Redefining the Principles in Fitness for Purpose and Value for Money in 21st Century Engineering Education

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Abstract: In the 21st century, redefinition of engineering education (EE) with its principles to fit the purpose and value for money has received a lot of attention globally. With increased demand for scholarly engineers worldwide, African universities are still faced major problem such as dearth of productive engineers with high skill potentials. This may be attributed to shortage of engineering educators, poor funding, and outdated curriculum,; hence the crux of this paper. This paper was guided by Becker's theory of Human Capital, focusing on investing in human capital through education and training, which will contribute immensely in producing engineers with valuable skills. This paper takes a broad look at the redefinition of principles that fits the purpose and value for money in EE. The specific objectives examine the fitness for purpose and value for money and fostering the quality of EE that will enhance EE, as well as its implications for EE in the 21st century in Africa. Thus to address this gaps, recommendations on total reengineering of EE in areas such as curriculum revision, equipping educators and students with knowledge abilities and skills were suggested.

Keywords: Engineering education, fitness, human capital, redefinition, purpose, value

I. INTRODUCTION

Globally, in the 21st century, several debates on redefinition that fits the purpose and value for moneyin engineering education (EE)has led to collective consciousness in new approach on how best to educate engineering students in Africa. This becomes an imperative for the realization of career goal in engineering fields. To achieve that, advancement and best methods in educating potential engineers in enabling them to adapt and keep pace with well-defined career possibilities are key for redefinition and value for money in EE (Buch, 2015; Brunhaver et al., 2017). Presently, it is required for engineering graduates to possess valuable skills fromindustrial training and internship. This may provide inspiring and rewarding intellectual skills for engineering students. Adopting modernized and internationalized expertise will bring positive implications to boost EE, most especially in emerging nations(Buch, 2016; Bakht, 2018.). Thiswill produce potential engineers with better skill development as well as being more productive than their international counterparts. However, African educational stakeholders has necessitated engineering institutions to continue to search and compete for global knowledge and collaboration in national and international research projects with the purpose to redefine institutional values and intellectual principles in EE.

EE is the dynamo of fourth industrial revolution (4IR) technological industries that increasingly drives labour growth with professional engineers displaying intellectual skills and competencies(OECD, 2014; Bennett, 2016). Notably, equipping EE institutes with 21st century skills and competencies, requires a significant change of national curriculum programmes in EE. This can rapidly becomebetter with a strong push in higher investment in knowledge capacity and innovations that will accelerate faster engineering charts of scholars at the international level(OECD, 2016).Funding of EE has been one of the barriers slowing down development and advancement of EE in Africa as they cannot fully compete internationally.

Hence, rapid development through modernized scientific and technological methodsin acquiring skills and competency, can contribute immensely to achieve the common goal of instituting EE(Davis et al., 2017; Bornasal et al., 2018). The quality of EE becomes very important as it allow forpursuit of essential human and social resources, involving knowledge and research skills. Redefinition of EE willbuild a crop of intellectual engineers with readjustmentinconventional knowledge and skills in order to achieve global excellence(Juhl et al., 2018; Kolmos et al., 2018). Engineering prospectuses are expected to show extraordinary theoretical and practical performances that will distinguished EE from other disciplines. This approach in EE usually are not limited to application of knowledge of mathematics, science and designs but involves identifying and demonstrating enhanced technique in solving engineering complex problems to better the modern day society.Thus, improving the quality of EE is anemphasized key subject in redefining EE to fit the purpose and value for money as this will bring significant positive changes in engineering sector across African nations(OECD, 2014; 2016). This paper presents a systematic review methodology by exploring the redefinition of the principles in fitness for purpose and value for money in 21st century within the context of EE in Africa. This systematic review approach identify and appraise published articles from year 2015 to 2020 in the fields of Engineering and education systematically. The purpose of this methodology is to evaluate published reviews of the redefinition of the core principles for the significant purpose and value for money in EE, to describe and discuss its implications in order to provide the best recommendations to engineering faculty, professionals and relevant stakeholders.

