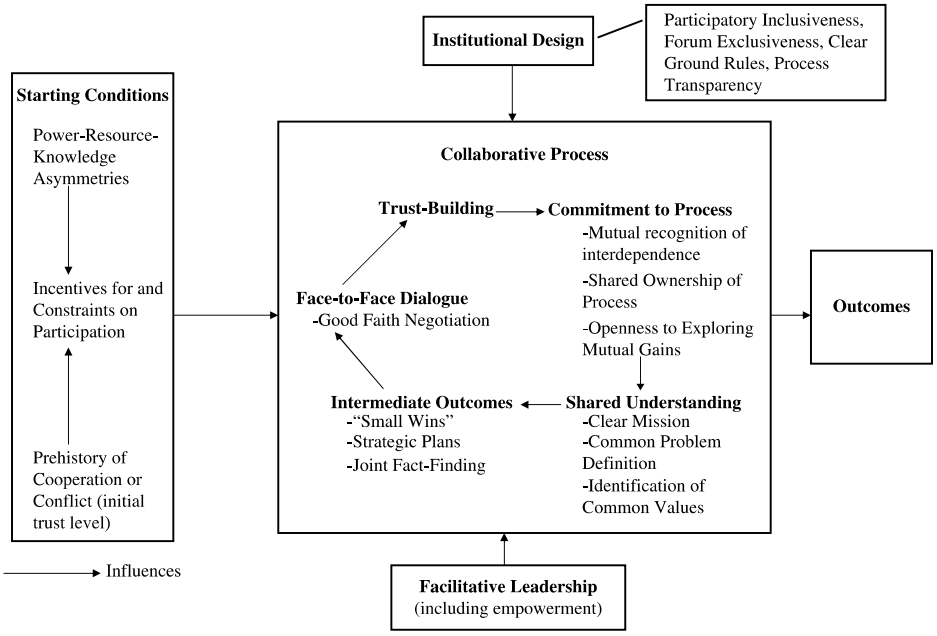


Figure 2.1: A Model of Collaborative Governance (Ansell and Gash,2008)

2.2 Methodology

We adopt the Elinor Ostrom's institutional analysis and development(IAD) framework to identify major types of structural variables that are present in community-based conservation programs in general and CBTH in particular (Ostrom, 2011). We prefer IAD framework because it enables us to fit multiple theories such as economic theory, game theory, social choice theory and the theory of common pool resources into institutional analysis of community-based conservation programs. It also helps in accumulating knowledge from empirical studies in assessment of existing or past community-based conservation programs. We

identify major elements and relationships that are important for analyzing and framing CBTH arrangements. We then adopt the model of collaborative governance by Ansell and Gash (2008) to make precise assumptions about variables and parameters that enable us to predict the outcomes of CBTH programs.

To understand the initial structure of CBTH programs, in line with Kiser and Ostrom (2000), we conduct a meta-theoretical synthesis by digging deeper and exploring the factors that affect the structure of natural resource conservation programs particularly from participation view point. In analyzing the environment of community-based natural resource management programs, we identify conceptual unit called an action situation that enables us to describe, analyze, predict and explain behaviors of stakeholders within institutional arrangements. According to Ostrom (2011), an action situation is a social space where individuals interact, solve problems, try to dominate one another or attempt to conflict. The context of community-based conservation programs in general and CBTH in particular resembles the action situation specified in figure 2.2. We try to isolate the given structure of CBTH programs called institutional design that affect the process of conservation programs in order to explain the behaviors of stakeholders during the process of collaboration and implementation.

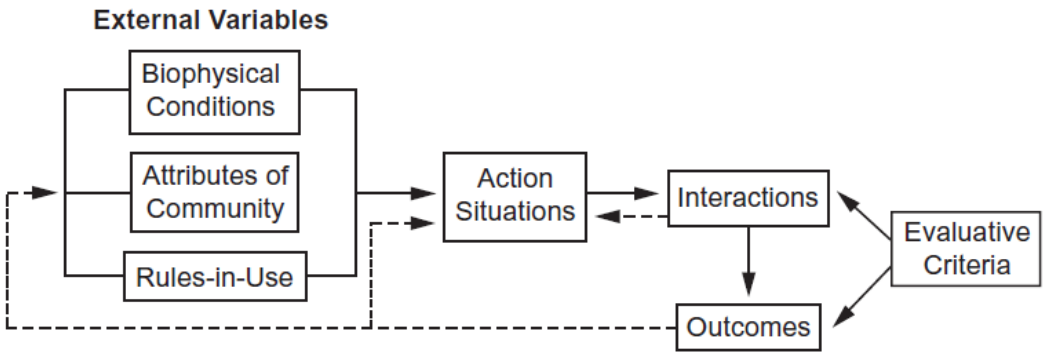


Figure 2.2: A Framework for Institutional Analysis(Ostrom,2005)

We illustrate the Ostrom's institutional analysis components by matching them with key components and processes of community-based conservation pro-

grams in the following way.

- **Actors:** Actors in the context of CBTH are those individuals or group of people whose actions are directly associated with resources inside protected areas. In our analysis, we assume that local community members make their decisions to participate in collaborative conservation program on the basis of what type of resources they may have access to, how much value they attach to it, how much knowledge they have about, what they believe they own and what internal mechanism they use to decide upon cooperation with other stakeholders of community-based conservation programs. Similarly, hunters who seek to hunt trophies are also actors and their actions are directly associated with potential outcomes of the programs.

- **Set of allowable actions:** The set of allowable actions include what type of method is allowed to utilize the resource. For example, in CBTH programs, participants decide on hunting method and age of animals, season for allowing hunting practices in protected area and limit or quota for hunting. Hunters on the other hand decide on amount of trophy fee that they are willing to pay.

- **Potential outcomes:** In CBTH contexts, potential outcomes of actions include, limit of the geographic region which might be affected as a results of actions by local people, and how alternate actions affect the livelihood of local people.

- **Level of control over choice:** Do members of community take their actions on their own initiatives? For hunters, before hunting the animals, do they obtain permit?

- **Availability of information:** How much information community members have about the existing population in protected areas, their characteristics, and about the market price of the trophy animals.

- **Cost and benefits of actions and outcomes:** How costly it might be for local community members to participate in CBTH programs and if not, then what are the likely consequences of their actions. Also, what type of benefits they might receive as a result of collaboration with state authorities or international organizations?

Following Ostrom (2009, 2011) and Cox, Ostrom, Walker, et al. (2010), we adopt a systematic methodology of literature search to review existing stock of knowledge on common-pool resource management and community-based conservation in general and CBTH in particular. Academic journals, book chapters, and reports across a wide range of disciplines, such as ecology, conservation, economics, governance, environment and development, were searched for theories and empirical studies on conservation and development through participation of local communities. In our search, we used multiple key words, such as conservation and development, community-based trophy hunting, collaborative governance, sustainable conservation and participatory governance for sustainable development etc. Although, our main interest is CBTH, we expand the scope of our case studies to wildlife conservation where economic benefits of natural resource stock are strongly associated with local people's livelihood.

2.3 Core Components of Collaborative Governance for CBTH

2.3.1 Starting Conditions of CBTH Programs

Ansell and Gash (2008) argue that incentives of stakeholders to participate in collaborative governance hinge upon power (and resource) balance[6] and certain level of trust among participants as initial background conditions at the outset of

[6]Power of stakeholders manifests in terms of status, organizational infrastructure to be represented (English, 2000), financial or human resources, skills and expertise (to engage in discussions about highly technical problem), and the time, energy, or liberty (to engage in time-intensive collaborative processes (Yaffee & Wondolleck, 2003)

collaborative governance (See figure 2.1). Power imbalance, or the prehistory of antagonism among stakeholders is likely to express itself in distrust, strategies of manipulation, and dishonest communications, and weaken the incentive to participate (Ansell & Gash, 2008; Schuckman, 2001; Warner, 2006). Thus, they posit that positive strategies of empowerment and representation of weaker stakeholders or/and steps to remediate the low levels of trust among the stakeholders should be taken to initiate collaborative governance effectively (Ansell & Gash, 2008).

Also, the incentive to participate in collaborative governance depends partly upon expectations of stakeholders about concrete, tangible, effectual policy outcomes or benefits against the balance of time and energy that collaboration requires (Brown, 2002; IUCN, 2012; Naidoo, Weaver, Stuart-Hill, & Tagg, 2011) and lack of alternative means through which stakeholders can achieve their interests unilaterally (W. B. Adams, 2013; Balint & Mashinya, 2006; Bouwen & Taillieu, 2004). Thus, four factors may interplay to affect the incentives to participate in collaborative governance in general: interdependence of stakeholders, power imbalance, prehistory of antagonism (level of distrust) and potential tangible benefits.

When it comes to conservation of wildlife through CBTH in developing countries, those four background factors may also work to affect the incentives to participate in CBTH. First, for CBTH to be considered by government as an alternative mechanism to conventional top-down, command-and-control conservation policy, such as protected areas, and proposed to local communities, interdependence between government and local communities should exit. In other words, government should have an incentive to capitalize on energy, ideal, and effort of local communities to conserve endangered wildlife and propose CBTH to local communities in the first place. Such incentive might come from the realization that previous government policies have failed to achieve conservation of wildlife, often with the help or advice of international conservation organiza-

tions (Khan, 2012).

Failure of community-based conservation programs in many cases often has something to do with the second factor, the prehistory of conflict between strong government and relatively weak local communities that may limit participation in collaboration in general. Conventional conservation policies, such as establishing national parks as protected areas, often lead to conflicts between government and local communities by restricting local communities from using natural resources including wildlife animals in protected areas and even displacing them forcibly out of the protected areas (Biggs et al., 2017; Frost & Bond, 2008; Mombeshora & Le Bel, 2009; Ribot, 2002).

Economically poor local communities who live on subsistence agriculture in their traditional lands perceive wildlife mainly as a threat to their livelihoods (Dickman, 2010). For example, in Uganda, stampedes of active wildlife animals on farmlands at the edge of the Kibale National Park actually reduced crop production dramatically (Naughton-Treves, 1997). Thus, they tend to poach wild animals illegally and harm their habitats for their survival and are often tempted to illegal wild animals trafficking for economic reason, which have limited the effectiveness of conservation policy (Jachmann, 2008; Treves & Karanth, 2003). In Mozambique, the colonial rules prevented local communities in reserved forests from using natural resources, consequently local communities were united against the government and consumed all the local forest resources (Virtanen, 2005).

Despite the uncertainty of effectiveness of community-based conservation from the beginning, government cannot but rely upon bottom-up approach that utilize the effort of local communities in conserving wildlife rather than ineffective command-and-control policies. In Pakistan's mountain regions of Karakoram, Hindukush and the Himalayas, protected Areas, usually established by the state, created conflicts with local livelihoods (Khan, 2012; Shackleton, 2001; Virk, Sheikh, & Marwat, 2003). Similarly, in Namibia, after the establishment of protected areas, Herero communities were disconnected from their forest re-

sources (A. F. Hoole, 2010). Taking these dynamics into consideration, the first contingency proposition is proposed as follows:

(1) If government realizes the failure of conventional conservation policies, then the government is more likely to consider and propose CBTH to local communities

The dependency of local communities on CBTH may come from power imbalances between strong government and weak local communities who neighbor or live closely with wildlife animals (Bouwen & Taillieu, 2004; Seixas & Berkes, 2010; Twyman, 2000). Considering economic survival and rights to use natural resources independently as the main interests of economically poor and politically weak local communities, it is less likely to have many alternatives to satisfy their interests than illegal poaching or reckless consumption of natural resources. In this context, the expectations to reap tangible benefits from collaboration in CBTH may affect strongly the incentive to participate in collaboration.

CBTH programs are based on the premise of financial incentives from regulated hunting of wildlife for local communities who are committed to conserve those animals (W. M. Adams & Hulme, 2001; Mayaka et al., 2005; Taylor, 2009; Virk et al., 2003; Wijnstekers, 2011). The expectations of direct benefits such as hunting and indirect benefits such as ecotourism for the local people can make them interested in being engaged in CBTH programs. Studies have shown high motivation and interest in participation in community based conservation programs in general where the potential for these incentives is higher (Frost & Bond, 2008; IUCN, 2012; Khan, 2012). CBTH is likely to be more attractive to local communities who live in remote and inaccessible areas or politically instable areas where alternative ways to make revenue, such as photographic ecotourism, may not be viable. According to Lindsey et al. (2007), trophy hunting has several advantages over photographic tourism in areas where infrastructure is not available, weather is not friendly for large public to visit, or high density of viewable wildlife is not available. Also, hunting industry is relatively more resilient

to political instability than usual tourism (Damm, 2008). Thus, the second contingency proposition is:

(2) Despite prehistory of conflicts and power imbalance as usual background conditions in many developing countries, if local communities perceive possibility to acquire necessary rights to manage their natural resources, as well as potential economic benefits from trophy hunting, they are more likely to come to the table for collaboration with the government.

One interesting case that may test the first and second propositions is observed in Zimbabwe (Baker, 1997). When the establishment of a national park, called 'Gonarezhou National Park' that had evicted the local community, called 'the Shangaan,' from their traditional lands in the 1960s did not bear fruit of conserving wildlife, the government suggested community-based conservation that would give the Shangaan people responsibility for wildlife in their areas. However, the Shangann community did not collaborate with the government proposal due to bad relations with the government and increased poaching in and around the park. In the early 1980s, the Shangaan agreed to work with government on the condition that the community would have the authority to manage wildlife in their areas and they would derive economic returns from safari hunting. Since the community started selling the right to kill two elephants for US 3,000 dollars over a 5 years period, the community could build a school, a grinding mill, and a clinic with the revenues from regulated hunting. With the tangible economic benefits from Safari hunting, the community's attitude toward wildlife animals changed dramatically enough to protect them as a valuable community asset (Andrade & Rhodes, 2012; Balint & Mashinya, 2006). Also, in Northern Pakistan, local communities who experienced conflicts with the government due to protected area policy, later participated in CBTH with their expectation of potential economic incentives (80% of the hunting revenues) from trophy hunting (Khan, 2012).

However, mere participation of local communities in initiating CBTH does not always guarantee successful outcomes in the end. Sneaky and pervasive power imbalances or lack of trust due to previous conflicts may lurk and prevent collaboration even after stakeholders start CBTH. Thus, we need to understand how internal process of CBTH deals with those problems of power imbalance, lack of trust, and poor governance. For example, in Kilosa district in Tanzania where two groups of communities experienced conflicts in competition for scarce resources, the government established Wildlife Management Areas (WMAs) in 1998 aimed at wildlife conservation and rural development at the same time. Although local community representatives actively participated in decision-making process from the beginning, however, during the implementation, conflicts occurred and were intensified further that caused the projects to fail in the end (Nilsen, 2009).

2.3.2 Facilitative Leadership

In order for successful collaboration from start of negotiation to structure process to the achievement of ultimate outcome, there should be actors with leadership ability of bringing broad range stakeholders to one platform, engaging them with collaborative spirit, setting clear ground rules, building trust, facilitating dialogue, explore creative solutions for common goals, maintaining technical credibility, empowering weaker stakeholders, and ensuring the integrity of collaborative process (Ansell & Gash, 2008; Bunge-Vivier & Martínez-Ballesté, 2017; Lasker, Weiss, & Miller, 2001; Yaffee & Wondolleck, 2003). In those contexts where power imbalances exist among stakeholders who distrust each other, leadership becomes more critical (Ansell & Gash, 2008). Also, scholars overwhelmingly argue that leadership should be facilitative rather than authoritative (Bouwen & Taillieu, 2004; Kaner, 2014; Nalbandian, 1999; Ozawa, 1993) Ansell and Gash (2008) propose that the types of facilitative leader may hinge upon the context of power distribution and incentive to participate. The

third-party actors whom stakeholders acknowledge and trust may provide neutral and facilitative services in high-conflict and low-trust situations, where power is balanced with stakeholders willing to participate. However, the context where power imbalances exist or incentives to participate are weak may requires strong "organic" leaders who might belong to community of stakeholders and have the ability to gain trust of various stakeholders at the start of the negotiation process. Thus, availability of such organic leaders might seriously limit the effectiveness of collaborative process (Ansell & Gash, 2008)

Literature on community-based conservation and CBTH also finds facilitative leadership crucial for success of programs (Bunge-Vivier & Martínez-Ballesté, 2017; German & Keeler, 2009; Jachmann, 2008; Paudyal et al., 2017; Shackleton, 2001). Considering general context of endangered species management in developing countries, such as prehistory of conflict and lack of trust, and building upon the second proposition in the previous section about economic-benefit-driven incentive to participate, facilitative third party actors, such as local and international conservation NGOs may be very helpful even in the context of power imbalance.

For CBNRM and CBTH to be initiated, there should be some actors who can help stakeholders to link social involvement and development with conservation objectives. Local, or international conservation NGOs can be instrumental in orchestrating relevant actors to buy that idea (Cash & Moser, 2000; Folke et al., 2005). For example, in Namibia, Garth Owen-Smith and Margaret Jacobsohn as leaders in local conservation pioneered the community-based conservation program called 'the Integrated Rural Development and Nature Conservation (IRDNC)' where they worked with local community, called 'Herero,' in order to link social and economic development to the conservation of region's wildlife and other natural resources (A. F. Hoole, 2010). The program was quite successful in controlling rampant illegal hunting of black rhinos and elephants and increasing most wild species with major contributions from community-

appointed game guards in the northeast of Namibia (Roe, Pathak, & Gutierrez, 2000). IRDNC's leadership was facilitative in fact-finding by engaging the Namibian government in conducting community surveys and setting up community game guard program. In Belize, a leader of NGO was instrumental in creating Port Honduras Marine Reserve by persuading the Belize Government and surrounding communities to adopt the Reserve and by linking international concerns on marine ecosystems with local economic needs (Fernandes, 2005; Seixas & Berkes, 2010). Also, in the Guyana's Community-based Arapaima Conservation, a local NGO played a role in finding funding for project, establishing links between local community and government authorities, and building their capacities (Fernandes, 2004). Also, International Union for Conservation of Nature (IUCN) played critical roles as a facilitator for conservation program in Northern Pakistan in educating local people, providing technical training for community wildlife guards and government field officers, creating an environment for mutual trust and commitment between the government agencies and community and safeguarding the whole process (Khan, 2012; Mir, 2006; Zafar et al., 2014).

Leadership may come from community side (Folke et al., 2005; A. F. Hoole, 2010; McIntosh & Renard, 2010) as well as government side (Balint & Mashinya, 2006). Once a community decides to participate in CBNRM or CBTH, 'organic' leadership of community representative become very important in informing community members about potential economic benefits from their own conservation efforts, and sharing their own knowledge with government and international organizations (Bunge-Vivier & Martínez-Ballesté, 2017; Folke et al., 2005; Seixas & Berkes, 2010). In CBTH, community leaders may lead the process of surveying wildlife, deciding on quotas, monitoring on illegal activities and poaching, and imposing penalties on community members who violate the rules (Taylor, 2009). Leadership roles of government officials in CBTH and CBNRM are also important in showing stable and transparent commitment during

collaboration process since abrupt change in government leadership often leads to the failure of the project . For example, in the CAMPFIRE program in Zimbabwe, community members lost their trust in the government after change of leadership in the government designated committee caused malpractices in the distribution of revenues of trophy hunting (Balint & Mashinya, 2006).

Considering all factors of facilitative leadership affecting CBTH, the third and fourth contingency propositions are formulated as bellows:

(3) Even if there is prehistory of conflict, lack of trust, and power imbalance between community and government, facilitative third parties, such as local or international conservation NGOs can play critical roles in initiating and maintaining CBTH.

(4) If "organic" leadership from community is instrumental in implementing conservation efforts as CBTH programs indicate, and government leadership provides stable and transparent commitments during the process, CBTH will be more likely to succeed.

2.3.3 Institutional Design

Institutional design in the model of collaborative governance refers to the basic protocols and ground rules for collaboration that are designed to secure the procedural legitimacy of the collaborative process (Ansell & Gash, 2008)(figure 2.1. Literature on community-based conservation programs suggests several design features for successful collaboration that include open and inclusive representation of important stakeholders (Bouwen & Taillieu, 2004; Mayaka et al., 2005; Newig & Fritsch, 2009), clear ground rules (Usongo & Nkanje, 2004), process transparency (Brunet & Aubry, 2016; Dudley, 2008), clear definition of roles (Baldus, 2009; Taylor, 2009), formalization of governance structures (Di Minin, Leader-Williams, & Bradshaw, 2016; Hayes, 2006), consensus-oriented decision-making and the use of realistic deadlines (W. B. Adams, 2013; Ansell & Gash, 2008). Exclusion of important stakeholders undermines the le-

gitimacy of collaborative outcomes (Ansell & Gash, 2008). Clear ground rules work to reassure stakeholders, who may have skeptical frame of mind and be sensitive to issues of equity and power imbalance, that process is fair, open, and transparent. Formal acknowledgment of transparent governance structure helps stakeholder to feel confident that the public negotiation is real rather than window dressing.

