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CONTENTS

A Study on Employability Skill Mismatch of New Passed Out Graduates of Bhutan

MD. HASSAN JAFRI

ABSTRACT

This present research examined the existence of a mismatch between employability and skills in Bhutan. Recent passed out graduates from different colleges of Royal University of Bhutan were the focus of the study. But the study was undertaken from the perspective of employers of graduates. A total of 12 organizations from different sectors, who were the recruiters of the graduates, formed the respondents to the research. HR department of the chosen organizations provided the data. Paired t-test was used to analyze the obtained data. Results indicated that a considerable mismatch in employability skill exists. Organizations have reported that what they needed in skills were not available in required level in recent passed out graduates. Implications of the study have been explicated in the research.

Key Words: *Employability, Skills, Mismatch, Bhutan*

Introduction

Employability skills refer to a set of skills, understandings and personal attributes — that make graduates more likely to gain employment and be successful in their chosen occupations, which benefits themselves, the community and the economy (Yorke, 2005).Employability skills play a strategic role in rendering the graduates employable in an economy. Graduate employability has been a key issue for higher education sector across the globe especially in developing economies. Employers expect graduates to have well developed skills, so that they can start making immediate contribution to the workplace when recruited (Bok, 2006; Confederation of British Industry, 2008). Shifts in the economy, prompted by globalization, technological change, increased competitiveness, and the growing sophistication of customer's and client's demands resulted in increasingly higher demand of generic skills alongside technical skills. But various reports from across the globe have shown the existence of employability skill gap in graduates, i.e. disconnect between the skills needed by organizations and the skills graduates learn in their educational institutions (European Centre for the Development of Vocational Training, 2012; Mishra, 2014; Srivastava & Khare, 2012).

The problem of skill gap does exist in Bhutan. Reports by World Bank (2010) and MoLHR (2014) clearly highlighted the issue. Unavailability of required skills in graduates creates a problem not only for graduates looking for job but also for organizations and the national economy. The most immediate impact of lack of employability skills are visible in unemployment, scarcity of human resources in the organization and slowing of the economy. However, no formal research has been undertaken to understand the mismatch of skills or the magnitude of the mismatch in Bhutan. The present study is an attempt to understand skills gap/ mismatch of recent graduates in Bhutan from employer's / organization's perspectives. Thus the study is designed to evaluate employability skills mismatch in recent graduates of Bhutan.

Literature Review

Employability Skills Mismatch

A skill mismatch in the labor market is a misallocation between the attributes of individuals seeking jobs and the attributes employers require for their vacant positions. Skill mismatch occurs when individuals' actual level of skill exceeds (skills surplus, over skilling, or skills underutilization) or falls short (skills deficit, under skilling) of the level of skill required for their jobs. According to Quintini, (2011), workers can either be over-skilled, hence possessing more skills than actually needed on the job (skill surplus), or under-skilled, possessing less skills than needed on the job (skill deficit). Over-skilling can be a problem because it may lead to skills loss and a waste of the resources that were used to acquire these skills. In addition, over-skilled workers earn less than workers who are well-matched to their jobs and tend to be less satisfied at work. This situation generates more employee turnover, which is likely to affect a firm's productivity. Under-skilling is also likely to affect productivity and slow the rate at which more efficient technologies and approaches to work can be adopted.

While there are variations in the classification of employability skills, there is a broad understanding among employers of what qualities, characteristics, skills and knowledge constitute employability skills for graduates. Employers expect graduates to have technical and discipline competences from their degrees but at the same time require graduates to demonstrate a range of broader skills and attributes that include team-working, communication, leadership, critical thinking, problem solving and managerial abilities etc. Employers also value critical thinking, ability to innovate and to work in teams etc, as these are required for innovation and anticipating and leading change (Harvey et al, 1997; Little, 2001; Lees, 2002). City & Guilds Centre for Skills Development (CSD) (2010), a UK based education and training related organization, acknowledged that skills employers expect regardless of the specific jobs being done are - Basic literacy and numeracy skills;Critical thinking skills;Management skills;Leadership skills;Interpersonal skills;Information technology skills;Systems thinking skills; and Work ethic disposition. Learner (2012) conducted research on employability skills in Australia and concluded that there are eight nationally agreed employability skills which are: communication, planning and organizing, teamwork, problem solving, self-management, initiative and enterprise, technology, and learning.

Mismatch in skills has individual, organizational and economic repercussions (Rainville, 2013; Verhaest & Omey, 2010). Individual consequences can be seen in the form of low wages and reduced job satisfaction. Organizational ramifications could be high turnover and reduced productivity. Macroeconomic ramifications from skill mismatch could be increase in unemployment and reduced GDP growth because of waste of human capital and reduced productivity.

A Skilled and educated workforce is the key resource to a vibrant and competitive economy. Employability skills are critical issue for both government and higher education institutions across the globe. One of the key reasons why many students invest in university education is to improve their employment prospects. However, achievement of good academic qualifications is highly valued, it no longer appears sufficient to secure employment (Yorke, 2005). Employers consider employability skills to be more valuable than specialist skills (California Postsecondary Education Commission, 2007). Robst (2007) emphasized that more generalist, basic transferable employability skills provide people the ability to enter the workforce, to perform jobs, to advance careers within a company, and to change jobs within and across industries. At entry level employers expect a graduate to come with certain skills such as communication, inter-personal, ability to speak English and work as part of a team, and basic computer knowledge. For technical graduate functional skills in the area of specialization area must. But employability skills and competencies are absent in most of the graduates

(Misra, 2014).The Indian Confederation of Industry (CII) in its findings revealed that 40 percent of India's population is under 25, yet only 5 percent of total Indian workforce is skilled. Of the 500 million (approx.) work forces in India, only 9 percent is engaged in the organized sector and only 5 percent have marketable skills (CII and City and Guilds Summit, 2008). A study on organizations in China showed that 6 out of 9 new Chinese university graduates are "deficient" in preparation for employment in their multinational company (The Conference Board, 2008). The Conference Board (2008) further reported that 6 out of 8 graduates are deficient in foreign language skills, 5 out of 8 graduates are deficient in "ability to think independently," 5 out of 8 in "teamwork skills, and 4 out of 8 in "entrepreneurialism.

Skills Mismatch in Bhutan

To the knowledge of the present researcher, no studies have been undertaken till date which addressed the skill mismatch in Bhutanese context. In the absence of such study, efforts have been made to draw inferences about the prevalence of the issue of skill mismatch indirectly from different reports. It is true that one of the pressing problems Bhutan is facing is the growing unemployment in the country. As per the Labour Force Survey by MoLHR (2014), graduate unemployment against the total unemployment in the country has increased sharply (4.55% in 2010, to 12.74% in 2012 and 32.37% in 2013). One of the important reasons for this is discrepancy in the quality of supply and demands of job seekers. In March 2014, Thimphu hosted a "Better Business Summit: Competitiveness through Collaboration" in which a document was released under the title of Factsheets: Education for the Future. The problem of unemployment in Bhutan is not a question of job availability, but rather current education system that are not able to adequately supply the skills and specialization needed for a modern and competitive economy, stated the Factsheet. The Factsheet further revealed that employers faced challenges when recruiting employees that were fresh out of schools and colleges and without much skill. Similar findings were shared in 'Bhutan Investment Climate Assessment Report' by the World Bank (2010). The World Bank (2010) report pointed out that unemployment problems among graduates are not only because of the unavailability of jobs but also unavailability of required competencies and skills. Very recently by a report titled - National HRD Advisory Series: a focus on Graduates and Labour market dynamics of the Department of Human Resources of MoLHR (2014) revealed similar findings. However, none of these studies examinee the skill mismatch that exists in Bhutan. Thus the present study is designed to understand the employability skill mismatch as perceived by recruiting organizations.

Method

The study used survey research design and the data were collected from the field to meet the objectives of the study.

Samples and Procedures

Samples in the study were drawn from the organizations that recruit graduates. We adopted the report of MoLHR's (2014) for selecting organizations for the data collection. According to the report of MoHLR (2014), graduates are mainly hired by organizations such Banking and Finance, Power sector, Hospitality and Tourism, Trading and Service sector, Production and Mining sector etc. Based upon the report we selected 12 organizations that were the recruiters of graduates. Data from the sample were collected randomly on standard questionnaire from the HR department of the selected organizations. Data were taken from those executives of the department who were actively engaged in recruitment and selection, with prior permission. All the necessary information regarding the study and the ways to respond to the questionnaire

was shared with the respondents. The respondents were assured of confidentiality of their responses and were told that their responses would be used for the research purpose only.

Research Tools

A self-reported structured questionnaire was used in the study. Employability skills are very broad and encompass several skills which vary across different regions and contexts. However, after thorough literature review and analysis, we developed a scale adapting the work of various researches such as Mihail, & Elefterie (2006), Nna Sunday (2013), and Rosenberg, Heimler & Morote (2011).A 36-items questionnaire / scale used in the present study covered following areas of skills.

1. Communication skills (oral and written)
2. Analytical and Problem solving skills
3. Team work skills
4. Negotiation skills
5. Planning and organizing skills
6. Creativity and innovation skills
7. Numerical skills
8. ICT skills
9. Time management and prioritizing skills
10. Critical thinking skills
11. Leadership skills
12. Interpersonal skills
13. Work ethics

The Questionnaire is designed in a way that required respondents (organization's representatives) to express their opinion on skills under two major categories of responses – "Skills Needed" and "Skills Received". Thus this structure of the scale helped to analyze the perception of skills mismatch of the graduates. Responses were taken on 5-point response options ranging from "Not at all to "Very Much". Questionnaire used in the present study was passed through face and content validity tests. Reliability analysis of the scale was also conducted and it is found to be 0.753 (alpha) on the present sample.

Results and Discussions

In order to analyze skill mismatch, we have used paired sample t-test. Tables given below showed the result of the test.

Results of Skills "Needed" by organizations and skills "Received" from fresh graduates are presented in the above table. Data presented in both the tables revealed that out of thirteen skills, a significant difference existed in eleven skills as perceived / assessed by employers / organizations. Skills where significant difference between the "Needed" and "Received" were found are - Communication skill ($t = 3.20$; $p = 0.008$), Analytical and Problem solving skill ($t = 9.38$; $p = 0.000$), Team work skill ($t = 2.41$; $p = 0.034$), Negotiation skill ($t = 3.70$; $p = 0.003$), Planning and organizing skill ($t = 6.41$; $p = 0.000$), Creativity and innovation skill ($t = 3.72$; $p = 0.003$), ICT skill ($t = 2.61$; $p = 0.024$), Time management skill ($t = 4.42$; $p = 0.001$), Critical thinking skill ($t = 4.42$; $p = 0.001$), Leadership skill ($t = 6.77$; $p = 0.000$) and Work ethics ($t = 2.60$; $p = 0.025$). No significant difference was found in Numerical and Interpersonal skills.
Looking at details, the table further revealed that major difference in skills "Needed" and skills "Received" were found to be in Analytical and Problem solving skill, Planning and organizing skill, Leadership skill, Time management and Prioritizing skill, and Critical thinking skills, as assessed by organizations/ employers. Magnitude of the difference in skills "Needed" and

"Received" can be gauged by looking at the Mean difference of the pair given in the table below.

Table 1: Mean, standard deviation, and mean contrast/ differences of "Skills Needed" and "Skills Received" of skills by employers / organizations (Paired Samples Statistics)

	Skills Comparison	Mean	Std. Deviation	Std. Error Mean
Pair 1	Communication Skill - N	13.83	1.52	.44096
	Communication Skill - R	10.83	2.28	.66096
Pair 2	Analytical and Problem Solving Skill - N	5.58	0.90	.25990
	Analytical and Problem Solving Skill - R	2.91	0.99	.28758
Pair 3	Team Work Skill - N	5.75	0.45	.13056
	Team Work Skill - R	4.91	1.16	.33616
Pair 4	Negotiation Skill - N	5.33	0.88	.25624
	Negotiation Skill - R	3.66	1.23	.35533
Pair 5	Planning and Organizing Skill - N	8.33	0.98	.28427
	Planning and Organizing Skill - R	5.58	1.72	.49937
Pair 6	Creativity & Innovation Skill - N	5.75	0.45	.13056
	Creativity and Innovation Skill - R	3.83	1.40	.40514
Pair 7	Numerical Skill -N	5.08	0.79	.22891
	Numerical Skill - R	5.41	0.79	.22891
Pair 8	ICT Skill - N	11.16	1.26	.36584
	ICT Skill - R	9.25	2.17	.62915
Pair 9	Time management Skill - N	8.58	1.56	.45157
	Time Management Skill - R	6.00	0.95	.27524
Pair 10	Critical Thinking Skill - N	5.16	0.93	.27061
	Critical Thinking Skill - R	3.58	1.16	.33616
Pair 11	Leadership Skill -N	5.83	0.38	.11237
	Leadership Skill - R	4.00	1.04	.30151
Pair 12	Interpersonal Skill - N	7.25	1.48	.42862
	Interpersonal Skill - R	7.16	1.58	.45782
Pair 13	Work Ethics Skill - N	11.50	0.67	.19462
	Work Ethics Skill - R	9.50	2.39	.69085

N = Skill "Needed" by organizations
R = Skill "Received" by organizations

Table 2: Mean, standard deviation, and mean contrast/ Differences of "Skills Needed" and "Skills Received" of skills by employers/ organizations (Paired Samples Statistics)

	Skills Comparison	Paired Differences					t- values	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Communication Skill - N Communication Skill - R	3.0000	3.24738	.93744	.9367	5.0633	3.200**	11	.008
Pair 2	Analytical &Problem Solving Skill - N Analytical &Problem Solving Skill - R	2.6667	.98473	.28427	2.0410	3.2923	9.381**	11	.000
Pair 3	Team Work Skill - N Team Work Skill – R	0.8333	1.19342	.34451	.0751	1.5916	2.419*	11	.034
Pair 4	Negotiation Skill - N Negotiation Skill – R	1.6667	1.55700	.44947	.6774	2.6559	3.708**	11	.003
Pair 5	Planning and Organizing Skill - N Planning and Organizing Skill - R	2.7500	1.48477	.42862	1.8066	3.6934	6.416**	11	.000
Pair 6	Creativity & Innovation Skill - N Creativity & Innovation Skill - R	1.9167	1.78164	.51432	.7847	3.0487	3.727**	11	.003
Pair 7	Numerical Skill–N Numerical Skill – R	-0.3333	1.23091	.35533	-1.1154	.4488	-.938	11	.368
Pair 8	ICT Skill - N ICT Skill – R	1.9167	2.53909	.73297	.3034	3.5299	2.615*	11	.024
Pair 9	Time management Skill–N Time Management Skill - R	2.5833	2.02073	.58333	1.2994	3.8672	4.429**	11	.001
Pair 10	Critical Thinking Skill–N Critical Thinking Skill - R	1.5833	1.24011	.35799	.7954	2.3713	4.423**	11	.001
Pair 11	Leadership Skill– N Leadership Skill – R	1.8333	.93744	.27061	1.2377	2.4290	6.775**	11	.000
Pair 12	Interpersonal Skill–N Interpersonal Skill - R	0.0833	2.77843	.80206	-1.6820	1.8487	.104	11	.919
Pair 13	Work Ethics Skill–N Work Ethics Skill – R	2.0000	2.66288	.76871	.3081	3.6919	2.602*	11	.025

** *p < .05. **p < .01.*

From the above table it can be concluded that there is a vast difference between the skills requirement and expectations of employers / organizations and the skills they (organizations/ employers) actually get when they recruit graduates from different colleges of Bhutan. From the above results, it can be inferred that the prevalence of the issue of skill mismatch exist. Findings of this study are in line with findings of other researches done in different countries which supported the notion of skill mismatch in graduates (Dixon, 2013; Parker, 2011; Mishra, 2014).

One reason for this gap in skills could be the difference in pace of change of market (organizational requirements) and institutions. Another reason could be the distance between organizations/ employers and institutions, i.e., educational institutions and recruiting organizations seem to work as separate systems. Institutions operating in close collaboration with organizations can help in bridging the gap. Unawareness and failure of students to understand the importance of these skills in market place could be another important reason for this gap. Learning of employability skills equally depends upon the student's willingness and efforts. Difference in perception of mismatch in skills in recent graduates could also be the deliberate attempt of employers/ organizations to put the blame of un-employability on to educational institutions and fresh passed out graduates seeking employment.

Conclusions

Considerable skill mismatch exists in the country the study revealed. Significant differences were found in eleven out of thirteen skills as required by employers/ organizations and skills present in graduates coming out of institutions. It is also found that the magnitude of the difference between the skills needed and skills received are of great concern, which ranged up to three times lower to the expectations of employers. In other words, what is available (skill level) in the fresh passed out graduates, organizations need three times more of that/ those skill(s). This is the concern which needs to be addressed. This issue can be addressed by working in collaboration between higher institutions and industry / organizations. It is true that in reality educational institutions and industries/ organizations work as a separate system in the economy given the fact that institutions are the supplier of human capital for the organizations. If it is not done, the gap between the skill needs of industry and the skills received by graduates may continue to grow.

Implication, Limitations and Future Research

The study aimed at understanding employability skill mismatch, findings of the study will help graduating students, educational institutions and policy makers to get insights on the issue. Graduating students who are getting ready to enter into job market will come to know what skills (other than technical skills / knowledge of area of specialization) are needed/ desired by organizations and assess themselves better so that they can prepare well. Insights gained from the research may also help universities and higher educational institutions to understand the gravity of the problem of skill mismatch and take remedial steps in producing 'business ready' graduates, able to make a dynamic start and rapidly adapt to change. Findings of the study also stimulate discussions amongst the planners and the policy making bodies on how best further develop research and policy on the employability skills and take corrective actions to minimize the issue.

The study is not free from limitations and its findings should be taken with some caution. One of the limitations of the study is that only 12 recruiting organizations provided the data. This may limit the ability to generalize the findings on wider level. Another major limitation is that the study used self-reported scale which has the tendency to be biased and social desirability, thus affecting the quality of the research findings. Mixed method approach could

have allowed enriched generalizable results. Future research should be undertaken keeping in mind above limitations to have better and comprehensive insights on the issue.

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Reflective teaching in thoughts or action: Bhutanese teachers' 2 Ps (Perception and Practices)

TANDIN WANGDI

ABSTRACT

Whilst the education and demographics of learners are changing with the pace of advancement of technology and innovations, teachers need to reflect on their actions and practices to satiate the demands of 21st century. Eight principals and 13 teachers volunteered to participate in the study. Questionnaire and interviews were used to gather perspectives on reflective teaching in schools under Dagana Dzongkhag (District).This study concluded that most of the schools do not have a Reflective Practice policy in place and teachers were classified at a technical level rather than at higher reflective thinking levels. Participants knew the benefits of reflective teaching but they were least equipped with the information and tools of reflecting teaching. The participants lacked prerequisite attitudes for reflective teaching- open-mindedness, responsibility and wholeheartedness.

