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Hydropower Construction Projects: Intention to Stay among Engineers

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Abstract
The level of Intention to Stay (IS) was found 2.846 below average (neutral). Among the respondents 61.3 % intend to stay in the job while 38.7 % intend not to stay on the job. At the same time 51.8% intend to Jump and 48.2 % intend not to jump to another organization in the second question. There were four projects under construction under Nepal electricity Authority. Seven projects with associated companies of Nepal electricity Authority. Officially six projects were in private sector. Total under construction hydropower projects was of 1371 (1047 + 324) MW. Kulekhani III was almost completing last package of Electro-Mechanical Works. Upper Tama Koshi was progressing on full phase targeting to complete by June, 2017. Chameliya hydro projects is also about to complete. Most of the respondents were: Aryan, Male, age up to 30 years, with bachelor's degree, with 1 to 5 years, civil engineers, from client. Only Nepalese engineers were respondent and very few of them were project manager. Therefore, a separate research on project managers is recommendable for future research. Employers are recommended to improve on reward, justice, safety, schedule, equipments and manpower plan and practice.

Keywords: Expectation, Satisfaction, Stress, Intention to Stay, Intention to Leave

Introduction
The development of hydropower started from Water Mills, Greek (third century BC); China (30 AD); India (fourth century AD). In 1882, USA (Wisconsin) first started hydropower generation in the world. In Nepal hydropower started in 1911 (Pharping Hydro); 1936 (Sunderijal Hydro) and 1943 (Letang Hydro). After democracy hydropower became the part of development plan in Nepal (Lacoul, 2015).

First five year plan (1956-1961 AD) started to plan hydropower and Electricity Corporation was established in 1964 during second three year plan (1962-1965). During third development plan Trishuli and Phewa hydropower were completed. Hydropower projects were constructed by government with foreign assistance and handed to the Corporation for operation and maintenance in those days (Lacoul, 2015). Now, Hydropower Development Policy, 1992, 2001; Electricity Act, 1992; Electricity Regulations, 1993 are enforced and amended as the need. Later National Water Plan, 2002 was implemented as per which targets were set for domestic demand of 2,035 MW in the year 2017 and 4000 MW in the year 2027 (Lacoul, 2015). Currently Nepal is facing power deficit, for which more investment and success of projects are vital. Engineers are one of the vital parts of these projects. Because inadequate institutional capacity is one of the challenge hydro projects are facing, which is also related to human resources (Pandey, 2009). So, Hydro-survey 2016 was conducted by this researcher to study about engineers in hydro construction sites. Hydro-survey 2016 covered engineers' expectation, satisfaction stress and intention to stay.

Research Methods
The total respondents for main research by web based questionnaire from May to October, 2016 were 144. The paper survey to supplement web based survey was filled up by 75 engineers in various hydro projects during May to October end, 2016. Therefore N=219 was the total number of respondents (engineers) in hydro projects of Nepal in 2016.

Status of Hydro Power Projects
In 1966, Dr. H.M. Shrestha assessed the total hydropower potential of Nepal as 83,500 MW in his doctoral dissertation defended in Moscow, Russia then USSR (Pandey, 2009).

No further study has been done since then. However, Nepal has a huge hydropower potential due to Himalayan Rivers and precipitation of 1700 mm in a year. The perennial rivers have the total amount of runoff over 200 billion cu. m. So, 40,000 MW of hydropower potential is economically feasible (Pandey, 2009). Hydropower potential of Nepal is (currently) estimated as 1, 40,000 MW (The Energy Forum Sept. 2016). But, less than 800 MW is being generated currently (NEA, 2016). So, there is the long way to go on utilizing water resources in Nepal. As of now, less than 50% population has access to electricity through the grid and off grid system. Therefore, targets by 2017 A.D. (Pandey, 2009) are as follow:

1. Up to 2035 MW hydropower electricity is to be developed to meet the projected domestic demand based on the scenario excluding export.
2. 50% of household are to be supplied with Interfaced Nepal Power System (INPS) electricity and 12% by isolated (micro and small) hydropower systems and 3% by alternative energy.
3. Per capita electricity consumption of 160 kWh will be achieved.

DOED (2016) has the following latest data:

1. Total hydropower potential 50,767.99 MW.
2. The total government reserved list 215 projects.
3. Total construction license issued 105 projects with total 2621.063 MW.
4. Sept 09, 2016 the number of construction license issued increased to 114.

