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REVIEW ARTICLE

PERCEPTION TOWARDS INDUSTRY BASED CAPACITY BUILDING IN INSTRUCTORS TO ENHANCE QUALITY APPROACH IN ENGINEERING

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ABSTRACT

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Modern Training and learning assume a vital job for making a designing understudy just as an instructor work prepared and refreshed. The present building training requests inside and out hypothetical learning just as active introduction to the knowledge. The primary reason instructor associated with building training need to experience Industrial connection is so they are all around arranged for all most recent specialized advancement and useful viewpoints in their picked field. It is an opportunity for them to put what they have realized as far as they can tell and to co-relate their insight with industrial specialists. It is favorable position for students as well as institution if the lecturer who is an engineer himself ideally with a long or normal connection with the industries. The paper expects to talk about this issue and present the author's understanding amid one of the modern connections and the result as students input in the wake of applying most recent, enhanced and imaginative points in course structure through engagement with industries.

KEYWORDS

practical learning, knowledge sharing, building training

1. INTRODUCTION

Botswana is a landlocked country in Southern Africa that edges the countries of Namibia, South Africa, Zimbabwe, and Zambia as appeared in figure 1.



Figure 1: Map of Botswana [1].

The geography is level, and up to 70% of Botswana is anchored by the Kalahari Desert, along these lines making it a pitifully populated country with insignificant green activity. The organization structure is a parliamentary republic; the head of state and head of government is the president. Botswana has a mixed fiscal system, which consolidates a variety of private chance, joined with bound together monetary orchestrating and government control. Botswana is a person from the Southern African Development Community (SADC). Instruction is instrumental to feasible improvement in Botswana, as indicated by another World Bank Group (WBG) ponder [2]. Botswana has gained huge

ground in training, yet the aptitudes sets important to address business issues are not sufficient.

World Bank report 2014 says that, improving quality instruction and access to work preparing that furnishes specialists with a different range of abilities would build business openings over all training dimensions and advance monetary development [3]. Instruction is one of the six key center points in the Vision 2016 and National Development Plan10, built up to help Botswana's financial development and enhancement. People in general interest in instruction is high, achieving over 9% of the nation's (GDP).

Elementary school enlistment in the nation remains at 90%, and over the most recent five years, this has helped the administration's drive to accomplish widespread essential training and has brought about between 96-100% of understudies proceeding to auxiliary instruction. Notwithstanding the advancement in expanding enlistment, Botswana lingers behind other comparative salary nations in understudy learning results, as per the universal benchmarking. Botswana is presently looked with the issue of instructed joblessness, with joblessness at 17.5% in 2012. Because of the low quality and significance of instruction and preparing, Botswana's workforce has deficient abilities to fulfill the present work needs bringing about a lack of gifted work [3]. The investigation, included four arrangement notes, analyzes the arrangement of instruction and abilities preparing in connection to work advertise needs and monetary development in the nation.

The discoveries featured three key territories for development: Improving the nature of essential instruction especially failing to meet expectations schools and schools in rustic zones, Developing fitting work advertise

ranges of abilities; and Increasing access to work preparing programs which will assist a decrease in the aptitudes hole in Botswana to broaden its economy, encourage a more grounded, progressively practical financial and business development, and outfit its workforce with an assortment of ranges of abilities that address issues.

University of Botswana, Botswana International University of science and Technology, Botswana Institute for Technology, Research & Innovation and Botswana Innovation Hub are consistently attempting to improve the designing instruction and research in the nation. Botswana Innovation Hub was additionally settled and fused as organization to create and work Botswana's first Science and Technology Park went for making a domain that bolsters new companies and existing neighborhood organizations just as pull in universal organizations and establishments to create and become focused innovation driven and information-based organizations. Botswana Innovation Hub bolsters the development of techno-rich business ventures over the long haul to expand the abundance of the nearby learning serious network, advance a culture of development, and invigorate the aggressiveness of part organizations and information-based establishments [4].

2. TECHNOLOGICAL SCENARIO & CAPACITY BUILDING

With quickly changing technological situation and regularly expanding worldwide availability just as intensity in current occasions, the job of specialized instruction being developed has turned out to be noteworthy and testing. Likewise, as a result of concentrated mechanical advancements, the worries of supportability, ecological debasement, asset consumption and comprehensive development have turned out to be progressively significant. The requirement for very much qualified designers/experts is increasingly basic with complex issues that influence the personal satisfaction of everybody all over the place and furthermore for organizations looking for balanced architects and experts who can go up against positions of authority [5].