Introduction

Reflection is the fundamental core of Teaching and Learning (TL) process. It is a way of being, rather than a set of practical strategies or set of demographic characteristics and attitude that a teacher possesses. It is a way of understanding oneself as a developing professional, enhancing continuous development and deepening knowledge (Boateng & Boadi, 2015). Moreover, "self-reflection is an introspective activity and refers to a person recreating the experience of acting in a given situation (Beverborg et al., 2015, p.191). Such activities help a teacher to relive the past experience and to generate new ideas to broaden the teaching repertoire.

Experience plays a quintessential role in all walks of our life. Mahatma Gandhi proclaimed that the "knowledge gained through experience is far superior and many times more useful than bookish knowledge", and it is further supported by Danish proverb, "he knows the water best who has waded through it". However, Richard (1990) argued that experience alone is insufficient for professional growth: experience coupled with reflection is a powerful impetus for teacher development (in Gatumu, 2009). It can be argued that experience is necessary for ones professional development but reflection on our experience enhances our practice. Iqbal, Jumani and Chishti (2015) stated that "human beings learn wisdom by three methods: first by reflection, which is noblest; second, by imitation which is easiest; and third by experience, which is the bitterest (Confucius)" (p.376).

Bhutanese teachers rarely practice the reflective teaching. It is evident from the records maintained by teachers themselves and the school. Teachers hardly write their lesson journals. Perhaps, it was only practice in the Teaching Practice. Thus, it is a high time to have empirical studies to ascertain the reflective teaching practices in Bhutanese school system.

Literature Review

Reflection is a vital tool to become a reflective teacher. The origin of the term reflection can be traced back to John Dewey (1993, in Pacheco, 2005; Fat'hi & Behsadpour, 2011; Negari & Beiranvand, 2013; Ghaslani, 2015)who did introduce "three different types of actions: impulsive action, routine action and reflective action" (Fat'hi & Behzadpour, 2011, p.244, Ghaslani, 2015, p.27). According to Griffiths (2000) and Pollard et al. (2006), 'trial and error' features impulsive action and routine action has the 'authority', 'tradition', 'preconception' and 'prejudice' as its indispensable components (in Fat'hi & Behzadpour, 2011, p.244). The reflective action involves "active, persistent, and careful consideration of any belief or supposed form of knowledge in the

light of the grounds that support it and further consequences to which it leads" (Farrell, 1998, p. 2). Reflective action is not simply doing what you are asked to do. John Dewey identified three attitudes as prerequisite for reflective action- open-mindedness, responsibility and wholeheartedness (Pacheco, 2005; Fat'hi & Behzadpour, 2011). Open-mindedness referred to teachers' willingness to examine the status quo and to look for possible alternatives to recognize the errors in their beliefs and practices. An action of responsibility involves being aware of the consequences to which the action lead. A responsible teacher should know what kind of actions he wants to practise and what consequences it might bring to the moral, social and psychological values of their students. And finally, the wholeheartedness refers to teachers being "zealous, pledged and devoted" (LaBoskey, 1997 in Fat'hi & Behzadpour, 2011, p. 2).

In 1980s, Donald Schon extended Dewey's work on reflection (Pacheco, 2005). Schon (1987) defined reflection as a "way of dealing with the problems related to practice. Allowing oneself to be more flexible in dealing with teaching problems and putting these problems in context to discover solutions for improving situation and overcoming the problems" (in Ghaslani, 2015, p.27). Similarly, Donald Schon indentified two kinds of reflections - reflection-in-action and reflection-on-action. Farrell (2004) explained, "Reflection-in-action is concerned with thinking about what we are doing… Reflection-on-action deals with thinking back on what we have done to discover how our know-in-action may have contributed to an unexpected action" (in Fat'hi & Behzadpour, 2011, p.244).Know-in-action is "analogous to seeing and recognizing a face in a crowd without "listing" and piecing together separate features; the knowledge we reveal in our intelligent action is publicly observable, but we are unable to make it verbally explicit" (Farrell, 1998, p.5). Reflection-in-action happens whilst teaching and it helps to reshape what we are doing when we encounter a non-routine problem in the process of teaching. Reflection-on-action occurs after teaching and it engages teacher to think on what they have done. It is a post-action evaluation where teachers question on reflection-in-action for their professional growth.

If the concept of reflection itself seems difficult to characterize, it is even more difficult to teach (Jay & Johnson, 2002). Therefore, Jay and Johnson (2002) developed a typology of reflection involving three intertwined dimensions: descriptive, comparative and critical reflection. Finlay (2008) explains the three dimensions as:

First reflect on an experience by mentally replaying the experience and describing it in a descriptive, non-judgmental way. The second stage involves attending to feelings – positive and negative – triggered by the experience, 'discharging' any negative feelings which may obstruct the reflection. The learner is then ready to re-evaluate the experience by progressing through four sub-stages: association (relating new data to what is already known); integration (seeking new relationships between the data); validation (determining the authenticity of the new ideas and looking for inconsistencies or contradictions); appropriation (making the new knowledge/attitudes one's own) (p. 9).

Furthermore, Van Manen classified this into three levels of reflectivity in 1997. The levels are ordered based on sophistication as technical-level, practical-level and the critical-level. In the technical level, the educators are concerned about the teaching technicalities like use of teaching skills and strategies, effectiveness of TL materials and application of knowledge in the classroom settings. In the second level, the educators are looking at teacher and student behaviours in relation to determining if their goals were met (Boogren, 2012). It is an opportunity to ponder on the assumptions that support teachers' action and the consequences of such practices (Para, 2012). The third highest level is critical level. It is also called dialectical- level by Taggert and Wilson (2005, in Boogren, 2012). It incorporates moral and ethical issues in making decisions. It includes the two lower levels.

The role of reflection in learning how to teach can make considerable contribution in escalating the preparation of teachers by complementing a growing knowledge base for teaching (Lowery, 2003). Teachers' views of teaching and learning are socially constructed.

These views are the building blocks of their epistemology, which form their educational philosophies (Ostorga, 2006).

Reflective teaching is not a product of practising a skill and implementing in the classroom. It is a process of planning, implementing, evaluating and changing ones belief for the betterment of one's professionalism. "Reflective thinking cannot be taught through a few simple techniques but requires education that transforms the pre-service teachers' ways of knowing, their views about knowledge and the roles of teachers and students" (Ostorga, 2006, p.19). Moreover, incorporating this teacher reflection process may be a way to provide teaching members a richer knowledge about the complex nature of teaching and possible methods for change and improvement in their practice (Jeon,2003). Understanding the nature of teaching through reflection will assist a teacher to seek a better means to organize one's practice and to begin to change their practice. Nevertheless, Usha Menon and Alamelu (2011) explained that most of the time, teachers with attitude problems feel whatever they do is right. This kind of attitude hampers students' learning and creates misunderstanding among the colleagues.

Research Questions

Central: The central questions that were addressed by this study are:

1: What do teachers perceive about the reflective teaching and what kind of reflective practices are used?
2: What is the importance of being reflective educator to provide the quality education to the students in Bhutanese schools?

Guiding: Following guiding questions shaped the study:

1. Do your school and subject department(s) has/have enforced reflective teaching policies and strategies?
2. What are commonly the used reflective strategies? Which strategy best befit you and why? How often do you use each reflective strategy?
3. What are the important positive aspects of being reflective practitioners?
4. What are the drawbacks in using the reflective strategies?
5. Was your peer-observer willing to observe your classes? Was he/she willing to provide you authentic feedback on your lesson?

Method

Design: The qualitative method was an appropriate method for this study. The qualitative case researchers try to preserve the multiple realities and the contradictory views of what is happening (Stake, 1995) in actual milieu of the case. Therefore, this study provided an opportunity to do an in-depth study about the reflective practices through observation, logical enquiry and using empirical information.

Participants: 13 teachers and eight Principals of six schools under Dangana District, Bhutan participated in the study. The sample consisted of five female (23.8%), 16 male teachers and principals (76.2%). The years of experience in teaching ranged from 1 – 35 years (Mean=11.6) with the age range of 23-54 years (Mean= 33.8). One participant possessed Primary Teaching Certificate, 14 Bachelors of Education, four Post Graduate Diploma in Education and two Masters of Education. There were seven Primary teachers and 14 Secondary teachers. All the schools are accessible to road facility and equipped with personal computers but a few schools have internet connection.

Data Collection: There are various methods to collect information in qualitative research. The four primary methods that qualitative researches rely on gathering information are: "(1) participating in the setting, (2) observing directly, (3) interviewing in depth, and (4) analyzing documents and material culture, with varying emphases" (Marshall &Rossman, 2011, p.137). For this study, the focus was on the third and the fourth methods. The first and second methods were left out as alternatives due to time constraint as participating and "conducting observational research can be very time consuming and resource-consuming" (Mason, 2002, p. 85).

It was imperative to conduct interviews due to the fact that interviews enjoy a much higher response rate than questionnaires (Raune, 2005) and unstructured interview can also explore people's interpretation and meaning of events (Punch, 2009) like the teachers' perception and interpretation of using reflective teaching strategies.

Data Analysis

Analysis basically means taking something apart (Stake, 1995). It is a process of giving meaning and making sense of the data collected. Denscombe (2010) states that there are some general principles that is commonly associated with the qualitative data analysis and eloquently stated that the analysis of qualitative data tends to regard as:

a. **Iterative:** It is an evolving process in which the data collection and data analysis phases occur alongside each other.
b. **Inductive:** analysis tends to work from the particular (localised data) to the general (abstract and generalized statements).
c. **Research-centred:** the values and experiences of the researcher are seen as factors influencing the analysis.

Therefore, the qualitative data analysis model (figure 1) proposed by Creswell (2009) involving multiple levels of analysis was integrated in this study as it address the above mentioned principles of the analysis of qualitative data. It suggests a linear and hierarchical approach building from the bottom to top but the author affirms that the stages are interrelated and not always work in the order presented.

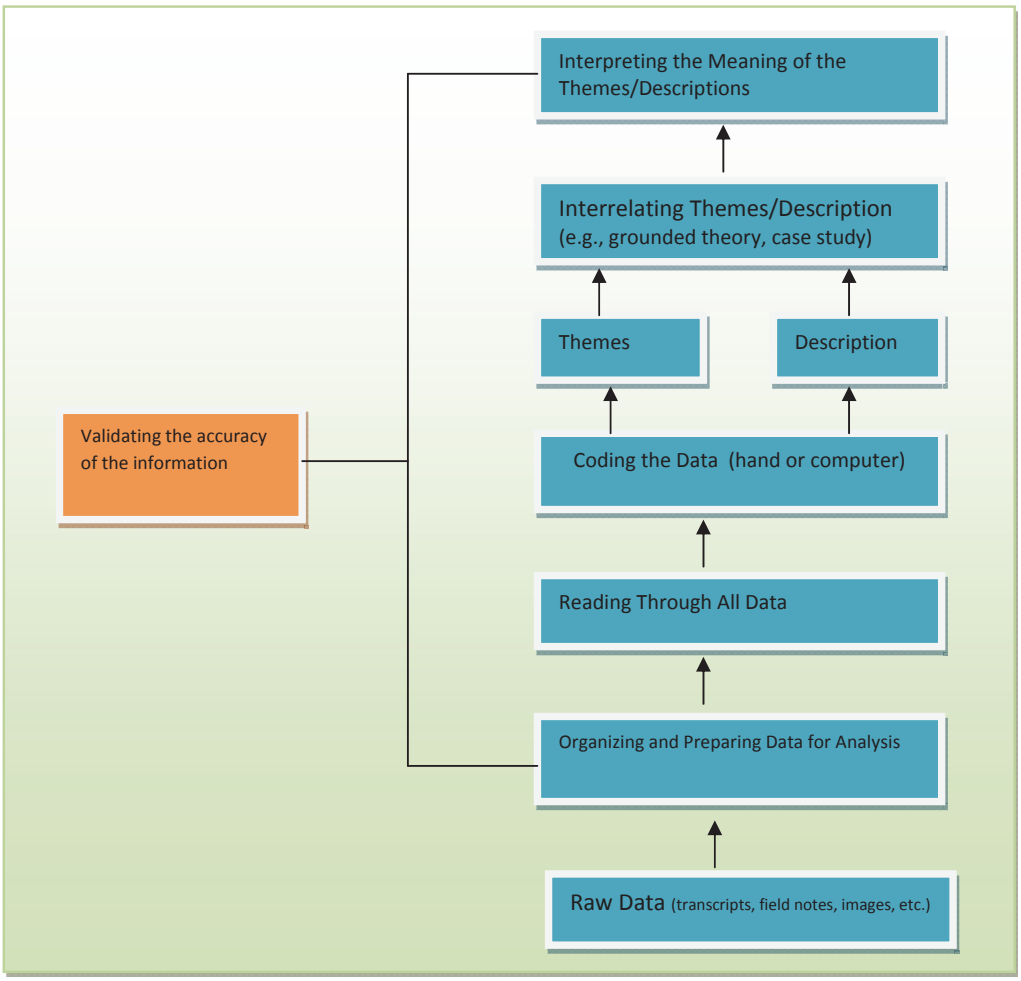

Fig. 1 Data Analysis in Qualitative Research. From: Creswell, (2009, p. 185)

The data collected were organized and prepared for analysis by arranging question wise to contrast. Editing, segmenting and summarizing the data were carried out to facilitate in data reduction (Punch, 2009) in second phase. The descriptive codes were used in the initial stage of the research. The codes were used to derive five themes that were discussed under the result section. Generated themes and descriptions were used for analysis. The detail discussions of the themes with detail information about individual participants were carried out under interrelating themes and descriptions. The meaning was derived from comparing the findings with information gleaned from the literature of theories (Creswell, 2009). The final stage was the lesson learnt from the study and the personal interpretation about the findings supported by evidences from the data.

Result:

The themes that emerged from the interviews are summarized and quotes are provided wherever necessary.

i. Reflective teaching policy: There are many policies in schools to foster strapping base and garner purposeful action through meaningful focus on the preset policies. The interviewees were asked about the reflective policies in their schools. Seven teachers out of 13 answered

YES (53.8%) but contradictorily three principals out of eight answered YES (37.5%). It can be understood that principals' expectation on reflective teaching is more than the teachers' expectation.

Some interviewees pointed out that "our school and subject departments do not have as such policy in reflective teaching but topic is used unfocused" (T11). "Due to shortage of teachers, we don't have much emphasis on it" (T1) and "we do have but because of workload we compromise with it" (T2).

Principals shared that "Yes we do enforce our colleagues on reflective teaching since we learn through recollection and make changes for the next session" (P3) and we do practice through " SLMSS, departmental meetings, observation and informal visits to the classes" (P1). However, some principals stated that "we don't have reflective teaching practices as of today but teachers are on the process of doing it" (P2, P4 & P8).

Since no school had a written policy, the study concluded that reflective policy in the schools who participated in the study have got inadequate or insufficient information required in making reflective teaching a part of teachers' effective practice.

ii. Meaning and training: There is no clear-cut definition with respect to the meaning of reflective teaching (Fat'hi & Behzadpour, 2011).However, it has gained its popularity as it has contributed in improvement of teacher education and teacher professional developments. Farrel (2004) provides a definition of reflective teaching which is somehow comprehensive:

> Teacher can become more empowered decision makers, engaging in systematic reflections of their work by thinking, writing, and talking about their teaching; observing the acts of their own and others' teaching; and by gauging the impact of their teaching on their students' learning. In these ways, teachers can begin to locate themselves within their profession and start to take more responsibility for shaping their practice. This I call reflective teaching (cited in Fat'hi & Behzadpour, 2011, p. 243).

In similar note, Zeichner & Liston (1996, p. 20) states that reflective teaching is "identifying, checking carefully, reflecting on beliefs, experiences, attitudes, knowledge, and values, and reflecting on limitations imposed by the social conditions in which teachers work" (cited in Ghaslani, 2015). In both definitions, it is very clear that reflective teaching is beyond asking "what?" and "how?" questions at a superficial level since "not all thinking about teaching constitutes reflective teaching" (Zeichner & Liston, 1996 as cited in Negari & Beiranvand, 2013, p. 777). A reflective teaching constitutes questions like "why we teach?"

Reflective teaching is defined by participants as:

"reflecting our own teaching after the class. Collecting feedbacks from students after the lesson" (P1)

"something to ponder on our own teaching by asking questions like how well did it go?What should I do to improve next time?" (P2)

"realizing within and at the end of classroom or other setting how you did and what best could be done to have impact in teaching and process oriented"(P5).

"a tool where teachers think over as which methods or pedagogies to explore to teach a unit and after doing so, how well he/she fair in exploring it and what its outcomes are (T1).

" look back on the lesson taught and to find out what went well and what did not go as per the plan or teachers expectations (T5).

It was observed in the study that the meanings expressed by most of the participants were close to that of technical teaching instead of reflective teaching since Zeichner and Liston (1996) explains the differences proclaiming that "if a teacher never questions the goals and the values that guide his or her work, the context in which he or she teaches, or never examines his or her assumptions, then this individual is not engaged in reflective teaching" (as cited in Negari & Beiranvand, 2013, p. 777). Moreover, Schon has emphasized that as reflective teachers ought to question their beliefs, attitudes, values, professional knowledge, subject knowledge, and theories working behind their practices to grow as professional (Iqbal, Jumani & Chishti, 2015). Therefore, the study concluded that most of the participants were at technical level which is the lowest level of reflective teaching.

It was learnt that six out of eight principals shared that they didn't receive any training in reflective teaching practices which makes it "very tough to give constructive feedbacks" (P1) and its difficult to "define the reflective teaching" (P4) without having a formal training. There is no certainty where teachers can be taught how to become reflective practitioners since "reflection is not a procedure that can be taught but rather a holistic orientation to teaching that can be helped to acquire" (Zeichner & Liston, 1996 as in Odeh, Kurt & Atamturk, 2010, p. 12).

iii. Reflective methods and framework:

Reflective teacher is an outcome of spending time and practicing of a sought-after behavior to develop reflective practices. It is a process where a teacher should follow strategic pathways to attain preferable outcomes. Brookfield (1995, as cited in Kamardeen, 2015) proposed a four-lens framework that can be engaged to become a reflective teacher.

1. The autobiography (self-reflection)- is the footing of critical reflection in that lecturers/ [teachers] focus on their experiences as learners.
2. The students' eye (student feedback)-relates pedagogical approaches that may need adjustment or that can be improved for better effects.
3. The colleagues' eye (peer assessment)- fostering critical conversations with colleagues, through mentoring, advice seeking and feedback, about ones teaching can yield useful insights for practice.
4. Theoretical literature (engaging with scholarly literatures)- lecturers/[teachers] who research, present and/or publish scholarly work about their teaching demonstrate an enlarged, forward-thinking practice (p. 64).

Using this framework, it was learnt that most of the teachers and principals who participated in the study used the first three lenses. For instance,

Mostly I useself-reflection. I asked my students questions to see how well I have fare. But sometimes, I do conferencing with other teachers too (T1).