For sustainable management of common pool resources, Ostrom (2008) suggests critical principles of a governing institution that resemble some of the institutional design of collaborative governance. For example, the governing institution should define clear group boundaries, ensure that community gets the right to participate in rule-making, and make sure that community has the the right to modify these rules in case they affect the interests of local community (Ostrom, 2008; Schumann, 2001). Identification of the affected community in local natural resource management is often made on the criteria of geographical proximity to the resource (B. Adams, 2008; Lebel et al., 2008). However, the number and the scope of stakeholders in wildlife conservation are often larger since some wild animals' habitats go beyond conserved areas (Child, 2013; Pietersen, 2011). Thus, representation of stakeholders in collaborative governance in wildlife conservation, such as CBTH, needs to be flexible and adaptable enough to accommodate both complex and diverse stakeholder interests.

When it comes to CBTH, literature identify local communities as key stakeholders who can be affected negatively by the wildlife movement (e.g., damage to farmlands or threat to human safety), positively by the wildlife use (e.g., revenues generated by trophy hunting and/or wildlife tourism), and who can contribute indigenous knowledge to making and implementing a conservation decision, and external groups, such as government organizations, international agencies, and NGOs, who bring expertise to collaboration (Balint & Mashinya, 2006; Bouwen & Taillieu, 2004; Damm, 2008; Graham, Notter, Adams, Lee, & Ochieng, 2010; Imran, Alam, & Beaumont, 2014; Stone, 2015).

Participation of broad spectrum of stakeholders in a rule-setting negotiation for CBTH is critical since CBTH requires a redefinition of forest, land, and wildlife use by different stakeholders, such as farmers, hunters, tourists, ecologists, or local authorities (Bouwen & Taillieu, 2004). When the attachment of one stakeholder such as farmers is stronger with farming practice, negotiating to redefine land use becomes conflictual but significant in achieving consensus at the end of the process. Bouwen and Taillieu (2004) suggest that, for sustainable natural resource management, agreeing upon the ground rules, such as roles of participants, scope of participants, and processes to convene multi-stakeholder meetings is important. Making choices about how to set bounds on a particular community or a set of communities in formulating a CBTH may be controversial and sabotage the negotiating process (Lebel et al., 2008).

2.4 Collaborative Process

The community-based trophy hunting is a collaborative process which evolve in multiple inter-dependent stages (W. M. Adams & Hulme, 2001; IUCN, 2012; Khan, 2012; Krug, 2001; Lebel et al., 2008; Mayaka et al., 2005; Paudyal et al., 2017; Taylor, 2009). These stages can be further classified into distinct steps which are generic in nature but each of them are specific to different circumstances depending on the nature of the case. In figure 2.3, we explain the components of the community-based conservation programs characterized by trophy hunting initiatives in line with the Ansell and Gash model in light of the existing literature.

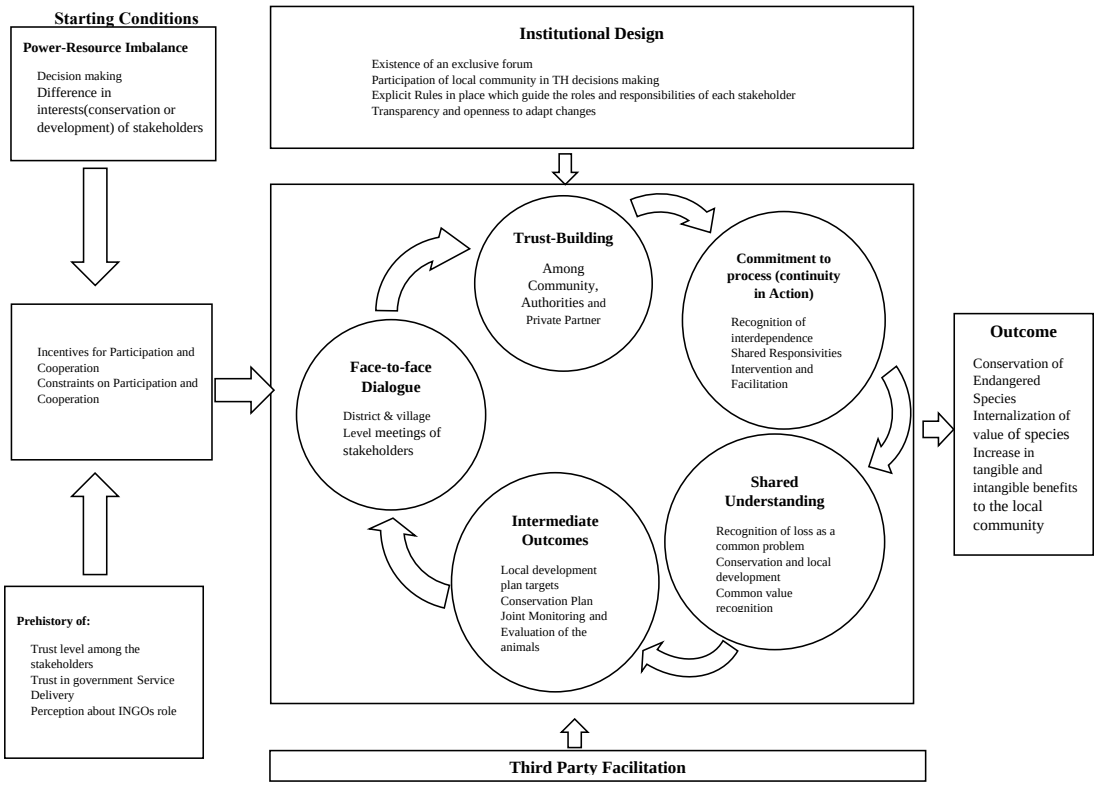


Figure 2.3: Collaborative Governance Model for CBTH (Adopted from Ansell and Gash, 2008)

2.4.1 Face-to-Face Dialogue among stakeholders

All collaborative governance types require face-to-face dialogue among stakeholders. However, Ansell and Gash (2008) argue that face-to-face dialogue itself does not always lead to collaboration. It can reinforce stereotypes or increase antagonism. In most of the community based conservation programs, face-to-face communication and dialogue between the local people, government authorities and the private partners plays significantly important role however, it does not necessarily guarantee successful conservation outcomes (Balint & Mashinya, 2006; Bunge-Vivier & Martínez-Ballesté, 2017; Chabwela & Haller, 2010; Damm, 2008; Frost & Bond, 2008; German & Keeler, 2009; Lindsey et al., 2007; Newig & Fritsch, 2009; Ostrom, 2008). Since, differences of opinions and perception about the ways in which conservation and development strate-

gies are formulated and adopted, exist in common pool related problem, therefore, sitting together around one table increase the chances of consensus (Khan, 2012). Although not sufficient condition, face-to-face dialogue improves better communication and decision making environment such as between government authorities, local community representatives and actors as well as private agency or partner particularly in contexts where the prehistory is dominated by conflicts (Ansell & Gash, 2008; Ostrom, 2008). According to Frost and Bond (2008), participation and the sense of ownership of marginal groups within community was highly enhanced when face-to-face dialogue and discussions held at multiple decision making occasions. Not only mere participation, studies also show discussion with local people and their representatives help build confidence and skills which are critical for the success of the negotiation process. However, the success of such discussion again depends on the available leadership as well as commitment to the process which are equally important for the collaborative process.

The decline of a promising CBNRM in Mahenye, Zimbabwe reflects huge gap in direct communication between the local people and the committee chiefs who were undemocratically imposed on them (Balint & Mashinya, 2006). This gap consequently resulted into the breaking of participatory system which was crucial for the success of conservation program. Another study on participatory collective action in the Kafue Flats, Zambia shows the local institutions regulating the common good were strengthened through discussion among local stakeholders (Chabwela & Haller, 2010). The basic idea of such discussion is to empower those who perceive limited role in decision making despite having differences of opinion about the mechanism.

While, literature on failed community conservation projects frequently attribute lack of communication as the main factor that reduce confidence, successful projects clearly indicate the role of open dialogue and communication (Balint & Mashinya, 2006; Chabwela & Haller, 2010). For example, despite

local people were not even aware of their rights, and had little confidence in the government, sitting around the same table with district authorities highly contributed in overcoming the communication barrier between the government and local people in Northern Pakistan (Khan, 2012). As an important step towards sustainable collaboration, we present the following proposition:

(5) Coupled with other parallel measures such as government service delivery, economic incentives etc, face-to-face meetings of the local community representatives with government officials or private partner will positively influence CBTH.

2.4.2 Commitment to Collaboration

The degree of stakeholders' commitment to the collaborative process can influence the CBTH through mutual recognition and joint appreciation. In many cases in developing countries, CBTH or CBNRM starts with the funding from international organizations through a formal proposal. In some cases such as the Northern Pakistan, the role of local people in formulating the contents of CBTH from the beginning is limited due to requirement of funding proposals. Despite such limitations, local people might still agree on some bounded objects of negotiation. These include, commitment of delivery of revenues (or benefits) from trophy hunting to the community welfare works that people expect, becoming part of the implementation mechanism specially when there is employment opportunities and performance of government authorities.

In Northern Pakistan case, the IUCN and Agha Khan Rural Support Program (AKRSP) suggested to the government the feasibility of a community-based natural resource management. Later, after the proposal for project funding submitted by IUCN to Global Environmental Facility (GEF) through United Nations Development Program (UNDP) got accepted, the local people were invited to the negotiation process where they cooperated in designing the ground rules for

setting up objectives of collaboration (GEF, 2011). Analysis of this project documents reveals a well-designed framework that gives more control to local people and empower their capacity to conserve natural resource, while equally showing strong commitment on the continuity of the project. Other studies point to the weak commitment by the central government agencies in continuing the CBTH process as a problem (Balint & Mashinya, 2006).

Commitment however depends on existing trust among stakeholders and transparency in procedures that establish the integrity for negotiation. Initiatives that seek increasing involvement of local communities can create a sense of commitment and ownership among local people that in turn overcome any power imbalances or differences of perceptions (Andrade & Rhodes, 2012). Ansell and Gash (2008) argue that despite a collaborative governance is mandated, lack of incentive to participate might be translated as lack of real commitment on the part of stakeholders. In the context of CBTH, a number of studies consider sustained commitment among stakeholders towards effective implementation of conservation plans as an important part of the collaborative process (W. B. Adams, 2013; Frost & Bond, 2008; Nagendra & Ostrom, 2012; Wijnstekers, 2011). Our analysis of relevant CBTH cases suggest that community's belief about government commitments to ensure equitable implementation always matter. For example in one case, two-thirds of those who knew that the government has passed a new land law, doubted the government's commitment in ensuring its equitable implementation (Soto, Munthali, & Breen, 2001). Although, the consensus- oriented governance greatly reduces the risks for stakeholders' commitment, the CBTH still needs willingness to accept the outcomes of deliberation, even if they do not go in line with stakeholder's full interest.

(6) A strong commitment demonstrated by stakeholders specially government and NGOs can win the cooperation of local community despite any limitation during the initiation of the CBTH.

2.4.3 Shared Understanding

With regard to developing a shared understanding, the context of CBTH differs from other collaborative programs. Ansell and Gash (2008) argue the creation of shared understanding about collective achievement at some point during collaboration. This might happen in those CBTH cases, where community is engaged from the beginning, however, in general, CBTH programs vary in the level of understanding between community and government or NGOs. Initially, local community perceives the outcome of collaboration as economic incentive and livelihood given the socio-economic conditions of the society and their attachment to natural resource. At the same time, intervention organization or governments' aims differ as their primary objective is environmental conservation. A recent study undertaken in Central Karakoram National Park, Pakistan by Imran et al. (2014) examined the differences in opinions about environmental objectives among four stakeholders associated with protected area. The study finds opinions of the stakeholders towards environmental objectives closely linked to their incentives. This indicates that despite differences in opinions, local community might develop understanding with government and international organizations if they agree on collective actions that embody incentives for local community. Several factors might influence local community perception about the natural resource conservation. These include, the history of conservation in the area, awareness of community about environmental concerns and benefits to the local community (Ormsby & Kaplin, 2005). Moreover, effective communication among stakeholders may help in developing shared understanding among stakeholders.

2.4.4 Intermediate Outcomes

Concrete, intermediate, "small wins" from collaboration represent not only tangible outputs, but also critical process outcomes that can feed back into a vir-

tuous collaborative circle of trust building and commitment (Ansell & Gash, 2008). Intermediate outcomes may not be helpful for trust building where stakeholders have more ambitious goals that cannot easily be parsed into small wins (Vangen & Huxham, 2003). Ansell and Gash (2008) even posit that a collaborative path should not be pursued by stakeholders when prior antagonism between stakeholders is high that requires long-term commitment to trust building and small wins are not expected. Intermediate outcomes in CBTH cases include local level development or conservation plans or spending of initial external funding on conservation related expenditures (Bunge-Vivier & Martínez-Ballesté, 2017; Shackleton, 2001; Wijnstekers, 2011). Continuity in these small wins are crucial for long term sustainability of the CBTH process. For example, in Northern Pakistan, the community as well as government anticipated intermediate wins such as the successful distribution of trophy revenue through village development plan and establishment of local monitoring team which looked after the animals (Khan, 2012). This crucially increased the long term commitment and cooperation among stakeholders. Despite conservation being main objective of IUCN, showing positive performance on small wins was necessary for long term success. We thus conclude that:

(7) Intermediate outcomes that create short-term tangible gains (for community) are crucial for building a momentum that can lead to successful CBTH process.

2.5 Factors Affecting the Outcomes of CBTH Programs

We extend the Ansell and Gash (2008) model to the next step of what determines the success or failure of community-based trophy hunting programs in developing countries. We apply core components of the model from starting conditions to the process completion in the context of CBTH and further explore condi-

tions under which a collaborative process may achieve conservation outcomes. Based on case studies of CBTH, we derive the following key factors influencing the outcome of CBTH programs.

2.5.1 Inclusiveness of Design

The success of community based conservation initiatives highly depends on the nature(inclusiveness) of the basic rules and protocols that provide procedural legitimacy and govern the whole process smoothly (Aheto et al., 2016; Baker, 1997; Bunge-Vivier & Martínez-Ballesté, 2017; Chabwela & Haller, 2010; IUCN, 2012; Khan, 2012; Nagendra & Ostrom, 2012; NASCO, 2010; Newig & Fritsch, 2009; Ostrom, 2009). These basic rules and protocols are collectively referred to institutional designs that allow (or obstruct) the inclusion of certain members of community through certain rules.

An inclusive institutional design ensure the opportunity for each stakeholder to deliberate with others about setting objectives for achieving policy outcomes through consensus (A. Hoole & Berkes, 2010; Mir, 2006; Shackleton, 2001). In such deliberative designs, there are more chances that indigenous knowledge and skills are incorporated which increases shared understanding of each stakeholder on the common good use (Natcher & Hickey, 2002; Redpath et al., 2013; Seixas & Berkes, 2010). Also non-inclusive representation of one or many stakeholders might lead to vicious cycle by increasing the power imbalance and knowledge gap (Aheto et al., 2016). Hence, an inclusive institutional designs should fulfill at least two important requirements. First, it must allow local people to possess property rights of resource use; secondly, it should enable local people to construct local level institutions that control the use of the resource, distribution of benefits and redressal of complaints arising during the use of the resources etc. In a study of five forests in Uganda, Banana and Gombya-Ssembajjwe (2000) find the condition of forests better in areas where property rights are well known and enforced than in those areas where national laws lack enforcement.

We thus argue that if explicit rules are in place which guide the roles and responsibilities of each stakeholder in a way that is inclusive and does not discriminate (or exclude) one stakeholder, then participatory process of the CBTH will be more sustainable in terms of participation and outcomes. We thus present the following proposition:

(8) If the existing institutional structure allows the creation of ground rules and basic protocols for collaboration that is inclusive and open to change, the CBTH is likely to be sustainable.

2.5.2 Defined Rules and Procedures

Existence of clearly defined laws, regulations and procedures developed with local community inputs and which are periodically reviewed and updated, can influence the success of CBTH programs. The key principles for successful CBTH programs as suggested by IUCN include a transparent government framework characterized by clear allocation of responsibilities, accounting for revenues in a transparent manner and distribution as per agreements, taking steps to eliminate corruption and ensuring compliance with all national and international requirements and regulations by relevant bodies such as administrators, regulators and hunters (IUCN, 2012). A case study by Gibson and Becker (2000) reflects a strong local community in Western Ecuador which failed to protect its forest and wild animals from illegal hunting despite the positive valuation of the tropical forests and secured property rights and a rich history of (other) micro-institutions. The same study finds that rules have had a direct impact on the condition of forest degradation and its related resources such as wildlife.

2.5.3 Conflict Resolution Mechanism

Whether CBTH programs result into successful outcomes depends on the way in which conflicts and deadlocks among the stakeholders are resolved. We find a

considerable number of cases where conflicting opinions have reduced commitment and hindered the implementation of community-based conservation programs (Nagendra & Ostrom, 2012; Redpath et al., 2013; Schumann, 2001; Taylor, 2009). A detailed study enlisting numerous failure cases by Chabwela and Haller (2010) indicates that conflicts between authorities and the local people over wildlife resource use have exacerbated the differences and resulted into failure. Studies also show a strong influence of economic incentives on conflict resolution in community based conservation programs. In Northern Pakistan, where perceived inadequate opportunities for income generation was observed as a main reason for lack of participation in environmental protection, local people were ready to conserve environment on the condition of incentives provision (Imran et al., 2014)

2.5.4 Capacity of Government Machinery

We note multiple cases of CBTH programs where uncertain behavior of government authorities and lack of decision making capacity related to community based conservation influence the morale of community participation that ultimately lead to failure in conservation (Balint & Mashinya, 2006; German & Keeler, 2009; A. F. Hoole, 2010; Khan, 2012). For example one conservation study highlights lack of clarity on key decisions among local officials which resulted into severe limits on benefits to local communities and effectively decreased their role in governance (A. Hoole & Berkes, 2010). In a case study of Central Karakoram National Park Pakistan, one view is quoted as: "We are ready to manage the pastures to conserve them but we wouldn't like the government to tell us that we have no use rights in the Park" (Imran et al., 2014)[P.296]. CBTH does not necessarily means that the community has been given full decision making power. For example, some community members still perceive that decision-making powers (other than fund distribution) lie with government-controlled departments. CBTH programs have been frequently halted due to

situations where government agency does not have the capacity(e.g knowledge, training etc), organization(e.g. skilled human resource), status(e.g. legislation), or resources to participate(e.g to initially finance the project), or to participate on an equal footing with other stakeholders (Bunge-Vivier & Martínez-Ballesté, 2017; Folke et al., 2005).

2.6 Conclusion

The governance structure of community-based trophy hunting programs can be framed as a form of collaborative governance that involve multiple stakeholders in the management of common pool resources. By conducting a detailed review on 80 published case studies, we develop contingency propositions that help practitioners and governments to understand and implement projects that seek environmental conservation in collaboration with local communities.

We identify four factors that may interplay to affect the incentive to participate in community based conservation programs particularly CBTH. These include interdependence of stakeholders, power imbalance, prehistory of antagonism (level of distrust), and potential tangible benefits. We argue that for, CBTH to be considered by government as an alternative mechanism to conventional top-down, approach, such as strictly protected areas, and proposed to local communities, interdependence between government and local communities should exit. We also argue that, despite the uncertainty of effectiveness of community-based conservation from the beginning, due to pre-history of conflicts, governments rely upon bottom-up approach that utilize the efforts of local communities in conserving wildlife rather than ineffective command-and-control policies. On the other hand, local communities cooperate and participate in CBTH due to power-imbalance between strong governments and weak communities who neighbor or live closely with wildlife animals.

Drawing on the country specific cases of CBTH programs, we further argue

that even if there are prehistory of conflict, lack of trust, and power imbalance between community and government, facilitative third parties, such as local or international conservation NGOs can play critical roles in initiating and maintaining CBTH. Since CBTH requires a redefinition of forest, land, and wildlife use by different stakeholders, therefore it is critical to have participation of a broad spectrum of stakeholders during collaborative process.

The key components of community based trophy hunting programs include, face-to-face dialogue between community, governments and international organizations, mutual trust building, commitment to collaboration, shared understanding of the environmental concerns and livelihood goals and achievement of intermediate outcomes. We finally identify factors affecting CBTH program's process that determine the outcomes of CBTH programs. These include, but are not limited to, inclusiveness of design, clearly defined rules, conflict resolution mechanisms and capacity building of government authorities.