Further, the worries for making the instructive educational module and preparing increasingly helpful for the national needs are getting to be critical. We have seen that in the previous couple of decades there has been a little increment in the quantity of specialized organizations and diverse designing focused courses. Nonetheless, the push on enhancing the nature of instruction in such a wide range of establishments has been slacking. Various specialized organizations exist in Botswana where countless are utilized and being selected from around the world. The specialized foundations give the specialized labor expected to meet the prerequisites of the nation. In these organizations, the most imperative segment of the data learning change is encouraged by the educators.

Botswana Qualification Authority regularly known as BQA is the controlling body which is progressing in the direction of overhauling of all courses kept running by various establishments and enlistment of all designing experts engaged with instructing [6]. The Botswana Qualifications Authority (BQA) is a parastatal set up by the Botswana Qualifications Authority Act, No 24 of 2013, to:

- Provide for and keep up the National Credit and Qualifications Framework (NCQF)
- Coordinate the instruction, preparing and abilities advancement quality affirmation framework, from early youth to tertiary dimension (long lasting learning).

The Botswana Qualifications Authority (BQA) Board, Executive Management and Extended Management group have created Strategic Plan for the period 2015-2020 as shown in figure 2. The system pursued to build up the vital arrangement was adjusted to, notwithstanding other best practice philosophies, the Balanced Scorecard Premium Execution Process as created by Kaplan and Norton. It expects to make an incorporated, shut circle, vital administration process connecting procedure detailing and arranging with operational execution [7].

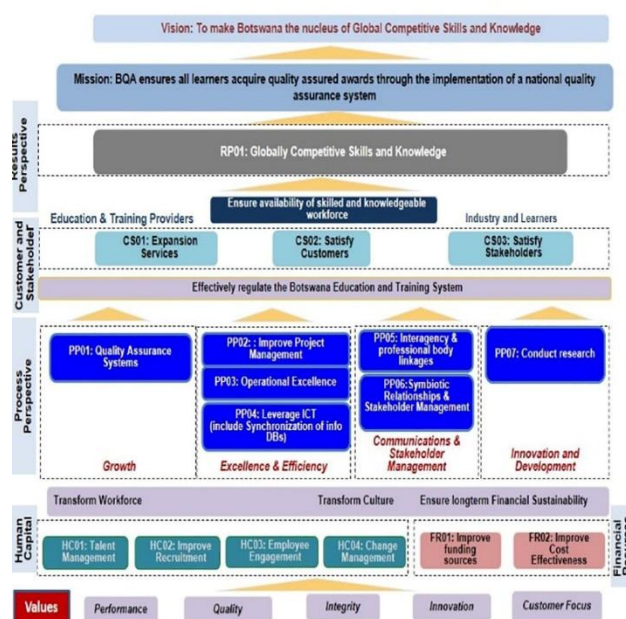


Figure 2: Botswana Qualification Authority strategy Plan [7].

Be that as it may, there is not really any system and chance to rouse scholastically splendid possibility to take up the occupations in the showing calling and prepare them for adapting up to the nature of training. In the related writing, numerous writers and onlookers have affirmed that there has been an extensive hole between what is found out in the classroom and the genuine setting of professional and specialized understudies' present and future working environments. This unsavory circumstance for the most part happens in creating nations where instructors in professional and specialized training have constrained information and involvement with genuine practice in industry. Analysts in the field of professional and specialized instruction have communicated genuine worry that there is a conspicuous hole between what

industrialists need and what the beneficiaries of professional and specialized preparing get [8].

The present move towards a post-educational system recommends that the diverse needs of post-school youth will be tended to in a progressively cognizant way, with improved access to and enunciation with advanced education, just as a clearer pathway to word related capabilities and the work environment. In the meantime, in any case, there is an acknowledgment of a need to guarantee that every one of the subsystems inside the post-educational system has the essential institutional ability to satisfy its job if this intelligibility will be accomplished. Royal academy of engineering report has abridged after difficulties as:[9]

- While scholastic staff may work intimately with industry on research, there is less inspiration to draw in with industry in connection to instruction.
- Academic staff, who are frequently principally made a decision on their execution as specialists, don't have room schedule-wise to build up the connections and assets past their current instructing materials. Correspondingly they don't really have sufficient energy to do the abnormal amounts of coordination that numerous modern commitment activities require.
- Industrialists don't comprehend what college situations resemble and are frequently astonished that educating isn't really the essential focal point of action.
- Academics, industrialists and PEI staff don't really have the correct abilities to scatter the training materials delivered.
- Academic timetables are settled, for the most part quite a while ahead of time. This is an issue particularly for senior industrialists as they don't comprehend what they will be taking a shot at so far ahead of time
- There are numerous modern commitment activities, however not really much coordination, either at a college level or at a national dimension.