Table 1: Hydro Projects under construction (source: NEA, 2016)

Name of the project	MW:	N (Respondent)*	Engineers**
13. Upper Tamakoshi	456.0	26	69
14. Tanahu	140.0	11	17
15. Chameliya	30 (increased now)	5	19
16. Kulekhani III	14.0	15	31
17. Upper Trisuli 3A	60.0	5 Both Trishuli.	46
18. Rahughat	32.0	1	10
19. Upper Sanjen	14.6	Included below in Sanjen.	
20. Sanjen	42.5	10 Both Sanjen.	27
21. Rasuwagadi	111.0	1	46
22. Madhy Bhotekoshi	102.0	1	35
23. Upper Trisuli 3B	37.0 (increased now)	Included above in Trishuli	
24. Other & Not Mentioned		Remaining	
Total	1047+324.45	219	500

* Only who mentioned name of project. ** As per interview in construction site.

In the table above four projects were under construction by NEA (2016). Seven projects were under construction by NEA associated companies. (So obviously the client was companies established with NEA as one of the promoter.) These were eleven projects under construction (were part of the study).

There were six projects under construction by Independent Power Producers (IPPs) which were: Naugadh Gad Khola (8.5), Suspa Bhukhani Khola (0,998), Mai Cascade Khola (7), Chhandi Khola (2), Upper Mai Khola (9.98), Dharam Khola A (2.5). The total installed capacity of these private projects under construction was 324.45 MW (the installed capacity of each projects was as given in the brackets) (NEA, 2016).These were all private projects of small installed capacity which were not covered by site visits. But all projects were covered by the respondents in this study. So, one recommendation is to study the private projects separately (and also comparative study with large projects). The study can be "Job Expectation satisfaction and stress for all construction professionals". The number of engineers involved in these projects was small though it counts for total population. Their responses would have been diluted while analyzed with whole sample. Thus, separate study will be of importance. Another factor is a separate research on engineers for each private project will not be practical, thus recommended to include all construction professionals. Next, these engineers would prefer to jump to other better opportunities. Another point to be considered was these engineers employed in private projects might express higher degree of dissatisfaction due to their interest on involvement to other projects.

Similarly, ninety one projects of IPPs (total 1721.532 MW) are entering to construction stage after financial closures. Forty-four projects (total 783.8 MW) of IPPs were on various stages of development. In the year 2015/16 twenty seven projects (total 457.58 MW) were signed for Power Purchase Agreement (PPA). So, total PPA (with IPPs) was reached 2829.78 MW of installed capacity. Besides these, Dudh Koshi Storage and Upper Arun Hydro Projects were under feasibility stage. Other planned projects were: Tamakoshi V, Upper Modi A and Upper Modi. Uttar Ganga Storage, Tamor Storage, Andhi Khola storage , Upper Bheri and Chainpur Seti were on different stages of development (NEA, 2016).

About the power plan of NEA, private sector (IPPs) will add 20 MW supply in 2017. NEA projects were expected to supply power: Kulekhani III in December, 2016; Chameliya in June, 2017 and Trishuli 3A in March, 2017 (but it was hard hit by the Earthquake). Solar of 64 MW is proposed to be added in 2017. An agreement was made on July 10, 2016 with Power Trading Corporation of India to supply 50 to 74 MW @ IRS 3.6 / kWh for August to December, 2016 (NEA, 2016).

Kulekhani III: Total engineers working in site were 31. Most of them were electrical engineers. The project was almost at the end of construction phase. It was visited at the end of September, 2016 for paper based survey. Qualitative interview was conducted at site with three engineers among them (31). Project status by July 18, 2016: total completion was 85% which includes 95% of Civil Works, 70% of Equipment supply and 37% erection of Electro-Mechanical Works were completed.

Chameliya Hydro Electric Project (CHEP) 30 MW:

Work Progress: 94% of total works was completed despite of many problems. Among which: 99.8% of Dam, 99.1% of Intake and 100% of Tunnel Works were completed by July, 2015AD. NEA, (2016) reported in July , 2016 as100 % of Dam, 99.1% of Head Race Tunnel (HRT), 94.1% of Audit Tunnel, Power House 100 %, Surge Tank 95%, Penstock 99%, Tail Race 99.8% and overall Civil Works 96.5% were completed.

Rahughat Hydro Electric Project (RHEP) (32 MW):

Work Progress: in July, 2016 (NEA, 2016) land acquiring and tree cutting permission was acquired.