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APPENDIX B

Community Based Conservation and Trophy Hunting Cases

S.No	Community-Based Programs	Country	Year	Mammals/Birds	Funding Organization	Publication Reference
1	Pendjari National Park: A protected area benefitting local communities in Benin	Benin	1986	Ion, African Elephant, Buffalo and Leopard	GTZ and KWF	IUCN(2011), A protected area benefitting local communities in Benin. https://www.iucn.org/ru/node/8509?amp;=
2	Pendjari national park (PNP) in Benin	Benin	1993	Roan Antelope, Western Hartebeest, Western Kob, Buffalo	Government	(1) Idrissou, L., van Paassen, A., Aarts, N., Vodouhè, S., & Leeuwis, C. (2013). Trust and hidden conflict in participatory natural resources management: The case of the Pendjari national park (PNP) in Benin. Forest Policy and Economics, 27, 65-74. (2) Vodouhê, F. G., Coulibaly, O., Adégbidi, A., & Sinsin, B. (2010). Community perception of biodiversity conservation within protected areas in Benin. *Forest Policy and Economics*, *12*(7), 505-512.
3	Communal Forests Management Support Project in Benin	Benin	2008	Small Antelopes And Small Game Species.	African Development Fund	https://www.afdb.org/fileadmin/uploads/afdb/Documents/Project-and-Operations/Benin_-_Communal_Forests_Management_Support_Project_PAGEFCOM_-_Appraisal_Report.pdf. (Access date: August, 2018)
4	Governing Biodiversity and Livelihoods around the W National Parks of Benin and Niger	Benin And Niger	1990	Elephants, Ungulates, Western Topi, The Cheetah, West African Manatee	WB & UNDP and German Aid(30% revenues go to the village organization)	Miller, D. C. (2013). *Conservation legacies: governing biodiversity and livelihoods around the W National Parks of Benin and Niger* (Doctoral dissertation, University of Michigan).
5	Jigme Singye Wangchuck National Park	Bhutan	1993	Tigers (Panthera Tigris), Leopards (Panthera Pardus), Red Panda (Alurus Fulgens), Gaur (Bos Gaurus), Golden Langur (Presbytis Geei)	Government	(1) Wang, S. W., & Macdonald, D. W. (2006). Livestock predation by carnivores in Jigme Singye Wangchuck National Park, Bhutan. *Biological Conservation*, *129*(4), 558-565. (2) Wang, S. W., Lassoie, J. P., & Curtis, P. D. (2006). Farmer attitudes towards conservation in Jigme Singye Wangchuck National Park, Bhutan. *Environmental Conservation*, *33*(2), 148-156.
6	Jigme Singye Wangchuck National Park, Bhutan	Bhutan	1996	Leopard, Tiger, Himalayan Black Bear Dhole	Government	Wang, S. W., & Macdonald, D. W. (2006). Livestock predation by carnivores in Jigme Singye Wangchuck National Park, Bhutan. *Biological Conservation*, *129*(4), 558-565.
7	Community-Based Natural Resource Management And Tourism: Nata Bird Sanctuary, Botswana	Botswana	1993	**Birds:** Kingfishers, Eagles, Bustards, Ostriches and Numerous Woodland Bird Species **Mammals:** Hartebeest, kudu, reedbuck, Springbok, springhares, jackals, foxes, eland, gemsbok, Zebras, monkeys, and squirrels	Government	(1) Stone, M. T., & Rogerson, C. M. (2011). Community-based natural resource management and tourism: Nata bird sanctuary, Botswana. Tourism Review International, 15(1-2), 159-169. (2) Stone, M. T., & Nyaupane, G. (2014). Rethinking community in community-based natural resource management. *Community Development*, *45*(1), 17-31.
8	Community-based Natural Resource management Programme in Western Botswana(Kalahari and Okwa Wildlife management areas)	Botswana	1986	Elephant, Giraffe Mountain Zebra, Dik-dik, Black-faced Impala,	Government	Twyman, C. (2000). Participatory conservation? Community-based natural resource management in Botswana. *The Geographical Journal*, *166*(4), 323-335.

9	The Chobe Enclave Community Trust, a community living adjacent to Chobe National Park in Botswana	Botswana	1984	Elephant	WWF + Government	Stone, M. T. (2015). Community-based ecotourism: A collaborative partnerships perspective. *Journal of Ecotourism*, *14*(2-3), 166-184.
10	Okavango Delta community trust based conservation	Botswana	2014	Cheetah, White Rhinoceros, Black Rhinoceros, African Wild Dog and Lion	UNESCO	State Of Conservation Report Okavango Delta Natural World Heritage Site, Botswana , 2015
11	Case study on the Okavango Community Trust(OCT), Okavango Kopano Mokoro Community Trust(OKMC), and Khwai Development Trust(KDT) in Botswana	Botswana	1997, 1998, and 1999	Elephant, African Buffalo, Hippopotamus, Lechwe, Topi, Blue Wildebeest, Giraffe, Lion, Cheetah, Leopard, Sable Antelope, Black Rhinoceros, White Rhinoceros,	Government	Mbaiwa, J. E. (2005). Wildlife resource utilisation at Moremi Game Reserve and Khwai community area in the Okavango Delta, Botswana. Journal of Environmental Management, 77(2), 144-156.
12	Sankuyo Tshwaragano Manage ment Trust (STM T)	Botswana	1995	Oryx Gazelle , Eland Taurotragus Oryx	NGO	Barnett, R., & Patterson, C. (2006). Sport hunting in the Southern African Development Community (SADC) region: an overview. TRAFFIC East/Southern Africa, Johannesburg, South Africa.
13	Khwai Development Trust (KDT)	Botswana	2000	Oryx Gazelle , Eland Taurotragus Oryx	NGO	Barnett, R., & Patterson, C. (2006). Sport hunting in the Southern African Development Community (SADC) region: an overview. TRAFFIC East/Southern Africa, Johannesburg, South Africa.
14	Nqwaa KhobeeXeya Trust (NKXT)	Botswana	1998	Oryx Gazelle , Eland Taurotragus Oryx	NGO	Barnett, R., & Patterson, C. (2006). Sport hunting in the Southern African Development Community (SADC) region: an overview. TRAFFIC East/Southern Africa, Johannesburg, South Africa.
15	Conservation and development alliances with the Kayapó of south-eastern Amazonia, a tropical forest indigenous people	Brazil	1992	Tayassu Pecari, Pteronura Brasiliensis, Priodontes Maximus, Panthera Onca	Conservation International do Brasil (CI-Brasil)	Zimmerman, B., Peres, C. A., Malcolm, J. R., & Turner, T. (2001). Conservation and development alliances with the Kayapó of south-eastern Amazonia, a tropical forest indigenous people. Environmental Conservation, 28(1), 10-22.
16	Kayapo Indigenous Area	Brazil	1990	Geochelone Tortoises, A'Ukre	Government	Peres, C. A., & Nascimento, H. S. (2006). Impact of game hunting by the Kayapó of south-eastern Amazonia: implications for wildlife conservation in tropical forest indigenous reserves. *Biodiversity & Conservation*, *15*(8), 2627-2653.
17	Lobeke National Park	Cameroon	1975	Elephants, Buffellos, and low land Gorillas	WWF	Usongo, L., & Nkanje, B. T. (2004). Participatory approaches towards forest conservation: the case of Lobéké National Park, south east Cameroon. *The International Journal of Sustainable Development & World Ecology*, *11*(2), 119-127.
18	Participatory Forest Conservation and Sustainable Livelihoods: Banyang-Mbo Wildlife Sanctuary	Cameroon	1996	Forest Elephants	Government	Nkembi, L. N. (2003, September). Participatory forest conservation and sustainable livelihoods: Banyang-mbo wildlife sanctuary. In *XII World Forestry Congress* (pp. 21-28).
19	The influence of institutions on access to forest resources in Cameroon: The case of Tofala Hill Wildlife Sanctuary	Cameroon	2014	Africa's Most Threatened Great Ape, The Cross River Gorilla	Fauna & Flora International (FFI)	Nkemnyi, M. F., De Herdt, T., Chuyong, G. B., & Vanwing, T. (2016). The influence of institutions on access to forest resources in Cameroon: The case of Tofala Hill Wildlife Sanctuary. *Journal for nature conservation*, *34*, 42-50.
20	The case of Lobeke National Park, South east Cameroon: Participatory approaches towards forest conservation:	Cameroon	2006	Loxodonta Africana Cyclotis , Western Lowland Bongos and Buffaloes	WWF & GTZ	Usongo, L., & Nkanje, B. T. (2004). Participatory approaches towards forest conservation: the case of Lobéké National Park, south east Cameroon. The International Journal of Sustainable Development & World Ecology, 11(2), 119-127.
21	Wildlife co-management in the Bénoué National Park-Complex, Cameroon: A bumpy road to institutional development	Cameroon	1993	Cameroon Lions, Elephants, Spotted Hyena, Water Buck, Warthog	Government & WB	Mayaka, T. B. (2002). Wildlife co-management in the Bénoué National Park-Complex, Cameroon: A bumpy road to institutional development. World Development, 30(11), 2001-2016.
22	Local perceptions of Waza National Park, northern Cameroon	Cameroon	1993	Antelope And Monkey Species, Elephant , Lion , Hyena, and A Diverse Avifauna	IUCN	Bauer, H. (2003). Local perceptions of Waza National Park, northern Cameroon. Environmental Conservation, 30(2), 175-181.
23	Understanding the Links Between Conservation and Development in the Bamenda Highlands, Cameroon	Cameroon	1987	The Primate Preuss' Guenon, Coopers Mountain Squirrel	BirdLife International	Abbot, J. I., Thomas, D. H., Gardner, A. A., Neba, S. E., & Khen, M. W. (2001). Understanding the links between conservation and development in the Bamenda Highlands, Cameroon. World Development, 29(7), 1115-1136.
24	Dzanga-Sangha Special Reserve	Central African Republic	1990	Blue Duiker *Cephalophus Monticola* And The Bay Duiker *Cephalopus Dorsalis*	Government	Noss, A. J. (1998). The impacts of BaAka net hunting on rainforest wildlife. *Biological conservation*, *86*(2), 161-167.
25	Zones Cynégétiques Villageoises (ZCV) are community hunting reserves	Central African Republic	1992	Elephants, Old World monkeys, Patas monkey, Hominoidea	Government	Mbitikon, R. (2004). Village hunting zones: an experiment of community-based natural resource management in the Central African Republic. Game & Wildlife Science, 21(3), 217-226.
26	A case study of Trophy hunting in western china	China	1997	Argali Ovis Ammon	Government	Harris, R. B., & Pletscher, D. H. (2002). Incentives toward conservation of argali Ovis ammon: a case study of trophy hunting in western China. Oryx, 36(4), 373-381.
27	Xishuangbanna Nature Reserve	China	1961	Asiatic Elephant (Elephas Maximus), Indo-Chinese Tiger (Panthera Tigris), Gaur	Government, UNESCO	Albers, H. J., & Grinspoon, E. (1997). A comparison of the enforcement of access restrictions between Xishuangbanna Nature Reserve (China) and Khao Yai National Park (Thailand). *Environmental Conservation*, *24*(4), 351-362.

28	Community-based natural resource management Practice in the Cardamom Mountains, Cambodia(Phnom Samkos Wildlife Sanctuary (PSWS))	Combodia	2000	Wild Animal(not specified	INGO	CASCIO, A. L., & Beilin, R. (2010). Of biodiversity and boundaries: a case study of community-based natural resource management practice in the Cardamom Mountains, Cambodia. Environmental Conservation, 37(3), 347-355.
29	A case study from the Saint Katherine Protectorate, Southern Sinai, Egypt	Egypt	1996	Sinai Leopard, Nubian Ibex, Dorcas Gazelles	Global Environmental Facility (GEF)	Grainger, J. (2003). 'People are living in the park'. Linking biodiversity conservation to community development in the Middle East region: a case study from the Saint Katherine Protectorate, Southern Sinai. Journal of arid environments, 54(1), 29-38.
30	St Katherine Protectorate	Egypt	1990	Red Fox, Sinai Leopard, Nubian Ibex	Government	Grainger, J. (2003). 'People are living in the park'. Linking biodiversity conservation to community development in the Middle East region: a case study from the Saint Katherine Protectorate, Southern Sinai. *Journal of arid environments*, *54*(1), 29-38.
31	Indigenous Common Property Resource System In The Guassa area of Menz	Ethiopia	1975	Ethiopian Wolf(Canis Simensis),	Government	Ashenafi, Z. T., & Leader-Williams, N. (2005). Indigenous common property resource management in the Central Highlands of Ethiopia. Human Ecology, 33(4), 539-563.
32	Community natural resource management: the case of woodlots in Northern Ethiopia	Ethiopia	1991	No Specified	Government	Gebremedhin, B., Pender, J., & Tesfay, G. (2003). Community natural resource management: the case of woodlots in northern Ethiopia. Environment and Development Economics, 8(1), 129-148.
33	Law, custom and community-based natural resource management in Kubulau District (Fiji)	Fiji	2005	Marine Animals and Terrestrial Animals	Government	Clarke, P., & Jupiter, S. D. (2010). Law, custom and community-based natural resource management in Kubulau District (Fiji). Environmental Conservation, 37(1), 98-106.
34	Western Community based Natural Resource Management in Ghats in southern India and Meghalaya state in north-eastern India,	India	1980	Actinodaphne Lawsonii ,Hopea Ponga, Madhuca	Not specified	Ormsby, A. A., & Bhagwat, S. A. (2010). Sacred forests of India: a strong tradition of community-based natural resource management. Environmental Conservation, 37(3), 320-326.
35	Community-based natural resource management and power in Mohammed Nagar village, Andhra Pradesh, India	India	1990	No Specified	Government	Saito-Jensen, M., Nathan, I., & Treue, T. (2010). Beyond elite capture? Community-based natural resource management and power in Mohammed Nagar village, Andhra Pradesh, India. Environmental Conservation, 37(3), 327-335.
36	Nanda Devi Biosphere Reserve	India	1990	Snow Leopard (*Panthera Uncia*), Brown Bear (*Ursus Arctosisbellinus*	Government	Maikhuri, R. K., Nautiyal, S., Rao, K. S., & Saxena, K. G. (2001). Conservation policy–people conflicts: a case study from Nanda Devi Biosphere Reserve (a world heritage site), India. *Forest Policy and Economics*, *2*(3-4), 355-365.
37	Kalakad Mundanthurai Tiger Reserve	India	2000	Tiger (Panthera Tigris), The Asian Elephant (Elephas Maximus)	Government	Arjunan, M., Holmes, C., Puyravaud, J. P., & Davidar, P. (2006). Do developmental initiatives influence local attitudes toward conservation? A case study from the Kalakad–Mundanthurai Tiger Reserve, India. *Journal of environmental management*, *79*(2), 188-197.
38	Gir National Park	India	1992	Asiatic Lions	GEF	Mukherjee, A., & Borad, C. K. (2004). Integrated approach towards conservation of Gir National Park: the last refuge of Asiatic Lions, India. *Biodiversity & Conservation*, *13*(11), 2165-2182.
39	Masoala National Park, Madagascar	Madagascar	1993	Red-Ruffed Lemur, Madagascar Serpent Eagle, Madagascar Red Owl, Helmet Vanga, Leaftailed Gecko	Several NGOs	Ormsby, A., & Kaplin, B. A. (2005). A framework for understanding community resident perceptions of Masoala National Park, Madagascar. Environmental Conservation, 32(2), 156-164.
40	A Case Study of Batang Ai National Park, Sarawak, Malaysia	Malaysia	1991	Orangutans (Pongo Pygmaeus)	Government	Horowitz, L. S. (1998). Integrating indigenous resource management with wildlife conservation: a case study of Batang Ai National Park, Sarawak, Malaysia. Human Ecology, 26(3), 371-403.
41	community based wildlife hunting management of in the Gulzat Local Protected Area of northwest Mongolia	Mongolia	2010	Altai Argali	Government+WWF	https://www.iucn.org/downloads/iucn_informingdecisionsontrophyhuntingv1.pdf
42	Mitigation of negative human impacts on large carnivore populations in Niassa National Reserve, northern Mozambique	Mozambique	2003	Lion, Leopard, Spotted Hyaena and African Wild Dog	NGO	Begg, C., & Begg, K. (2009). Niassa carnivore project. Produced for SRN, Maputo.
43	The Koakoveld Community based Conservation Project(Kunene region)	Namibia	1982	Elephant, Black Rhino, Giraffe, Plains And Mountain Zebra, Kudu, Gemsbok, Impala, Springbok, Duiker, Steenbok, Klipspringer	WWF/IUCN +Local NGO	Kiss, A. (2004). Is community-based ecotourism a good use of biodiversity conservation funds? *Trends in ecology & evolution*, *19*(5), 232-237.
44	Ehi-rovipuka Conservancy under a national Community-Based Natural Resource Management Programme (CBNRM) that	Namibia	1990	Elephant, Springbok, Oryx, and Kudu	government funded	Hoole, A., & Berkes, F. (2010). Breaking down fences: Recoupling social–ecological systems for biodiversity conservation in Namibia. *Geoforum*, *41*(2), 304-317.

45	Community-based Natural Resource Management project in Kunene Region of Namibia	Namibia	1994	Hartmann's Mountain Zebra, Black Rhino	Namibian NGO	Jones, B. T. (1999). Policy lessons from the evolution of a community-based approach to wildlife management, Kunene Region, Namibia. Journal of International Development: The Journal of the Development Studies Association, 11(2), 295-304.
46	Caprivi Communal Conservancy	Namibia	1980	Elephant, Black rhino, Giraffe, plains and mountain zebra, Kudu,	DFID	Bandyopadhyay, S., Guzman, J.C. & Lendelvo, S. (2010) Communal Conservancies and household welfare in Namibia. Ministry of Environment and Tourism, Windhoek, Namibia
47	Torra conservancy COmmunity based Natural resource Management	Namibia	1998	Elephant, Black Rhino, Lion, Leopard, Cheetah, Hyaena, Giraffe, Mountain Zebra, Springbok, Oryx and Kudu	Government +NGO	Scanlon, L. J., & Kull, C. A. (2009). Untangling the links between wildlife benefits and community-based conservation at Torra Conservancy, Namibia. Development Southern Africa, 26(1), 75-93.
48	Conservation activities in Kaokoveld Namibia	Namibia	1983	Elephant, Black Rhino, Lion, Leopard, Cheetah, Hyaena,	IRDNC - WWF	Holmes, T. (1992). Conservation activities in Kaokoveld (north-west Namibia). Biodiversity & Conservation, 1(3), 211-213.
49	Communal and freehold rangelands in the Waterberg region of north-central Namibia	Namibia	2000	Oryx Gazelle , Eland Taurotragus Oryx	No specified	Kauffman, M. J., Sanjayan, M., Lowenstein, J., Nelson, A., Jeo, R. M., & Crooks, K. R. (2007). Remote camera-trap methods and analyses reveal impacts of rangeland management on Namibian carnivore communities. Oryx, 41(1), 70-78.
50	Impacts of community-based conservation on local communities in the Annapurna Conservation Area, Nepal	Nepal	1989	Rhesus Macaque, Himalayan Black Bear, Barking Deer, Leopard And Porcupine	King Mahendra Trust for Nature Conservation (KMTNC)--NGO	Bajracharya, S. B., Furley, P. A., & Newton, A. C. (2006). Impacts of community-based conservation on local communities in the Annapurna Conservation Area, Nepal. Biodiversity & Conservation, 15(8), 2765-2786.
51	Annapurna Conservation Area (ACA)	Nepal	1996	Not Specified	Government	Baral, N., & Stern, M. J. (2010). Looking back and looking ahead: local empowerment and governance in the Annapurna Conservation Area, Nepal. Environmental Conservation, 37(1), 54-63.
52	Annapurna Conservation Area	Nepal	1993	Mountain Tigers	Government	Bajracharya, S. B., Furley, P. A., & Newton, A. C. (2006). Impacts of community-based conservation on local communities in the Annapurna Conservation Area, Nepal. *Biodiversity & Conservation*, *15*(8), 2765-2786.
53	Mountain Areas Conservancy Project Chitral Region- Pakistan	Pakistan	1999	Markhor and Ibex trophies	UNDP & GEF	Mir, A. (2006). Impact assessment of community based trophy hunting in MACP areas of NWFP and Northern Areas. *Report for the Mountain Area Conservancy Project, IUCN Pakistan*.
54	The Torghar conservation project: management of the livestock, Suleiman markhor (Capra falconeri) and Afghan urial (Ovis orientalis) in the Torghar Hills	Pakistan	1986	Suleiman Markhor, Capra Falconeri Megaceros, And The Afghan Urial, Ovis Orientalis Cycloceros,	Mainly financed by the sale of trophies. Small grants were provided by the World Wildlife Fund-Pakistan, the Houbara Foundation, Safari Club International and the UNDP	Woodford, M. H., Frisina, M. R., & Awan, G. A. (2004). The Torghar conservation project: management of the livestock, Suleiman markhor (Capra falconeri) and Afghan urial (Ovis orientalis) in the Torghar Hills, Pakistan. *Game and Wildlife Science*, *21*(3), 177-187.
55	Community based Trophy Hunting Program (CTHP)-Northern Areas of Pakistan	Pakistan	1996	Himalayan Ibex, Markhor	WWF-Pakistan & IUCN-Pakistan	Mir, A. (2006). Impact assessment of community based trophy hunting in MACP areas of NWFP and Northern Areas. *Report for the Mountain Area Conservancy Project, IUCN Pakistan*.
56	Khunjerab village Community based Trophy Hunting Organization	Pakistan	1995	Marco-Polo Sheep, Ibex, Blue Sheep, And Snow Leopard	IUCN- Pakistan	Mir, A. (2006). Impact assessment of community based trophy hunting in MACP areas of NWFP and Northern Areas. *Report for the Mountain Area Conservancy Project, IUCN Pakistan*.
57	Community based Conservation and Trophy Hunting of Ibex in Khyber Valley- Northern Pakistan	Pakistan	1990	Ibex	Community Driver Funding(under MACP)	Mir, A. (2006). Impact assessment of community based trophy hunting in MACP areas of NWFP and Northern Areas. *Report for the Mountain Area Conservancy Project, IUCN Pakistan*.
58	Community based Conservation and Trophy Hunting of Ibex in Basho Valley-Northern Pakistan	Pakistan	1995	Ibex	Government Forest Department	Mir, A. (2006). Impact assessment of community based trophy hunting in MACP areas of NWFP and Northern Areas. *Report for the Mountain Area Conservancy Project, IUCN Pakistan*.
59	Community based Conservation and Trophy Hunting in Bunji-Northern Pakistan	Pakistan	1996	Markhor	IUCN	Mir, A. (2006). Impact assessment of community based trophy hunting in MACP areas of NWFP and Northern Areas. *Report for the Mountain Area Conservancy Project, IUCN Pakistan*.
60	Community based Conservation and Trophy Hunting of Blue Sheep in Shimshal Valley Pakistan	Pakistan	1989	Blue Sheep And Ibex	Japanese Government	Mir, A. (2006). Impact assessment of community based trophy hunting in MACP areas of NWFP and Northern Areas. *Report for the Mountain Area Conservancy Project, IUCN Pakistan*.
61	Community based trophy hunting in Tooshi-Shasha Conservancy in Pakistan	Pakistan	1995	Markhor	Government +WWF	Ali, H., Shafi, M. M., Khan, H., Shah, M., & Khan, M. (2018). Socio-economic benefits of community based trophy hunting programs.