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The main objective of this paper is to fill the research gap by contributing to the overall understanding of redefining the principles in fitness for purpose and value for money in EE. Specifically, we explore what makes for the fitness for purpose and value for money to enhance EE; and fostering the quality of EE in Africa by improving the demands of fitness for purpose and value for money; as well as its implications for EE in the 21st century in Africa, hence, recommendations were suggested.

II. METHODOLOGICAL APPROACH

This paper adopted the Systematic Review Methodology, which is logical and appropriate step, allowing the findings of separate reviews to be compared and contrasted, providing engineering faculty members with the findings they need. Large number of studies on redefining the principles in fitness for purpose and value for money in EEhave been published by engineering educators and professionals in the 21st century(Mallett et al., 2012; Ouhbi et al., 2015). This becomes seeming as systematic reviews of differentauthors based on study objectives of this paper,assess, review and convey existing studies in a single space. The methods used to identify and evaluate published reviews systematically, are drawn from existing studies (Leandro Cruz et al., 2019;Trevelyan, 2019), following scientific research practices in the conduct and reporting of systematic reviews are explicitly explained. The process of identifying and appraising all published reviews allows researchers to describe the quality of the compiled existing studies, summarize and compare the conclusions of the reviews as well as discussing the implications and recommendations of the conclusions of the reviews (Bornasalet al., 2018; Wilson-Lopez et al., 2020).

III. OVERALL LITERATURE REVIEW

Africa has huge potential for developmental growth linked with her youthful bulging population and abundant natural resources that needs to achieve its demographic dividends for any nation's economic. Engineering is one area that requires specific attention as it provides highly and intellectual skilled personnel for industrial and economic development(UNDP, 2017; WFEO, 2018). Engineering practices unlock huge potential for economic developmental growth, that make faster progress towards achievingSustainable Development Goals (SDGs) in African regions. However, lack of engineering capacity and heavy reliance in bringing international expertise continue to persist in EE for two major reasons. These include insufficient output from training institutions, and poor quality education as well as lack of practical experiences among EE graduates(Filho et al., 2016; Abdulwahed et al., 2017). Yet Africa nations has serious pressing developmental needs that require the expertise of an engineers. Engineering educators need to change their teaching approach to enable engineering graduates to have an open-mind in becoming creative problem solvers in engineering fields. There is little attention for developing EE to incorporate skills and ethics in engineering, as accreditation and quality assurance for EE lack criteria that require incorporating professional skills in education in Africa. Thus, this puts engineering graduates of the 21st century at a significant disadvantage while competing with their global counterparts(OECD, 2016; Passow et al., 2017). Remarkably, EE is getting global and the present scenario in EE is undergoing a paradigm shift as a result of internet accessibility, new innovations, and internationalization process. Hence, engineering curriculum programmes are required to be oriented towards market and developmental needs(Petersen, 2015; Korte, 2018). Embracing new inventions and gaining inspiration from experiences from industrial organizations, are of paramount importance to redefine the principles in fitness for purpose and value for money in EE. Presently, the diversity of students opting for EE poses a lot of significant challenges for engineering institutions, as it involves culturally diverse set of students (Wilson-Lopez et al., 2020). These group of students with individual differences in culture, abilities, and previous educational experiences for individual learning must be obliged if EE have to be redefined with core principles and value for money. Notably, EE goals may effectively be chased within the context of a comprehensive scrutiny of relevant conventional features of EE interrelated system and practices in meeting with economic global system (Buch et al., 2015; Bornasalet al., 2018). This promotesthe attainment of adopting better principles desired as value for money among EE students and practicing engineers. It can only be achievable by building and laying more emphasis on collaborative research in EE and engineering practices(Daviset al., 2017). Also, the main goal of EE redefinition and identifying its value for money is to reengineer EE by stating what EE would define as its outcomes.The outcome definition of EE can be acknowledged through desired result and redesigning the criteria of what the outcome is supposed to be compared with is the quality of the nature of the processesthat are involved. These desired outcomes consists of an enhanced educational experiences for EE student who has diverse opportunities to pursue engineering programme as a liberal education(Kovalchuk et al., 2017; Korte, 2018). Efforts from engineering educators to bring about programmes changes will support and enhance public understanding of engineering programme, fostered by hi-tech literacy of public domain that will elevate EE. The nature of EE and given its professional practices depend on the structure and rigor of EE vis-à-vis professional educational programmes will play a major role in enhancing student's level of academic achievements(Petersen, 2015; Korte, 2018). Advocating for redefinition of core principles in EE and its value for money should be replaced with formal learning methods that are more capable and flexible, therebyimmeasurably in improving the standards of EE. Besides, collaborative research engineering projects can be reintroduced and rebuilt on significant models and effective processes acquired from engineering educators and professionalsin the industries (Ouhbi et al., 2015; Kovalchuk et al., 2017).