However, it has been observed that all the reflective tools are used superficially since,

"To be very honest my teachers hardly use any of the strategies mentioned above except observing lessons using forms developed by principal. (P2).

Observation of teacher's lesson by the principal is done once in a block (T4), and lesson is observed by friends 2-3 times during a term [T6].

This finding resembled that of Negari and Beiranvand (2013) which states that teacher may not have possessed expertise for reflection and reflective practices and so their levels of using reflective tools may have been low. This could be possibly because of two reasons- "firstly, teachers' levels of background knowledge regarding reflection and reflective practice may have been low. Secondly, teachers may not have had positive attitudes towards reflective teaching" (p. 780).Moreover, the reflective teaching is possible only if a teacher devotes quality time to reflect as cyclical process and develop positive attitude to the profession. This finding can be supported by the statements given by the participants as following:

Due to time constraint, I have not used any of the above given strategies(T2).

I use internet to upload the activities i conduct to receive feedbacks from other teachers across the country (T1).

So far we have peer reflection and document the form used (P2).

Due to heavy workload; the reflective mechanisms are left least emphasized (P8).

In general, the gap between practice and theory was seen alarming. Teachers are often aware of the term reflective practice and the importance of being reflective but they do not really apply this to their life teaching experience (Kurt & Atamtiirk, 2010). Moreover, no participants did an action research or written anything related to their teaching experiences and professional development, which supports the first finding that participants are still at the initial stage of reflective practice.

iv. Prerequisite of reflective practices:

Reflective practice requires "a commitment towards changes, towards understanding, and most importantly, a commitment towards continuous self-development" (Pacheco, 2005, p. 6). Reflective teacher also requires enhancing teachers' professional knowledge and skills, their self-awareness as they focus in teaching (Negari & Beiranvand, 2013). "No advice, nor any technique for facilitating reflection, is universally helpful" (Hubball, Collins & Pratt, 2005). It is a method or strategy to be selected, adapted and used by the individual teacher based on the nature of the topic, types of learner and the environmental setting in which they work. "When teachers engage in reflective practice they not only develop knowledge of reflective methods and strategies to achieve an end product of reflection, but also develop necessary three main character attitudes to accompany the reflective process, which include open-mindedness, responsibility, and whole-heartedness" (Farrell, 2014, p. 2).

Most of the teachers who had participated in the study asserted that their lessons were observed by principals, subject department heads and other teachers. However, five principals out of eight (62.5%) never had any teacher in their classes to observe their lesson. The reasons are:

Yes, I invited [teachers to observe my class] several times but nobody is willing ... May be they have some kind of feelings of superior and inferior. I need to avoid/break the wall (P2).

The teachers never give feedback though I am open to them (P1).

After the observation, giving authentic feedback and support is imperative. The teachers and principals in the study stated that:

My friends give authentic feedbacks and it helped me in professional developments. Sometimes we have discussions during interval time (T1, T3, T4, T5).

Contrarily, some teachers didn't receive authentic feedback from their observers. T12 states that

"If our friends observe we actually don't get authentic feedback"

In addition, three teachers out of thirteen never observed others class pertaining to time constraint and being new in the field of teaching. Those who got the opportunity had a different say on giving feedback.

I couldn't give authentic feedbacks due to lack of time, personal indifferences and fear of taking it personally instead of professionally (T1).

And,

As I am a new teacher, I find it uncomfortable to give (T6).

However, to some participants it's easy to give authentic feedback to their close friends. For example,

I don't have much problem in providing authentic feedback as I have done only within close friends (T3).

In general, principals had no problem in providing feedback to their teachers.

v. Advantages and disadvantages:

The literature of reflective teaching is replete with various definitions, models, and frameworks making reflective practice difficult due to lack of consensus on the terminology for reflective practice which lead to methodological effects (Negari & Beiranvand, 2013). Moreover, many participants pointed out that time constraint was the main issue in reflective teaching. For instance,

Some of the drawbacks of reflective teaching is time constraint, more school activities, limited resources like internet connection for references and research process (P6).

It was pointed out that the acceptance of feedback by the teacher colleagues, authenticity of the feedbacks provided and more workload in schools are also found to be a hindrance in practicing the reflective teaching.

When we are giving feedbacks to our colleagues, they don't take it positively which makes hard to provide authentic feedbacks (T3).

The other clerical work has provided very little room to explore beyond (T10).

Besides these drawbacks, the reflective teaching takes an important place in the ever evolving education system with a common goal to become a 'good teacher' and to get out of the 'I am always right' –syndrome in the classroom. A reflective teacher can produce a reflective student as reflective teacher can be benefited by reflective teaching in four ways according to Farrell (1998): "(1) Reflective teaching helps free the teacher from impulse and routine behavior, (2) Reflective teaching allows teacher to act in a deliberate, intentional manner and avoid the "I don't know what I will do today" syndrome. (3) Reflective teaching distinguishes teachers as educated human beings since it is one of the signs of intelligent action. (4) As teachers gained experience in a community of professional educators, they feel the need to "move" beyond the initial stages of survival in the classroom to reconstruct their own particular theory from their practice" (p. 9).

The study learnt that most of the participants were well informed about the benefits of the reflective teaching. It was learnt that reflective teaching is going to benefit the students. The advantages of reflective teachings are:

1. Produces more active and intelligent students who tend to learn themselves and who are independent (T1).
2. Create a room for professional development (T2)
3. Cost effective and save time as we can realize our mistake and commit not to make again (T10).
4. We know how to address the issuesand make us learn accordingly (T11)
5. We become competent, open,effective andchange as per need (T13).
6. To be critical, analytical and grow professionally. (P2).

To encapsulate, the positive aspect was found to be more emphasized compare to the negative aspects of reflective teaching depicting the need of reflective teaching at this juncture in schools in Bhutan.

Discussion:

The study concluded that those schools participated in this endeavour didn't have adequate and insufficient information required to make reflective teaching a part of teachers' effective practice. If there is lack of a reflective culture in a school setting, it would be difficult for the teacher to be reflective since "individual reflection has little relevance beyond narrow workplace requirements; it is increasingly collaborative; and it has a temporal character" (Benade, 2015, p.52).

The second finding depicts reflection level of participants being at technical level since "all the reflections at the technical level are related to the determined educational outcomes and contain applications relating to teaching methods and behaviours" (Dervent, 2015, p. 262). Dervent (2015) states that in this practice,"while focusing on reaching to a determined goal, they ignore alternative solutions, students' understanding, emotions, will, and characteristics" (p. 262). Examining self/others' teaching behaviours, skills and its effectiveness after the classes are the major practices practiced in the schools that participated in the studies. Bartlett (1990) says that in order for teachers to become reflective, they have to transcend the technicalities of teaching and think beyond the need to improve our instructional techniques (as cited in Farrell, 1998). And if teachers remain at a stage where teaching is mechanical, without learning from their experiences in class and relating them to theory, their practice will never be considered professional (Pacheco, 2005). In other words, teachers will have to include justifications of their own reflection based on current theories of teaching (conceptual reflection) and look beyond theories and practices to examine their meaning within ethical, moral and social ramifications (critical reflection) rather than focusing their reflection only on behavioral actions (descriptive reflection) (Farrell, 2014).

In the third finding, it was observed that teachers were least equipped with the methods and reflective models. Most of the participants claimed to use self-reflection and peer reflection but no records were maintained. The schools need to rethink and look for the best practices of reflection that will suit their school culture and student demographics.

There can be no true reflection without a teacher developing a set of attitudes that are at the heart of the reflective process (Farrell, 2014).In the fourth finding, teachers need to develop their attitudes towards open-mindedness, responsibility and wholeheartedness. Teachers should question about their teaching beliefs and sought better alternatives from their colleagues. Teacher should be open to the feedbacks they received from employing various reflective tools. Teachers should be responsible for the consequences of their actions. A reflective teacher teaches with whole heart.

Eventually, it was learnt that most of the participants agreed that reflective teaching is desirable and a need for their professional development. Tabachnick and Zeichner (2002) states that, "there is not a single teacher educator who would say that he or she is not concerned about preparing teachers who are reflective" (cited in Farrell, 2014, p. 1). The workload and time constraint were the most common drawbacks to be a reflective teacher. Reflecting and deploying reflective tools on the entire lesson that you teach may not be possible. It is to use our common sense that reflecting on some interesting lessons based on feedback received and undertaking action research within one's capacity would help in applying the new conclusion drawn in more routine circumstances. Reflection is not panacea to all the problems that we encounter in becoming a good teacher and a learner to be a good teacher. The aim of reflective teaching is to help teachers shift from routine actions rooted in common-sense thinking to reflective action stemming from professional thinking (Pollard et al., 2008).

Conclusion

Teaching experiences alone is not enough to foster development unless they are deliberately reflected on, and teachers are encouraged throughout their careers to take on the roles of reflective practitioners where they consciously subject their beliefs and classroom practices

about teaching and learning to critical analysis (Farrell, 2014). Reflective teaching is the fundamental core in professional development and to provide quality service for our students. The four lens framework of Brookfield (1995) is recommended because it encapsulates all levels of reflective teaching. A wholehearted teacher with open-mindedness and responsibility at the heart of their teaching profession can make a reflective teacher and a profound "learning teacher".

This study examined the educators' perceptions on reflective teachingand uncovered the commonly used reflective mechanisms and practices. It is not free from limitations. The study didnotexamine effectiveness of reflective teaching, comparison between the effectiveness of reflective tools, gender issues and student demographics. More studies focusing on these topics are required to ensure the impact of reflective teaching. The future researchers may include more probing or re-conceptualizing questions about when they had a really memorable 'good' lesson (or a good lesson in the past week), and explain how they shared the experiences with another teacher in the field. Moreover, the sample was small and the data collection was done over a short period of time. The researcher's participation in reflective practices with the participants would make the data more authentic. Nevertheless, it is hoped that the themes discussed in this study will mark the beginning of more pragmatic researches to determine the implication of reflective teaching to enhance the professional development and to meet the demand of 21st century learners.

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Glacier lake outburst flood in Bhutan: A common concern across the border

DEBASIS PODDAR

ABSTRACT

In the wake of climate change syndrome worldwide, by courtesy increase in industrial (read anthropogenic) emission of the developed hemisphere and decrease in sequestration of the rest, meltdown of mountain glaciers followed by glacier lake outburst flood (hereafter GLOF) poses a challenge before the civilization. In particular, meltdown of these Himalayan glaciers being faster than elsewhere and with transboundary impact out of the same emerges as concern for the South Asian community. Despite enviable nature with gross national happiness (hereafter GNH) of its people as the dividend, Bhutan suffers from climate sin committed by others in global community with a consequence that mountain glaciers face too fast decline for the lakes to contain excessive water so released and succumb to the gross detriment of lower riparian states for no fault of its own. The course of its tributaries moving toward the South to flow out into the Brahmaputra, a major river of the region, India and Bangladesh ought to suffer the GLOF syndrome since the same appears beyond reasonable control for a (ny) state to contain within its national border. The worst among potential arrays of the disaster is altogether new watercourse created out of the LGOF syndrome to flood locality after locality on its way until the same merges with its destination either in India or in Bangladesh.

The author hereby explores the GLOF jurisprudence in its nitty-gritty and thereby strives to set international legal principles of transboundary issues and available practices involved therein in regional context. In conclusion, he has put emphasis on comity of states followed by regional cooperation toward fortifying the SAARC jurisprudence from within its stakeholders. A blessing in disguise, the states concerned are left with no other option but to accept the same in their own interest to survive a disaster together. Also, the same opens incidental opportunity for social solidarity across the border the way the War facilitated all belligerent states of the West get integrated. Likewise, flood disaster appears an opportunity in disguise.

Keywords: *transboundary harm, due diligence clause, International law, climate diplomacy, policymaking, etc.*

Introduction

The forthcoming literature being one from the discipline of judicial science, relevant research methodology is adhered to throughout this effort. By and large, descriptive and analytic in its essence, resort to International Law- Bhutan is party to the system of governance- followed by best practices worldwide is observed to arrive at findings and suggestions at the end. Besides, a comparative method is applied between those with similar positioning, albeit wherever plausible. Also, the author hereby deciphers legal documents and materials to fortify his discursive castle. With most perfect blend of other branches of social science, this constitutes an interdisciplinary piece of work to underscore the underlying tantrums between research and development inter se and thereby demonstrates a newer domain in context. The way given mode of development worldwide leaves adverse impact on carrying capacity of the life sustaining climate on the planet cannot be neutralized through research until human civilization observes self-discipline and thereby minimizes hitherto self-defeating exercise to the detriment of an increasingly critical struggle for survival. Albeit pronounced with same breath, development and research now appear face-to-face at loggerheads. While in harmony, these two facilitate humanity toward its fruition and not otherwise.

Back to context, Bhutan is a land-locked state with tribal population as vast majority in its demography. An agrarian economy, Bhutan is innocent in terms of climate sin committed across the world. Environment in general, and climate in particular, know no border and thereby transcend national divider to turn omnipresent worldwide. Despite its innocence, therefore,

Bhutan pays the climate price too dear to bear with and not due to fault of its own. After all, they played no role to vitiate the global climate while they are not spared from wrath of the nature. Thus, the international legal regime to fix state responsibility for internationally wrongful acts cannot be applicable here since the transboundary harm occurred and scheduled to occur in time ahead cannot be attributed to Bhutan anyway. On the contrary, the developed and developing states owe remedy to Bhutan since the latter suffered havoc out of the impugned aspiration of the former toward breakneck development to gross detriment of the sustainability. However, here there is a research problem in terms of allocation of loss for the state since the same may get measured in cases of horizontal harm- as were the cases so far- while the global climate change perpetrates harm in vertical direction.

At first, few deadly greenhouse substances take resort to upward movement, reach the stratosphere, leave adverse impact there, get ozone cover ruptured, cause global climate change and indulge in sharp rise of sustainable temperature of the planet, and thereby meltdown mountain glaciers including those in the eastern Himalayan ranges and in territorial jurisdiction of Bhutan. By courtesy its circuitous route, identification of individual wrongdoer state(s) and quantum of contribution to transboundary harm against Bhutan, presence of culpa against victim state and determination of quantum of abetment, if any, all these appear core moot points of concern. With given strength of science and technology, and that also developed by these offending states, justice appears a juridical grandeur to naïve tribal subjects of Bhutan.

GLOF syndrome across the border

The matter, however, declines to stop the ordeal here and continues to carry forward to put few others, e.g. India and Bangladesh respectively, being lower riparian states adjacent to Bhutan. Thus, there are two parallel arrays of research problems: (i) while developed and developing states damage life-sustaining climate on the Earth, Bhutan is reduced to a default victim of climate injustice with impunity; (ii) while the GLOF syndrome transcends territorial jurisdiction of Bhutan and affects neighbouring states through inundation of habitat, in its immediate effect, these two states get offended against Bhutan for their damage to gross detriment of bilateral and regional relations inter sewithin the subcontinent. At bottom, however, the impugned matter initiates its course elsewhere. Even if question of liability arises from within the subcontinent, as one of the worst sinners vis-à-vis quantum of emission, India has had none other to blame in its region; but itself. India, therefore, cannot take resort to legal recourse against Bhutan since the same is likely to release floodgate of climate change debate once again to its inconvenience; neither land-locked Bhutan affords to close default sea corridor on its own for access to the world outside through maritime routes. Here the best solution lies in robust regional, at least bilateral, relations rather than the law and litigation discourse involved therein.

A cursory glimpse on the river map of Bhutan leaves no doubt that all its tributaries flow from the North to the South to take entry to territorial jurisdiction of India and thereby merge with the Brahmaputra- a major river of the eastern Himalayan region-either in India or in Bangladesh. (Bhutan: River Map 2012) Needless to point out that the default destination of the GLOF syndrome- if occurs there- ought to be India with adverse consequences involved therein. In its essence, the Brahmaputra- a major river in the North-East India resembles unruly horse to care none under the Sun. The GLOF syndrome is bound to add value to existing predicament of the region and thereby confirms further peril to already impoverished lower riparian population below. Even before the watercourse takes entry to India and Bangladesh, the same commits havoc within Bhutan as well. In a nutshell, all three states are thereby reduced to servitude in the wake of larger spiral syndrome culminated out of global climate change. A need of the hour calls for integrated disaster management mechanism through a series of preventive and curative measures on the part of these affected states together. At first, regional cooperation model is required to arrive at broad-based consensus on common cause. Thereafter, each needs to identify its given stake. For instance, Bhutan may facilitate

India through access to its land as trouble-shooter with available technical expertise while Bangladesh, being a land of innumerable watercourses, may assist India through its enriched experience in watercourse management. Also, Bhutan may share its sui generis traditional knowledge of glacier management since time immemorial. In its own regional interest, PaxIndica as per the trendy term (Tharoor 2012), India is left with no other option but to showcase its leadership potential to this end. Albeit with reasoning of their own, the same is imperative for one and all of other South Asian stakeholders to resist entry of outsiders to the subcontinent. In the contemporary world, invaders are unlikely to pour in through its coercive force. Rather they are set to arrive at the subcontinent under the disguise of kind saviours and thereafter usurp the system of governance in a way or other (Mutua 2001).

In particular, the territory of Bhutan being the natural divider between the Far East (Asia) and South Asia, onus to keep these two regions apart lies on the state to satisfaction of its neighbours. Since none of its South Asian neighbours ever invaded elsewhere, with its contentious presence in Tibetan plateau, China appears an odd state out to affect major regional interests of South Asia. Also, Bhutan is bound to suffer the first brunt in case of potential Chinese penetration to the region through its territory. In its own national interest, therefore, Bhutan ought to safeguard the regional interest from the Chinese intervention in regional areas of concern; GLOF being one of them. Also, another default reasoning lies in the cause-effect syndrome. Since South Asian neighbourhood is set to get flooded, India and Bangladesh possess their respective stakes to the impugned matter.

Toward multilateral watercourse regime

Apart from navigation, all these hitherto international river regimes, e.g. Danube, Suez, Panama, and the like, are constituted on the basis of right to water in general- and clean water in particular (Clapham 2012). Perhaps for the first time in the history of civilization, if it takes place, the proposed regime is all about the right against water since the glacier watercourse out of overflow from these lakes is thereby set to cause irregular flood for lower riparian slopes rather than regular feed for the farmland as and when needed. In a populated subcontinent like South Asia, outburst flow poses a potential disaster to gross detriment of the regional public interest. In its bizarre turn, the circumstance demonstrates wisdom in favour of right against water as appurtenant to right to water and the same deserves attention of water activism.