62	Community based trophy hunting in Kaigah valley district Kohistan Pakistan	Pakistan	2005	Markhor	Government	Ghafoor, A. (2014). Sustainability of Markhor Trophy Hunting Programme in District Kohistan Pakistan (Doctoral dissertation, Universiti Sains Malaysia).
63	The dual nature of parks: attitudes of neighboring communities towards Kruger National Park,	South Africa	2002	Lion, Leopard, Rhinoceros (Both Black And White Species), Elephant, And Cape Buffalo	Government	(1) Anthony, B. (2007). The dual nature of parks: attitudes of neighbouring communities towards Kruger National Park, South Africa. Environmental Conservation, 34(3), 236-245.
64	Community based conservation of Markhor in Hazratishoh and Darvaz Ranges of Tajikistan	Tajikistan	2004	Markhor	Community based NGO	Alidodov, M., et al., 2014. Survey of markhor at the Hazratishoh and Darvaz Ranges, Tajikistan. State Forestry Agency under the Government of the Republic of Tajikistan, Dushanbe
65	Trophy hunting concessions for Argali and ibex in the Pamirs region in Tajikistan	Tajikistan	2000	Snow Leopard	NGO	Kachel, S.M. 2014. Evaluating the Efficacy of Wild Ungulate Trophy Hunting as a Tool for Snow Leopard Conservation in the Pamir Mountains of Tajikistan. A thesis submitted to the Faculty of the University of Delaware in partial fulfillment of the requirements for the degree of Master of Science in Wildlife Ecology; 87 pp.
66	The Culman Wildlife Project(CWP)	Tanzania	1990	Wildebeest, Zebra, Buffalo and Impala	INGOs	Safaris, Tanzania Game Tracker, and Robin Hurt Safaris. "The Cullman Reward and Benefits Scheme." *This volume* (1996).
67	The Dorobo Tours and Safari Projects	Tanzania	1990	Wildebeest, Gazelle, Zebra	Wildlife Department	Leader Williams, N., Kayera, J. A., & Overton, G. L. (1996). *Community-based conservation in Tanzania; proceedings of a workshop held in February 1994*. IUCN, Gland (Suiza). Species Survival Commission.
68	Oliver's Camp Community Conservation Initiative	Tanzania	1992	Elephant	Wildlife Department	Leader Williams, N., Kayera, J. A., & Overton, G. L. (1996). *Community-based conservation in Tanzania; proceedings of a workshop held in February 1994*. IUCN, Gland (Suiza). Species Survival Commission.
69	TANAPA Community Conservation	Tanzania	1985	Zebra, Wildebeest, Buffalo And Elephant	INGO(African Wildlife Foundation)	Kangwana, K., & ole Mako, R. (1998). *The impact of community conservation initiatives around Tarangire National Park (1992-1997)*. Institute for Development Policy and Management, University of Manchester.
70	Mburo National Park Community Conservation Programme(CCP)	Uganda	1992	Impala Aepyceros Melampus, Eland Taurotragus Oryx And Zebra Equus Burchellii	Government	Infield, M., & Namara, A. (2001). Community attitudes and behaviour towards conservation: an assessment of a community conservation programme around Lake Mburo National Park, Uganda. *Oryx*, *35*(1), 48-60.
71	Kibale Association for Rural and Economic Development (KAFRED)	Uganda	1991	Variety of Primates and Birds	Government	Lepp, A. (2007). Residents' attitudes towards tourism in Bigodi village, Uganda. *Tourism management*, *28*(3), 876-885.
72	Bwindi Impenetrable National Park	Uganda	1991	Mountain Gorillas	Government	Hamilton, A., Cunningham, A., Byarugaba, D., & Kayanja, F. (2000). Conservation in a region of political instability: Bwindi Impenetrable Forest, Uganda. Conservation Biology, 14(6), 1722-1725.
73	A comparison of attitudes toward state-led conservation and community-based conservation in the village of Bigodi	Uganda	1990	Baboons, Buffalos and Elephants	Government	Lepp, A., & Holland, S. (2006). A comparison of attitudes toward state-led conservation and community-based conservation in the village of Bigodi, Uganda. Society and Natural Resources, 19(7), 609-623.
74	Luangua Integrated Resource Development Project(LIRDP	Zambia	1988	Elephant Ivory	Government (Initial Revenue distribution: 40%: Management Cost 35%: Local Community 25%: Government)	Leader Williams, N., Kayera, J. A., & Overton, G. L. (1996). *Community-based conservation in Tanzania; proceedings of a workshop held in February 1994*. IUCN, Gland (Suiza). Species Survival Commission
75	Zambia Wetland Project	Zambia	1986	Elephant Ivory	WWF/IUCN	Chabwela, H., & Haller, T. (2010). Governance issues, potentials and failures of participative collective action in the Kafue Flats, Zambia. *International Journal of the Commons*, *4*(2).
76	Communal Area Management Program for Indigenous Resources (CAMPFIRE)	Zimbabwe	1988	Elephant Ivory, Zebra, Lion,	Government + INGOs (Revenue Distribution benefits to Wards: 50% local community, 15 % government levy & 35% Project Maintenance and promotion)	Child, B. (1996). The practice and principles of community-based wildlife management in Zimbabwe: the CAMPFIRE programme. *Biodiversity & Conservation*, *5*(3), 369-398.
77	Savé Valley Conservancy (SVC)	Zimbabwe	1990	Elephants, Rhinos, Buffalo And Lions	Government	Lindsey, P.A., et. al. 2008. Savé Valley Conservancy: a large scale African experiment in cooperative wildlife management. Pages 163-184
78	Bubye Valley Conservancy (BVC)	Zimbabwe	1996	Lions, African Elephants, African Buffalo, Rhinos	Government	BVC. n.d. Bubye Valley Conservancy. Bubye Valley Conservancy, Zimbabwe. http://bubyevalleyconservancy.com
79	The Cawston Game Ranch in Zimbabwe	Zimbabwe	1990	Plains Zebra, Giraffe, Tsessebe, Common Impala, Bushbuck, Red	Private	Lindsey, P. A., Alexander, R., Frank, L. G., Mathieson, A., & Romanach, S. S. (2006). Potential of trophy hunting to create incentives for wildlife conservation in Africa where alternative wildlife-based land uses may not be viable. Animal Conservation, 9(3), 283-291.
80	Communal Lands in Zambezi Valley of Zimbabwe	Zimbabwe	1991	Guineafowl or Duike	Government	Byers, B. A., Cunliffe, R. N., & Hudak, A. T. (2001). Linking the conservation of culture and nature: a case study of sacred forests in Zimbabwe. Human Ecology, 29(2), 187-218.

CHAPTER 3

TEACHERS' MONITORING AND SCHOOLS' PERFORMANCE: EVIDENCE FROM PUBLIC SCHOOLS IN PAKISTAN

3.1 Introduction

The recently developed "Sustainable Development Goals (SDGs)" emphasize the need for more rigorous efforts through empirical findings that suggest feasible courses of actions to improve teaching quality and children learning achievement (UN, 2018). Despite some success in children enrollment, the overall quality of education especially at primary and secondary levels has remained the lowest in South Asian countries such as Pakistan, India and Bangladesh. Recently, a countrywide survey on educational attainment in India finds 44 percent of the children aged 7–12 years unable to read a basic paragraph, and 50 percent cannot do simple subtraction despite increased school enrollment (A. V. Banerjee, Cole, Duflo, & Linden, 2007). According to Annual Status of Education Report (ASER-Pakistan) which reveals important trends each year covering over 255,000 children from 144 districts, Pakistan continues to be in a state of education emergency and learning lies at the heart of it (ASER, 2016). This is evident from its recent reports showing 52% surveyed children in grade 5 could read at story level dipping from 55% in 2015. Similarly, for English it was 46% (49% in 2015) and for arithmetic, it was 48% in 2016 compared to 50% in 2015. Also, variation in learning level coincides with a shift from government to pri-

vate sector and vice versa across different provinces in the country . In similar circumstances, as A. V. Banerjee et al. (2007) suggest, policies that only increase school enrollment may not guarantee learning outcomes. Recent evidence also support the idea that interventions that only focus on school participation might not improve test scores for the average student (Abdulkadiroğlu, Pathak, & Walters, 2018; Burde & Linden, 2013; Duflo, Glennerster, & Kremer, 2007; Malik et al., 2015; Munene, 2015).

One important component of school environment is the presence of teachers that influence overall performance of children (A. V. Banerjee & Duflo, 2009; Glewwe & Kremer, 2006). Teachers' absence has been a widespread problem in developing countries particularly in far-flung rural areas. Recent studies in education research document evidence that increased absence rate of teachers is strongly related with school and children performance (A. Banerjee & Duflo, 2006; Banerji, Bhattacharjea, & Wadhwa, 2013; Chaudhury, Hammer, Kremer, Muralidharan, & Rogers, 2006; Duflo & Hanna, 2005).

A number of factors can be found responsible for increased absenteeism such as distance from school, lack of appropriate incentives (Scott & Wimbush, 1991), ineffective monitoring (Duflo & Hanna, 2005) and other socio-economic factors (Alcázar et al., 2006). One of the important sources of differential teachers and schools performance is the type of monitoring and administrative oversight of schools and the resulting reward and penalty system. For example resources may be spent on hiring and payment to teachers who are absent from their schools such as the presence of ghost schools (Glewwe & Kremer, 2006). According to ASER (2015), teachers' presence was one of the main factors to account for differences in learning outcomes across public and private schools in Pakistan. Also, there has been increasing focus by practitioners and development researchers on teaching quality and punctuality that has significant direct and indirect effects on children performance (Duflo et al., 2007; Munene, 2015). Literature on teacher's performance indicates that teacher incentives and other

interventions have larger impact in low performance settings (Murnane, Ganimian, et al., 2014). However, considering the high absenteeism in developing countries, incentives alone may not work unless coupled with effective supervision of teaching staff particularly in rural areas. In Pakistan's Punjab province, a public-private partnership program that offered bonuses for teachers, had limited effect on children's test score because such incentives were not effectively linked with students performance (Barrera-Osorio & Raju, 2015). Similarly, incentivizing administrative staff such as headmasters in schools without effective monitoring mechanism may not improve teachers attendance and children learning (Habib, 2015; Kremer & Chen, 2001). With regard to effectiveness of monitoring methods, previous studies suggest different ways of supervision such as strengthening administrative oversight and community-based supervision to ensure better teachers' attendance (Alcázar et al., 2006; Habib, 2015).

Teachers failure to attend schools is mainly due to the lack of capacity of administration(e.g principle) and the beneficiary(children or local community) to monitor and penalize absence (Duflo & Hanna, 2005). Although, the headmasters have power to penalize absence by rules, nevertheless, by virtue of their close relationships with teachers (who generally belong to local community), they are unable to enforce penalty or report absence to higher authorities. Resultantly, higher authorities in governments who are responsible for decision making, lack the real reporting of data from far-flung rural areas or get manipulated records about schools and teachers presence.

A number of reforms initiatives have been proposed for developing countries that can maximize the quality of learning of enrolled children, reduce dropout ratio and attract out-of-school children (Hathaway, 2005). The main focus of these studies remains both on the demand and supply side of education such as provision of educational facilities, widening access to education and increasing enrollment in schools etc. (A. V. Banerjee & Duflo, 2009; Jones, Schipper, Ruto, & Rajani, 2014; Raikes, 2016). With regard to teachers' availability in schools

in developing countries, few studies have attempted to investigate the effectiveness of different policies that are targeted at schools or teachers' supervision. These include teachers' incentive programs such as providing incentives based on exam score of children, direct monitoring of teachers performance through camera coupled with high-powered incentives and community-controlled interventions etc. (Alcázar et al., 2006; Duflo & Hanna, 2005; Scott & Wimbush, 1991). The World Development Report suggests expansion of community-based monitoring of schools that might strengthen the flow of information between community and school administration and effectively involving community in hiring, firing and payment or transfer of teachers (WB, 2018). However, contextual evidence on community-based monitoring reflect less effectiveness of such programs particularly in rural areas (A. Banerjee & Duflo, 2006; Kremer & Vermeersch, 2005). One important factor is the awareness of local community or average education level that might influence the community response to teachers' unavailability. In other words, given the overall low education level in community (more often in developing countries), it is less likely that local people will realize the consequences of teachers' absence and its effect on children learning. While much has been researched about significance of teacher's availability and school facilities, less is known about how to increase teacher's attendance especially in rural and remote areas in an effective and cost efficient way.

This paper takes advantage of data collected by the Annual Status of Education Report (ASER)-which is similar to ASER-India and Uwezo in Africa-, to attempt a natural experiment on a recently introduced government-schools monitoring project by the Khyber Pakhtunkhwa government in Pakistan. We attempt to find a comparable administrative unit that has not been affected by the policy yet shares similar socio-economic and demographic characteristics across the border with the treated administrative unit.

The results discussed in this chapter suggest a number of practical insights.

First, school performance in terms of teacher's attendance and availability of facilities can be increased by increasing monitoring of schools using professionally trained monitors and adaptation of latest technology. Second, evidence support the idea that improving schools performance affect parents and children behavior in terms of sending children to schools and attending schools respectively. Earlier studies based on natural experiments and randomized evaluations find mixed results on the effect of monitoring on children's learning outcomes in developing countries vis-à-vis indirect incentives and rewards systems. Third, given the weak public education system in developing countries, monitoring of schools and teachers should be coupled with appropriate incentive/punishment mechanism in order to have a lasting impact on children performance. Finally, we argue that there is scope for the use of nationally representative surveys in conducting natural experiments for assessing the impact of education programs carried out by sub-national governments in developing countries.

The following section gives a brief account of the education system in Pakistan, its short history and major problems that hinder the road to achieving quality education. The 3rd section provides a detailed description of the monitoring program and its implementation procedure. Section 4 outlines theoretical framework in the light of previous works. Experimental design and its key conditions are discussed in section 5. Section 6 describes the data, section 7 details the empirical strategy followed by results and discussion in section 8. The last section concludes.

3.2 Gaps in Pakistan's Education System

Being the sixth largest country in the World, Pakistan inhabits population of around 210 million of which 64% is below the age of 30 (UNDP, 2018). Despite significant decline in fertility level in recent years, Pakistan's population is still growing at a rate of 2% per year, highest in South Asia (WB, 2018). Ac-

cording to Burki (2005), those less than 18 years old will account for about 50% of total population in 2030. This represents a big challenge as a significant proportion of young people will be poorly educated and inadequately skilled in case the successive governments fail to launch and implement ambitious education reforms.

To understand the structure of education system in Pakistan, it is important to dig into its history that started in the late 1940s. For the first 25 years (1947 to 1970), Pakistan's education system was relatively efficient, not much different from its neighboring India. Dominated by public sector, education departments in provinces were responsible for administering primary and secondary schools and colleges with a public sector teachers training schools and colleges. For several decades, the number of private schools was small within the system of education. However, after the denationalization in 1990s, the private schooling became another major source of education at the lower level particularly for the elite class of society.

Currently, the large public education system starts with primary schools at the lower level (0 to 5 grades), then secondary and high schools, and autonomous public funded universities at the highest level. Over the years, the amount of budget spent on public education has been one the lowest compared to other countries for various reasons. The World Bank's latest estimates show Pakistan's spending on education nearly 4.9% of its GDP with about 30% spending on primary education. According to Pakistan's Economic Survey, the overall literacy rate is 58% with male 70% and female 48% (MOF, 2017). In other words, nearly one-half of the women cannot read or write while this gap is much higher in rural areas. Solutions proposed for reforming the public education include incentives for parents and children, increasing the proportion of public resources going into education sector, diversion of more funds towards primary schooling and investment in teachers' training and improving the quality of schools and curriculum (Hathaway, 2005).

Pakistan continues to suffer from slower growth in key socio-economic indicators reflected by the human development report as compared to its neighboring countries such as India and Bangladesh (UNDP, 2016). Low education quality, both at primary and secondary level is at the centre of many problems that the country face in almost all regions. According to a study by International growth Centre (ICG), in Khyber Pakhtunkhwa(KP) province (the focus of this paper) in 2012-13, only 63% of 4-9 years old children were enrolled in schools with a much lower (56%) female enrollment (Habib, 2015). For higher grades, the net enrollment is even worst. For example, for middle schools, the net enrollment was hardly 40% reflecting a significant dropout or no-enrollment during the middle school age group (11 to 15 years). Similarly, teacher's absenteeism rate was 16% for primary, 21% for middle, and 17% for high schools indicating unavailability of teaching service at a critical school age. With regard to learning achievements, the entire country including KP province faces alarmingly low performance. Out of surveyed enrolled children, only 40% of grade-5 children could answer the second-grade level mathematics and language questions. From the supply side of education, the KP province employs nearly 55% of the civil servants in education department with a significant number of teachers. In other words, teachers make up at around 75% of the 180,000 employees overall in elementary and secondary education department. To what extent this chunk of employment has been effective is the policy question that motivates this study.

Recently, as part of the constitutional amendments, Pakistan has devolved most of administrative and fiscal decision making to the provinces. In this devolved setting, provinces are autonomous in reforming their education sectors to improve the dismal conditions of schools and teachers quality and children learning. The establishment of an Independent Monitoring Unit (IMU) is one such initiative taken by the provincial government of Khyber Pakhtunkhwa (KP) province that aims at monitoring teachers and schools performance through trained monitors equipped with smart-phone aided facility(section 3 provide

more details on IMU). According to ICG's analysis on the IMU school level data in 2014, there was significant variation in teacher's attendance and student attendance rates at the primary and secondary level (Habib, 2015). Also, large variation in school size measured as enrollment of children and teachers-students ratio were identified. Exploiting this variation, the same study by applying a statistical model, finds significantly positive effect of teachers attendance and school infrastructure on the children enrollment rates.

With the exception of seven districts-in hard areas[7] - where additional incentives are offered, the KP government has a uniform incentive structure for teachers similar to other provinces of Pakistan. Moreover, to improve girl's education, the KP government gives additional allowances for female education supervisors to increase their inspections to schools. Similarly, to attract girls enrollment, the KP government offers stipend program for secondary students for selected districts with low enrollment. Also, in two districts, special scholarships are offered for girls for their enrollment in schools (e.g Kohistan and Torghar). A detailed review of the KP government civil service rules carried out by ICG's research shows the presence of a number of direct and indirect incentives for improvement in teacher's attendance and students learning (Habib, 2015). However, these incentives were not properly linked with government objectives of improving education outcomes. The review further finds that promotion and up-gradation procedures, performance evaluation and transfer policies were not realistically linked with teacher's attendance measurements or student performance in exams, suggesting the need for a more objective criteria for measuring teacher's performance.

[7]Currently, seven districts i.e., Kohistan, Battagram, Tor Ghar, Dir Lower, Dir Upper, Shangla and Tank have been identified as "hard areas" for girls' schools (Habib, 2015)

3.3 Program Description

In struggle for quality improvement in education sector, in 2014, the Khyber Pakhtunkhwa (KP) provincial government took an important initiative of establishing a landmark project, Independent Monitoring Unit (IMU), for monitoring teachers and schools performance through trained monitors equipped with smartphone aided facility. The project was aimed at monitoring and data collection for over 28,000 public sector primary and secondary schools in the province. The basic objective of the IMU was to ensure presence of teachers through effective monitoring besides collection and compilation of data on basic schools facilities such as electricity, boundary wall, toilets, and furniture etc. The specific objectives of the project included, collection of data on the presence of teachers in school, number of children enrolled, schools facilities, availability of school administration and other school related information.

Lunched formally in April 2014, the IMU's mandate was to monitor over 28,000 schools with over 121,618 government appointed teachers across the province. The implementation of IMU project needed quite laborious work as the KP province is geographically characterized with rugged terrain and dispersed population in rural areas(figure 3.1). Also, over the last 18 years, the education sectors in KP province and it's neighboring federally administered tribal areas, have been a direct target of terrorism resulting into destruction of hundreds of schools particularly girls school and killing of several teachers including female teachers. The IMU program conducts monitoring using both human efforts and technology for keeping external control while dealing with shirking teachers and school administration.