Upper Trisuli (3A) 60 MW:

NEA, (2016) reported that the contractor constructed steel bridge (completed). Temporary Camp in Head Work was

established. In tunneling 607 m of Audit Tunnel was completed. Second stage of river diversion was completed. Four Radial gates were installed. Construction of Intake and 106 m Approach Channel was completed. Prior to earthquake April 25, 2015: Head works 95 %, 97% of Desander Concreting, 3867m out of 4076m (95%) Head Race Tunnel, 23% of Tunnel Lining, 57% of Surge Tank excavation, excavation of Power House and Switch Yard, Tail Race Tunnel were completed. Concreting of Draft Tube 1 and 2 with Gantry Crane installation were completed, 33% of Tail Race Tunnel (TRT) lining, 35% of steel lining of Penstock were completed. Large quantity of materials was arrived in site. 40 number of tower foundation out of 142 towers was completed with concreting. Transmission line by Chinese contractor: Tower foundation and other related works were on progress.

Rasuwagadi Hydropower Project

Work Progress: in April, 2015 earthquake damage was reported. Work progress before earthquake was reported to be impressive. 11 kV Transmission Line work was on going. Employer's camp was almost ready, Power House and Transformer Cavan was on going. Pilot Tunnel was on going. Desander Tunnel was in final stage of completion. Excavation of under sluice was completed before earthquake. Reconstruction of new coffer dam was completed. Lot 2 Electro-mechanical M/s Voith Hydro India manufacturing was going on as per agreement of July 31 2014. Lot 3 Transmission Lines was going on. In 2016 the contractor left the job and in Nov. 2016 again agreed to resume the work was on major news (The Energy Forum, 2016).

Sanjen (Upper) (SHEEP-14.8 MW) and 7. Sanjen Lower (SHEP 42.5 MW)*

Work Progress: Lot 2 (contactor SUHEP was ECI - BGCCPL J/V) Civil works was on progress; concreting in Weir and Under Sluice and Desander construction was on progress about to be completed. 1143 m out of 2140 m tunnel was completed.32m vertical surge was on break through, Desander RCC was on progress valve chamber with penstock tunnel was on break through; power house excavation was on going. Lot 2 (contractor SEWS-TUNDI J /V): Tunnel 905.5 m out of 5200 m was completed. Power House excavation was almost completed. Excavation of Headwork was on going. Lot 3 Electro-Mechanical for both projects (Donfang Electric Corporation, China): fabrication in China was on progress. Lot 4 Hydro Mechanical for both projects: (Nepal Hydro and Electric (NHE)) was on progress, factory inspection was on going. Lot 5: Transmission line design was completed and Initial Environmental Examination (IEE) was on progress for 7 km which was needed to join with Chileme Hub.

Madhya BhoteKoshi HEP (102 MW)

Land acquisition was at final stage and construction was about to start activities (NEA, 2015): Lot 1: was little delayed. From 11 February, 2014 was ongoing till now. Contractor: Lot 2: M/s Andritz Hydro from Sept 9, 2014 (Electro-Mechanical etc). Lot 3: Transmission line, Preliminary design was on progress.

In (NEA, 2016): Lot 1 slow down by landslide and earthquake blockade continued from Sept 2015 to July 5 2016 due to flash flood.

Lot 2 Electro Mechanical M/s Andritz Hydro, India: as per July 09, 2014 agreement manufacturing was on progress. Lot 3 was transmission line.

Upper Tamakoshi HEP (456 MW)

Work Progress: (NEA, 2016) Head Race Tunnel (HRT) concreting was 85.3% completed, HRT excavation was 81.2% completed, Other tunnels were 99.2% completed, Power House and transformer cavan excavation were completed (100%), Tail Race Tunnel was 100% completed, P/H and transformer cavan concrete 81.7% were completed.

Rowaling Diversion Scheme will follow Upper TamaKoshi.

Tanahu Hydropower Project (140 MW)

Work Progress: (NEA, 2016) Commission target was set for 2019 (AD). Supplementary EIA was completed. Prequalification for bidders Phase 1 and 2 were recently completed.

Upper Trishuli 3B Project (37 MW)

Work Progress: (NEA, 2016) EIA was approved by Ministry of Environment. 85% of Camp, PPA and Financing were almost complete. Design and tender documents were being reviewed. Prequalification of EPC was completed. 45% of Test Audits were completed. Memorandum of Understanding (MOU) of transmission line between TJVCC and NEA was completed. It is targeted to commission in 2019.