Back to watercourse regime, a sui generis model is imperative for intensive research on glacier meltdown out of dark (read carbon-centric) development model followed to culminate into toxic emission across the world. While other watercourse regimes strive to facilitate free flow through riparian states and access to watercourse for non-riparian states if so agreed upon, the proposed regime is hereby conceptualized to put glacier water within the bounds of its lake and not to allow potential watercourse initiate out of overflow due to outburst of the lake. Thus, the regime is meant to check potential release of excessive water from the glacier to its lake and thereby contain the same within its basin. In case of outburst, the regime is defeated on the count of prevention and set to initiate curative measures to minimize damage to the best extent possible. Given opportunity, the proposed model is set to create newer jurisprudence in either bilateral or multilateral relations hitherto least explored in watercourse governance, if at all. In naïve perspective, water is perceived as the lifeline for civilization. However, in given context, water ticks like time bomb in the glacier lakes of Bhutan to cause inundation death and destruction and thereby put civilization elsewhere to real peril; a jurisprudence absent in traditional literature:

"When the whole course of a river and both its banks are within the territory of a single state, that state's control over the river is as great as over any other part of its territory, unless its rights have been limited by treaty. The only rivers which concern international law are those which flow either through, or between, more than one state. Such rivers are conveniently called 'international rivers'; and they raise the question whether each of the riparian states has full

control of its own part of the river, or whether it is limited by the fact that the river is useful or even necessary to other states. Clearly, one important interest at stake is that of navigation; it may be of vital concern to an up-river state that states nearer the mouth should not cut off its access to the sea. It may also be important to non-riparian states to have access to the upper waters of the river. But we are also increasingly aware of the importance of the economic uses of rivers for such purposes as irrigation, the supply of water to large cities, and the generation of hydro-electric power. It is obviously desirable that all these interests should, so far as possible, be effectively protected" (Clapham 2012).

From national perspective, India has had pioneer initiatives to its credit toward launch of dedicated policymaking regime under the National Action plan on Climate Change (hereafter NAPCC) in 2008 followed by the National Mission for Sustaining the Himalayan Ecosystem (hereafter NMSHE), with seven others, under the same in 2010. Indeed, a substantial part of the same is situated outside the territorial its jurisdiction, India thereby took a holistic approach to this end. After all, in case of irreversible damage in the Himalayan ecosystem, India is set to emerge as one among worst sufferers though two so called Himalayan states including Bhutan are set to suffer no lees. Also, Bangladesh is another to suffer havoc. Albeit prepared in South Asian context, even the mission missed the GLOF syndrome so far as inundation out of outburst thereof and the deadly impact on lower riparian land and its habitat are concerned:

"The Himalayas house one of the largest resources of snow and ice and its glaciers which form a source of fresh water for the perennial rivers such as the Indus, the Ganga, and the Brahmaputra. Glacial melt may impact their long-term lean-season flows, with adverse impact on the economy in terms of water availability and hydropower generation. Recession of Himalayan glaciers will pose a major danger to the country" (NMSHE 2010).

Also, another discourse appears relevant to this end. In international law, the term 'common heritage of mankind' refers to elements and areas demarcated as those beyond the threshold limit of sovereign claims of all nation states and thereby belong to the global commons. There are but few- not too few- posited well within the limits of sovereign jurisdiction of a nation state or another but critical enough to the legacy of humanity in a way or other. These objects and areas falling short of getting elevated to common heritage are named 'common concern of mankind' and thereby deserve care and caution on the part of host states for maintenance of the same (Noyes 2012). The eastern Himalayan glaciers in given fragility of global climate together constitute an object under the discursive umbrella of common concern of mankind.

Way back since 1988, the UN General Assembly itself recognizes that climate change is a common concern of mankind. Also, the Assembly determines that necessary and timely action should be taken to deal with climate change within a global framework (UNGA 1988). Accordingly, the proposed regime appears in consonance with the climate governance regime. Later the position received acknowledgement from climate change forum that change in the Earth's climate and its adverse effects are a common concern of humankind (UNFCCC 1992). Consequently, the principle named 'common but differentiated responsibilities and respective capabilities' (hereafter CBDR) imported a corollary legal fiction to enable the global community take resort to disaster management mechanism and thereby slowdown adverse effect to this end. Later the concerned protocol did carry forward given legacy to facilitate states address climate hazards elsewhere through policy formulation and cooperation (KP 1997). Thus, despite the GLOF syndrome in the eastern Himalayas being situated beyond their respective territorial borders, India and Bangladesh possess their stakes to this end; more so because they are the potential victim of the disaster in foresight. Also, in its own interest, Bhutan is likely to initiate the proposed model. If released, after the outburst, Bhutan itself is set to suffer the first and perhaps the worst brunt. As source state, therefore, Bhutan is hardly left with option. In the given circumstance, subject to bilateral treaty, extension of the Mission with focus on Himalayan ecosystem may get extended to these Eastern Himalayan lakes within the territorial jurisdiction of Bhutan in mutual interest since the Mission is set to initiate vigilant concentration

on Himalayan springs and protection of high-altitude lakes and thereby demonstrates the potential to cover the GLOF syndrome as well.

In worst circumstance, if Bhutan prefers to observe wait-n-watch strategy, the due diligence clause cannot be raised as default defence against the pleading for remedies claimed by India and Bangladesh respectively. The magnitude of such predictable mass destruction ought to shoot through its roof vis-à-vis resource reserve available with a standalone state like Bhutan relying on gross national happiness rather than gross development product. Thus, after remedial measures to the satisfaction of India and Bangladesh, Bhutan is likely to suffer havoc due to want of material resource. If remedy is declined, Bhutan is bound to suffer loss of face before its immediate next door neighbourhood followed by consequent toll on the regional relations inter se. As per draft articles issued by the International Law Commission, for internationally wrongful acts, state ought to do reparation for injury suffered by others by any of following three means: (i) restitution; (ii) compensation; and (iii) satisfaction (ILC 2001). While the threat stood perceived and predictable, also preventive measures went suggested in advance, inaction cannot be condoned by either judicial or quasi-judicial proceedings anyway. In final count, in the absence of immediate action to address the evil, anarchy is bound to prevail over to cause irreversible damage to lower riparian states in time ahead and thereby hoodwink the rule of international law genre.

Juxtaposition of research and development

In technical sense of the term, and more so in natural science discipline, a catchphrase is in vogue to club otherwise two distinct words, e.g. 'research' and 'development' together and thereby refers to discursive meaning and thereby serve a specific purpose vis-à-vis methodology. The author, however, splits these two words and thereby applied them in their respective meanings as per dictionary of social science discipline. Thus, in this effort, development refers to the technical meaning in development studies rather than the development either of or out of research.

To be precise, argumentative position hereby offered lies in the following statement: unlike research and development, the way they are construed in technical terminology, development against climate and research on sustainable climate management cannot walk hand-in-hand. On the contrary, even if both of them walk parallel, the given pace of development is set to defeat the research initiative in final count to gross detriment of sustainable climate on the Earth. The line of contention is meant to facilitate Bhutan raise the same to claim its stake to earn reparation from the climate fund constituted under the auspices of the UNFCCC-KP regime to do climate justice for those innocent in terms of contribution to global climate change. On the contrary, despite contribution toward carbon sequestration through its forest cover spread over about eighty percent of its territory, Bhutan is set to succumb to the GLOS syndrome out of climate change. The aspirant hemisphere needs to clear its policy choice rather than indulgence in both development drive to get the climate vitiated and thereafter research initiative to get the climate recover the brunt. In the given self-defeating game, these states gain twice: (i) first, they reap the harvest of development at the cost of sustainable global climate; and (ii) then, they get engaged in research work to minimize predicted, if not perceived, damage out of global climate change caused by themselves and thereby encash benefit through sale of high-value patented technology to rest of the world innocent to this endand earn periodic subscription to get rid of the vulnerability of climate change. Since the same offends a cardinal principle expressed through the following legal maxim- "COMMODUM EX INJURIA SUA NEMO HABERE DEBET" (means no person ought to have advantage from his own wrong) (Black 1968), the erratic state practice through double role- both savage and saviour of the sustainable climate- is subject to challenge before the International Court of Justice in The Hague. In the absence of international environmental court, victim states have had no recourse left out but to knock the doors of mainstream world court. In the absence of

relevant causes of action from the states, however, the Environmental Chamber created by the International Court of Justice stood defunct way back since 2006. If Bhutan initiates a cause of action, a new chapter will thereby be created in hitherto chronicles of the Court.

As part of the larger project of regional cooperation across the subcontinent, SAARC has had the opportunity to pursue their common cause. Also, the nonaligned movement (NAM) may get involved to this end. However, presence of habitual climate offenders, e.g. India, China, and the like, appears immediate speed breaker for such movement since they are no less responsible than their occidental counterparts for climate change across the world. All least developed countries in terms of gross development product, Bhutan being one among them, may get connected to carry forward their cause ahead. Thus, the small island states threatened by inundation out of the given sea-level rise including states like Bangladesh-threatened by inundation of lion's share of its landmass in the wake of sea-level rise- are set to join hands out of mutual national interest to have reparation as suggested by the International Law Commission. After all, besides polar glaciers, hitherto frozen water released from these mountain glaciers also appears add-on to put these seaworthy states to deep sea in literal sense of the term. In larger public interest, imperative need lies in coordination between these two arrays of differently vulnerable cluster of states raise their voice together in course of climate diplomacy worldwide; The way newly independent decolonized states together outnumbered the Western states in the floor of UN General Assembly.

In holistic sense of the global climate discourse, even a savage state is bound to turn a victim and succumbs to its own sin. India is itself a classic illustration to this end. For instance, India has had substantial contribution to global emission to its discredit. Albeit by circuitous routes, global climate change backfires India for its contribution to climate sin. The GLOF syndrome appears one among them where an innocent state in terms of climate sin is left with no other option but to release unguided watercourse- like unguided missile- to gross detriment of one that indulges in climate sin through breakneck development to maximize its gross development product. Thus India cannot afford to create tantrum against Bhutan since, in the given circumstance, the same may get attributed to itself in final count. In its own national interest, therefore, India ought to offer active support, technical cooperation and thereby get the relevant mission NMSHE extended to these eastern Himalayan glaciers and their respective lakes despite those being situated within the territorial jurisdiction of Bhutan. Such a coordination, however, requires fortified bilateral relations to this end.

Notwithstanding the increasingly intensified development drudgery to pave the way for global climate change, research continues to appear as last, though not final, resort to slowdown the disaster to the best extent possible. Research thereby plays painkiller; meant to hoodwink and not to cure adverse impact. Back to the GLOF syndrome, two rescue routes are available to get rid of the disaster: (i) arrangement to contain the flow from these glaciers to affordable limits of their respective lakes and thereby prevent outburst flow, and (ii) arrangement to channelize those beyond resistance to planned and controlled watercourse through lower riparian states toward the Brahmaputra and thereby prevent disaster out of overflow from these glacier lakes. If implemented, these man-made watercourses are set to support both Bhutan and India alike.

Conclusion

In final count, the preceding effort proves that dark mode of development and research taken up to whitewash the same lacks sense the way consumption of tobacco and milk together cannot be prescribed as acceptable diet to harm the health first and thereafter help recovery from the self-inflicted harm and thereby strike balance in public health. Likewise, research alone cannot neutralize the adverse impact of dirty development. What the relevant regime suggests is immediate resort to clean development mechanism (Kyoto Protocol 1997). Also, development sans environment constitutes the travesty of development in technical sense of the term. Earlier these errant states internalize the axiom is better for all including themselves.

At present, the climate jurisprudence requires them (i) to minimize the given growth under the disguise of development, and (ii) to maximize research on hitherto damage perpetrated meanwhile and thereby bring in status quo antebefore 1992 to the best extent plausible. These two are coextensive in their essence. These two appear corollary to one another and one cannot walk alone toward the grandeur of sustainable development; jus cogens (peremptory norm of public international law) with little doubt behind. What appears anathema is the indulgence in unjust enrichment out of climate research output by those errant states responsible for its damage and thereby engage phenomenal commercial gain out of their own guilt. Thus, Climate change technology transfer from sinner to innocent ought not to attract financial implication on either side as the former owes the same to the latter since long back out of historical reasoning. Rather than good Samaritan, India is bound by moral obligation to offer regional support and cooperation to Bhutan grapple with climate change worldwide and consequent GLOF syndrome in particular. Regional effort, therefore, constitutes no charity to this end.

Last but not least, so far as the juxtaposition of research and development is concerned, these two factors ought to swap their respective seats inter se to lessen adverse impact. At present, development is caught with its breakneck rush through GDP and research grapples with to keep pace with development. In time ahead, research ought to exceed development in its reach to take increasingly unsustainable climate back to normalcy while toxic emission in the name of development ought to slow down its pace to offer breathing opportunity for the humanity with sense of relief in its struggle for existence. The civilization is left with no other option but a reversal of juxtaposition to this end. So far as methodology to attain the purpose is concerned, regional approach with global climate mandate pays better to maximize success. Thus, 'think global, act local' mantra may be followed through team spirit of regional supranational institutions like SAARC in case of South Asia, as committed by states parties:

The (SAARC) Leaders emphasized on a greater focus to pursue people-centric development with due emphasis on socio-cultural progress and upholding traditions and value and in that regard, noted the concept of Gross National Happiness pursued by Bhutan, inter alia, in ensuring people-centric development culture, preservation of environment, better governance (SAARC Summit, 2010).

Even if Bhutanese wisdom under GNH discourse may no longer be plausible for India to follow with its vast population, states possess the due freedom in pursuit of happiness the way they prefer until the same commit breach of happiness for others. While Bhutan resembles a model polity in pursuit of its green development, rest of the world ought to respect the same through restraint from undue intervention even if the model does not suit others in the state of affairs of their respective affairs of state elsewhere. Had the GLOF syndrome been addressed by regional states together, the same is set to introduce a model of integrity of the South-South tie in time ahead with South Asia as a model for rest of the world to this end.

What Bhutan observes is voluntary simplicity in its lifestyle. While Nepal being positedin similar setting as another Himalayan state is set to follow the Western statecraft, etc., quite contrary to its time-tested ethnic legacy, Bhutan prefers its ancient antiquity and thereby declines the so called development to get quantified by production of goods and services. By courtesy its traditional wisdom, Bhutan is embodiment of the wisdom pronounced through Cocoyoc Declaration to provide "a safe and happy life" and failure of the contemporary world to provide the same (Cocoyoc Declaration, 1974). In final count, therefore, Bhutan is no victim of underdevelopment since the distance it maintains from so called material development constitutes informed and enlightened policy choice on its part. If climate invades these two potential lower riparian states from territorial jurisdiction of Bhutan through the GLOF syndrome, the disaster ought to get construed as contributory on their part in general, and of India in particular, while Bhutan ought to get out of the matter with clean hand provided the state allows access to these neighbours to its territory for all preventive measures to be taken in advance. In a nutshell, onus of prevention and cure of such potential climate disaster would lie on the

global capital and technology along with Indian initiative, rather than on Bhutan as the source state, through minimal possession of these Eastern Himalayan glaciers and their respective lakes without occupation of the same lest occupation turns invasion of foreign territory to gross detriment of the state sovereignty anyway.

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Teacher Placement in Schools of Bhutan: An explorative study

KARMA LHADEN

ABSTRACT

Teachers play an important role in the students' learning and in ensuring the quality of education. Their placement is one of the factors determining their service quality. Therefore, identifying the problems associated with their placement can help the schools perform better where several stakeholders involved in placing a teacher in a school. It comprises of the Royal University of Bhutan (RUB), the Ministry of Education (MoE), the Royal Civil Service Commission (RCSC), the Dzongkhag Education Officers (DEOs) and the Schools. Each stakeholder has a role of adding value to the service chain and to enhance the quality. However, the value chain is faced with problems such as poor demand forecasting, inappropriate ratio of theoretical-practical training, lack of efficient communication, and limited capacity of teacher training colleges.

Introduction

Modern education in Bhutan was first introduced in 1913. Until then, monastic education was the only form of education. A handful of students across the country were compelled to join modern schooling. A small group of teachers from India was brought to teach those students and the curriculum was based upon the Indian education system where students were also taught in the Indian language. Gradually as the country started opening its doors to the outside world, the economy started progressing and the education system also changed. In 1968 the nation's first teacher training college was established, then called the National Institute of Education. Slowly the country entered the highly competitive global world. Now no longer is Bhutan veiled from globalisation and so it is facing the challenges of these transitional times.

Education has always been the nation's top priority (Planning Commission, 2000). However, education has been faced with many challenges like quality education, teacher shortage and inadequate infrastructural facilities among many others (Royal Education Council, 2009). Teachers are the main stakeholders who will determine the quality of services that the ministry can provide to the learners. While the ministry is challenged with quality of education, supplying every school in the country with qualified, and an adequate number of, teachers remains difficult. The ministry continues to review their policies to ensure better services in the country.

Cooperation among different stakeholders can result in efficient delivery of service quality (Stank, Keller, & Daugherty, 2001). According to the authors, every stakeholder plays an important role in creating a value chain and collaboratively results in facilitating behavioural change. Inter-organizational collaboration is very important for creating a value chain, and improving the quality of services. Likewise, teacher placement in Bhutan also involves different stakeholders, each adding value along the chain.

Every year, Royal University of Bhutan (RUB) deploys hundreds of teacher graduates in different schools in Bhutan. While the school principals compete to forward their requisition, the District officers contact the ministry for supply of teachers in their respective districts. However, such push and pull strategy in Bhutan has always been challenging. With involvement of several stakeholders in the supply of teachers, the need for enhancement in logistic services has become imperative. Therefore, understanding the role of each agency through Value Chain lenses would help in determining pragmatic solutions.

Value Chain of Teachers in Bhutan

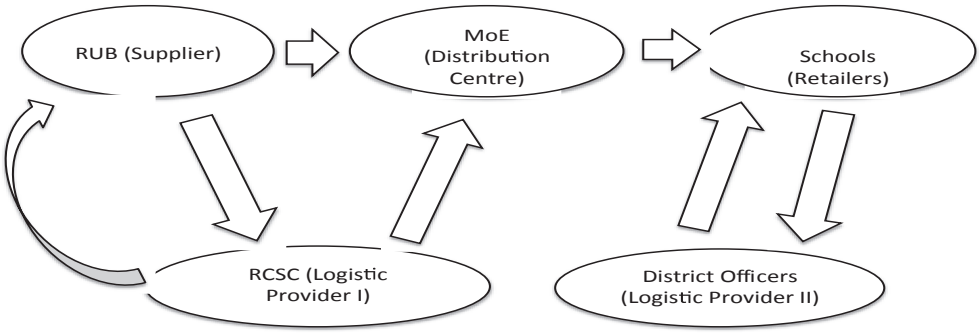

Figure 1. Value Chain of Teachers

The diagram above is the value chain structure of teachers in Bhutan. The upper chain represents the Royal University of Bhutan (RUB) as the supplier of teachers, consisting of two teacher-training colleges in the country. Samtse College of Education (SCE) and Paro College of Education (PCE) train and educate students upon completion of secondary school (i.e class 12) or Bachelor's degree. Class 12 students are provided four years of training and awarded a Bachelor's degree in Education (B.Ed) with allows them to teach from primary level to class 10th standard as per their subject specialisation. Trainee teachers joining the course upon completion of the general Bachelor's programme are trained with two subject specialisations for one year. They are awarded a Postgraduate Diploma in Education (PgDE) and to be placed in middle and higher secondary schools to teach classes from 9th standard to 12th standard. PgDE teachers undergo pre-selection by the RCSC and are briefed and trained on Civil service regulations before they are trained at teacher training colleges. B.Ed teachers are trained and briefed on the same upon completion of their teacher training. Thus, RCSC serves as a logistic provider enabling an efficient value chain between the RUB and the MoE. The MoE acts as a distribution hub that is responsible for placement of teachers to various schools across the country. And teachers are finally forwarded to 20 DEOs to be placed in schools in their district.