To take cognizance of this, redefinition in EE must be exploited to accommodate EE and work experiences at both national and international levels. Thus far, most engineering institutions have made little significant advancement in reaching this goal, primarily as most programmes employed are always left at institutional level to implement without no support(Mallett et al., 2012; Petersen, 2015). Besides, most engineering learning institutions have not been fully involved with professional and industrial organizations in assisting them to achieve their goals. Moreover, increased attention to teaching and mentoring of students is key in enriching undergraduate engineering students to gain knowledge that will draw a rewarding attention and excellence in their school activities (Leandro Cruz et al., 2019). Engineering educators should be involved in development of instruments and methodologies that will help to assess students' conceptual understanding of engineering disciplines. All of these teaching, mentoring and learning activities may encouraged faculty members to reflect and re-evaluate themselves as well as redefine their approaches to teaching and mentoring (Davis et al., 2017; Bornasal et al., 2018).Importantly, African engineering schools are facing great challenges, as looking forward to better opportunities are more difficulty for young graduates to achieve.Yet, the growing significance of EE and engineering practices to this modern society tends to be held in relatively low esteem compared to other learned professions viz. law and medicine(Kovalchuk et al., 2017).

Redefining Engineering Education to Enhance its Fitness for the Purpose and Value for Money

Achieving quality in EE is a core ingredients for a successful reappraisal to enhance significant changes that will stimulate its fitness for purpose and value for money in the 21st century. Thus far, EE has been characterized by both rapidly increasing variety of demands made on engineers based on their professional lives as well as their professionalism of the services they provide in the public domain(Davis et al., 2017). Yet, there is a growing concern that in African universities offering EE is failing to keep pace with the global demand in producing new generations of scholarly engineering graduates. Hence, this has to do with the structure and knowledge content of engineering courses and curriculum programmes that has changed relatively over the past decades. More so, the emergent of total obligation put into EE has received slow pace of change that do not reflect the hitches affecting the systemic educational reform within engineering units (Bornasal et al., 2018). Conversely, the case for redefinition of EE for change to fit the purpose and value for money is absolutely recognised; but the challenges that EE is being faced with makes it not to happen. In other words, the pressing problems in EE is not whether or not to change but how to make those changes for readjustment of EE programmes in order to produce graduates that will have social capital for their career path they have followed(Petersen, 2015). However, educational change has been receiving a strong drive to reshaped and increase the talent pools of engineering graduates and the need to prepare them to address complex industrial and societal challenges in 21st century. Existing studies (Kovalchuk et al., 2017)have documented that a lot of debates have arisen within stakeholder group meetings in particular, to have a round table discussion on the readjustment of EE courses. Most existing educational interventions and reform strategies put in place to successfully redefine and appraise EE, are done with the involvement of engineering faculty and professionals, that are committed in improving the quality of EE(Abdulwahed et al., 2017). Notedly, the ability to function by using several specialized subjects or skills to understand the impact of engineering on the global and socio-economic factors are important aspects of learning outcomes to prepare engineering graduates for a global workforce (ABET, 2015). Besides, redefinition of EE has attracted a lot of increased calls for quality enhancement, most especially for undergraduate EE with better opportunities that will propel them in real world experiences with engineering professionalism.Engineering educational curriculum programmes are expected to incorporate engineering project-based learning opportunities in which students are involved in range of different courses and skills(ABET, 2015). This becomes imperative for engineering student to be equipped with practical knowledge of engineering design and professional skills including capstone experiences. Team building among students should be encouraged through team teaching, constituted from various disciplines within engineering departments rather than engaging engineering students with non-engineering majors on such collaborative projects based(Villanueva et al., 2018). Though, there are course collaborations that will bring the pairing of engineering students with non-engineering students especially at the lower cadre of learning. Studies have indicated that engineering students that are engaged in interdisciplinary based-projects do not only gain experiences but also report gains in soft skills from other disciplines, professionalism and sense of responsibility in engineering(Trevelyan et al., 2018b). This further will enhances engineering graduates to have a strong abilities to communicate technical content to non-technical majors, and increased their likelihood to work on cross-disciplinary projects. Significantly, traditional methods of teaching and training in EE were created as an instructional materials that are not revised and have devalue the social consciousness of students(Kovalchuk et al., 2017).