Unnecessary to accentuate that with such a drawback drift, an endless loop is made that keeps on working, bringing about further debasement of the nature of instruction. Given the above situation, the requirement for satisfactorily expanding the nature of specialized training and making it increasingly more proper to the present prerequisites is winding up intense and requires exertion with respect to the checking offices just as the partners. It is also possible to identify a superficial, sub-optimal approach to capacity building, and a more effective one.

Figure 3 shows the capacity building approach, which has been divided into 9 different approaches. We can consider these approaches in education field also. Training alone will not be resulting the improved performance unless it is linked to an enabling institutional environment [10]. Figure shows a capacity building approach which leads to strong development at personal, performance and institutional level.

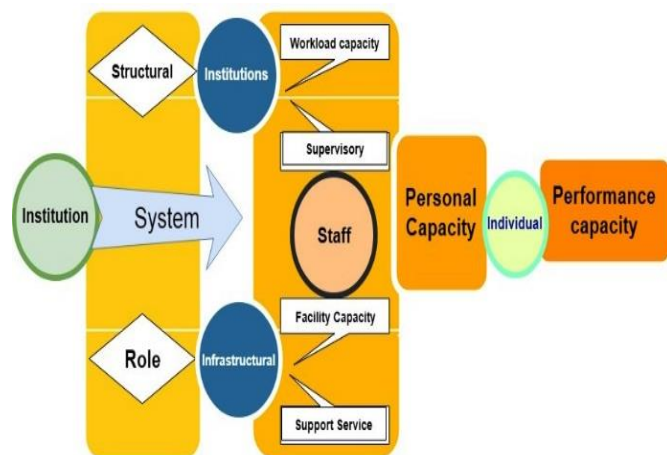


Figure 3: Capacity Building approach [11].

3. CASE STUDY: LEARNING THROUGH EEEP PROGRAM

The aptitudes need in the academic world and current zones is one of the rule obstacles to accomplishing the organization's ex-squeezed money related improvement targets. This has made aptitudes enhancement basic to country's improvement and advance. The Royal Academy of Engineering's report Engineering Graduates for Industry features the requirement for an extreme increment in the association of industry at national and nearby dimensions in building training to guarantee that college degrees are fit for the future, addressing the necessities of industry and the desires for understudies. Four late reports distributed by the Royal Academy of Engineering feature the need to enhance the quality and extent of designing training on the off chance that we are to fulfill the needs

of understudies and managers for industry-important aptitudes The Enriching Engineering Education Program is constrained by the Royal Academy of Engineering as a noteworthy part of its work centered at supporting and adulating the cutting-edge period of overall pros and building institutional limit generally. The program is continued running with the liberal help of the Anglo-American Group Foundation. The Enriching Engineering Education Program is focused on a mix of two-way secondments and synergistic workshops [9].

These secondments and workshops have incited improved industry-the academic world associations and achieved expansive advantages for the two social occasions, for example by modifying the instructive modules even more eagerly to national and common progression needs. The author served a work-based secondment at Morupule coal mine (MCM) in July 2018, study/observe different engineering processes to extend the gaps or scope for thermal analysis and raw supply to a power plant especially initiating part of a power plant's modern Rankine cycle for improvement needed to enhance the different related processes. Also, to identify and eliminate any form of excess during testing, conversion & inspection practice.

4. ABOUT THE INDUSTRY

Morupule coal mine (MCM) lies on the eastern edge of the Kgaswe Coalfield. The resource contains good quality low sulphur sub-bituminous coal which is perfectly suited for steam raising. The raw product (RoM coal) is a direct feed into the coal fired power plants adjacent to the mine, owned by Botswana Power Corporation.