Push and Pull Strategy

The diagram below is integration of Push and Pull Strategy:

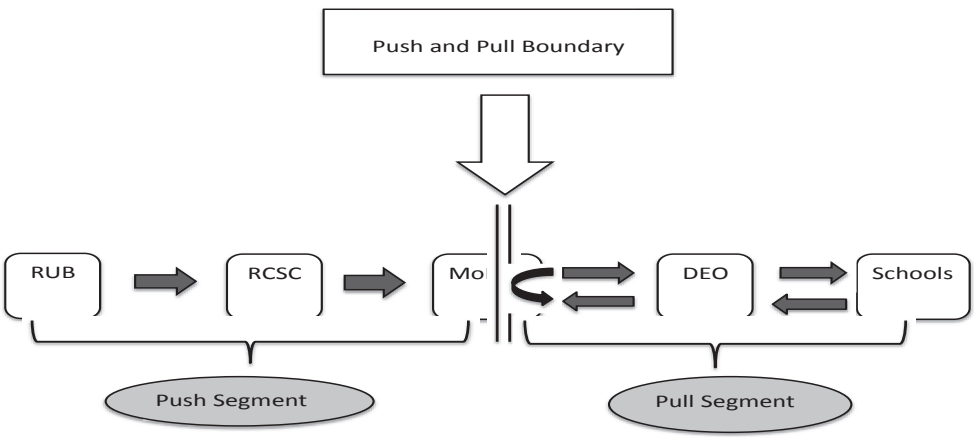

Figure 2. Push and Pull Strategy

The number of teachers to be trained under the RUB is decided according to the demand of the MoE. The RUB uses historical data depicting the number of schools and the number of students in each standard across the country. Based upon the data, the RUB allocates the training slots in B.ed and PgDE every year. Using long term forecasting of demand, each year teacher graduates are supplied to the MoE. Since there is shortage of teachers, demand remains predictable each year, thus Push Strategy is used (Simchi - Levi et al., 2008). The MoE allocates teachers as per the requisition made by the DEOs. Any school in need of teachers cannot directly ask the MoE but has to forward their requirements to their DEOs. Then, the DEOs will assess the schools' need and forward their requisition to the MoE. Hence, supply of teachers in the lower end of value chain is done through a Pull Strategy.

Centralized System of Supply Management

The two teacher training colleges were earlier under the MoE and both the teaching colleges were closely monitored and controlled by the MoE. 0n 18th April 2003, a royal charter was issued by His Majesty, the Fourth King of Bhutan for formation of the RUB as an autonomous body to provide tertiary education in the country (Royal University of Bhutan, 2012). Since then, PCE and SCE have been functioning under the RUB and supply teachers as per the need of the MoE. Although, the RUB has been granted autonomy in training of teachers, the decision-making on supply is still centralized at the MoE.

Additionally, the MoE is to ensure matching of demand and supply by working in close contact with the DEOs. Nevertheless, the DEOs have been given autonomy of placement of teachers in different schools in their districts in the recent years. Each year the MoE will receive fresh teacher graduates from the RUB and they are distributed across the country. The information will be sent to the DEOs and teachers are instructed to report to them for their placement. Despite the fact that most of the DEOs have been school principals and so are able to match vacancies with the different subject and role specialisation of the teachers, placement of the right personnel in the right school has been challenging. Irrespective of their specialisation, most fresh graduates prefer secondary school placement to primary school placement due to better facilities and a lighter workload. In addition, schools in urban places attract most of the teacher graduates and consequently schools in remote places face a shortage of teachers (Pokhrel, 2015). The resulting pressure can be partially understood as a cause of wrong placement of teachers. Often this wrong placement of teachers undermines their work commitment and affects the quality of education (Price & Collett , 2012; Sharplin et al., 2010).

Structural Problems in Teacher Placement

Due to involvement of different stakeholders, teacher placement in Bhutan is challenged with multiple structural problems. These problems are as discussed below:

1. **Poor Demand Forecasting.** Every year intake number by the RUB for the two teaching colleges has been determined by studying the need in the country. However, the data that the RUB uses every year is not reviewed although demand for different subjects changes over the period of time. This is due to the use of aggregate demand information, which is based on the shortage of teachers forecasted four years ago.
   In addition, the lack of study in identifying the teacher requirement in different subjects has been one of the determinants for the problem. Besides, the government is constantly pressuring the RUB to ensure the quality of teachers. Thus, limiting the number of slots by setting higher academic marks. This results in few students being selected to undergo teacher training. Hence, the problem of mismatch of demand and supply arises in the teacher market.
2. **Inappropriate Ratio of Theoretical- Practical Training.** B.Ed teachers have to undergo teacher training for four years. The trainees spent three and half years in

learning theoretical perspectives on teaching, and the teaching practice is done for only six months. On the other hand, PgDE trainees have to undergo a training period of only a year, where their teaching practice is further limited to forty-five days. This minimum period allocated for teaching practice will undermine the importance of imparting skill-based training to the teacher graduates. This view was strongly supported by Towsea et al., (2002) who argued about the importance of skill-based training before placing the teachers in schools.

3. **Poor Communication.** In a centralized system, effective communication between different stakeholders is crucial for the central authority to make strategic plans (Simchi - Levi, Kaminsky, & Simchi - Levi, 2008). As discussed earlier, due to long bureaucratic procedures, actual requisition made by the schools always gets altered before it reaches the MoE. This is also because DEOs have to ensure that their district should not have excess teachers. Thus, this results in a breach in effective communication.
4. **Limited Training Capacity.** The RUB is also challenged by its limited capacity for training teachers. There are only two teacher-training colleges and they cannot take more than 500 trainees each year. Colleges are not only facing a shortage of trained teaching staff, but are also facing inadequate infrastructural facilities, which limits the intake of trainees.

Recommendations and Conclusion

Murgatroyd and Morgan (1993) claim that no team in an organisation is an island: to achieve excellence in quality service delivery, each stakeholder should share ideas and information to work collaboratively. Therefore, effective coordination between different parties in supply of teachers is essential to ensure quality service and accomplish learners' satisfaction. They further argue that gathering information and disseminating that information to others is mandatory for strategic decision-making (Murgatroyd & Morgan, 1993). Hence, proper communication between different teams and use of updated demand data is advisable to reduce demand and supply mismatch.

Teachers play a very important role in delivering better service to the learners (Butt & Rehman, 2010; Ministry of Education, 2010). Teachers' morale will have great impact on service level. Many teachers in the MoE are seen leaving their profession due to poor incentives and dissatisfaction about their job. This dissatisfaction is often due to wrong placement. When a primary school teacher trained to teach in lower classes gets placed in secondary schools, they feel burdened. Similarly, when a secondary teacher who is well equipped with content knowledge for higher studies is placed in primary schools they can find it very challenging to connect to their learners. Thus it leaves a great impact on the service level.

Although training period of B.Ed programme of four years cannot be compromised as it would lead to the issue of quality of teachers, nonetheless, the structure of their course can be altered for the better. As the issue is regarding mismatch of demand and supply due to poor demand forecast, B.Ed graduates can be trained with general teaching skills and strategies in their first three years and then registered for different subject specialisation in their fourth year. This will not reduce lead-time, but demand forecast can be based on data that is only one year old rather than four years out of date.

Furthermore, government constantly conducts workshops and seminars to evaluate and deregulate policies and the framework of education. But it is not deregulation that the system is in need of. The same policy can help solve the problem if it is organised for its effectiveness and efficiency.

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Potential impacts of discharging vehicle wash wastewater in rivers: a case study of Thimphu and Paro, Bhutan - a review

REETA RAI, SUBODH SHARMA, DHAN BAHADUR GURUNG AND BISHAL K SITAULA

Abstract

In Thimphu and Paro most of the vehicle wash centres, are located along the river banks and release untreated wastewater into the rivers. Major pollutants present in vehicle wash wastewater are the petroleum hydrocarbon wastes such as petrol, diesel, and grease, nutrients, heavy metals, surfactants, and dissolved solids. Wastewater discharged into natural ecosystems such as rivers can adversely affect water quality, its biota, and human health. Therefore, the main aim of this review is to present the potential impacts of discharging vehicle wash wastewater into the tributaries of Wang Chhu. The word "Chhu" means "river" or "water" in Dzongkha, an official or national language of Bhutan. Different methodologies on assessing impacts of releasing vehicle wash wastewater into the rivers are presented. The sources of information for this paper include newspapers, books, conference proceedings, government acts and policies, international agencies reports, journals, and author's own field visits. Findings show that direct discharge of untreated vehicle wash wastewater into the rivers affects water quality and aquatic biota. There is a gap between policies and practices with regard to management of vehicle wash wastewater in Bhutan. This review recommends concerned authorities of the government to implement some mitigation strategies for the management of vehicle wash wastewater.

Key words: *Bhutan, vehicle wash wastewater, pollutants, physico-chemical parameters, and macro invertebrates.*

Introduction

Water is one of the essential elements responsible for sustaining life on earth. Water is important to all living organisms, ecological systems, human health, agriculture, and economic developments. Despite its importance, water is the most poorly managed resource in the world (Chutter, 1998)and aquatic ecosystems are threatened by anthropogenic activities (Meybeck, 2003; United Nations Educational Scientific and Cultural Organization [UNESCO], 2009). In recent years, rapid urbanisation and industrialisation have introduced large quantities of pollutants into the aquatic ecosystem(Begum, HariKrishna, & Khan, 2009). Such anthropogenic activities lead to deterioration in water quality and quantity that impact not only the aquatic ecosystem, but also availability of safe water for human consumption (United Nations Environment Programme [UNEP], 2006). According to Phiri, Mumba, Moyo, and Kadewa (2005) most rivers in urban areas of the developing countries are the end point of wastewater discharges. Water pollution is one of the leading causes of poor livelihood and ill health (Lenton, 2004).

Bhutan, a tiny Himalayan country and a home to 765,545 people (Bhutan Statistical Bureau, 2015), living in close harmony with nature is not spared by the challenges of managing wastewater. With the launching of the first five year plan in 1961 that flagged off many economic activities, road construction received major thrust to ease transportation and elevate economic activities in the country (Penjore, 2007). Transforming economy with expanding road networks and rapidly increasing vehicles required vehicle wash centres in various parts of Bhutan. Vehicles are washed to remove dust, preserve aesthetic appeal, and to increase their life span. Hence,many vehicle wash centres were established along the rivers flowing through major cities of Bhutan such as Thimphu and Paro.

However, without any scientific investigations and empirical data the impact of releasing vehicle wash wastewater into the rivers of Bhutan is poorly known. Therefore, specific aim of this review is to present potential impacts of discharging vehicle wash wastewater into the rivers

and impacts of its major pollutants on river water quality and macro invertebrate communities. The present state of river water quality of Wang Chhu and Pa Chhu and implementation and effectiveness of Bhutan's wastewater management policies and acts will be also reviewed. Bhutan's vehicle wash wastewater issue and management practices will be compared with some other countries of the Hindu-Kush Himalayan (HKH) region. Different methodologies on assessing and monitoring the impacts of releasing vehicle wash wastewater into rivers will be discussed in South Asian context.

Materials and Methods

Information presented in this paper are based on review and analysis of Bhutanese newspapers, books on river water pollution, conference proceedings, government acts and policies, international agencies reports, articles published in regional and international journals. In addition, reflections from preliminary field visits to study area in Thimphu and Paro are also included.

Results and Discussion

1. State of river water quality in Bhutan

Although Bhutan is a part of the Hindu Kush – Himalayan (HKH) region which has the largest reservoirs of freshwater in the world (Rees, 2004) limited information is available on quality of freshwater resources in Bhutan. Bhutan has four major river systems (Figure 1) namely: the Amo Chhu, the Wang Chhu, the Punatshang Chhu, and the Drangme Chhu (Himalayas, 2000). These rivers are fed mainly through permanent and seasonal snows, glacier melt, and monsoon precipitation (Royal Government of Bhutan - World Bank [RGOB-WB], 2015) and flow out of the Himalayas, to join the Brahmaputra River in India.

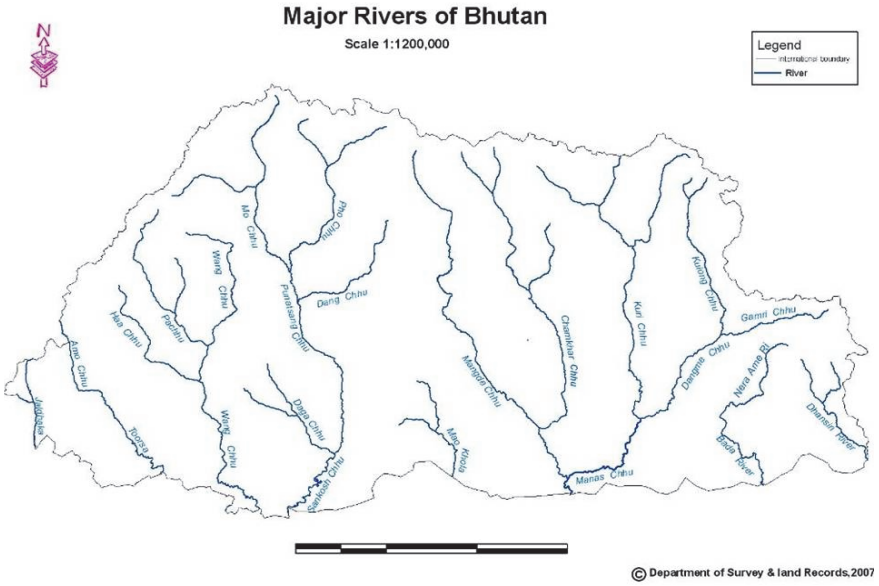

Fig 1: Four major river systems in Bhutan (Source: Department of Survey & Land Records,2007)

The National Environment Commission (NEC) with assistance from the Asian Development Bank (ADB) took the first initiative in 1997 to study water quality in the form of a National Baseline Water Quality Survey (NBWQS) to develop a national water quality

database for major watersheds in Bhutan. Data indicated that Bhutan's water resources are healthy on a macro-scale and Bhutan's rivers are highly oxygenated, slightly alkaline with low conductivity and have no traces of salinity (ADB, 2004). Recently, ADB has presented that Bhutan has abundant water but needs better development and coordinated management of existing water resources (Gyelmo, 2016). However, WHO (2011) has concluded that, Bhutan faces a number of challenging issues in water resource management with the expansion of industry, agriculture, increase in use of water due to changing lifestyles and urbanization.

Among the four major river systems, Wang Chhu is in the limelight of environmentalists as few studies have highlighted deterioration in its quality due to anthropogenic activities. Pradhan and Mandal (2008) assessed the water quality of three major rivers of Bhutan namely, the Punatshang Chhu, the Wang Chhu and the Pa Chhu. Based on this report, the water quality in these rivers are affected by the anthropogenic activities such as unsanitary conditions along the river banks, improper disposal of solid wastes, discharge of untreated domestic wastewaters, and agricultural runoff.

The river quality assessment carried out by Shresta et al. (2008) in the HKH countries have reported that the sewage discharge, industrial effluents, agricultural runoff, solid wastes, vehicle washing, river crossing, and mining are the major stressors of Bhutan's rivers. In 2007, International Centre for Integrated Mountain Development (ICIMOD) also reported that the section of the Wang Chhu flowing through the Thimphu city is highly polluted and categorised it into the River Quality Class V. According to European Union Water Framework Directive (EUWFD), the River Quality Class V with a colour band of red signifies high pollution.

In 2012, NEC assessed physical, chemical, microbiological, and biological characteristics of the Wang Chhu. Findings as reported in Bhutan Broadcasting Service (BBS) stated that it is highly contaminated with effluents from industries, oil and grease from automobile workshops, and dumping of solid wastes. Giri and Singh (2013) evaluated the impact of land use/land cover changes (LULC) on water quality of the Wang Chhu in Thimphu by analysing physico-chemical parameters, total coliform, and benthic macro invertebrates at upstream, within the urban area, and downstream. This study reported that rapid urbanization leads to deterioration of water quality and depletion of aquatic biota.

2. Vehicles wash wastewater issue in Bhutan.

In Bhutan, an establishment for washing vehicles is called an automobile workshop or car wash centre. With the increasing number of vehicles in Bhutan (Table 1) the production of waste water from vehicle wash centres is increasing. Zangmo (2016), reported that as per the study carried out by ADB, Bhutan approximately generates 6.5 million litres of vehicle wash wastewater every year, the largest volume of wastewater generated in the country. The report also predicts that by 2018, around 21.2 million litres of vehicle wash wastewater will be generated.

Table 1: Growth trend of motor vehicles (Source: Ministry of Information and Communication, 2016).

Year	Number of vehicles
2010	53382
2011	62707
2012	67449
2013	67926
2014	69602
2015	75190

Most of the vehicle wash centres are located along the rivers making it easier for operators to draw water for washing and discharging wastewater into the same rivers. There are 35 vehicle wash centres in Thimphu and 7 in Paro (Figure 2 & 3).