The IMU hired 550 Data Collection and Monitoring Assistants (DCMAs or monitors) and subsequently appointed them in every district of KP province. Their job is to visit randomly to government schools located within assigned administrative clusters (at least one time each month to each school). The assign-

ment of clusters rotate clock-wise on monthly basis to minimize the possibility of relationship-bias. For example, the monitor who inspected cluster-A in January, will inspect cluster-B in February and so on. Each DCMA is required to visit at least 3 to 4 schools every day in schooling-hour to collect data. They are not allowed to share any prior information with schools or teachers about their scheduled visits. Upon inspection of the school, DCMAs are required to send attendance status of teachers (confirmed with their thumb-impression) to the central office through GPRS system installed in their smart-phone. The performance of DCMAs is in turn supervised by the District Monitoring Officers (DMOs) appointed one for each district across the province (H. Altaf[8] , interview, October 2018).

The IMU operation is based on IT application by trained monitors following a structured protocol provided by the provincial independent monitoring authority. The DCMAs collect data by physically verifying various school-based indicators after visiting the school in his/her designated area. The DCMAs then upload information directly to the database of IMU using a prescribed questionnaire designed by the Elementary and Secondary Education Department (E& SED) of the KP province. The DCMAs use a special android application for conducting various checks and filtering techniques to ensure provision of accurate data. The data sent by DCMAs to the database is further analyzed by IMU's IT team using various statistical tools to help make incentive (reward and punishment) decisions and take other necessary actions. So far, according to IMU officials, prizes worth 220 million Rupees have been distributed under the Teachers Incentive Program (TIP) among teachers that have higher attendance record. The IMU data was utilized in deciding on TIP criteria. However, with regard to penalty of low performing teachers, there is no such record of punishment or any decision whatsoever.

[8]A personal Interview was conducted online with Mr. Ataf Hussain, IMU official at District Shangla of KP Province to obtain information about the organizational structure and job description of IMU monitors and their appointment methodology.

So far, the government reports suggests that teachers attendance and punctuality have improved significantly ever-since the launch of the IMU, however, there is no empirical evidence about the impact of the extent to which the IMU has increased teachers attendance and students' academic performance. This proposed research therefore will be a significant contribution towards genuine evaluation of this project.

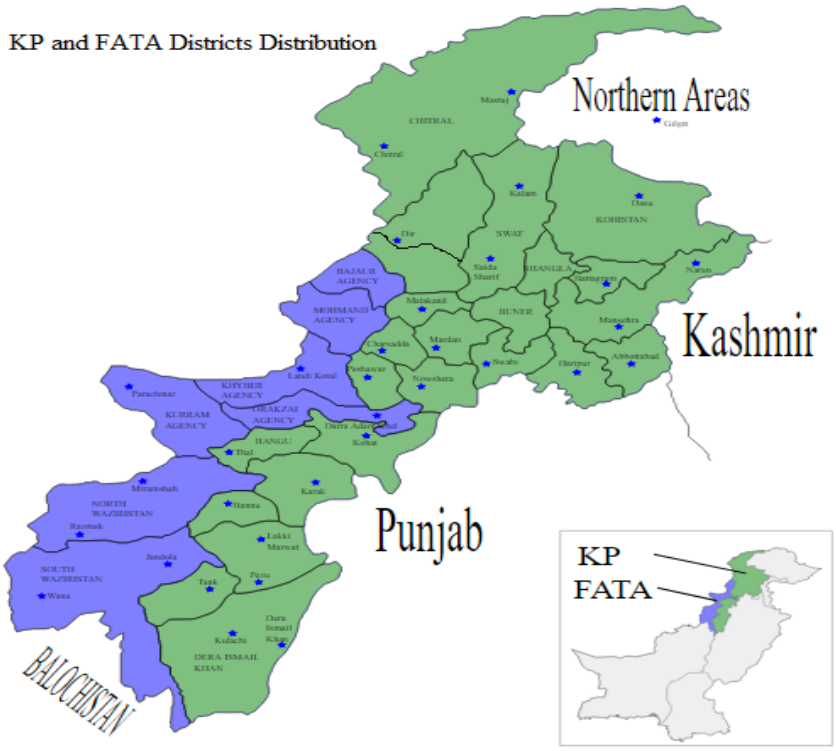

Figure 3.1: District wise Map of KP and FATA

3.4 Theoretical Framework

Analogous to the famous production function in economics which is used to model how inputs are transformed into output by a firm, an education production function can be designed to reflect how specific inputs into a child's envi-

ronment affect learning achievements (Koedel, Betts, et al., 2007). Literature in education research divides inputs of education production function into three types; individual child-related inputs, household-related and school-related inputs. From the individual child perspective, factors such as natural aptitude, motivation and vigor to work, maturity, gender and physiological characteristics etc. may affect his/her learning achievement (Todd & Wolpin, 2003). From the household perspective, factors that affect child's education include, parents-related characteristics such as education, health and motivation etc., household socio-economic conditions and environment for learning. The third (probably more important) type of inputs is the school quality that greatly influence children learning and educational attainment. A combination of school-related factors such as teachers' quality, school environment and size, infrastructure, peer groups, distance from home etc. may have direct or indirect effect on child's performance.

To understand the impact of certain education policy on learning outcomes, Glewwe and Kremer (2006) suggest the use of household(the parents of child) utility function, subject to certain constraints. The main arguments of this utility function are the consumption of goods and services at different points in time (including leisure), and each child's years of school and learning. The constraints faced by household are the production function for learning, the impact of years of schooling and learning capacity on the future labor income of a child, life-cycle budget constraint, and some other constraints for which child labor is one of the possible input.

The production function for learning is hence a structural relationship represented as the following:

$$A = \alpha(S, Q, C, H, I) \tag{3.1}$$

Where A represent skills learned(achievement), S shows the years of schooling, Q represents a vector of school-related characteristics or quality, C is a vector

of child-related characteristics (e.g age, gender etc.), H represents a vector of household characteristics, I is a vector of educational inputs by parents such as spending on text books and private tuition etc. For simplicity purpose, let's assume that only one school is available to each household and that parents cannot change the characteristics of that school. In other words, Q is exogenous to the household. Given this condition, household (parents) can maximize utility by choosing years of school S and educational inputs I. This implies that S and I can be considered as a function of four exogenous variables. This relationship is represented by the following equations:

$$S = f(Q, C, H) \tag{3.2}$$

$$I = g(Q, C, H) \tag{3.3}$$

We insert (3.2) and (3.3) into (3.1) to get the reduced form of the production function for learning :

$$A = h(Q, C, H) \tag{3.4}$$

Education policy makers are primarily interested in evaluating the impact of education policies on academic achievement A. In doing so, consider a change in one element of school quality such as a policy that increase teachers presence in school (the focus of this study), equation (3.1) shows how such changes in school quality might affect children learning skills when all other explanatory variables are held constant. In other words, such an effect is termed partial derivative of A with respect to Q. However, equation (3.4) will give us the total derivative of A with respect to Q, because it allows for changes in S and I (and may be other factors) in response to change in Q. For example parents may respond to increase in teachers' punctuality by increasing their spending on children or changing decisions on dropout. Alternatively, parents might reduce their spending or attention if they think better school quality is a substitute for their input. For example Das, Dercon, Habyarimana, and Krishnan (2004) find that parents

cut back their expenditures when schools were provided grants by government. While examining education policies, whether estimation of total or partial relationship is useful is an important question. Glewwe and Kremer (2006) suggest the use of equation (3.4) because it shows what will actually happen to A after a change in one or more component in school quality or prices. Using equation (3.1) would be inefficient for it does not account for changes in factors such as years of schooling and parent's input decisions. Nevertheless, the use of partial derivative through (3.1) is also of interest for it enables us to capture the overall welfare effects. For example, if parents reduce spending in response to school quality, they might raise their spending on any other consumer good. In this scenario, equation (3.4) might not capture increase in household welfare. Glewwe (2004) argues that any potential factors that have opposing effects on household welfare would cancel each other out, and hence change in learning skills A using equation (3.1) can enable us to reasonably approximate overall welfare effect.

In this study, we extend the framework suggested by Glewwe and Kremer (2006), to examine the schools monitoring program(the main focus of which is teachers' attendance) that affects the schooling outcomes. School quality can be measured by a number of school-related indicators. Policy changes into those indicators can bring about significant differences in school quality if carefully designed and implemented. Our main premise is that increasing external oversight of teachers and administration through monitoring program (MP) is likely to change the behavior of teachers (as a core component of Q). We further assume that such a large scale program might interact with local community characteristics (denoted by L) to determine the quality of schools in the form of equation (3.5).

$$Q = q(L, MP) \tag{3.5}$$

Our first research questions is related to one of the key indicators of school quality e.g teacher's attendance. Lack of effective supervision of school-staff and relevant facilities often lead to negative consequences in the form of children

enrollment, attendance, dropout and parents' behaviors associated with school-aged children. Some studies indicate, grade repetition and leaving school at an early age are common due to teachers unavailability in the schools (Glewwe & Kremer, 2006). Subsequently, we substitute equation (3.5) into (3.4) to obtain the reduced form relationship as the following:

$$A = h(C, H, L, MP) \tag{3.6}$$

Equation (3.6) enables us to estimate the functional relationship of monitoring program with the outcome variables of our interests (e.g. learning). Given the limited resources spent on education in developing countries such as Pakistan, availability of teachers in schools affect the availability of other schools' resources. For example, teachers' availability leads to children availability and other staff presence which helps ensuring the availability and maintenance of facilities at the school. Similarly, unavailability of schools facilities such as textbooks, blackboards, furniture's, boundary wall and library etc. may affect parents and children attitude towards school's environment. For example, in rural and far-flung desserts such as Tharparker region in Sindh and South Punjab, and mountainous regions of Khyber Pakhtunkhwa Pakistan, lack of proper physical facilities, poor construction or no availability of school building and furniture are commonly reported problems that lead to low enrollment and high dropout ratio (Hathaway, 2005). In some parts of Pakistan, survey reports reveal cases where teachers may be paid but nonetheless they are absent from their schools (Hathaway, 2005; Malik et al., 2015). Also, funds allocated for certain facilities such as books and furniture never get utilized in reality leading to inefficient allocation of budget spent on education.

If teachers input and school environment is critical for children performance, then understanding the functional relationship in equation (3.6) is important. Thus our second research question is related to examining how inputs such as school and teachers' quality affect a child's learning achievement as measured

by a standard ability test.

From a general equilibrium view point, increase in human capital is the obvious output of an education production function. Economists measure such an output in the form of wage returns, contribution to economy through skilled labor and rate of returns etc. in the long run (Bukowitz, Williams, & Mactas, 2004). However, in the short run, since the child is still in school, the output could be measured as cognitive achievement through ability tests in different subjects of interests which could be used as important antecedents for all such attributes of individual that may contribute to the productivity of students once they join the labor force.

3.5 Experimental Design

This study aims at estimating the effect of the IMU program introduced by the KP provincial government in Pakistan on school quality measured in the form of teacher's attendance on one hand, and on children learning outcomes measured through ability tests in three subjects e.g reading, math and english, on the other hand. To do so, it is important to use a model that truly identifies the causal effect of the IMU program. Literature on impact evaluation methodologies suggests several tools to estimate the impact of a policy intervention in education sector on student's achievement and school quality (Abdulkadiroğlu et al., 2018; Alcott & Rose, 2015; Burde & Linden, 2013; Card & Krueger, 2000; Croke, 2014; Duflo et al., 2007; Malik et al., 2015; Munene, 2015). The focus of these studies is to know the likely impacts of various policy interventions on students' academic achievements. Recently, randomized control trials (RCTs) have been considered the most effective design to find causal effect particularly in developing countries. For example incentive program linked with teachers presence measured through camera photograph with children in randomly selected schools in India by Duflo and Hanna (2005) reduced teachers absence significantly and improved

test score. Similarly, in a randomized trial in Nicaragua, radio instructions had significant impacts on pupils' math score (Jamison, Searle, Galda, & Heyneman, 1981). In Kenya, randomized experiment of provision of school meals was found to have positive impact on test score as long as teachers were well trained (Kremer & Vermeersch, 2005). In a remedial education program in urban India that focused on improving learning environment in government schools, increased test scores was observed at a reasonably low cost (A. V. Banerjee et al., 2007). Also in India, a computer-assisted learning program suggests potential positive impact on students' learning achievement (A. V. Banerjee et al., 2007). However, besides other challenges such as implementation etc., one of the big limitations associated with such experiments is their high cost of implementation.

The second most credible design in recent impact evaluation literature is natural experiment. In the absence of random assignment of subjects, one can exploit variation caused by any policy change that is exogenous in nature. In such cases, the simplest way of calculating the causal effect is using "difference-in-difference" (DiD) method, by comparing pre-program difference with the post-program difference between treated and untreated groups. Evidence from recent natural experiments in low and middle income countries suggests a positive impact of increasing school quality on students' academic performance, despite extensive variation in different contexts. These experiments include(but are not limited to) impact evaluation of primary school environments on secondary school outcomes using data on Ethiopian Jews by Gould, Lavy, and Paserman (2004) and impact of class size on student academic performance in Israel using Maimonides' Rule by J. D. Angrist and Lavy (1999) etc. Results of natural experiments vary by context and by subjects owing to a number of reasons. For example, a natural experiment using Israeli data shows reducing class size raises reading score but not math score, while providing computers has no effect on academic performance (J. Angrist, Bettinger, Bloom, King, & Kremer, 2002).

One big challenge of such experimental designs is the availability of control (untreated) group that satisfies all conditions for an ideal comparison. For example, in the context of school' monitoring program, one needs to have schools that are not directly or indirectly affected by the policy targeted for treated schools. Another challenge is to find schools that share similar characteristics with the treated schools before the intervention. In cases where the outcome variables between the treated and untreated subjects vary before the interventions, studies attempt to mitigate this challenge by adopting the common trend assumption conditional with availability of data.

Recently, the two stage least square (2SLS) or instrumental variables (IV) is adopted as an alternative approach to estimating the impact of education policy interventions. According to this approach, a variable is used as an instrument which may or may not arise from natural experiment, but is correlated with the endogenous variable and uncorrelated with the unobserved factors that might affect the outcome variable (e.g child's learning). In IV estimation, the common variation between the instrument and the endogenous variable is exploited in estimating the effect of certain variable of interest (Wooldridge, 2013). Despite its convincing power in explaining education production function, finding a good instrument is often a challenge.

While natural experiments (and randomized trails) are meant to create a pool of such results that are less likely to suffer from estimation problems, development economists stress the need for a much larger set of results on a more representative sample of population before reaching a general conclusion. Nevertheless, in many developing countries, natural experiments and randomized control tails are considered the most effective means for improving school quality through addressing the problems associated with teachers' behavior (Glewwe & Kremer, 2006).

Understanding the impact of policies that affect teachers' behaviors is critical particularly in the context of developing countries that suffer from higher

absenteeism. Considering the exogenous nature of IMU program introduction in KP province Pakistan, we attempt to exploit an annually representative survey data produced by the Annual Status of Education Report (ASER) to conduct a natural experiment. It is known that the purpose of ASER data collection is unrelated with the IMU program in all aspects whatsoever. We attempt to find a comparable administrative unit that has not been affected by the policy yet shares similar socio-economic and demographic characteristics across the border with the treated administrative unit. We test this by conducting a pre-program trend analysis on all variables used in our estimations.

3.6 Data

Out main data source is the 5 years country wide Annual Status of Education Report (ASER) Pakistan survey, from 2012 to 2016. The ASER[9] is frequently cited in reference to teachers attendance, children enrollment and attendance, learning ability, private school enrollment, and other key education indicators by renowned researchers (Banerji et al., 2013; French, Kingdon, et al., 2010; Jones et al., 2014; Zaka, 2018). ASER is the large scale citizen-led, household based initiative managed by Idara-e-Taleem-Aagahi (ITA)-Pakistan in partnership with a number of governmental and non-governmental organizations, to provide reliable data on the status of primary and secondary education in all rural and few urban districts of Pakistan. Each year, ASER conducts a comprehensive assessment on the state of learning, school performance, and other indicators of primary and secondary education throughout rural Pakistan. Mobilizing more than 10,000 volunteers each year, the survey covers 600 household in each of Pakistan's 136 districts yielding a large national dataset of 81600 households and around 286,000 children per year. Table 3.1 provides year wise coverage of ASER data for KP and FATA (the target of our study). The ASER household survey include learning tests performed by children at home while a separate

[9] ASER-Pakistan survey is similar to ASER-India(Pratham) and the Uwezo surveys in Africa.

survey of government and private schools is conducted in sample villages.

The ASER sampling framework is systematic and well designed. For example, each district is provided with a village list with population information given by the National Bureau of Statistics (NBS). In view of variability in key variables, population distribution and field resources, ASER selects a sample of 600 households from each district. Each district is further divided into 30 villages whereas 20 household are selected from each village. The ASER adopts two stage sampling design. In the first stage 30 villages are selected using probability proportional to size (PPS) method. In the second stage, 20 household[10] are selected from each of the 30 selected villages. Village is considered as the primary sampling unit, while household is treated as secondary sampling unit. Every year, the ASER survey retains 20 villages from previous year, 10 new villages are added and 10 villages are dropped from the previous year. With regard to schools selection, ASER choose at least one government school which is mandatory (could be more than one) and one private school form each selected village. (ASER, 2015, 2016).

Table 3.1: ASER Survey Coverage (2012 to 2016) for KP and FATA

Survey Coverage	**2012**		**2013**		**2014**		**2015**		**2016**	
	KP	**FATA**	**KP**	**FATA**	**KP**	**FATA**	**KP**	**FATA**	**KP**	**FATA**
No. of Districts	23	9	25	9	27	9	26	11	24	9
No. of Villages	688	270	763	265	789	270	769	330	704	270
No. of Households	13,702	5,375	15,144	5,271	15,663	5,369	15,032	6,544	13,807	5,390
No. of Children	41,003	18,529	46,877	18,722	49,473	18,743	46,045	22,890	41,804	17,753

Notes: The number of districts covered each year in KP and FATA are not equal because of two reasons. First, coverage in districts which were affected by military operation against extremist groups such as Mohmand Agency was skipped in 2012. Secondly, districts where the ASER team couldn't reach due to other administrative difficulties such as district Kohistan were also skipped. However, the number of missing district each year ranges between 1 and 4.

The primary strength of ASER dataset is its enormous sample size of children aged 5 to 16 years, households, government schools and private school related information across all districts in rural Pakistan that provides a clear picture of the state of schooling across the country. Secondly, the ASER learning tests which are well organized and carefully designed and conducted at home

[10] ASER divides each selected village into four parts: Surveyors are required to start from the central location and pick every 5th household in a circular fashion till 5 households are selected from each part (ASER, 2016).

provide an opportunity to analyze children's ability without any potential school bias. Testing at school often carries a potential bias when teachers push more competent students forward during the survey. This feature of ASER testing allows us to be more confident about the validity and findings on learning tests. Moreover, ASER household survey collects data on all potential child-related and household related socio-economic variables that might affect learning ability such as age, gender, enrollment status, school status(government or private), current grade, tuition facility, house-condition and ownership and parents' education etc. Table 3.2 and 3.3 show the summary statistics of the 5 years ASER surveys annual data pooled form 2012 to 2016. The third important feature of ASER survey is its systematic coding of districts, villages, households, and children identification (IDs) that allows us to apply fixed effect models to control for any group-specific unobserved characteristics. Finally, the ASER provides sufficient baseline datasets that enable us to conduct pre-treatment and falsification test on all relevant factors affecting school based and children related outcome.

3.7 Empirical Strategy

The unique setting of the study area, the launching of monitoring program and ASER survey give us an opportunity to conduct a form of natural experiment. It is known that the monitoring project, IMU, was launched in the middle of April, 2014 across all districts of KP province. In Pakistan, two months summer vacations are observed every year from mid-June to mid-August. During the vacations, teachers are not required to attend schools. The ASER collects data in September each year. In this way, considering the starting date of the program and summer vacations, it is less likely that the ASER data collected in September, 2014 has captured the program impact for two months. During the first two months at the outset of the program (from mid-April to mid-June), a large scale program is less likely to be fully operationalized.

Table 3.2: Government and Private Schools Summary (2012-16) pooled

	Government Schools		*Private Schools*	
Variables	KP	FATA	KP	FATA
Primary School(1 to 5)	0.655	0.789	0.272	0.208
Middle School Type A(1 to 8)	0.048	0.093	0.286	0.283
Middle School Type B(6 to 8)	0.095	0.003	-	-
High School Type A(1 to 10)	0.089	0.107	0.397	0.487
High School Type B(6-to-10)	0.157	0.005	-	-
All other school types	0.006	0.004	0.042	0.021
Average Enrollment of Children	230.755	155.404	293.698	386.779
Average Children Attendance	153.279	131.903	261.715	342.863
Average No. of Teachers Appointed	7.724	5.019	12.885	11.696
Average No. of Teachers Present	6.687	4.477	11.145	10.788
Student teacher ratio	38.468	39.145	25.434	33.56
Teachers-Attendance Ratio	0.875	0.897	0.919	0.906
Children Attendance Ratio	0.844	0.826	0.867	0.889
Laboratory Available(yes=1)	0.208	0.086	0.405	0.346
Compute Lab Available(Yes=1)	0.065	0.035	0.263	0.096
Internet Availability	0.03	0.007	0.19	0.05
N (No. of Schools surveyed)	3618	1386	1718	240

Notes: Table 3.2 reports data from ASER government and private school surveys (pooled from 2012 to 2016). Values on school types and facilities represent the mean percentage of the surveyed schools. Student-teachers ratio, teacher's attendance ratio and children attendance ratio represents average ratio on corresponding variables. E.g. Teachers Attendance Ratio is calculated as no. of teachers present/total appointed teachers. Similarly, Children-Attendance Ratio is calculated as no. of children present/total enrollment in the surveyed school. KP stands for Khyber Pakhtunkhwa Province representing the treatment group while and FATA represents the control group called Federally Administered Tribal Areas. Middle schools type B and Higher schools type B do not apply for private schools.