Figure 4: MCM Plant view

MCM plant view is shown by figure 4 where, washed coal products (clean coal) are consumed by various customers locally (hospitals, schools, breweries, abattoirs, clay brick manufacturers etc.), with the bulk of the washed coal sold into regional markets in RSA, Zimbabwe, Namibia and Zambia. Large size washed coal (nuts and cobbles) within certain limits of phosphorus content are used in the ferrochrome smelting as reductant, reducing costs of premium reductants like coke and or metallurgical coal. MCM started its operation in 1973, is approximately 293 north of capital city, Gaborone located on the eastern part of central Botswana. It is the country's only coal operating mine with a production capacity of 2.8 million tonnes per annum. The mine is estimated to contain 70 billion tonnes of proven and probable reserves and is wholly owned by Mineral Development Company Botswana. It is the first organization in Africa to achieve ISO 55001:2014 certification. Developed by the UK-based Institute of Asset Management, the international Standard for Asset Management is a system that coordinates activities of physical asset and its important interfaces with human, information and intangible assets. MCM has five departments namely;

- ❖ Human Resources
- ❖ Commercial
- ❖ Safety Health Organization
- ❖ Engineering
- ❖ Business

These five departments has 34 sections of which all in together has a work force of above 320 peoples (approx.). MCM is located on the outskirts of Palapye, along the Serowe-Palapye road and it is currently owned by Botswana Government under a company called Minerals Development

Company of Botswana (MDCB) after an acquisition from Debswana. MCM started production back in 1973 after being established as a subsidiary of Anglo American in 1970, and it was then acquired by Debswana as a 100% owner in 2000 until being owned by MDCB in 2016. The Power stations in Morupule are supplied with coal from adjacent Morupule Colliery. Adjacent to Morupule A, Morupule B power station was set to end acute shortage of power in Botswana. It has four 150MW units thus producing a total of 600MW as compared to 132MW produced by Morupule A power station. The Morupule B power station uses coal as fuel which is from the Morupule colliery mine. Coal is a mineral possessing chemical energy. Carbon made from ancient plant material gives coal most of its energy. This chemical energy is released in a process to generate electricity [12].

5. KNOWLEDGE SHARING

The first induction includes safety information, overview of plant area/activities, medical test, general Induction which covered the following areas; Wellness & HIV/AIDS, Security, Clinic, Ventilation,

Communications, Industrial relations & Development. The second induction which was basically for underground mine visit. It involves the training session to wear different safety things.

The objectives of the study visit to underground section was to familiarize and become conversant with the Mining methods; grade control; floor and roof profiling; legal statutes; coal blending framework; sectional moves and other key mining processes including sections being mined; different equipment being used and ventilation operation. The mining method used in MCM mining operations is Bord and Pillar. This method utilizes pillars as support of the roof of the mine in an eco-friendly manner. Around MCM area is the Kalahari Karoo Sub Basin where sandstones overlie the Palapye Group sediments and Archean basement rocks inclusive of the MCM seam. MCM seam is mined to a height of 4.2m, controlling the horizon by leaving 2m allowance of roof, and 1m allowance of ground. Figure 5 below stratigraphy of the MCM area.

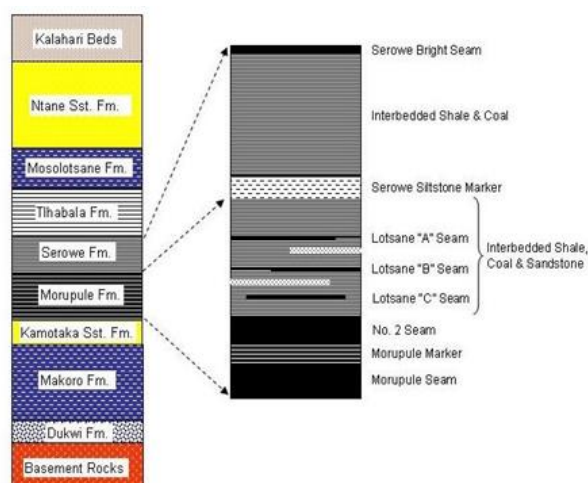


Figure 5: Rock Structure Stratigraphy [13]

For each section, a Continuous Miner cuts the face of coal, having coal conveyed onto 3 shuttle cars, operating in an alternating manner. The shuttle cars then offload coal onto the feeder breaker which then reduces size of coal to a maximum of 200×300mm. Coal then goes from the feeder

breaker to the section conveyor belts which then connect with trunk belts to supply treatment plant with run-off-mine coal (ROM).