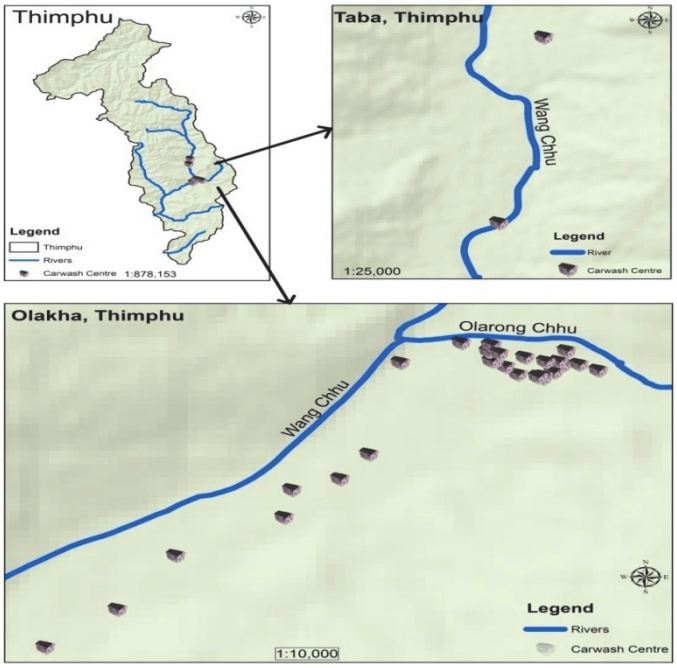

Fig 2:Locations of vehicle wash centres in Thimphu

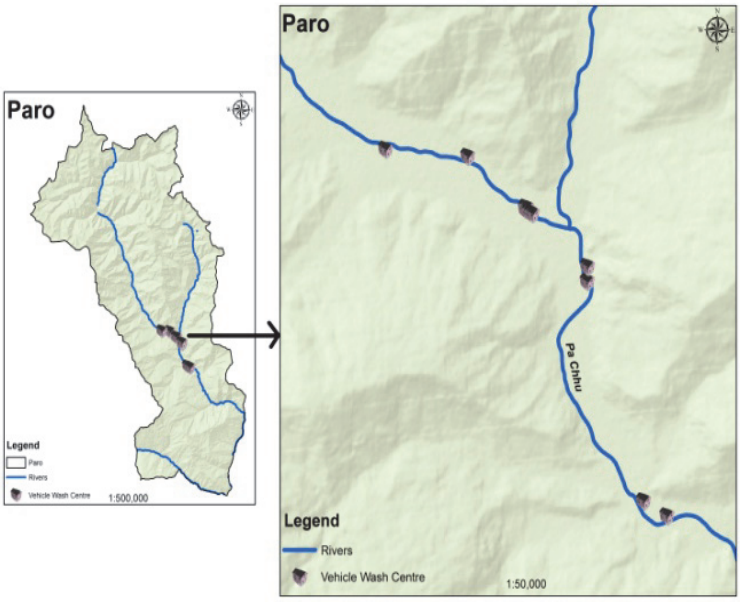

Fig 3:Locations of vehicle wash centres in Paro

In Thimphu, most of the vehicle wash centres are located at Olakha which discharge wastewater into the Olarong Chhu,a tributary of Wang Chhu (Figure 4). Among the three wastewater outlets, one passes through a small treatment plant designed to separate oil and grease. Automobile workshops were shifted from Changzamtok to Olakha in 2008 with an aim of addressing environmental concerns. However, in the last 8 years environmental safety has not been considered except this small oil and grease separator plant which also remains dysfunctional most of the time. Zangmo (Kuensel, 2015) has also reported flow of oil and detergents from Olakha workshops into the Olarong Chhu due to dysfunctionality of this plant.

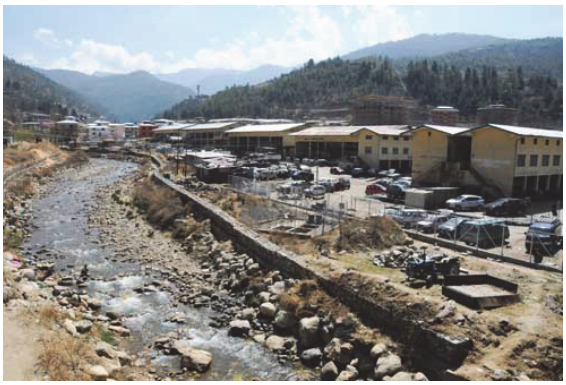

Fig 4:Olarong Chhu flowing beside Olakha automobile workshops

3. Acts and policies for the management of wastewater in Bhutan

Planned economic development of Bhutan started with the launching of first five-year plan in 1961. Thereafter, Bhutan started making impressive economic developments, but it soon realized that the accelerated economic activities stressed natural resources. The Royal Government of Bhutan (RGOB) established the first environmental institution, the NEC in 1989, and has bestowed it as an independent authority with highest decision making power on all matters relating to environment and its management in the country. The National Environment Protection Act (2007) and the National Environment Strategy (1998) set the overarching legal framework for environmental protection and management in Bhutan.

Over the past 27 years, Bhutan has developed comprehensive acts, policies, and regulations for the management of wastewater and safeguarding water bodies from its impacts. The legislations and regulatory provisions encompassing the issues relating to wastewater management and safeguarding of water bodies include: Water Policy (2003), Waste Prevention and Management Act (2009), Environmental Standards of Bhutan (NEC, 2010), Waste Prevention and Management Regulation (2012), Water Act of Bhutan (2011), and Guidelines for Vehicle Wash Facility (n.d.).

Section 41 (a & b) of the Water Act of Bhutan (2011,p.21), states “A person may not discharge any effluent directly or indirectly to any water resource unless the discharge is in compliance with the Effluent Discharge Standard (2010). Effluents must be treated using best available technology before discharging into the environment”. Similarly section 46(c) of the Waste Prevention and Management Act (2009, p.30) treats dumping of hazardous waste into water bodies and land as an offence of misdemeanor and offender is liable to be sentenced in accordance with the Penal Code of Bhutan. Even in presence of such legislative provisions,wastewaters from industries, hospitals, laboratories, households, and vehicle wash centers are released into the environment without any treatment in many parts of the country. Till now, only three towns, Thimphu, Phuntsholing, and Gelephu have piped sewerage and treatment facilities from where treated sewages are discharged into the rivers. This calls for

clear strategies from the government for the implementations of existing ordinances and acts especially related to the management of vehicle wash wastewater.

Bhutan could learn from best practices implemented in other countries as discussed below. In developed countries like United States, Europe, and Australia environmental agencies have well structured regulations, acts, and policies for protecting their environment from waste related to automobiles. In United States, Environmental Protection Agency [EPA] (2001) regards an automotive repair industry as a significant generator of hazardous waste therefore, EPA enforces federal clean water act and safe drinking water laws, provides support for municipal wastewater treatment plants, and takes part in pollution prevention efforts aimed at protecting watersheds and sources of drinking water. European countries such as England and Scotland have separate pollution prevention guidelines (PPG) for garages and vehicle service centres. In South Australia, environmental pollution by wastewaters from automobile workshops is protected by various laws like Environment Protection Act (1993), the Water Quality Policy (2003), and the Public and Environmental Health Act (1987). People are forbidden to discharge or deposit a pollutants related to auto servicing like cleaning agents, detergents and their by-products, engine coolant, hard waste (e.g., vehicles, tyres, batteries, & metal parts),oil, grease, lubricants and petroleum products, and solvents into any water body or onto land where it might enter a water system.

4. Vehicle wash wastewater issue in Hindu Kush Himalayan region

The Hindu Kush–Himalayan (HKH) region that includes the mountain territories of Afghanistan, Bangladesh, Bhutan, China, India, Myanmar, Nepal, and Pakistan are among the largest reservoirs of freshwater in the world and are the source for the three major rivers of south Asia: the Indus, Ganges, and Brahmaputra (Rees, 2004). Freshwater from the HKH region is a critical resource for South Asia as a whole. Although the HKH is considered immensely rich in water resources (Chalise, 1993) the growing population and rapid economic developments are exerting immense pressure on the water resources of the region.

In entire HKH countries vehicles are either washed in vehicle wash centres, rivers, lakes, streams, and private lawns though their country's environmental acts and policies forbid washing in natural water bodies (ICIMOD, 2007). Exact volumes of vehicle wash wastewater production are not available for all the HKH countries as there is no distinction among the wastewater produced from different sources. Total volume of wastewater produced in Bhutan, India, Nepal, and Pakistan are presented (Table 2).

Table 2: Country wise estimated wastewater production in HKH region

Sl. No	Country	Volume of wastewater production	Data source
1.	Bhutan	6.5 million litres/year of vehicle wash wastewater	Zangmo (2016)
2.	India	38 billion litres/day of municipal wastewater	Phukan (2014)
3.	Nepal	296 million liters/day of domestic, municipal and industrial wastewater	Nyachhyon (2006)
4.	Pakistan	4369 x 109 litres/year of municipal and industrial wastewater	Murtaza & Zia (2012)

Many Asia-Pacific countries still do not consider wastewater management as a priority and inadequate wastewater management systems pollute groundwater, rivers, and coasts- the same water bodies used for drinking, fishing, bathing and swimming (ADB, 2016). This could be due to lack of awareness on impacts, unaffordable establishment and operating costs, and

less attention from the policy makers. India, which is economically advanced than many Asian countries like Bangladesh, Bhutan, Nepal, and Pakistan, also does not have 100% treatment capacity of sewerage and wastewater. Central Pollution Control Boards of India (CPCB, 2007) reports that due to improper design, poor maintenance, frequent electricity break downs, and lack of technical man power, the facilities constructed to treat wastewater do not function properly and remain closed most of the time.

Some amount of wastewater is also used in irrigation to overcome the water crisis. According to Kaur, Wani, and Singh, (2012), and Murtaza and Zia (2012), in light of increasing water scarcity in India and Pakistan, several recent policy documents have started emphasizing water conservation and reusing of wastewater after treatment. In Nepal, waste water is extensively reused in agriculture, washing automobiles, and in industries. Using recycled water has benefitted in using a resource that would otherwise be discarded and wasted (Bhandari, 2014). Using recycled water also reduces pressure on environment by reducing the use of environmental waters. However, in Bhutan the need for recycling wastewater has not been felt owing to the availability of large amount of freshwater.

5. Impact of vehicle wash wastewater on water quality

Bartram and Ballance (1996) define water quality as a term used to express the suitability of water to sustain various uses or processes. Water quality is commonly defined by its physical, chemical, biological, and aesthetic characteristics usually with respect to its suitability for a particular purpose. A water body that supports healthy ecological environment and protects public health is said to be of good quality. The quality of water in natural water bodies such as rivers and lakes are affected by a wide range of natural and anthropogenic activities. In fact, water quality changes the way communities use the water for different activities like drinking, irrigation, recreation, and commercial purposes. Water quality is affected by changes in nutrients, sedimentation, temperature, pH, heavy metals, non-metallic toxins, persistent organics and pesticides, and biological factors, among others (Carr & Neary, 2008). Measurements of these indicators can be used to monitor changes in water quality as the variations of the physico-chemical properties of water directly influence the biotic communities.

Wastewater from vehicle washing and cleaning activities can damage the environment and pollute rivers, streams, and groundwater (Bhadula, Choudhry,& Joshi, 2012). Wastewater from automobile workshop is commonly called oily wastewater as the water mainly consists of petroleum hydrocarbons like oil and grease. Environmental pollution with petroleum products has been recognized as a serious environmental problem (Horsfall, 2001). Petroleum products can be highly toxic and hazardous to soil fauna and human (Adewoyin, Hassan, & Aladesida, 2013). Number of studies (Bhatti et al., 2010;ICA, 2005; Margesin & Schinner, 1998; Smith, Daniel, Shilley, & Hollie, 2009; Sablayrolles, Vialle, Vignoles, & Montrejaud-Vignoles, 2010), has reported the presence of petroleum based compounds in vehicle wash wastewater.

Component of oily wastewater like oil will cover the surface of water and cut off oxygen diffusion from air to water (Kadarwati & Herlina, 2008) and contribute to BOD and Chemical Oxygen Demand (COD) in wastewater (Yasin, Iqbal, Rustam, & Zafar, 2012). It also reduces Dissolved Oxygen (DO), increases temperature (T) and pH of the water body and is associated with aquatic habitat degradation, reduced productivity, and loss of biodiversity (Enujiugha & Nwanna, 2004). Phosphates in detergents can lead to freshwater algal blooms that release toxins and deplete oxygen in water bodies. When algae decompose, they use up oxygen available for aquatic life.

Several works on physico-chemical analysis of wastewater from automotive workshop have been reported. In Lahore, Pakistan (Yasin, Iqbal, Rustam, & Zafar, 2012) investigation on the damage caused by automobile workshops to the environment by analysing various physico-chemical parameters in wastewater showed that all the parameters were greater than the National Environmental Quality Standards (NEQS).The potential impacts highlighted were DO

depletion, impairment in photosynthesis, fatality to aquatic life, toxicity to water resources, and human life. The authors proposed implementations of stringent policies from the government for tackling wastewater from automotive workshops.

Bhadula, Choudhry, and Joshi (2012), analysed physico-chemical parameters like T, pH, BOD, COD, total dissolved solids (TDS), and total suspended solids (TSS) of untreated and treated effluents of Shivam Automobile Limited at Haridwar and found the average means of all the parameters were higher in the untreated effluent in comparison to treated effluent. This study has also cautioned that vehicle wash wastewater pollute water bodies and damage aquatic ecosystem.

Bujang, Ibrahimand, and Aweng (2012), suspected that an increase in the number of motor vehicle workshops were causing water pollution around Kota Bharu, Malaysia. To prove this hypothesis, oily wastewater samples were analysed for parameters like BOD, COD, DO, oil, and grease from three different automotive workshops. The values obtained for all the sampling points were higher than the standards set by the Environmental Quality Act (1974) and Environmental Quality (Sewage) Regulation (2009).

In Nigeria, Adewoyin, Hassan, and Aladesida (2013), examined the extent of ground water and soil pollution arising from auto-mechanic activities in Ibadan metropolis. Ground water and top soil samples were analysed for both physico-chemical parameters and some heavy metals for a period of two months. They found that high concentrations of pollutants build up in the soil and seep or percolate into the groundwater, thereby posing hazards to people and soil fauna.

6. Impact of vehicle wash wastewater on aquatic organisms.

Disposal of wastewater into surface water bodies cause harmful impacts to aquatic biodiversity. When environmental stresses caused by human interference become excessive or too frequent, freshwater ecosystem functioning breaks down; food webs become distorted, plant and animal communities change, and some species disappear (Raven, 2013). Among the main effects of pollutants on aquatic organisms, studies report severe pathological problems (Forbes & Cold, 2005), behavioural changes (Heckman & Friberg, 2005), and species migration and disappearance (McIntyre et al., 2005). Degraded ecosystems through anthropogenic activities can no longer regulate and restore themselves; they lose their resilience, further accelerating the decline in water quality and availability (UNESCO, 2015). Bottom-dwelling aquatic organisms may ingest petroleum contaminants and transmit them up through food chain until they accumulate in dangerous concentration levels in fishes. Hydrocarbons also harm fish directly, and damaged fish eggs may not develop properly (USEPA, 2003).

Heavy metals are associated with vehicle body parts, fuels, and oils (Table 3). In vehicle wash centres, heavy metals get into the wastewater due to normal wear of auto brake linings, tires, vehicle exhaust, and fluid leaks (Smith, Daniel, Shilley,& Hollie, 2009). Automobile wastes poured on the ground increases the level of heavy metals which drain into both surface waterways and ground water because of the connection between lands, air, water, and soil (Utang, Eludoyin, & Ijekeye, 2013).

*Table 3: Heavy metals associated with vehicle body parts, fuel, and oils,** Primary Source, * Secondary Source (Modified from Sansalone and Buchberger, 1997).*

Heavy metals	Vehicle body parts	Fuel	Oil		
	Brake	Tyre	Frame and body		
Cadmium	*	**			
Chromium		**			
Copper	**	**			
Iron		**	**		
Lead	*	*		*	*
Nickle		**			
Zinc	**	**	**		

Dissolved copper in wastewater from normal wear of auto brake linings impair the olfactory system of fishes. Baldwin, Sandahl, Labenia,and Scholz (2003) studied impacts of copper on olfactory function and raised a concern for the survival of salmon populations within the Pacific Northwest. Endangered salmons rely on their sense of smell for critical behaviours such as homing, foraging, and predator avoidance.

Begum, Hari Krishna, and Khan (2009), analysed heavy metals in water, sediments and fish samples in Madivala Lake in Bangalore and reported increase in metal concentrations from water to sediment then to fish samples in the order;Pb> Cr > Cd > Ni. Maximum concentrations of heavy metals were found in kidney, liver, and muscles and there is potential danger for human exposure to heavy metals from eating fishes caught in such polluted lakes. Many health issues are associated with consumption of heavy metals contaminated fishes like irritation, skin rash, respiratory failure, birth defects, asthma, allergies, heart disorder, cancer, kidney disorder, and diabetes (Akpan & Thompson, 2013).

Qu et al. (2010), characterized response of benthic macro invertebrates to heavy metals in high mountain streams of China and reported that heavy metals mainly affected the sensitive taxa of Plecoptera, Ephemeroptera, and Trichoptera in total abundance and species richness. A deleterious impact on freshwater macro invertebrates, particularly the loss of metal sensitive orders such as Ephemeroptera, Plecoptera, and Tricoptera, due to heavy metal contamination of sediments from urban runoff has been also reported (Beasley& Kneale, 2003).

Detergents are widely used in vehicle washings and form the major part of wastewater. According to Abel (2006), synthetic detergents are reported to be acutely toxic to fish in concentrations between 0.4 and 40 mg/l. His findings on toxicity of synthetic detergents on fish include gill damage followed by asphyxiation, sub lethal effects like retardation of growth, alteration of feeding behaviour, and inhibition of chemoreceptor organs. Invertebrates, especially in their juvenile stages, were found to be extremely sensitive to detergents. Concentrations below 0.1 mg/1 interfere with growth and development in some species of macro invertebrates.

7. Monitoring of river water quality due to the effects of wastewater

Monitoring river water quality normally consist of investigating entry of pollutants, assessing impacts, and controlling further degradations of river water quality. UNEP (2006, p.12) states, “water quality is neither a static condition of a system, nor can it be defined by the measurement of only one parameter”. Typically, water quality is determined by comparing the physical and chemical characteristics of a water sample with water quality guidelines or standards. Although many water quality studies have been conducted solely by analysing physico-chemical parameters of wastewater and surface water, use of this methodology alone is regarded as traditional. This method is useful in determining only the sources of water contamination, since

the biological responses to pollution are not accounted. Chemical water samples reflect the conditions only for that period when sample is taken, since chemical concentrations may be highly variable from day to day depending on the timing and volumes of discharges, precipitation events, and water flow patterns. Therefore, there is now a widespread recognition that not only physical and chemical but biological analysis is required for an appropriate assessment of the river quality (Wright, Sutcliffe, & Furse, 2000). Bio-monitoring provides an indication of both current water quality conditions as well as long-term changes (Jacobsen, Cressa, Mathooko, & Dudgeon, 2008).

Bio-monitoring involves the use of indicators, indicator species or indicator communities comprising of macro invertebrates, fishes, and algae. The water quality can be determined by assessing abundance, diversity, and species richness of an indicator species which in turn will reflect pollution levels. Most water quality agencies that routinely collect bio survey data focus on macro invertebrates (Rosenberg & Resh, 1993). A great deal of work has been done using macro-invertebrates as bio-indicators of pollution in HKH region (Chowdhary, Zieritz,& Alridge, 2016; Giri & Singh, 2013; Gurung & Dorji, 2014; Korte et al., 2010; Mophin & Murugesan, 2014)

Benthic macro-invertebrates are organisms without backbones that inhabit bottom substrates of water bodies and are visible to naked eye. Benthic macro invertebrates include insect larvae, annelids, oligochaetes, crustaceans, molluscs, and gastropods. Benthic macro invertebrates are often used in studies to determine the quality of waters because of their high numbers, known pollution tolerances, limited mobility, and wide range of feeding habits, varied life spans, and dependence on the land environment around the stream. The benthic invertebrate community provides reliable and relevant signals about the biological effects of human activities and integrates the effects of stressors over time (Korte et al., 2010). Costs to implement bio monitoring of rivers is low compared to physical and chemical monitoring (Barbour, Stribling, & Karr, 1995; Dudgeon, 2003; Resh, Norris, & Barbour, 1995).