Table 3.3: Children Related Summary-2012-16(Pooled)

Variables	KP	FATA
Demographic Characteristics		
Child Age	9.038	8.438
Gender(Female=1)	0.397	0.37
Child Enrollment Status		
Child Enrollment Status(Yes=1)	0.755	0.675
Child Dropped Out(Yes=1)	0.034	0.033
Child School Type		
Child Enrolled in Government School(Yes=1)	0.518	0.481
Child Enrolled in Private School(Yes=1)	0.218	0.168
Child Enrolled in Other Schools(Yes=1)	0.014	0.024
Household Socio-Economic Conditions		
Private Tutoring(Yes=1)	0.072	0.05
House Ownership(Yes=1)	0.896	0.917
House Construction Weak(Yes=1)	0.348	0.544
House Construction Semi-Strong(Yes=1)	0.329	0.297
House Construction Strong(Yes=1)	0.323	0.158
Electricity Connection Available(Yes=1)	0.892	0.882
Mobile service Available(Yes=1)	0.841	0.687
TV Available(Yes=1)	0.512	0.406
Parents Information		
Father Age	41.004	39.38
Father Ever Attended the School	0.585	0.51
Father Years of Education	5.847	4.57
Mother Age	35.635	35.252
Mother Ever Attended the School	0.274	0.117
Mother Years of Education	2.202	0.77
N (No. of Children surveyed aged 3-16 years)	225202	96637

Notes: Table 3.3 reports summary of the main variables from ASER- household survey (pooled from 2012-to-2016). Age-related variables and years of education represent average years while all other variables are dummies representing the average percentages of the surveyed units. KP stands for Khyber Pakhtunkhwa Province representing the treatment group while and FATA represents the control group called Federally Administered Tribal Areas.

Figure 3.2 shows the time-line and ASER data collection from 2012 to 2016. Given this context, we do not have reason to consider year 2014 as a post-program period and expect the effect to take place in 2015. Our treatment period therefore consists of two years (2015 till 2016) in the selected districts. By the same token, considering 2014 as pre-program period is also likely to bias our estimate, given the launch of the program in April, 2014. Although, we present results of 2014 as pre-program (in Appendix C) for checking any possible difference, we rely on 2012 to 2013 as pre-program in our main results.

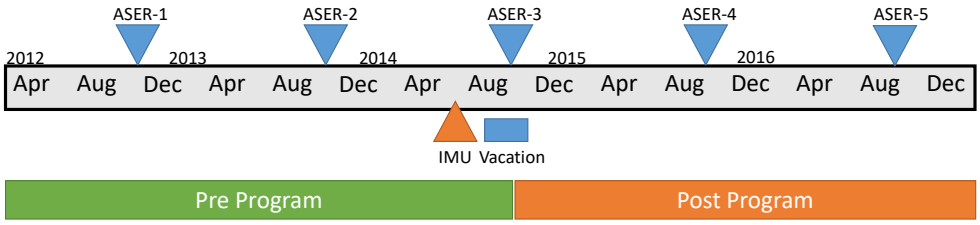

Figure 3.2: Time line of ASER Data Collection and the Launch of IMU

3.7.1 The Model

Our main outcome variable in the first place is whether the intervention program has increased teacher's attendance in government schools in KP province.

We hold the following assumptions to carry out diff-in-diff analysis in the given settings:

- The primary, and secondary education system in FATA is same as the KP due to the Examination Systems conducted by designated Education Boards[11].

- There is no significant difference in teacher's attendance and children performance between KP and FATA before the IMU introduction.

[11] Education boards are constitutional bodies responsible for implementing school curriculum, conducting and supervising annual examinations and declaring results of government and private schools under their jurisdiction. All boards are located in KP province but consists of districts under its jurisdiction both in KP and FATA. In total, there are 8 Education Boards in KP province.

- FATA and KP share similar characteristics in terms of social, economic, geographic, and cultural conditions and population density etc.
- Our treatment period consists of two years (2015 till 2016) in the KP while the Pre-Treatment period consists of two years from 2012 to 2013. Year 2014 in our main analysis is considered as period of implementation.

We estimate the effect of monitoring program on school outcomes using the following equation:

$$Y_{idt} = \beta_0 + \beta_1 Monitoring_{idt} + \beta_2 X_{idt} + \alpha_d + T_t + \epsilon_{idt} \tag{3.7}$$

Where,

Y_{idt} represents outcome on surveyed government school i in district d in time t.

$Monitoring_{idt}$ is an interaction of treatment districts and post-year t.

e.g. $Monitoring_{idt}$=1 if school i belongs to district d of KP province & t = 2015 or 2016 (School is exposed to monitoring program) and 0 otherwise

X_{idt} is a vector of school level controls.

α_d is the district fixed effect.

T_t is year fixed effect.

ϵ_{idt} is error term clustered at village(=school) level

In a similar fashion the children test performance is estimated by the following equation:

$$Y_{igdt} = \beta_0 + \beta_1 Monitoring_{igdt} + \beta_2 X_{igdt} + \alpha_d + T_t + G_g + \epsilon_{igdt} \tag{3.8}$$

Where,

Y_{igdt} represents normalized test score of surveyed child i in district d in grade g at time t.

$Monitoring_{igdt}$ is an interaction of treatment districts and post-year t.

e.g. $Monitoring_{igdt}$=1 if Child i of grade g belongs to district d of of KP

Province & t = 2015 or 2016 (Child is exposed to monitoring program) and 0 otherwise.

X_{idt} is a vector of child related and household related controls.

α_d is the district fixed effect.

T_t is the year fixed effect.

G_g individual grades' fixed effect.

ϵ_{idt} is error term clustered at village(=school) level.

3.7.2 Pre-Program Trend in KP and FATA

We take advantage of the pre-program data to test the common trend assumption - the outcome in treatment and control group would follow the same trend in the absence of the treatment. The results suggest that teacher's attendance on average did not vary significantly between treatment and control before the policy was introduced. The same is true for children test performance. Table 3.4 and 3.5 present the pre-program trends between KP and FATA on our main outcome variables, teacher's attendance and children standardized test scores respectively. The coefficient of the interaction term(pre-program diff) shows that after controlling for observed factors such as schools' existing teaching quality, training quality, school age and size, the difference between KP and FATA in terms of teachers attendance ratio is not statistically significant in 2013 as well as in 2014. A similar common trend was observed between KP and FATA on normalized test score of children as shown in table 3.5. We observe that, on average, coefficient of the interaction term of the normalized score for reading, math and english in lower grades (0 to 5) is not statistically significant indicating similar performance of KP children with FATA children in terms of these subjects. This is in line with previous studies that indicated lower performance of both KP province and FATA compared to the country-average in terms of basic reading ability at lower grades. With regard to education sector reforms, a close analysis of the recent government decisions in KP and FATA shows that during these five

years period, there was no significant policy intervention other than education reforms that mainly focused on teachers attendance, school infrastructure and oversight (Habib, 2015; Zaka, 2018).

Table 3.4: Pre-Program Trend, Teachers Attendance Ratio

Dep. Var: Teachers Attendance Ratio	Year=2013	Year=2014
Pre-Program Diff (Treatment*Post)	0.0264	-0.0201
	(0.0230)	(0.0173)
School Teaching Quality	0.0359	0.0327**
	(0.0225)	(0.0166)
School Training Quality	0.00330	0.0223
	(0.0268)	(0.0185)
Urban	0.160***	0.0953*
	(0.0587)	(0.0554)
Old schools	0.00565	-0.00121
	(0.0138)	(0.0103)
School Size	0.0861	0.128***
	(0.0579)	(0.0423)
School Facilities	YES	YES
District FE	YES	YES
Year FE	YES	YES
Constant	0.706***	0.745***
	(0.0510)	(0.0426)
Observations	1,933	2,967
Adj. R-squared	0.074	0.060

Notes: The table reports Pre-Program difference between KP province (treatment) and FATA (control) on teacher's attendance. Column (1) represent year=2013 vs Pre=2012 while column (2) represent Post=2014 vs Pre=2012-13. The outcome variable is the ratio of teachers present in school to the total appointed teachers. Variable Pre-Program Diff is a typical diff-in-diff interaction of *to-be-treated province* (KP) and Post (year =2013 in column (1) and year=2014 in column (2)). Due to District and year fixed effect applied in each regression, we do not include variables for treatment and posts. Variables *School Teaching Quality* and *School Training Quality* are continuous variables showing the ratio of teachers with master's degree and specific training level to the total appointed teachers in each school. *School Facilities controls* include availability of water, boundary, toilet, library, playground, laboratory, computer and internet. *School Size* is a continuous variable representing the ratio of children enrolled in surveyed school to the school with highest number of enrolled children. The data is taken from the ASER-Pakistan School Survey. Standard errors clustered at village level are shown in parentheses. The unit of observation is the surveyed government school. Statistical significance at the 1, 5, 10% levels are indicated by ***, **, and *, respectively.

In conducting pre-program analysis of children test performance, we control for all possible observed child-specific characteristics such as age, gender, parents education, household size and dummies for house ownership and facilities. We also conduct a pre-treatment analysis on upper grade children and including 2014 as pre-program (see Appendix C for results). Overall, the trend is similar in all subjects except lower performance in normalized english score of children belonging to treatment province in upper grades.

Table 3.5: Pre-Program Trend, Normalized Test Score

	Normalized Test Score Lower Grades-(0-to -5)		
	Reading	Math	English
Pre-Prog Diff (KP*Year13)	-0.0354	-0.0442	-0.0435
	(0.148)	(0.148)	(0.155)
Child -Related Controls	Yes	Yes	Yes
Parents Education Controls	Yes	Yes	Yes
Household Characteristics Dummies	Yes	Yes	Yes
District FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Grade FE	Yes	Yes	Yes
Constant	-0.662***	-0.562***	-0.452***
	(0.119)	(0.125)	(0.130)
Observations	19,757	19,659	19,608
Adj. R-squared	0.023	0.022	0.019

Notes: Table 3.5 reports the pre-program difference using diff-in-diff estimates on the children test performance for Post=2013 vs Pre=2012 using the ASER Household Survey data. Standard errors clustered at village level are shown in parentheses. The unit of observation is surveyed 3 to 16 year's old child enrolled in government school from Grade-0 to grade-5. The dependent variable is the test score normalized by grade. The pre-program difference is a typical diff-in-diff interaction of *to-be-treated* province (KP) and Year 2013. Fixed Effect on individual grade, District and year applied in each regression. Child-related controls include age, private tuition; parent's education controls include, mother and father highest education in years; household characteristics include ownership, house condition, and availability of electricity, mobile and television facilities. Statistical significance at the 1, 5, 10% levels are indicated by ***, **, and *, respectively.

3.8 Results

3.8.1 Program Impact on Government Schools Outcomes

Table 3.6 reports the main results of the monitoring program on the ratio of present teachers to total appointed teachers using basic OLS model in equation (3.7). We check the program effect using different post and pre-program-years to see any difference during post-program two years. Since most of the KP province and FATA contains rural areas, time-invariant district-specific factors such as school density (schools per km2) and location of district administration offices etc., might affect the outcome variable(see Appendix table C.9 for list of districts in KP and FATA). To overcome any time-invariant district-specific unobserved characteristics and time trend, we use district fixed effect and year fixed effect respectively throughout our regressions. Also considering the potential variation in teacher's behaviors, we control for schools teaching and training quality, urban districts, history, size and a vector of school-related facilities. School teaching and training quality is measured as a ratio of teachers with master's degree and professional training certificate to the total appointed teachers in the surveyed school. We represent schools' history as a dummy of old schools

with more than 50 years of establishment equals to one. As suggested by previous studies, enrollment of children in schools might affect teachers attendance behavior (Koedel et al., 2007), we therefore control for school-size represented by enrollment. The role of school infrastructure in creating better teaching environment is well documented in education literature (A. Banerjee & Duflo, 2006; Hathaway, 2005). We control for all school-related facilities surveyed by ASER (e.g. availability of water, boundary wall, toilet, library, playground, laboratory, computer and internet).

Table 3.6: Teachers Attendance Ratio

Dep. Var: Teachers Attendance	(1)	(2)
Monitoring (Treatment*Post)	0.0665***	0.0256
	(0.0172)	(0.0162)
School Teaching Quality	0.0375**	0.0301**
	(0.0150)	(0.0127)
School Training Quality	-0.00375	0.00607
	(0.0182)	(0.0147)
Urban	0.0620	0.0159
	(0.0408)	(0.0346)
Old-school	0.000548	-0.00469
	(0.00919)	(0.00863)
School Size(enrollment)	0.0460	0.0368
	(0.0448)	(0.0433)
Schools Facilities Controls	YES	YES
District FE	YES	YES
Year FE	YES	YES
Constant	0.880***	0.839***
	(0.0302)	(0.0350)
Observations	3,019	3,919
Adj. R-squared	0.075	0.055
Mean of the dep. Var:	.886	.883

Notes: Table-3.6 shows the main effect of the monitoring program on teacher's attendance. Column (1) represent Post=2015 and Pre=2012-2013. Column (2) represent Post=2015-2016 while Pre=2012-13. The outcome variable is the ratio of teachers present in school to the total appointed teachers. Variable Monitoring is a typical diff-in-diff interaction of treatment (KP) and Post (for corresponding year). Due to District and year fixed effect applied in each regression, we do not include variables for treatment and posts. Variables School Teaching Quality and School Training Quality are continuous variables showing the ratio of teachers with master's degree and specific training level to the total appointed teachers in each school. School Facilities dummies include availability of water, boundary, toilet, library, playground, laboratory, computer and internet. School Size is a continuous variable representing the ratio of children enrolled in surveyed school to the school with highest number of enrolled children. The data is taken from the ASER-Pakistan School Survey. Standard errors clustered at village level are shown in parentheses. The unit of observation is the surveyed government school. Statistical significance at the 1, 5, 10% levels are indicated by ***, **, and *, respectively.

Table 3.6 column (1) shows a significantly positive effect of the program on teachers' attendance ratio in the year(2015) immediately following the program. Controlling for observable covariates such as existing school teaching and training quality, location, history, school size, and a vector of school facilities, the

coefficient of the interaction term shows an increase of .067 percentage points in teachers' attendance ratio in the KP province as compared to FATA. In other words, being exposed to the monitoring program, on average, teacher's attendance in government schools is likely to increase by nearly 8% in the first year of program implementation. This effect is larger given the mean value of the dependent variable (.881). In table 3.6, we do not include 2014 data, considering it a transition period. Column (2) adds year 2016 as post-program period into our analysis. It can be observed that the program effect is not significant and has been decreased by nearly half after two years of program implementation. The effect is however statistically significant at 5% when we include year 2014 in our analysis. Appendix table C.4 reports results after including year 2014 as post-program period.

There could be several reasons for decreasing effect of the program. First, the expected penalty (or reward) as a result of IMU may not have been strictly observed despite absenteeism reports by IMU. Secondly, as other studies observe, there could be "learning effect" from the perspective of teachers as they might have learnt sources of shirking by establishing contacts with people who might observe visiting monitors on their way to schools (A. Banerjee & Duflo, 2006). This can happen more likely in far-flung rural areas, where distance between schools and monitors' place of residence is large. In their paper on addressing absence in India using a camera photograph, A. Banerjee and Duflo (2006) contend external control of monitoring by someone within the institutional hierarchy such as headmaster or principle due to possible collusion with teachers. Although the case of KP monitoring program does not have this problem of external control (e.g. monitors do not belong to schools, rather they are externally appointed and their jobs are rotated), yet we cannot rule out the possibility of shirking by teachers in areas where teachers' distance from school is small.

Although, the effect decreased in the second year, the overall impact of IMU

program appears to bring immediate improvement in teacher's attendance over a large area. We check the robustness of our model [equation (3.7)] on various sub-samples of school levels such as primary schools (0-to-5 grades) and high schools (6-to-10 grades) and a reduced sample of districts bordering[12] with FATA. The results (shown in section 3.8.4) are similar and follow the same pattern as observed in table 3.6. Also, we conduct a falsification test using the private schools data on post-program period by running the same regression as table 3.6. Results of falsification test (shown in Appendix table C.1) reflect no systematic difference in teacher's attendance pattern in private schools suggesting evidence in favor of IMU effect on government schools.

3.8.2 Learning Achievements

Even if monitoring increased teacher's presence in schools, it is not clear whether increased teachers presence affect learning achievements. In other words, whether teachers teach once they decide to be in school, is the question of our interest in this section. Several factors can be considered in explaining the mechanism through which any potential impact of increased oversight of teachers and schools might influence the learning capacity of children. The basic theory behind hypothesizing the direct effect of teachers monitoring on children performance is the marginal cost of teaching after a teacher is present in school. Especially at lower level, such as primary schools where the subject contents are not much difficult, and, where few teachers are appointed per school. We assume that after being present in school, at lower level, teachers generally tend to teach (they don't want to shirk), hence children get benefited of their increased presence (Duflo & Hanna, 2005). In other words, getting teachers to schools may work effectively at the lower level schools. At higher level however, the marginal cost of teachers after being present in school might be higher given the subject contents difficulty at higher grades such as maths, english and science

[12]There are sixteen districts in KP province which share border with districts (agency) in FATA.

subjects of 9th or 10th grade. Previous studies support the idea that developing countries such as Pakistan and India, are suffering from the low teachers' capacity at higher level (Hathaway, 2005).

Secondly, parents might positively respond to a large scale oversight program in rural areas in terms of sending children to schools. Although, in many poor societies the opportunity cost of sending children to school is greater than the benefits of educating them, however, recent evidence on education status in South Asia confirm the slackness of parents towards sending children to school due to school quality or teachers absence rather than economic reasons (A. Banerjee & Duflo, 2006; Glewwe & Kremer, 2006). At higher grade level such as grade 9th and 10th, teachers' absence from schools might affect parent's response. For example the potential financial incentives for teachers when they (deliberately) avoid teaching at schools in order to increase the chances of private tutoring, might pose a financial challenge for parents (Glewwe & Kremer, 2006).

The third source of monitoring effect on children performance might be the link between teacher's attendance and children attendance. We check the program impact on children attendance measured as number of present children on the day of survey to the total enrollment in the school. Results shown in Appendix table C.2 suggest a slight increase (1.7% with 10% significance level) in children attendance in year 2015, however, the magnitude is small indicating a subtle effect on children attendance. The program effect on children attendance is not significant when we add 2016 as a post-program year. In either of our specifications, children attendance appears to be less affected (or unaffected) during the year immediately after the program. This is surprising as a number of studies document a strong association of teachers attendance with school participation and hence children academic performance. However, Glewwe and Kremer (2006) differentiate school participation from children attendance and argue that increasing teachers attendance and school quality might increase par-

ticipation which means giving more time to school related tasks rather than mere attendance.

Finally, governance reforms such as monitoring that target school quality appears to hold more promise than simply providing monetary incentives to teachers based on test scores. For example, threat of a top-down audit significantly reduces corruption (Olken, 2007) and teachers at schools that were inspected more often resulted in reduced absence (Chaudhury et al., 2006). However, there are limited evidence that externally controlled monitoring when coupled with clear and credible threat of punishment induces "good" teaching behavior at school.

We turn to our second outcome of interest, children test performance to see the direct effect of the monitoring program on the test performed by enrolled children at home. We follow (Glewwe & Kremer, 2006) to obtain the reduced form relationship using model (3.8) [equation (3.6)] in estimating normalized test performance in three different subjects e.g reading, mathematics and english. With regard to the level of difficulty, the ASER test questions[13] for each subject are designed to measure the very basic learning, english and math ability in view of achieving SDG indicator 4.2.1 (ASER, 2016). According to ASER reports, the survey is pitched to grades 2 and 3 competencies only, corresponding with the SDG indicators for tracking learning at the lower primary level. The survey procedure in ASER annual publications also confirms the low difficulty levels of tests. In addition to that, ASER data survey also include three additional questions(called bonus questions) for reading, two bonus questions related to math and one additional question related to english.

Although, these additional questions might still be easier, we attempt to utilize them to construct normalized test variable for upper grade children (See Appendix figure C.1 for details on the procedure of ASER test questionnaire). In their paper on ASER-India, Banerji et al. (2013) describe that children of grade 3

[13]The ASER HH survey contains five basic questions ranging from low difficulty to higher difficulty. For example, for reading, five test dummies are whether the surveyed child is at beginners level, can read letters, can read words can read sentence, can read story. Similar procedure is adopted for mathematics and English questions.

onwards have no difficulties in completing all questions asked by ASER survey. Nevertheless, in view of the extremely discouraging learning status in Pakistan reported by different organizations over the last few years, we rely on ASER's basic test questionnaires (five questions each subject) for lower grade children to gauge the ability level of enrolled children. We aggregate the individual dummies for each of five questions in each subject to construct a raw score for each surveyed child and subsequently normalize[14] by individual grades to obtain a reliable measure of test score. A similar procedure was adopted for ASER bonus questions to create normalized test score for children enrolled in higher grade children (see Appendix table C.5 and C.6 for results on upper grade children and including year 2014 as pre-treatment.)