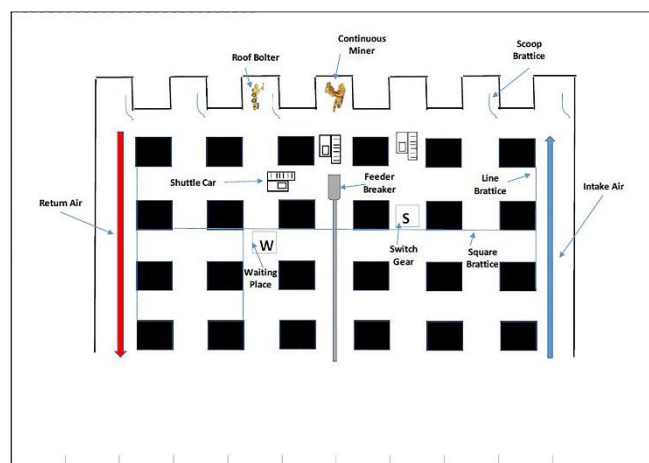


Figure 6: Ventilation: Section Air Control [12].

Air control in sections is administered in such a way that proper ventilation of air travelling at last through road (ltr) velocity of greater than 1m/s passes through the split of operatio. To achieve this, use of ventilation brattices is actioned as shown in Figure 6 above. Intake air is directed by line brattices towards the last through road. The mining sequence always starts on the side of the intake airway in the section, to ensure that adequate fresh air is supplied at the face when the continuous miner is in operation. According to Botswana Mines Quarries, Works &

Machinery (BMQWM) Regulation 108, methane level shall not exceed 1.25% and carbon monoxide level shall not exceed 25ppm. Overall, author was able to appreciate Underground mining, Geology Section, Treatment Plant, Mechanical Workshop, Electrical Workshop, Garage, Supply and Chain Section during study visit. It also involves the study of the quality monitoring of coal in terms of proximate analysis (moisture, volatile matter and ash content), phosphorus analysis and sulphur analysis. Also, transferred the skill of working on a newly commissioned XRF machine

and Calorific Value Calorimeter as shown in figure 7. It was highlighted that it is critical to monitor and advice the coal processing chain in terms of their operational parameters, as a reference to tested and reported qualities.



Figure 7: Analysis with the help of Bomb calorimeter

The coal processing method understanding in the Treatment Plant through the appreciation of the conveying system, equipment maintenance and the coal washing process were also covered in study. Participating in machinery assembly and maintenance at the mechanical workshop was a good experience. With the understanding acquired on the development process of the on-coming MCM3 base layout and geological structure of the current operating mine unit [12].

6. IMPLEMENTATION AND FEEDBACK

This secondment was a part of study arrangement to fill the post knowledge sharing gap in line to the prior study done in a thermal power station, during which refurbishment of Turbine, ash handling system, main plant compressor system, main central control room and water treatment plant were studied and observed. We executed the information and experience picked up amid the secondment served at thermal power plant in the instructing of the courses like Thermodynamics II, refrigeration and air conditioning and likewise in final year projects, which are core mechanical engineering building courses at University of Botswana, through various seminars, presentations, lectures and tutorials involving design, processing & overhauling of refrigeration duct system, chemical analysis, combustion analysis, thermal analysis, water treatment etc [14]. The experience gained from this training and observation is shared with stakeholders, students, technicians and general public through knowledge sharing workshop. Despite the fact that the targets of the secondment were of a wide assortment it is important that there are a couple of viewpoints that make an effective building fellow.

7. CONCLUSION

The achievement of these activities depends on the foundation of viable academic- industry organizations to configuration, convey and advance them. The difficulties of globalization require our designing alumni to be completely furnished with the important learning and aptitudes before they enter the workforce. One of the manners in which that can be accomplished is through refreshing their teacher moreover. Particularly, Mechanical Engineering understudies (the individuals who are examining Thermal procedures, Different thermodynamic procedures, cycles, Boiler, Turbine, Production tasks and upkeep under their educational modules) got data about current commonsense learning in the area. There is a high probability for intrigued students to do explore based last year projects in the territory of warm investigation, Plant enhancement and Quality generation. Other staff individuals will have a chance to comprehend the working data and significance of various fuel investigation, thermodynamic cycles, plant activities and machine apparatuses through my report and furthermore acknowledge handy ramifications in tasks.

Through students' tasks can be actualized in other potential enterprises to think about their activities, enhancement in nature of designing exercises, diminish their lead time and increment their incomes. Obviously, shaping the connections that empower modern commitment can take a ton of time and exertion, which all should be reshaped when the relationship arrives at an end. Industrialists ought to consider approaches to make their mediation last, perceiving that they may not generally have the capacity to take part themselves. In this way, there is a requirement for a short preparing bundle to plan scholastics who will be associated with mechanical commitment. There is a need for lecturers teaching engineering to engage with the industries and improve or update their skills. This is the only way they can produce good engineers.

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