The first bio-assessment of water quality using macro invertebrates was started in Europe in 1902 by Kolkwitz and Marsson as cited by Metcalfe (1989) ; Rosenberg and Resh (1993). The earlier systems were purely descriptive or qualitative and mainly based on the presence or absence of indicator species in relation to organic pollution like discharges of domestic sewage. Soon around 1950s, biologist felt the need to present their complex biological data in a numerical form such as indices or scores. Many such indices have been described by Ghetti and Ravera (1994); Hering, Moog, Sandin,and Verdonschot (2004); Pauw, Ghetti, Manzini,and Spaggiari (1992) that ensure comprehensible biological information which is acceptable in decision-making processes.

In Asia, river assessment with benthic invertebrates is still in its infancy (Korte et al., 2010). The knowledge about riverine biodiversity is incomplete and bio-monitoring and conservation of rivers is underdeveloped in Asia(Dudgeon, 2003). Among the HKH region, the first river quality assessment using benthic macro invertebrates was carried out in India by CPCB (1999) and in Nepal by Sharma and Moog (2005). According to Bandyopadhyay, Rodda, Kattelmann, Kundzewicz, and Kraemer, (1997); Sharma, Bajracharya, Sitaula, and Merz (2005), and CPCB(2006), bio-monitoring using benthic macro invertebrates are potentially suited for water quality management in Asia due to increasing anthropogenic interferences and steep pollution gradients which are normally reflected by biota.

Korte et al. (2010), have developed a multi metric index to detect river deterioration caused by anthropogenic activities in HKH countries. Subsequently, HKHbios an assessment system based on benthic macro-invertebrates has been developed by Ofenbock, Moog, Sharma, and Korte (2010) to evaluate the ecological status of rivers in the HKH countries.

8. Management practices of wastewater from vehicle wash centres

Apart from assessing the impacts of wastewater from vehicle wash centres, recent trend in research focuses on treatment of wastewater before discharging into the surface water or

reusing it. Information on the physico-chemical parameters of wastewater is very important before treatment for discarding or reusing. Wastewater threatens river water quality and aquatic lives if discharged untreated. Physico-chemical parameters are very important for choosing the correct methodologies for treating the wastewater before discharging into water bodies. For some wastewater, only primary treatments like removing solids, minimizing odour, and neutralizing pH are required. Some wastewaters require secondary treatment involving biological processes to reduce BOD and COD while tertiary treatment is required for further purification of wastewater by removing sludge and precipitates. According to Mazumder and Mukherjee (2011), removal of oil and grease in oily wastewater from automobile service stations is feasible by chemical coagulation with Alum.

Since vehicle wash wastewater contains organic matter and nutrients like nitrogen and phosphorous it can be used for agriculture. Chowdhury, Sinha, Singh, and Krishna (2012),experimented use of automobile workshops effluent on leguminous plants like Cicerarietinum and Vignaradiata and found that such effluent help in germination and growth of plants. Using wastewater as an alternative to chemical fertilizer will also reduce the risks of eutrophication in surface water bodies. Though reuse of wastewater for irrigation purpose is a common practice, lack of adequate treatment of wastewater prior to irrigation can cause soil deterioration, vegetation destruction and contamination of aquatic environment (Nnaemeka, Chukwuemeka, Emmanuel, Achuka, & Boniface, 2014).

Conclusion

This paper presents impacts of discharging vehicle wash wastewater into rivers and subsequent effects on water quality and macro invertebrate communities. Changes in physico-chemical parameters of river water due to contaminants present in vehicle wash wastewater directly affect the macro invertebrates. The main contaminants usually present in vehicle wash wastewater are oil, grease, surfactants, nutrients, heavy metals, and solids. Assessing impacts of discharging wastewater into rivers by physico-chemical analysis and accounting macro invertebrate communities is regarded as a holistic approach. This methodology is suitable for Bhutan, which lacks advanced scientific facilities to carry out such assessments.

Acts, policies, and regulatory provisions for the management of vehicle wash wastewater in Bhutan are not implemented effectively and depict a gap between policies and practices. The ongoing river water pollution due to vehicle wash wastewater has been pointed out mostly by national newspaper Kuensel and BBS radio service, which means that there is a need for scientific assessment to reason out the cause and effects and tackle the wastewater problem in a scientific way. However, the concerned authorities of the government cannot afford to remain ignorant on the ongoing pollution and they may need to develop policies and plans for implementing appropriate mitigation strategies such as onsite treatment of vehicle wash wastewater using simple technology.

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The Fate of Traditional Rangeland Management Practices under Bhutan's Changing Policies and Socio-economic Conditions

KUENZANG TSHERING, WU NING, KARMA PHUNTSHO, NAKUL CHHETRI, NAMGAY BIDHA AND KEZANG DEMA

ABSTRACT

Bhutan Land Act of 2007 is the latest policy change, which will have huge impacts on nationwide traditional rangeland management practices. It was approved in 2007 and will be implemented by 2017, keeping a grace period of 10 years for preparation to the change. Rangeland users across the country might have to adapt to a new system once the act is implemented. In the process of adaptation to the change they might become vulnerable to socio-economic and environmental changes. The expected impacts of the policy change and other drivers of change like socio-economic factors on traditional rangeland management systems of yak herding communities of Toorsa Strict Nature Reserve were investigated in this study. The household survey was conducted in three yak herding gewogs of Haa, while key interview and focus group discussions were conducted with the herders and the livestock extension officers from the same gewogs. It was found that implementation of the latest policy would breakdown the customary rangeland management practices and traditional institutions. The change is also likely to trigger heaving grazing pressure in temperature zones while grazing pressure in the alpine zones might get reduced. These changing dynamics will alter the ecosystem composition and functioning of high-altitude rangelands thereby threatening the livelihood of the yak herders by making them more vulnerable to environmental and economic changes.

Keywords: *yak, rangeland, grazing, alpine, temperate*

Introduction

Rangeland covering nearly 33 percent of ice-free land globally (Ellis, 2008) provides both tangible and intangible ecosystem goods and services (Millennium Ecosystem Assessment, 2005; Havstad et al., 2007) supporting tens of millions of people (Papanastasis, 2009). Rangelands are generally defined as the type of land suitable for grazing by wild or domesticated animals and generally maintained as a quasi-natural ecosystem (USDA-NRCS, 1997). The rangeland ecosystem is the largest land use type in the Hindu Kush Himalayan (HKH) region, covering over 60 percent of total land area (Zhaoli, 2009). Rangelands in the region are the source of livelihood for 25 to 30 million pastoralists and agro-pastoralists. They also provide critical ecosystem services to 1.3 billion people living downstream (Miller, 1996; Shaoliang and Sharma, 2009). The rangelands in the HKH region are also suitable habitat for many endemic flora and fauna (Miller, 1996; Shaoliang et al., 2007; Brandt et al., 2013). Rangelands in the HKH mountain regions have also increasingly became popular tourist destinations (Miller, 1996). Rangelands in Bhutan are undergoing considerable change and the general believe is that the quality of rangeland is deteriorating. However, there are only few scattered literature on change in pastoral lifestyle (Ura, 1993; Ura, 2002) and its impacts on rangelands (Gyamtsho, 1996; Roder, 2002; Moktan et al., 2008; Wangchuk, 2010).

Rapid globalization and various factors like change in national policies, technological change and economic change seem to be altering the original range of variability within which socio-ecological systems function. This change often raises new challenges leading to degradation and marginalization of arid rangelands (Janssen et al., 2007; Whitfield and Reed, 2012). For example in China, there is a growing trend to promote agriculture and livestock production among pastoral communities mainly through changes in rangeland management systems(Miller, 1996; Ning and Richard, 1999). The current global trend of pursuing efficiency and fairness through establishing market-oriented land property systems based on private

ownership of the land (Sjaastad and Cousins, 2009; Ybarra, 2009) is changing customary land use practices worldwide.

Similarly in Bhutan, since the enactment of the 1969 Bhutan Forest Act there has been a series of policy changes affecting rangeland resources utilization (Ura, 1993; Chophyel, 2009). The core idea of this series of forest, livestock and pasture policies was to improve livestock productivity by promoting sedentary lifestyle of the migrating herders(Ura, 1993). However the enactment of various policies related to rangeland and livestock were always done based on the assumption that rangeland quality is deteriorating as reported by Ura(1993).

As per the most recent Land act 2007, all communally and privately owned rangelands in the country will be nationalized and leased back to the different users under private ownership. One of the main driving forces for this new policy is to ensure equitable distribution of rangeland resources. Under the new act irrespective of possession of livestock and their herd size all yak herders will receive their share of grazing land and they will be allowed to rent out their share of grazing land.

The central government is yet to implement the new policy although it was approved by parliament in 2007. The delay is due to the 10 years grace period given for implementing this new policy. As per the new land act, there will be 10 years of grace period where Royal Government of Bhutan will be developing mechanisms of distribution, paying compensation to privately owned rangeland and developing a rangeland management manual which will guide the users to sustainably manage their rangeland. Till then it depends on the users whether they want to adopt the new law or continue business as usual.

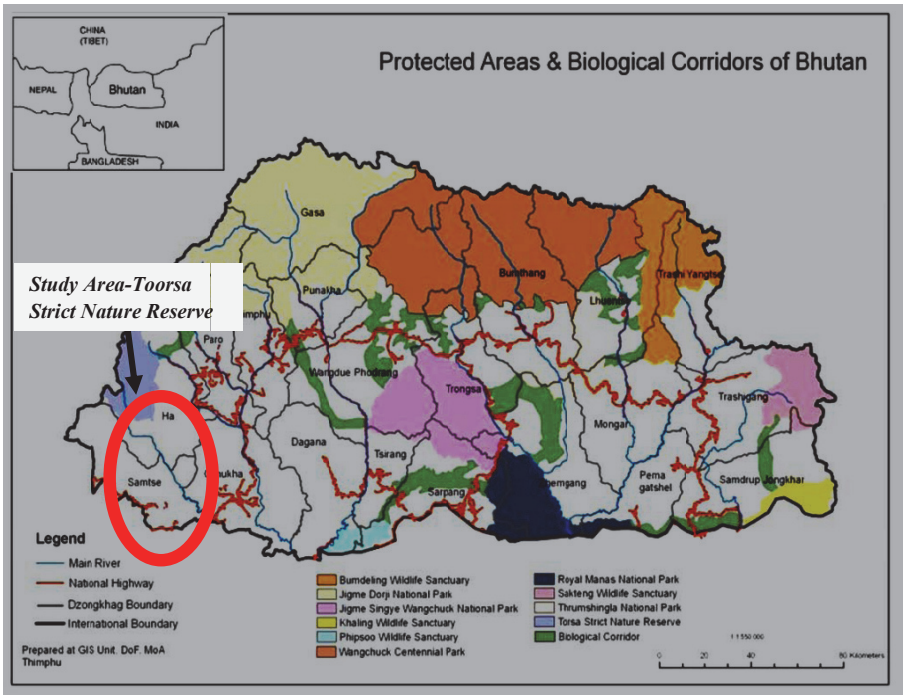
However, according to recent media reports, herders in Merak and Sakteng in Eastern Bhutan are already requesting the government to reconsider the latest policy, Land Act 2007 (Wangdi, 2014). For some places like Paro, where herders have been using rangelands belonging to monasteries (Ura, 1993) by paying rent, might welcome this new policy, but other herders across the country might have to adapt to a completely new system once the act is implemented. In the process of adaptation to the change they might become vulnerable to socio-economic and environmental shocks. Whether the change might increase or decrease the degree of exposure of herders to socio-economic variability and whether the change is going to improve the perceived degrading quality of rangelands is yet to be ascertained.

Currently apart from two reports by government agencies(Chophyel, 2009; Gyeltshen et al., 2010) no studies have investigated the change in customary rangeland management systems under changing policies and socio-economic conditions. Any decision based on the limited information regarding the overall dynamics of change in rangeland management systems might further marginalize the yak herders. The need for understanding rangeland user dynamics is also reflected in the management plan of the current study area, Toorsa Strict Nature Reserve (TSNR), where conservation agencies are looking for ways to integrate interest of rangeland users into their management plans (WCD, 2011). This study aims to fill this knowledge gap by investigating the expected impacts of change in national rangeland policies and socio-economic factors on traditional rangeland management systems in TSNR.

Study area

In Bhutan the word tsamdrog is used to refer to rangelands, which generally fall within the altitudinal range of 400 to 5000 metres above sea level (masl) (Gyaltsen, 1996; Gyeltshen et al., 2010). A total area of 406,523 ha has been registered as tsamdrogin Bhutan (MoA, 2007). The high altitude rangeland stretches from North of Haa in the west to northeast of Trashigang, dispersed over the entire northern region of Bhutan and amounting to 3.9 percent of total land cover in the country (Chophyel, 2009). Rangeland is used by migratory herds of yaks and other livestock depending on their location (Roder, 2002). The rangeland ecosystem is the main source of livelihood for yak herders (Chophyel, 2009) who constitute 1.3 percent of 84,474 total rural households in Bhutan (RGOB, 2012).

TSNR is the only strict nature reserve in Bhutan falling under IUCN category Ia, with total area of 60950 ha. The reserve is located between 27° 34' and 27°11' latitude and 88° 54' and 89° 10' longitude in western Bhutan, bordering the Indian state of Sikkim to its west and Tibetan Autonomous region of China to the north. Altitude of the area ranges from 1400 m to over 5000 m above sea level (WCD, 2011).



Map 1 showing the study area – Toorsa Strict Nature Reserve (Adapted from Department of Forest and Park Services, RGOB)

The reserve has the most pristine temperate forest and alpine vegetation in Bhutan and arguably in the Himalayas. It is the habitat for endemic plant species like *Viola bhutanica, Bhutantherahimalayana, Meconopsissuperba* and *Bryocarpumhimalaicum.* Other flagship species like Red Panda and Snow leopard have also been recorded (WCD, 2011). The reserve is also the catchment of Amochu and Wangchu rivers in Bhutan, which feed hydropower plants downstream (Wangchuk, 2011). Given the rich biodiversity it was designated as part of the Sacred Himalayan Landscape linking the three major trans-boundary conservation areas in China, India and Bhutan (WCD, 2011).

According to the TSNR management plan, the pastoral community living around the reserve rear three distinct types of large ruminants in three production systems, namely; *lanor* (transhumant yak system in alpine and temperate region), *thanor* (migratory cattle in temperate and subtropical regions) and *yuelnor* (sedentary livestock rearing system in rural and semi-urban settlements) as shown in Figure 1. Yaks usually graze inside TSNR while thanor graze inside TSNR during summer months only. *Yuelnor* graze year round in the buffer zones of the nature reserve (WCD, 2011). Yak husbandry forms an integral part of the pastoral system in TSNR, for example the average annual income from dairy products in 2012 ranged from Nu.10506 (US $ 175) to Nu. 23,938 (US$ 400; 1 US$=60 Nu.) (ADB, 2013).

A preliminary reconnaissance study found that during summer months the yaks generally graze in alpine zones and in winter they migrate down to temperate zones. While

other migratory cattle herds consisting mainly of local breeds they migrate between summer pastures in temperate and winter pastures in sub-tropical regions as depicted in Figure 1.

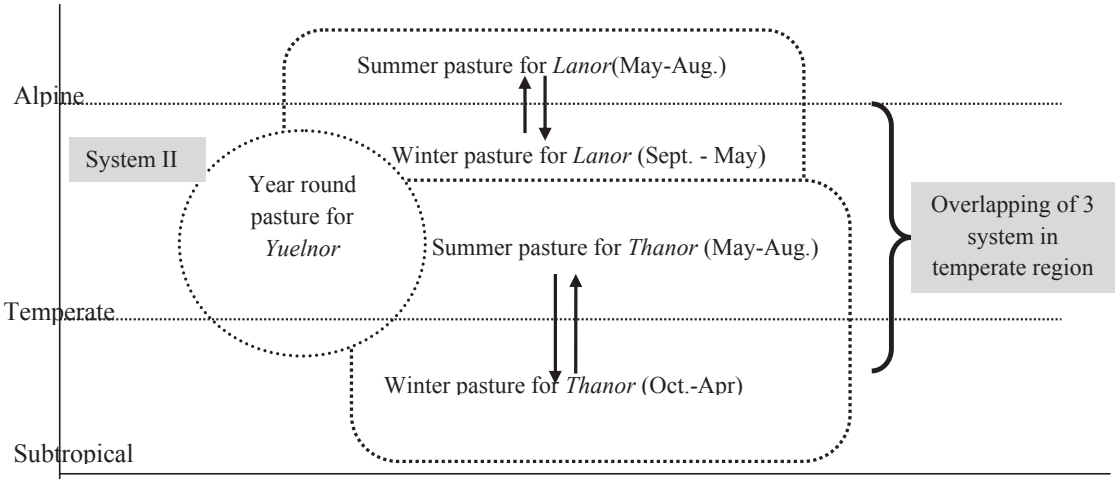


Figure 1 Transhumant migration of yaks and other breeds of cattle in study area

(↓↑ Showing the direction of migration)

Traditional resource use mechanism

Northue (joint-cattle ownership) is a unique livestock rearing system practiced between Sama and other higher altitude gewogs (sub-district) of Haa dzongkhag (district) which falls in the buffer zone of TSNR. During summer livestock is owned by the upper three gewogs and graze in temperate region while in winter the partner in sub-tropical region of Sama gewog takes over the ownership.

Rangeland resource utilization in TSNR is guided by well-defined and mutually agreed upon rights and rules backed by various social controls and sanctions (Ura, 1993; WCD, 2011). Committee members consisting of one representative from each household with yaks or other migratory herds of cattle divide the total area of rangeland among an equal number of herders, according to their customary rules. Then each herder throws the dice and whoever gets the highest number will be the first one to choose the pasture of their choice. In Katsho gewog re-distribution of rangeland is held every three years while it is held every five years in Eusu and Bji gewogs. This old age traditional system is now under transformation and greater changes are expected due to implementation of the new rangeland policy.

Methods

A review of rangeland policies in Bhutan since 1969 was conducted using the policy analysis framework described by Bellamy et al.,(1999). Impacts of the implemented policy on rangeland management systems were then identified through a review of the relevant policy documents and government reports.