Table 3.7: Program Effect, Normalized Test Score (Grade 0 to 5)

	Normalized Test Score					
	Post=2015			*Post=2015+16*		
	Reading	Math	English	Reading	Math	English
Monitoring (KP*Post)	0.0722	0.137**	0.119**	-0.010	0.014	0.021
	(0.0624)	(0.0538)	(0.0588)	(0.0591)	(0.0504)	(0.0556)
Child -Related Controls	Yes	Yes	Yes	Yes	Yes	Yes
Parents Education Controls	Yes	Yes	Yes	Yes	Yes	Yes
Household Characteristics Dummies	Yes	Yes	Yes	Yes	Yes	Yes
District FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Grade FE	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-0.390***	-0.358***	-0.151	-0.233***	-0.264***	-0.431***
	(0.0934)	(0.0866)	(0.0932)	(0.0793)	(0.0780)	-0.0779
Observations	41,142	40,923	40,922	58,678	58,476	58,475
Adj. R-squared	0.096	0.097	0.093	0.065	0.078	0.081

Notes: Table 3.7 reports the Post-program difference using diff-in-diff estimates on the children test performance for Post=2015 and Post=2015+2016(pooled) vs Pre=12-to-2013(pooled). The data is from the ASER Household Survey. Standard errors clustered at village level are shown in parentheses. The unit of observation is surveyed 3 to 16 year's old child enrolled in government school from Grade-0 to grade-5. The dependent variable is the test score normalized by grade. Variable Monitoring is an interaction of treated province (KP) and Post. Fixed Effect on individual grade, District and year applied in each regression. Child-related controls include age, private tuition; parent's education controls include, mother and father highest education in years; household characteristics include ownership, house condition, and availability of electricity, mobile and television facilities. Statistical significance at the 1, 5, 10% levels are indicated by ***, **, and *, respectively.

Table 3.7 reports the direct program effect on normalized test scores for lower grade (0 to 5) enrolled children using 2012 and 2013 as Pre-Program. For simplicity purpose, we only report coefficients of the interaction term of KP and post-program year to show the differential effect of the treatment after the program. Previous literature on learning outcomes documents effects of factors

[14] After constructing the raw score, we standardize the score as:

$$z = (x - \bar{x})/\sigma \tag{3.9}$$

where $\bar{x}$ and σ are the mean and standard deviation of the test score respectively by individual grade

such as individual characteristics, parent's education and household characteristics on the learning performance of children (Abdulkadiroğlu et al., 2018; Azam, Kingdon, & Wu, 2016; A. V. Banerjee et al., 2007; Croke, 2014; Jackson, 2009; Raikes, 2016). We therefore control for individual child-specific characteristics, parents education and household characteristics along with district fixed effect and year fixed effect. The first three columns report the program effect on reading, maths and english test scores normalized by individual grade for year 2015 as post-program. The last three columns report the two years (2015 & 2016) program effect on normalized test score of lower grade children.

We observe a significantly positive effect of the IMU program on enrolled children performance in maths and English while positive (but not significant) effect on reading. Conditional on child-specific controls, parent's education and household characteristics, on average, being in the KP province increases a child's normalized test performance by 0.07 standard deviations (SD) points in reading, 0.13 SD points in maths and 0.11 SD points in english. Adding 2016 as post-program year into analysis shows that there is no significant direct effect of IMU on children test performance. We also check the direct effect of the program on higher grade (6 to 10) children. The results are reported in Appendix table C.5 and C.6. Since data on the higher grade related questions was not available in year 2012, therefore, we report the results of higher grade children which include 2014 as pre-program period. Though significant at 10% level, the program effect is positive for higher grade children in reading bonus question and english bonus questions. This decreasing effect of program on higher grade children is consistent with earlier findings by Banerji et al. (2013) on the difficulty level of the ASER-India test questions. In estimating results for table C.5 and C.6, we only include children that are currently enrolled in government schools and for whom information on covariates were available.

After adding 2016 as post-program year, the direct program effect on lower grade children normalized test score is positive, but not significant indicating a

decrease in the program effect during the year 2016. Nevertheless, for higher grade children, the program effect persisted, though slightly reduced. Controlling for child-specific factors, parents and household characteristics, and the district and year fixed effects, the IMU increases the ability of higher grade children to answer bonus-test questions by 0.127 SD points for reading, 0.136 for english at 5% significance level. This decrease in effect of children test performance coincides with the decrease in teachers' attendance in 2016 as reflected in table 3.6 giving more weight to the possibility of direct effect of the monitoring program on children test performance. One way of linking the decreasing effect on children performance might be the reducing efforts of teachers even though they are present in school. Previous evidence also does not rule out this possibility. In estimating the effect of teacher's incentive program in Kenya, Kremer and Chen (2001) find a short run increase in learning score and argue that gains in learning were only temporary and were not accompanied by increases in teaching efforts.

Our results on the children test score provide evidence in support of the idea that absence of teachers at lower grades schools causes low learning achievements in developing countries. Thus addressing teacher's absence at lower level could be a key policy direction that can positively affect learning achievements of lower grade children. Such a policy direction might combine external control monitoring tools such as IMU with appropriate incentive mechanisms to maintain the quality of schools on sustainable basis. With regard to higher grade children, besides increased oversight, teacher's education or training quality may be coupled with efforts of increasing their attendance to ensure learning achievements.

3.8.3 Enrollment Status

Enrollment has been widely used as a key indicator for achieving sustainable development goals particularly children of age 5 to 16 in developing countries. A large number of out-of-school children in rural areas of Pakistan has been

a persisting issue that requires effective solution. According to recent reports, Pakistan continue to suffer from low enrollment and high dropout rate at primary and middle level schooling (Gouleta, 2015). A review by the International Growth Centre (ICG), in Khyber Pakhtunkhwa(KP) province in 2012-13 shows only 63% of 4-9 years old children were enrolled in schools with a much lower (56%) female enrollment (Habib, 2015). For higher grades, the net enrollment is even worst. For example, for middle schools, the net enrollment was hardly 40% reflecting a significant dropout or no-enrollment during the middle school age group (11 to 15 years).

Table 3.8: Program Effect, Children Enrollment Status

Dep. Var: Enrollment Status[0,1]	Post=2015		Post=2016 & 2016	
	OLS	Probit	OLS	Probit
Monitoring(treatment*Post)	0.0317**	0.040*	0.00105	0.004
	(0.0152)	(0.017)	(0.0133)	(0.015)
Child Age	0.0352***	0.039**	0.0363***	0.040**
	(0.000610)	(0.001)	(0.000547)	(0.001)
Gender(Female=1)	-0.196***	-0.217**	-0.191***	-0.212**
	(0.00494)	(0.005)	(0.00427)	(0.005)
Mother Highest Education	-0.00161***	-0.002**	-0.00189***	-0.002**
	(0.000555)	(0.001)	(0.000501)	(0.001)
Father Highest Education	0.00553***	0.007**	0.00587***	0.007**
	(0.000414)	(0.000)	(0.000366)	(0.000)
House-ownership	0.0134*	0.016	0.00772	0.010
	(0.00805)	(0.009)	(0.00735)	(0.008)
HH- Size	-0.00161***	-0.002**	-0.00175***	-0.002
	(0.000498)	(0.001)	(0.000487)	(0.001)**
Urban Districts	0.0751**	0.095*	0.0655*	0.083
	(0.0355)	(0.044)	(0.0352)	(0.044)
HH-Facilities Controls	Yes	Yes	Yes	Yes
District FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Constant	0.506***		0.517***	
	(0.0212)		(0.0179)	
Observations	144,988	144,988	188,579	188,579
Adj. R-squared	0.195		0.190	

Notes: Table 3.8 reports the Post-program difference using diff-in-diff OLS coefficients and Probit marginal effects on the *enrollment status of surveyed children.* The first two columns reports results on the 2015 as post-program only while the last two columns reports post-program period as 2015 & 2016. The pre-program period in all columns is 2012 and 2013(pooled). The dependent variable is a binary which child is enrolled in government school and zero otherwise. The sample does not include children that are enrolled in private or other schools. Variable Monitoring is an interaction of *treated province* (KP) and Post-program period. District and year fixed effect are applied throughout regression while controls for household facilities are also included. The data is from the ASER Household Survey. Standard errors clustered at village level are shown in parentheses. The unit of observation is surveyed 3 to 16 year's old child. Statistical significance at the 1, 5, 10% levels are indicated by ***, **, and *, respectively

To investigate the overall effect of the monitoring program on the enrollment status of children surveyed at home, we analyze ASER household survey data from 2012 to 2016. The ASER household survey include a variable on the status of children of age 5 to 16 asking whether they are enrolled in schools or

not. We drop all those children enrolled in private school, madrassas[15] or any other school to obtain reduced sample of children either enrolled in government schools or not enrolled. We attempt our diff-in-diff model for post-program year as 2015 only and 2015 and 2016 together to see the two years post program effect. Results reported in table 3.8 are suggestive of the positive direct effect of monitoring program on gross government school enrollment. Since enrollment status is a binary variable, in addition to simple OLS, we also compare probit model while controlling for all household and child related characteristic. The OLS estimates show that conditional on household characteristics, compared to FATA, the probability of a schooling age child to be enrolled in government school increases in the KP province by 3.1% in 2015 while this effect is not significant in 2016. The probit marginal effects imply that children in KP province have a 4% higher probability of getting enrolled in government schools compared to FATA.

Both OLS and probit results point to a similar drop in the gross enrollment of children in 2016 consistent with a similar trend in children's test outcomes and teachers attendance. However this effect should be interpreted carefully due to two reasons. First, children enrollment mainly depends on school density. In other words, if the government schools (e.g per village) increases, it might increase the gross enrollment per village. Secondly, each year, there might be a linear trend in population growth coupled with increasing awareness campaigns by government and non-government organizations. While we are applying district fixed effect and year fixed effect which control for any district specific characteristics and time trend respectively, we believe this effect may come through parents whose behavior might be affected by the government's monitoring program. Earlier studies also support the idea that parents positively respond to increasing school quality in terms of enrolling their children in schools (Glewwe & Kremer, 2006; Jones et al., 2014). Although these effects seem to be small,

[15]Madrassas are religious institutions where basic learning courses are taught besides religious literature.

considering the status of out-of-school children in developing countries particularly Pakistan, the implication of these results is worth noticing. If a government policy targeted at one aspect of schooling such as teachers' attendance, affect children enrollment into government schools and test performance simultaneously besides increasing school quality, then the cost of such policies should be evaluated in terms all three outcomes of education; school quality, learning outcomes and enrollment.

3.8.4 Robustness Check

Table 3.9: Program Effect on Only Primary Schools[grade0 to 5]

Table -5 : Program Effect on Only Primary Schools[grade0 to 5]

Dep. Var: Teachers Attendance	(1)	(2)	(3)	(4)
Monitoring (Treatment*Post)	0.0657***	0.0567***	0.0243	0.0141
	(0.0182)	(0.0209)	(0.0165)	(0.0194)
School Teaching Quality	0.0384**	0.0396**	0.0298**	0.0316**
	(0.0162)	(0.0194)	(0.0140)	(0.0160)
School Training Quality	0.0243	0.00995	0.0263*	0.0175
	(0.0165)	(0.0208)	(0.0147)	(0.0172)
urban	-0.0164	-0.0244	-0.0521	-0.0255
	(0.0379)	(0.0640)	(0.0440)	(0.0393)
old-school	-0.00946	0.000805	-0.0104	-0.00386
	(0.00986)	(0.0115)	(0.00936)	(0.0107)
School Size(enrollment)	0.199***	0.159**	0.145***	0.105
	(0.0550)	(0.0693)	(0.0549)	(0.0683)
Schools Facilities Controls	YES	YES	YES	YES
District FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Constant	0.785***	0.764***	0.827***	0.819***
	(0.0355)	(0.0405)	(0.0307)	(0.0342)
Observations	2,765	2,087	3,429	2,751
Adj. R-squared	0.082	0.090	0.066	0.065
Mean of the dep. Var:	0.887	0.887	0.887	0.887

Notes: 3.9 shows the main effect of the monitoring program on teacher's attendance in government run primary schools only. Column (1) & (2) represent Post=2015 while Pre=2012-2014 & Pre=2012-2013 respectively. Similarly Column (3) & (4) represent Post=2015-2016 while Pre=2012-14(1) & Pre=2012-13 (2) respectively. The outcome variable is the ratio of teachers present in school to the total appointed teachers. Variable Monitoring is a typical diff-in-diff interaction of treatment (KP) and Post (for corresponding year). Due to District and year fixed effect applied in each regression, we do not include variables for treatment and posts. Variables *School Teaching Quality* and *School Training Quality* are continuous variables showing the ratio of teachers with master's degree and specific training level to the total appointed teachers in each school. *School Facilities dummies* include availability of water, boundary, toilet, library, playground, laboratory, computer and internet. *School Size* is a continuous variable representing the ratio of children enrolled in surveyed school to the school with highest number of enrolled children. The data is taken from the ASER-Pakistan School Survey. Standard errors clustered at village level are shown in parentheses. The unit of observation is the surveyed government primary school where children from grade0 to 5 are taught. Statistical significance at the 1, 5, 10% levels are indicated by ***, **, and *, respectively.

Table 3.10: Effect on Reduced Sample of Bordering Districts

Dep. Var: Teachers Attendance	(1)	(2)	(3)	(4)
Monitoring (Treatment*Post)	0.0800***	0.0779***	-0.00384	-0.000501
	(0.0176)	(0.0178)	(0.0220)	(0.0230)
School Teaching Quality	0.0462**	0.0313	0.0356**	0.0257
	(0.0218)	(0.0255)	(0.0178)	(0.0199)
School Training Quality	0.0127	0.000746	0.0123	0.00587
	(0.0252)	(0.0322)	(0.0217)	(0.0255)
urban	-0.0478	0.0393	-0.0905**	-0.0637
	(0.0481)	(0.0456)	(0.0454)	(0.0497)
old-school	-0.00143	0.00716	-0.00723	-0.00390
	(0.0130)	(0.0151)	(0.0122)	(0.0140)
School Size(enrollment)	0.127**	0.0733	0.138**	0.100
	(0.0556)	(0.0634)	(0.0542)	(0.0627)
Schools Facilities Controls	YES	YES	YES	YES
District FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Constant	0.759***	0.738***	0.789***	0.775***
	(0.0385)	(0.0427)	(0.0348)	(0.0378)
Observations	1,515	1,123	1,845	1,453
Adj. R-squared	0.056	0.070	0.050	0.056
Mean of the dep. Var:	0.871	0.871	0.871	0.871

Notes: Table-3.10 shows the main effect of the monitoring program on teacher's attendance in government run schools using the reduced sample of districts bordering with FATA and FATA. Column (1) & (2) represent Post=2015 while Pre=2012-2014 & Pre=2012-2013 respectively. Similarly Column (3) & (4) represent Post=2015-2016 while Pre=2012-14(3) & Pre=2012-13 (4) respectively. The outcome variable is the ratio of teachers present in school to the total appointed teachers. Variable Monitoring is a typical diff-in-diff interaction of treatment (KP) and Post (for corresponding year). Due to District and year fixed effect applied in each regression, we do not include variables for treatment and posts. Variables *School Teaching Quality* and *School Training Quality* are continuous variables showing the ratio of teachers with master's degree and specific training level to the total appointed teachers in each school. *School Facilities dummies* include availability of water, boundary, toilet, library, playground, laboratory, computer and internet. *School Size* is a continuous variable representing the ratio of children enrolled in surveyed school to the school with highest number of enrolled children. The data is taken from the ASER-Pakistan School Survey. Standard errors clustered at village level are shown in parentheses. The unit of observation is the surveyed government school. Statistical significance at the 1, 5, 10% levels are indicated by ***, **, and *, respectively.

3.9 Conclusion

Initiatives to reduce teachers' absenteeism in public schools range from offering incentives to instituting school committees to decentralizing of education to local government to externally controlled monitoring etc., however, to what extent such initiatives persist their effect and how much they affect children learning performance is rarely understood. In this paper, we examine the effect of a large scale public schools monitoring program featured by the use of smartphone aided facility through professionally trained monitors in the KP province of Pakistan. We use five years data from a country wide annually representative survey to compare treated region with a neighboring untreated region that share similar characteristics in all aspects except the program. Our data consists a rich

set of variables that allow estimation of education production function in the context of a purely exogenous intervention. Our findings suggest that monitoring of government schools through trained monitors equipped with smart-phone-aided biometric facility improved teacher's attendance by nearly 8% in the year immediately following the program. However, this effect decreases by nearly half after two years of the program introduction.

We also find the program's direct effect on the enrolled children's test performance at home. Enrolled children's standardized reading, math and english ability in monitored schools has improved significantly by 0.07, 0.13 and 0.11 standard deviation points respectively at the lower (0-5) grades. There is slight improvement in standardized test performance of higher grade children. We also find a positive immediate effect of the program on the likelihood of school-aged children enrollment into government schools suggesting responsiveness of parents towards a large scale program.

Our results on the children performance provide evidence in support of the idea that absence of teachers at lower grade schools causes low learning achievements in developing countries. Thus addressing teacher's absence at lower level could be a key policy direction that can positively affect learning achievements of lower grade children. Such a policy direction might be combined with external control monitoring tools such as IMU with appropriate incentive mechanisms to maintain the quality of schools on sustainable basis. With regard to higher grade children, besides increased oversight, teacher's education or training quality may be coupled with efforts for increasing their attendance to ensure learning achievements.

Two broad implications can be derived from our results. First, incorporation of advanced technology in schools monitoring has a stronger effect on teachers and children performance simultaneously. Such initiatives might have wide range effects than the targeted outcomes. Secondly, how long such effects sustain, depends on complementary measures that links teachers performance with

children performance.

3.10 Limitations and Future Research Directions

Despite having a clear identification strategy, our work is subject to certain limitations. First, we use survey data that is collected on annual basis, and only captures the yearly inspections of schools. Using monthly data on teacher's attendance might be more useful in evaluating any differential effect between KP and FATA schools performance. Secondly, we couldn't access more detailed administrative data on the characteristics of monitors employed by IMU for more in-depth analysis of the program. Data collected by IMU staff on teacher's attendance and school performance might be useful for comparison of ASER data and IMU data. Thirdly, the test questions for higher-grade children might weakly represent their performance because of low standard of questions designed by ASER. ASER's test questions mainly target low grade children as shown in Appendix. Although we utilize the bonus questions to create normalize test score for higher grade children, a more standardized design of tests taken at home for higher grade children would be more useful in gauging children performance. Finally, establishing a systematic channel between teacher's attendance and children performance is important despite our findings that monitoring program has directly affected children test score. Given the differential effect in 2015, future research might utilize two stage least square (2SLS) approach for establishing a clear link between teacher's attendance and children test score.

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APPENDIX C

Tables and Figures

Table C.1: Falsification Test on Private Schools Data

Dep. Var: Teachers Attendance Ratio	Post=2015(a)	Post=2015(b)	Post(a)	Post(b)
Monitoring (Treatment*Post)	0.000348	-0.0196	-0.0244	-0.0473
	(0.0335)	(0.0375)	(0.0257)	(0.0298)
School Teaching Quality	0.0348*	0.0239	0.0364*	0.0292
	(0.0190)	(0.0225)	(0.0198)	(0.0234)
School Training Quality	-0.00510	0.00115	-0.00739	-0.00506
	(0.0244)	(0.0322)	(0.0239)	(0.0304)
urban	0.0166	0.0408	0.00401	-0.0332
	(0.0297)	(0.0311)	(0.0276)	(0.0407)
old schools	-0.0232	-0.0260	-0.0262	-0.0276
	(0.0198)	(0.0220)	(0.0193)	(0.0214)
enrollment	0.0768*	0.0530	0.0874**	0.0718
	(0.0402)	(0.0507)	(0.0395)	(0.0488)
Schools Facilities Controls	YES	YES	YES	YES
District FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Constant	0.511***	0.576***	0.776***	0.545***
	(0.0267)	(0.189)	(0.0346)	(0.0297)
Observations	1,674	1,292	1,944	1,562
Adj. R-squared	0.064	0.100	0.057	0.081

Notes: This table reports the falsification test of the monitoring program on teacher's attendance using private school data. We run the same specification of our main effect on the private school data to see any systematic trend in the teacher's attendance of private school data. Column (1) & (2) represent Post=2015 while Pre=2012-2014(1) & Pre=2012-2013 respectively. Similarly column (3) & (4) represent Post=2015-2016 while Pre=2012-14(1) & Pre=2012-13(2) respectively. The outcome variable is the ratio of teachers present in school to the total appointed teachers. Variable Monitoring is an interaction of treatment (KP) and Post (for corresponding year). Due to District and year fixed effect applied in each regression, we do not include variables for treatment and posts. Variables *School Teaching Quality* and *School Training Quality* are continuous variables which show the ratio of teachers with master's degree and specific training level to the total appointed teachers in each school. *School Facilities controls* include availability of water, boundary, toilet, library, playground, laboratory, computer and internet. *Enrollment* is a continuous variable representing the ratio of children enrolled in surveyed school to the school with highest number of enrolled children. The data is taken from the ASER-Pakistan School Survey. Standard errors clustered at village level are shown in parentheses. The unit of observation is the surveyed private school. Statistical significance at the 1, 5, 10% levels are indicated by ***, **, and *, respectively.