In this way major projects were studied and analyzed for work progress on July, 2015 and July, 2016. The analysis found that Rasuwagadi was disturbed and stopped work, though the progress of construction was there. Trishuli 3B and Sanjen upper were searching for final approvals to start construction. Tanahu hydro project just got EIA approved and yet to mobilize for work. Rahughat was acquiring the land. Madhya BhoteKoshi, Rasuwagadi, Kulekhani III, Chameliya, Upper Trishuli 3A, Sanjen Lower, Upper Tama Koshi were on full phased construction targeting to complete in near future. Middle Marsyangdi was just inaugurated, so it was removed from the list of detail analysis. This was the status of 11 major projects under construction in Nepal. From which about 1100 MW (1044 or 1047) will be added.

Intention to Stay (IS)

The level of IS was found 2.846 below average (neutral). Among the respondents 61.3 % intend to stay in the job while 38.7 % intend not to stay on the job. At the same time 51.8% intend to Jump and 48.2 % intend not to jump to another organization in the second question.

Table 2: Intention to stay level

Items,	Mean	Std. Deviation	N
I would prefer to continue working in this organization	3.33	1.020	204
If circumstances permitted I would jump at a chance to accept a job in another organization	2.36	1.081	204

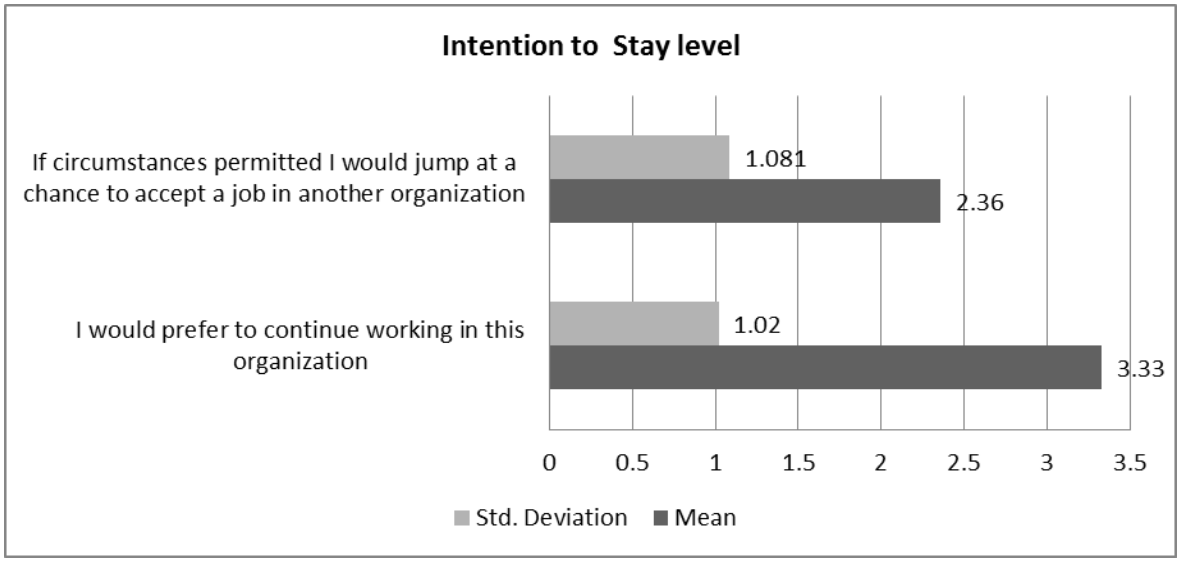

Fig 1: Measurement of IS

The reliability was found low in this combined two item scale (0.369).This study was more important on association of other variables with IS than for level and causes of IS. The proposal of this study had no objective to measure IS, but as a litmus test to analysis and findings of this research, IS was measured. Further research on level and causes could be recommended in hydro projects of Nepal.

IL or IS occurs immediately before one actually leaves or stays on current position (Mobley 1997: Layne, 2001: Shrestha and Shrestha, 2012). It was found for bank employee in Nepal that JS and IL are negatively correlated at 0.01 levels (Shrestha and Shrestha, 2012). The same tool was used two items as reliability tested by Rahim (1997, r=0.79), for which only validity criterion tested by its originator (Donnelly and Ivancevich, 1975 and Martin and Hunt, 1980: Shrestha and Shrestha, 2012). And found moderate level of Turnover Intention 2.915 and sd. 0.877 among employee of Nepalese commercial Bank was comparable with mean value (2.864) of IS in reversed scale.