An extensive household survey was conducted from June to July 2013 to assess the reality from the perspective of the yak herders. The target population was selected from three gewogs of Haa dzongkhag, which fall under TSNR. Convenient sampling technique (Marshall, 1996) was used where we tried to interview as many households as possible from all the three gewogs. Almost 50 percent of yak rearing households in Bji and Katsho gewogs were surveyed. In the case of Eusu gewog there were only five herders, so all of them were interviewed. Altogether, 56 percent of the yak herding households (N=25) were surveyed

using structured questionnaires. The survey questions were adapted from the rangeland and indigenous cattle management studies conducted in high altitude areas of Northern Nepal by Dong et al., (2007). Questions focused on land tenure changes, customary institutions, traditional rangeland management practices, improved pasture development and constraints to yak rearing. Secondary data on yak population and the number of yak rearing households from national livestock data were analyzed and compared to further support the findings from the survey. The yak population in the study area was also compared to the earliest yak population reported Ura (1993). The results of the household survey were analyzed using simple descriptive statistics with Microsoft excel tools.

Further, interviews with key informants and focus group discussions were carried out using the participatory rural appraisal (PRA) framework described by Jorgensen (2008) to gain deeper insights into the topics raised in the household survey. Finally, through participatory observation, burning of the shrubs in rangeland and the conditions of fencing to control grazing were recorded in field notes, as suggested by Olsson and Folke (2001).

Results

Drivers of change in rangeland management

Change in land tenure

Pre-1960s: For generations yak herders in TSNR followed their customary communal tenure and management of rangeland. During the early 1960s, the Royal Government of Bhutan systematized a new grazing land tax and every herder was required to officially register their grazing land with approximate size and area. Grazing lands were registered in the name of private individuals, community, monastic institutions and others. Under the new law the owners were required to pay annual tax irrespective of herd size or extent of the pasture. However, there was no major change in access to rangeland resources except that after registration the owners had to pay tax.

During the 1970s: With the enactment of the 1979 Land Act and the 1969 Forest Act, there was a major shift in actual ownership of the rangeland. According to these acts land ownership was changed and registered as government land while owners were given the user rights. Herders were allowed use rangelands located within and beyond their district boundaries. They also had legal rights to protect against trespassing and encroachment into their grazing lands. However, the customary practice of leasing part of the grazing land and collecting rent was ruled out.

Current situation: The most recent policy change was the enactment of the 2007 Land Act which will be implemented by 2017, where the existing rangeland will be nationalized and will be leased back to the pastoralists for not more than 30 years. One of the major changes according to the new act is that the users can only become a lessee within their district. In TSNR currently more than half of the yak herders graze in community rangeland owned by communities of Bji, Eusu and Katsho gewog. Some of their grazing sites also fall under Paro district. Herders also reported that they graze in government land and few households also have rights to their private rangeland, which they do not have to share with the other herders. However, by 2017 when the 2007 Land Act gets implemented, all the rangelands in TSNR will be under private ownership contrary to current scenario shown in figure 2.

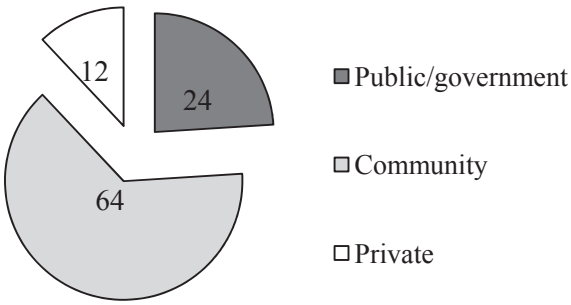


Figure 2 Land ownership of yak grazing sites shown in percentage

As per the latest policy, the state will also assist users in developing improved pastures and encourage farmers to rear improved breeds for cattle aiming to increase the productivity. However the capacity of the herders to cope with the change was discussed in the subsequent pages.

Reduction in incidences of burning

Practice of indiscriminate burning of alpine pastures during dry winter season has always been in conflict with national forest policies of Bhutan since the first one was enacted in 1969. According to 25 percent of the respondents, burning is the only known remedy for improving the pasture quality. Although Royal edict was issued in 1981 allowing yak herders to use burning to manage rangeland in alpine regions under supervision of technical persons from forestry department, all of the respondents were of the opinion that using fire for rangeland management was illegal. However, this has not stopped them from using burning as a practice. Remains of recent burning were frequently observed during the field visit.

However respondents of focus groups discussion agreed that herders always start fires with the fear of being apprehended, due to which the total area burned by individual herders is less than what they used to practice in the past. Respondents also cited other reasons like having abundant summer fodder in their alpine regions in recent years has reduced burning pasture in winter.

Reduction in number of yak rearing households and reduced yak and sheep population

Changing socio-economic priority of the households has directly resulted in reduction of the number of households rearing yaks and also reduction in yak population over the past decades. Total yak rearing households has drastically declined, from 161 households in 1990 to 35 in 2013 (Figure 3). Currently on an average each households owns 56, 61 and 76 yaks in Bji, Eusu and Katsho gewogs respectively.

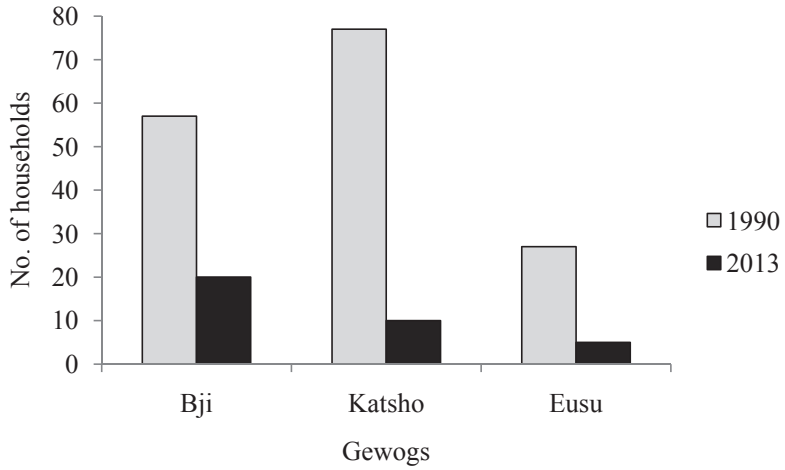


Figure 3 Number of households rearing yaks (The earliest report on yak population in the study area was by Ura (1993))

Over the past two decades, the yak population has been decreasing (figure 4). Households giving up yak herding have either sold their yaks or they have leased their yaks to the remaining herders. During the focus group discussions, the participants agreed that reduction in number of households rearing yaks and reduced yak population has reduced overall grazing pressure on rangelands in alpine zones where yaks graze in summer. They also reported that grazing by huge herds of sheep owned by sheepherders from Samtse dzongkhag has completely stopped over the last decades. This has reduced competition on their yak grazing sites in alpine pastures during the summer. Herders speculate that nowadays readily available and cheap imported garment might have made rearing sheep for wool less profitable. According to the focus group discussants alternative income earning opportunities must have also lead to interruption of sheep rearing.

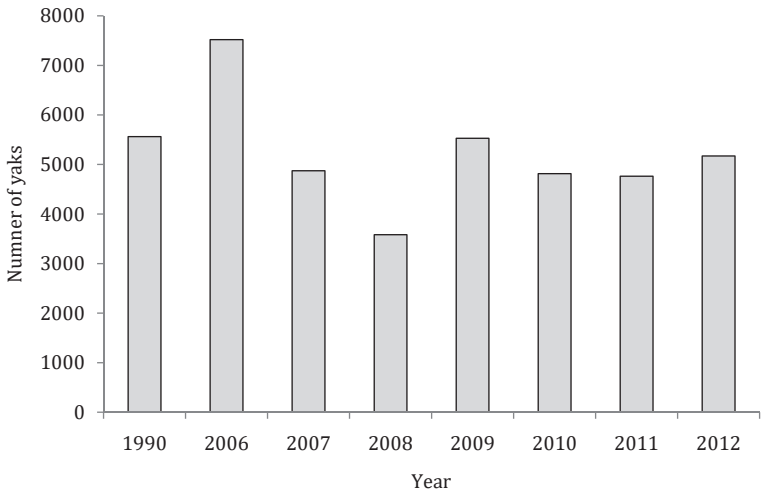


Figure 4 Trend of Yak population (The earliest yak population of the study area was reported in 1990 by Ura (2013). It was presented here to provide an overview of population trends over the decades)

Farm labour shortage

Yak herders nowadays prefer their children venturing into other economic activities, which offer better income earning opportunities with less hardship than rearing yaks. This has caused farm labour shortage. More than half of the survey respondents have cited household labour shortage as main reason for the decline in number of households rearing yaks. While other reasons for quitting yak rearing was also due to lack of government support and better income earning opportunities besides yak herding. Those herders who gave up yak herding opted for small scale agriculture activities, off-farm wage labour and settled for sedentary lifestyle rearing livestock of improved breeds and local breeds.

Impacts of the change on traditional rangeland management

Interruption of transhumant migration

According to the latest policy, leasees will be eligible for grazing land within their district only. In case of yak herders of Haa, movement of yak herders will be allowed within Haa dzongkhag only. Currently the yak herders use some grazing sites of both summer and winter pasture falling under Paro dzongkhag. Further the movement of other migratory herds from Haa into other districts like Samtse and Chukha dzongkhag will also be stopped. This will increase the pressure on grazing sites in temperate zones. It was noted during the survey that 70 percent of the yak herders complained about scarce fodder resources during winter months in the temperate zones. Limiting movement of the animals into other districts will further exacerbate the situation in winter grazing sites in temperate zones.

Complete breakdown of the customary institutions

When respondents were asked whether they were satisfied with customary institutions, 84 percent of the respondents said 'yes'. The new policies will completely breakdown local customary rangeland management and resource sharing mechanisms. It will be a complete shift from customary communal management model to household tenure and household management model. The communal ownership of the rangelands under TSNR will be changed into private ownership.

Currently the herders still practice their customary rules and regulations. However, there are already reported incidences where herders get into conflicts over grazing rights. For instance, in the recent years yak herders from Haa has to face strong competition in their winter grazing sites by cattle from Paro dzongkhag. Since the grazing sites fall under Paro dzongkhag most of the cattle owners from Paro are anticipating the new policy approved by parliament in 2007. During the focus group discussions, participants unanimously agreed that different levels of awareness of the new policy were the main cause of the conflicts. Moreover no clear-cut directions during the intermediately stage between enacting the new rangeland policy (Land Act, 2007) and implementation have caused confusion among different user groups. The conflict resolution mechanisms under the customary institutions also seem to be ineffective under such circumstances.

Customary practices of controlling grazing pressure are losing its significance

The reduction in yak population and reduced number of households rearing yaks in the past decade was found to degenerate the significance of traditional practices of controlling grazing pressure. For example all the herders of Eusu gewog were required to gather around Tshotshokha (N 27° 22.49' E 89° 12.62') and graze their yaks together at the same place for almost three months in a year. It was done to reduce grazing pressure on other sites. According to the elderly herders this was also an important social event for the yak herders. This practice has completely stopped over the last decade.

In the past herders also put fencing at strategic locations between two grazing sites in

order to control grazing pressure. Fencing is generally built of stone walls and wooden structure. Traditionally such blockages have to be well maintained to control indiscriminate grazing. However, most of the blockages observed during the field visit were be poorly maintained. The herders also agree that they do not maintain this blockage fencing in the alpine pasture due to abundant fodder resources in summer pastures.

Increasing localized pressure on rangelands

Farm labour shortage has affected grazing dynamics in winter grazing sites for yaks in the temperature region. Discussants during focus group discussions agree that the sedentary breeds of cattle seldom grazed remote pastures. They believe low grazing pressure has resulted in shrub encroachment into the grasslands. However, the situation is completely opposite in the pastures near the villages. Year round grazing by sedentary breeds of cattle and winter grazing by yaks has resulted in heavy grazing pressure in the grasslands nearby villages like in grazing sites near Damthang and Womjee.

Heavy grazing pressure and shrub encroachment in temperate region reduces fodder availability for the yaks in winter. The participants also report loss of young and weak animals during winter months mainly due to fodder scarcity. According to some elderly herders during key informant's interview, limited fodder resources in winter months is the bottleneck to take advantage of abundant fodder resources in summer pasture. Increasing localized pressure might also result in habitat fragmentation.

As shown in table 1 only few households were found to using supplementary feeds like turnip, radish and mustard oil cakes during winter months. However, labour shortage, crop raiding by wild animals and limited technical support from government limits herder's interest in growing supplementary feeds, as reported during focus group discussions. Other reasons like limited milk production in winter, makes less priority to feed the animals unless they are very weak or under extreme climatic conditions like snowing.

Table 1 Status of growing winter supplementary feeds

Percentage of Respondents

Survey questions	Yes	No
Do you supplement livestock with additional feeds in winter?	37	62
Do you grow improved fodder to feed livestock in winter?	40	60
Do you harvest and preserve your surplus feeds for winter months?	12	33

Change in vegetation composition

Reduction in fire incidences will trigger change in vegetation composition, which over the long run might completely change the ecosystem. According to Ura (1993), most rangelands in eastern Bhutan are always maintained by burning during dry seasons. However restriction might completely change the vegetation composition.

Threatens indigenous ecological knowledge

Elder herders during key interview sessions expressed their concern in losing basic indigenous ecological knowledge. For instance previously herders assess the productivity of pasture based on abundance of species like *Potentilla coriandrifolia* and *Chesneyanubigena,* which they believe to possess higher nutrition values. Herders used to prefer pastures with high abundance of these plant species that grows at higher altitude.

Discussion

Loss of significance of traditional rangeland management practices were also reported from other pastoral communities like Merak and Sakten (Chophyel, 2009) and in Ura where herders were also reported to have realigned their migration routes parallel to roads and quickening the return from remote pastures (Ura, 2002). Breaking down the customary practices and local institutions under changing rangeland polices is similar to changes which occurred under China's grassland contracting policy. Under this policy in China, for short term it has increased the livestock productivity. However, over the long run it has made the herders more vulnerable to extreme climate and economic shocks. Similar change in land tenure has reduced the adaptive capacity of the herders of Alxa Left Banner in Inner Mongolia (Zhang et al., 2013).

Reforming rangeland policy by privatizing has reported to be negatively affecting the livelihoods of the herders mainly due to elimination of their traditional coping strategies with non-equilibrium conditions (Jun Li et al., 2007; Li W, 2011; Zhang et al., 2013). Pastorals traditional knowledge of exploring heterogeneity of resources through migration of herds and rearing diverse livestock were some of the adaptive strategies under extreme climate events like drought (Zhang et al., 2013).

However, when herder's mobility was restricted, it was found to be negatively impacting the relationships among the herders and between herders and other stakeholders. The impact of reduced mobility on economic situation was visible in terms of reduced household saving of the herders under restricted mobility (Zhang et al., 2013). Restriction of mobility of people and animals has also been found to result in habitat fragmentation (Hobbs et al., 2008). Hobbs (2008) also argued that spatial isolation of grazing ecosystems limits the ability of people and animals to exploit heterogeneity in vegetation. Access to heterogeneous vegetation through means of transhumant migration provides critical options in case of arid and semi-arid ecosystems to sustain human economies and ecological processes (Hobbs et al., 2008).

The problem of intense grazing on one site and creating localized grazing pressure was also reported in rangelands of Western Sichuan province (Ning and Richard, 1999) and Yunnan (Shaoliang et al., 2007) of China, where winter pasture areas are overgrazed while remote summer pastures tends to be destocked. Increased grazing pressure during growing season in winter grazing sites leads to scare fodder resources during winter months. This was found to be the bottleneck in increasing the livestock population to take advantage of abundant resources in summer grazing sites (Ning and Richard, 1999; Shaoliang et al., 2007). A similar pattern seems to be developing in the rangelands of TSNR. Investigating the impacts of grassland contracting policy in Inner Mongolia has also found similar cases where restriction of herder's mobility has increased localized pressure on rangelands. Often overgrazing due to increased localized pressure can lead to other environmental issues like soil erosion and habitat fragmentation (Li W, 2011).

It is very hard to predict the impacts of burning or stoppage of burning on the rangelands in Bhutan with limited empirical evidences. Huge variation in vegetation and fire environment often makes it difficult to generalize response of vegetation to fire (Guevara et al., 1999)b. According to Roques et al.,(2001) burning cessation has triggered shrub encroachment in South African Savannas. Sherman (2008) also reports similar findings in north western Yunnan, China.

On the other hand there are mixed results of reaction between burning and shrub growth. For instance, dendrochronological analysis by Brandt et al., (2013) suggested that the region wide burning ban in 1988 may have fostered initial establishment of dwarf rhododendrons that then spread rapidly in alpine meadows in the southern Himalayas. However burning does not appear to have driven patterns of shrub encroachment (Brandt et al., 2013). Other studies also reports that once the grassland changes into shrub land, shrub cover increases regardless of fire frequency, and some shrub species actually spread faster with burning (Briggs et al.,

2005), likely due to fundamental changes in ecosystem structure and function (Bond and Keeley, 2005).

Similar to our findings, the farm labour shortage was identified as the main cause of decline in yak rearing trend in Bumthang and Wangdi dzongkhags in Bhutan (Gurung, 2012). Decreasing yak rearing trend was also recorded in Merak and Sakten in Eastern Bhutan (Wangchuk et al., 2013) due to labour shortage. Besides massive impact on ecosystem compositions, according to Farooquee and Nautiyal (1999) such trends also increases the risk of losing bulk of indigenous knowledge related to animal breeding and environmental management.

Access to other profitable economic activities like collecting highly valued fugal species, Cordycepssinensis in alpine regions and inadequate basic services facilities in remote places were some other reasons for decreasing trend in yak rearing central and western Bhutan (Gurung, 2012). According to Bhutan National Statistical Report, 2013 (ADB, 2013), income generation from wage labour and sale of vegetables and fruits is the number one cash income sources for yak rearing gewogs of Haa, which might also support the fact that trend of yak rearing is decreasing. Department of livestock in Bhutan also acknowledges the decreasing trend in yak rearing without much change in yak population (DoL, 2013), mainly because those herders leaving the yak herding either sell their herds or leave the herds with the remaining herders (Gurung, 2012).

Conclusion

Once the 2007 Land Act is enforced the customary rangeland management practices and traditional institutions are likely to breakdown and lose their significance for the yak herders. Over the years farm labour shortage and reduction in number of yak rearing households have reduced overall grazing pressure in the alpine zones. However the grazing pressure in winter grazing sites for the yaks in the temperate region is likely to increase significantly due to; 1) year round grazing in most of the grazing sites, 2) shrub encroachment in remotes grazing sites, 3) limited improved fodder and supplementary feeds and 4) interruption of transhumant migration of cattle from Haa to neighbouring dzongkhags. The change in dynamics of rangeland management systems in long run is likely to change the high-altitude rangeland ecosystems. The change threatens livelihood of the yak herders by making them more vulnerable to environmental and economic changes. The issue of heavy grazing in temperate zones could be the top priority issue to be addressed before implementation of the Land Act, 2007.

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