Table C.2: Children Attendance in Government Schools

Dep. Var: Children Attendance Ratio	Post=2015(a)	Post1=2015(b)	Post(a)	Post(b)
Monitoring (Treatment*Post)	0.0177*	-0.00579	0.00873	-0.0168
	(0.00973)	(0.0116)	(0.0103)	(0.0121)
School Teaching Quality	0.0104	0.0166*	-0.000394	0.00357
	(0.00817)	(0.00959)	(0.00800)	(0.00912)
School Training Quality	-0.00269	0.00140	0.00139	0.00773
	(0.00952)	(0.0112)	(0.00897)	(0.0103)
urban	0.00428	-0.0510*	-0.0215	-0.0434
	(0.0258)	(0.0293)	(0.0229)	(0.0276)
Old schools	-0.00862	-0.00905	-0.00790	-0.00865
	(0.00534)	(0.00620)	(0.00528)	(0.00606)
Schools Facilities Controls	Yes	Yes	Yes	Yes
District FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Constant	0.802***	0.800***	0.792***	0.790***
	(0.0186)	(0.0214)	(0.0170)	(0.0190)
Observations	4,053	3,019	4,953	3,919
Adj. R-squared	0.095	0.125	0.092	0.112

Notes: This table shows main effect of the monitoring program on children attendance. Column (1) & (2) represent Post=2015 while Pre=2012-2014(1) & Pre=2012-2013 respectively. Similarly column (3) & (4) represent Post=2015-2016 while Pre=2012-14(1) & Pre=2012-13(2) respectively. The outcome variable is the ratio of children present in school to the total enrollment. Variable Monitoring is an interaction of treatment (KP) and Post (for corresponding year). Due to District and year fixed effect applied in each regression, we do not include variables for treatment and posts. Variables *School Teaching Quality* and *School Training Quality* are continuous variables which show the ratio of teachers with master's degree and specific training level to the total appointed teachers in each school. *School Facilities controls* include availability of water, boundary, toilet, library, playground, laboratory, computer and internet. The data is taken from the ASER-Pakistan School Survey. Standard errors clustered at village level are shown in parentheses. The unit of observation is the surveyed government school. Statistical significance at the 1, 5, 10% levels are indicated by ***, **, and *, respectively.

Table C.3: Pre-Program Difference, Normalized Test Score

	Normalized Test Score					
	Lower Grades-(0-to -5)			Upper Grade (6 -10)		
	Reading	Math	English	Reading	Math	English
Pre-Program Difference (KP*Post)	-0.150**	-0.0112	-0.0657	0.0218	0.0783	-0.334***
	(0.0633)	(0.0571)	(0.0601)	(0.0622)	(0.0590)	(0.0917)
Child -Related Controls	Yes	Yes	Yes	Yes	Yes	Yes
Parents Education Controls	Yes	Yes	Yes	Yes	Yes	Yes
Household Characteristics Dummies	Yes	Yes	Yes			
District FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Grade FE	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-0.443***	-0.00221	-0.0470	1.211***	0.685***	0.257
	(0.0927)	(0.0846)	(0.0906)	(0.134)	(0.161)	(0.186)
Observations	38,923	38,818	38,762	11,054	11,054	10,942
Adj. R-squared	0.068	0.062	0.069	0.115	0.111	0.116

Notes: This table reports the pre-program difference using diff-in-diff estimates on the *children test performance* for Post=2014 vs Pre=2012 & 2013 using the ASER Household Survey data. Standard errors clustered at village level are shown in parentheses. The unit of observation is surveyed 3 to 16 year's old child enrolled in government school from Grade-0 to grade-5(first three columns) and grade-6 to 10(last three columns). The dependent variable is the *test score normalized by grade*. The pre-program difference is a typical diff-in-diff interaction of *to-be-treated province* (KP) and Post (which is equal to 1 if year==2014 and 0 if year=2012 or 2013). Fixed Effect on individual grade, District and year applied in each regression. Child-related controls include age, private tuition; parent's education controls include, mother and father highest education in years; household characteristics include ownership, house condition, and availability of electricity, mobile and television facilities. Statistical significance at the 1, 5, 10% levels are indicated by ***, **, and *, respectively.

Table C.4: Teachers Attendance (Different Pre-Program Periods)

Dep. Var: Teachers Attendance	(1)	(2)	(3)	(4)
Monitoring (Treatment*Post)	0.0756***	0.0665***	0.0344**	0.0256
	(0.0151)	(0.0172)	(0.0140)	(0.0162)
School Teaching Quality	0.0344***	0.0375**	0.0278**	0.0301**
	(0.0125)	(0.0150)	(0.0111)	(0.0127)
School Training Quality	0.0129	-0.00375	0.0167	0.00607
	(0.0143)	(0.0182)	(0.0125)	(0.0147)
urban	-0.0303	0.0620	0.00645	0.0159
	(0.0469)	(0.0408)	(0.0310)	(0.0346)
old-school	-0.00379	0.000548	-0.00650	-0.00469
	(0.00785)	(0.00919)	(0.00751)	(0.00863)
School Size(enrollment)	0.0945***	0.0460	0.0789**	0.0368
	(0.0357)	(0.0448)	(0.0351)	(0.0433)
Schools Facilities Controls	YES	YES	YES	YES
District FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Constant	0.884***	0.880***	0.846***	0.839***
	(0.0295)	(0.0302)	(0.0344)	(0.0350)
Observations	4,053	3,019	4,953	3,919
Adj. R-squared	0.066	0.075	0.054	0.055
Mean of the dep. Var:	.883	.886	.881	.883

Notes: This table shows the main effect of the monitoring program on teacher's attendance. Column (1) & (2) represent Post=2015 while Pre=2012-2014 & Pre=2012-2013 respectively. Similarly Column (3) & (4) represent Post=2015-2016 while Pre=2012-14(1) & Pre=2012-13 (2) respectively. The outcome variable is the ratio of teachers present in school to the total appointed teachers. Variable Monitoring is a typical diff-in-diff interaction of treatment (KP) and Post (for corresponding year). Due to District and year fixed effect applied in each regression, we do not include variables for treatment and posts. Variables *School Teaching Quality* and *School Training Quality* are continuous variables showing the ratio of teachers with master's degree and specific training level to the total appointed teachers in each school. *School Facilities dummies* include availability of water, boundary, toilet, library, playground, laboratory, computer and internet. *School Size* is a continuous variable representing the ratio of children enrolled in surveyed school to the school with highest number of enrolled children. The data is taken from the ASER-Pakistan School Survey. Standard errors clustered at village level are shown in parentheses. The unit of observation is the surveyed government school. Statistical significance at the 1, 5, 10% levels are indicated by ***, **, and *, respectively.

Table C.5: Program Effect, Test Score(Post=2015 and Pre=2012 to 2014))

	Normalized Test Score					
	Lower Grades-(0-to -5)			Upper Grade (6 -10)		
	Reading	Math	English	Reading	Math	English
Monitoring (KP*Post)	0.130**	0.140***	0.150***	0.100*	0.0307	0.121*
	(0.0524)	(0.0478)	(0.0508)	(0.0594)	(0.0561)	(0.0707)
Child -Related Controls	Yes	Yes	Yes	Yes	Yes	Yes
Parents Education Controls	Yes	Yes	Yes	Yes	Yes	Yes
Household Characteristics Dummies	Yes	Yes	Yes	Yes	Yes	Yes
District FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Grade FE	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-0.431***	-0.0736	-0.0709	1.439***	1.017***	0.710***
	-0.0779	-0.0703	-0.0751	(-0.124)	(-0.13)	(-0.149)
Observations	60,308	60,082	60,076	17156	17156	17059
Adj. R-squared	0.067	0.067	0.070	0.147	0.160	0.143

Notes: This table reports the Post-program difference using diff-in-diff estimates on the *children test performance* for Post=2015 vs Pre=12-to-2014(pooled). The data is from the ASER Household Survey. Standard errors clustered at village level are shown in parentheses. The unit of observation is surveyed 3 to 16 year's old child enrolled in government school from Grade-0 to grade-5(first three columns) and grade-6 to 10(last three columns). The dependent variable is the *test score normalized by grade*. Variable Monitoring is an interaction of *treated province* (KP) and Post (which is equal to 1 if year==2015 and 0 if year=2012 or 2014). Fixed Effect on individual grade, District and year applied in each regression. Child-related controls include age, private tuition; parents education controls include, mother and father highest education in years; household characteristics include ownership, house condition, and availability if electricity, mobile and television facilities. Statistical significance at the 1, 5, 10% levels are indicated by ***, **, and *, respectively. (See Appendix table A4 (b) for complete regression results.)

Table C.6: Program Effect, Test Score (Post=2015+2016 and Pre=2012 to 2014)

	Normalized Test Score					
	Lower Grades-(0-to -5)			Upper Grade (6 -10)		
	Reading	Math	English	Reading	Math	English
Monitoring (KP*Post)	0.0730	0.0221	0.0657	0.127**	0.0198	0.136**
	(0.0474)	(0.0440)	(0.0461)	(0.0506)	(0.0490)	(0.0618)
Child -Related Controls	Yes	Yes	Yes	Yes	Yes	Yes
Parents Education Controls	Yes	Yes	Yes	Yes	Yes	Yes
Household Characteristics Dummies	Yes	Yes	Yes	Yes	Yes	Yes
District FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Grade FE	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-0.355***	-0.0691	-0.0226	1.435***	0.963***	0.814***
	-0.0724	-0.0672	-0.071	(0.107)	(0.114)	(0.129)
Observations	77724	77515	77509	21,744	21,744	21,373
Adj. R-squared	0.053	0.064	0.067	0.128	0.147	0.113

Notes: This table reports the Post-program difference using diff-in-diff estimates on the *children test performance* for Post=2015 & 2016 vs Pre=12-to-2014 (pooled). The data is from the ASER Household Survey. Standard errors clustered at village level are shown in parentheses. The unit of observation is surveyed 3 to 16 year's old child enrolled in government school from Grade-0 to grade-5(first three columns) and grade-6 to 10(last three columns). The dependent variable is the *test score normalized by grade*. Variable Monitoring is an interaction of *treated province* (KP) and Post (which is equal to 1 if year==2015 & 2016 and 0 if year=2012 or 2014). Fixed Effect on individual grade, District and year applied in each regression. Child-related controls include age, private tuition; parents education controls include, mother and father highest education in years; household characteristics include ownership, size, house condition, and dummies for availability if electricity, mobile and television facilities. Statistical significance at the 1, 5, 10% levels are indicated by ***, **, and *, respectively.

Table C.7: Estimates of Test Performance(Post=2015, Pre=2012-to-14)

	Grade-0 to Grade-5			Grade-5 to Grade-10		
	Reading	Math	English	Reading	Math	English
DiD(treatment*Post)	0.130**	0.140***	0.150***	0.100*	0.0307	0.121*
	(0.0524)	(0.0478)	(0.0508)	(0.0594)	(0.0561)	(0.0707)
Post(=2015, Pre=2012-14)	0.0310	-0.00182	0.00452	-0.246***	-0.119**	-0.222***
	(0.0478)	(0.0418)	(0.0450)	(0.0496)	(0.0494)	(0.0630)
Treatment(KP)	-0.169**	-0.395***	-0.275***	-0.543***	-0.404***	-0.844***
	(0.0850)	(0.0787)	(0.0819)	(0.130)	(0.117)	(0.132)
Child Age	0.0847***	0.0722***	0.0674***	-0.00800	-0.0109	0.0157
	(0.00814)	(0.00749)	(0.00737)	(0.00828)	(0.00854)	(0.00969)
Mother Highest Education	-0.00139	-0.00102	0.000449	-0.00220	0.000379	0.00317
	(0.00238)	(0.00214)	(0.00229)	(0.00296)	(0.00258)	(0.00311)
Father Highest Education	0.00103	0.00150	0.00161	0.00512***	0.00410**	-0.000725
	(0.00157)	(0.00155)	(0.00158)	(0.00177)	(0.00176)	(0.00221)
House-ownership	0.0737***	0.0367	0.0219	0.0295	0.0228	0.0492
	(0.0256)	(0.0242)	(0.0261)	(0.0321)	(0.0304)	(0.0385)
Private Tutoring	0.196***	0.154***	0.160***	-0.00228	-0.0585	0.160***
	(0.0407)	(0.0380)	(0.0426)	(0.0428)	(0.0451)	(0.0435)
Electricity Availability	0.0136	-0.0412	-0.0542	-0.0325	0.0168	0.0892*
	(0.0454)	(0.0405)	(0.0430)	(0.0419)	(0.0427)	(0.0514)
Mobile service Availability	0.0848***	0.0543**	0.0889***	0.0975***	0.0510	0.0840**
	(0.0255)	(0.0233)	(0.0254)	(0.0363)	(0.0340)	(0.0390)
TV availability	0.0241	0.0158	0.00277	-0.0299	-0.0432**	0.0207
	(0.0191)	(0.0184)	(0.0186)	(0.0221)	(0.0210)	(0.0240)
House condition	0.0375	0.0436	0.0497	0.0297	-0.0135	0.0581
	(0.0331)	(0.0320)	(0.0321)	(0.0412)	(0.0381)	(0.0456)
HH- Size	-0.000153	0.00184	0.000509	9.57e-05	0.00170	0.00136
	(0.00145)	(0.00138)	(0.00148)	(0.00135)	(0.00135)	(0.00152)
District FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
Grade FE	YES	YES	YES	YES	YES	YES
Constant	-0.431***	-0.0736	-0.0709	1.439***	1.017***	0.710***
	-0.0779	-0.0703	-0.0751	(-0.124)	(-0.13)	(-0.149)
Observations	60,308	60,082	60,076	17156	17156	17059
Adj. R-squared	0.067	0.067	0.070	0.147	0.160	0.143

Notes: This table reports the Post-program difference using diff-in-diff estimates on the *children test performance* for Post=2015 vs Pre=12-to-2014(pooled). The data is from the ASER Household Survey. Standard errors clustered at village level are shown in parentheses. The unit of observation is surveyed 3 to 16 year's old child enrolled in government school. The dependent variable is the *test score normalized by grade*. Variable Monitoring is an interaction of *treated province* (KP) and Post (which is equal to 1 if year==2015 and 0 if year=2012 or 2014). Fixed Effect on individual grade, District and year applied in each regression. Statistical significance at the 1, 5, 10% levels are indicated by ***, **, and *, respectively

Table C.8: Estimates of Test Performance(Post=2015+2016, Pre=2012-to-14)

	Grade-0 to Grade-5			Grade-5 to Grade-10		
	Reading	Math	English	Reading	Math	English
DiD(treatment*Post)	0.0730	0.0221	0.0657	0.127**	0.0198	0.136**
	(0.0474)	(0.0440)	(0.0461)	(0.0506)	(0.0490)	(0.0618)
Post(=2015, Pre=2012-14)	-0.108**	-0.256***	-0.235***	-0.119**	-0.0562	0.126**
	(0.0477)	(0.0424)	(0.0450)	(0.0488)	(0.0488)	(0.0596)
Treatment(KP)	-0.0447	-0.263***	-0.115	-0.418***	-0.215**	-0.591***
	(0.0755)	(0.0735)	(0.0750)	(0.101)	(0.0923)	(0.102)
Child Age	0.0802***	0.0673***	0.0623***	-0.00715	-0.0115	0.00688
	(0.00685)	(0.00660)	(0.00618)	(0.00719)	(0.00742)	(0.00825)
Mother Highest Education	0.00250	0.000588	0.00310	-0.00231	-0.00128	0.00413
	(0.00216)	(0.00210)	(0.00215)	(0.00252)	(0.00232)	(0.00269)
Father Highest Education	0.00378***	0.00419***	0.00340**	0.00410***	0.00342**	-0.00337*
	(0.00140)	(0.00145)	(0.00142)	(0.00154)	(0.00154)	(0.00191)
House-ownership	0.0468**	0.0381*	0.00586	0.0230	0.0454	0.0613*
	(0.0226)	(0.0223)	(0.0243)	(0.0281)	(0.0301)	(0.0331)
Private Tutoring	0.277***	0.249***	0.266***	0.0151	-0.0589	0.112***
	(0.0371)	(0.0397)	(0.0399)	(0.0345)	(0.0402)	(0.0382)
Electricity Availability	0.0166	-0.00693	-0.0377	-0.0308	0.0510	0.0587
	(0.0374)	(0.0340)	(0.0359)	(0.0380)	(0.0422)	(0.0439)
Mobile service Availability	0.0333	0.00955	0.0560**	0.0712***	0.0277	0.0395
	(0.0217)	(0.0204)	(0.0222)	(0.0272)	(0.0261)	(0.0301)
TV availability	0.0205	0.0180	0.0189	-0.0140	-0.0524***	0.0408*
	(0.0169)	(0.0169)	(0.0169)	(0.0195)	(0.0186)	(0.0209)
House_condition	0.0282	0.0302	0.0302	0.0453	0.0550	0.0655*
	(0.0299)	(0.0304)	(0.0299)	(0.0361)	(0.0348)	(0.0391)
HH- Size	-0.00129	0.00193	0.000142	-0.000398	5.15e-05	-0.000119
	(0.00146)	(0.00140)	(0.00148)			
District FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
Grade FE	YES	YES	YES	YES	YES	YES
Constant	-0.355***	-0.0691	-0.0226	1.435***	0.963***	0.814***
	-0.0724	-0.0672	-0.071	(0.107)	(0.114)	(0.129)
Observations	77724	77515	77509	21,744	21,744	21,373
Adj. R-squared	0.053	0.064	0.067	0.128	0.147	0.113

Notes: This table reports the Post-program difference using diff-in-diff estimates on the *children test performance* for Post=2015 & 2016(pooled) vs Pre=12-to-2014(pooled). The data is from the ASER Household Survey. Standard errors clustered at village level are shown in parentheses. The unit of observation is surveyed 3 to 16 year's old child enrolled in government school. The dependent variable is the *test score normalized by grade*. Variable Monitoring is an interaction of *treated province* (KP) and Post (which is equal to 1 if year==2015 or 2016 and 0 if year=2012 to 2014). Fixed Effect on individual grade, District and year applied in each regression. Statistical significance at the 1, 5, 10% levels are indicated by ***, **, and *, respectively

Table C.9: List of Districts in Khyber Pakhtunkwha and FATA

Federally Administered Tribal Areas(FATA)	*Khyber Pakhtunkhwa (KP)*	*Bordering*
FATA-Bannu	Abbottabad	No
FATA-Lakki Marwat	Bannu	YES
FATA-Peshawar	Battagram	No
FATA-Tank	Buner	No
Khyber Agency	Charsadda	YES
Mohmand Agency	Chitral	No
Orakzai Agency	D.I.Khan	YES
Bajaur Agency	Hangu	YES
FATA-Kohat	Haripur	No
Kurram Agency	Karak	YES
FATA-DIKhan	Kohat	YES
	Kohistan	No
	Lakki Marwat	YES
	Lower Dir	YES
	Malakand	YES
	Mansehra	No
	Mardan	YES
	Mardan-Urban	YES
	Nowshera	YES
	Peshawar	YES
	Peshawar - Urban	YES
	Shangla	No
	Swabi	No
	Swat	No
	Swat-Urban	No
	Tank	YES
	Tor Ghar	No
	Upper Dir	YES

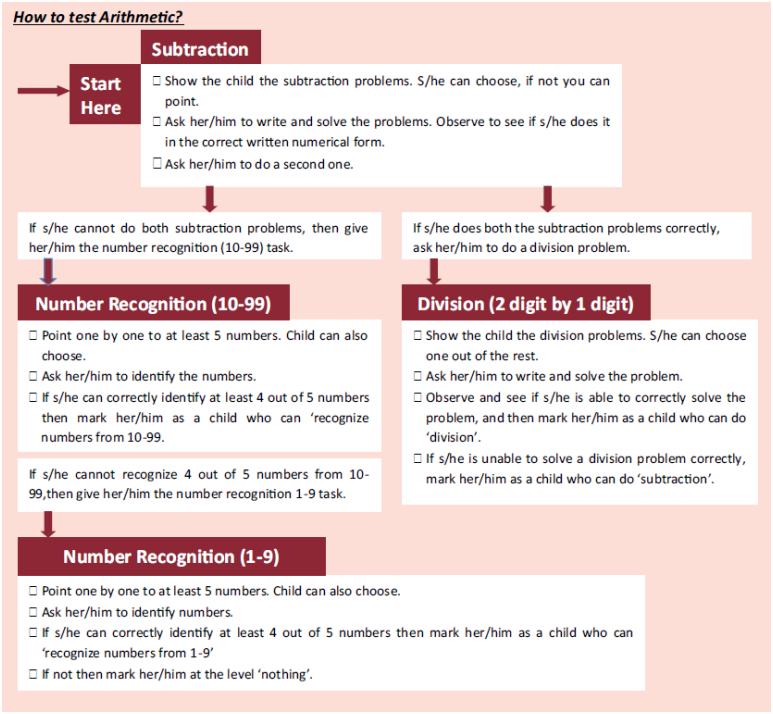

Figure C.1: ASER-Pakistan(2016) Children Test Procedure(Math Test)