Open Question & Interview

There was one open question where respondents were requested for their comments. The respondents comments regarding this survey was summarized: long questionnaire, incorrect English language, some contradictions between two questions, irrelevant Job Expectation survey and doubt on the result of this survey.

The respondent's suggested to include health related questions too. They said the responses will change over the time. This kind of survey is very good, relevant and important for hydro sector in working situation of Nepal and found helpful on learning.

Regarding the other comments about projects can be summarized as follows:

1. Most of the projects do not practice proper pay, recognition and reward system.
2. Discrimination was perceived between Nepalese engineers and foreign engineers. Pay and promotion was severely pronounced as discriminating.
3. Need of Training was demanded by most of the engineers.
4. Relationship between participants of project was recommended as a need for project success.
5. Team, cooperation and discipline was found important.
6. Skipping of work and carelessness of staff was realized as problem.
7. They were Satisfied when they delivered the result.
8. They suggested doing what one can do.
9. Especially for Private Company the comments were: there was monopoly (on pay and promotion); there was no importance given for family life, personal life and higher studies; insufficient staffing and to become project Manager at private contractor was a difficult and tough job.

Conclusion

Supply of electricity was found lagging far behind the actual demand, though hydropower potential is estimated as high as 83,500 mw in Nepal. During this study, only eleven hydropower projects of Nepal electricity authority and its associated companies were found under construction with a total installed capacity of 1044 mw. Several (6) private projects were in progress for some time and government also planning to start two projects on hydropower. The department of electricity development, ministry of energy had issued construction license to 114 projects by Sept. 9, 2016.

About 500 engineers were working in those projects. Among them 219 engineers responded to research questionnaires aimed at this study regarding their job expectation, satisfaction and stress. The data was gathered through web based questionnaires or paper based survey. A total of nine hydropower construction sites were visited and in-depth interview was conducted that represented sites. The verbal comments obtained from in-depth interview and open-ended comments on questionnaire were summarized. Hydro projects were under construction (restarted) in May to October, 2016 after a major earthquake in Nepal (April, 2015). Almost for a year or even more, most of the hydro projects were stopped as road accessing to the projects was damaged. Additionally, there were flashfloods which blocked access roads, damaged the projects and also stopped construction works in many project sites until September - October, 2016. However, Middle Marsyangdi was inaugurated in October, 2016.

Kulekhani III was almost completing last package of Electro-Mechanical Works. Upper Tama Koshi was progressing on full phase targeting to complete by June, 2017. Sanjen Lower and Trishuli 3A were running normally. Sanjen upper and Trishuli B was about to start. Rasuwagadi had road blockade. The contractor stopped the work in October, 2016 but resumed it again in December, 2016. Chameliya Project was in progress for many years which was near to completion. Tanahu, Madhya BhoteKoshi and Rahughat were just starting construction works. Several projects in Dordi Khola in Tanahu district were ongoing that was initiated by a private sector. Private sector projects were small in capacity but had encouraging participations from the people. Project wise research is recommended in future. A separate research on private sector for construction professionals was also recommended. The employer, engineers and government were recommended to improve expectation, satisfaction and stress among engineers in construction sites of hydro project.

Most of the respondent were: (i) Aryan (77 %), (ii) Male (95.5%), (iii) having family annual income of half to one and half million (in NRs)(52.6%), (iv) with bachelor's degree education only (>53.9%),(v) having two or more trainings (57.5%),(vi) with two or more project experience (65.8%), (vii)with 1 to 5 years (> 45%) experience , (viii) civil engineers (65.3%), (ix) from client (>40%) .Only Nepalese engineers were respondent, (x) belong to small and middle size organization having less than 250 employees (xi) of age group up to 30 (of course >21 years, 53.4. %), (xii) married (58.4%), (xiii) with two (2) or more dependents (89.5%) including parents, (xiv) but not having children (52.5%), (xv) very few of them were project manager (14 out of 219). Therefore, a separate research on project managers is recommendable for future research.

Since Intention to Stay was found low in this research, recommendations are made to retain engineers in hydro construction projects of Nepal. Employers are recommended to improve on reward, justice, safety, schedule, equipments and manpower plan and practice. The researcher are recommended for Psychometric test retest, moderations of tools, project wise study, study for project managers, study for construction professionals, comprehensive study on each themes and correlations of one to one aspects. Engineers are recommended to manage expectation and to understand satisfaction also come from individual characteristics. Job Stress and poor satisfaction are causes of poor health, life wellbeing, engineers must manage them.

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