engineering courses(Kovalchuk et al., 2017). This has brought discouragement among non-engineering majors to have a broader participation in highly competitive and elite engineering higher education.In preparing engineering students for a global career, they should be made to acquire global competencies and multicultural skills that would stand as a workable knowledge and skills that are essential to succeed in a globalized world(Villanueva et al., 2018). Therefore, the rapid pace of knowledge development and technology in engineering fields require a new paradigm to develop engineering graduate students with teamwork skills that will compete globally.

Fostering Quality of EE improves Demands of Fitness for Purpose and Value for Moneyin Africa

Quality education is critical for human capital development having skills and moral values that will stimulate a productive human resource for economic growth in 21st century. Educating competent and global competitive engineering graduates has significant benefits not for employment but also gaining better opportunities that demands a quality demand and value in EE(Trevelyan et al., 2018). African universities should begin to capitalize on the dynamics that will ensure quality of education for educating competent potential engineers. Becoming a global competent engineer do not only requires comprehensive technical knowledge in engineering but for young promising graduates to develop themselves in having strong hard and soft skills, which has become an imperative in solving complex engineering problems in the 21st century(Cardoso et al., 2016). Fostering quality in engineering discipline is to improve the demands of fitness for purpose and value for money, which has become a topical issue in EE. The understanding of quality features in EE has given rise to exchange of ideas on how engineering faculty and professionals perceive and define quality within engineering institutions(Elassy, 2015). On the other hand, academic faculty have received less attention on an insightful studies on redefinition of quality type required in EEas compared with other non-engineering programmes(OECD, 2014; ABET, 2015). As scholarship is limited amidst recognition, is what stimulate redefinition of quality in EE. This lie as the core of academic work that focus on opinion of academics on issues associated with quality in Engineering institution crucial to the ongoing deliberation in educational system in Africa(Elassy, 2015, OECD, 2016). The belief that academics' views pertaining to persistent call on redefinition of quality type of EE may explicitly or implicitly support institutional efforts if much investments on funding and infrastructures are put in place(ABET, 2015). Global engineering universities are pushed to change more rapidly as they invest more on emerging and more specific skills to boost economic activity. EE is not just about industrializing the world but to improve human society for collective good (OECD, 2014; 2016). Though, theoretical definition of excellent fostering in improving demands for fitness of the purpose and value of money in EE is a challenging endeavor. As this involveefforts in undoing quality elicited by existence offaculty and professionals with anindulgence in engineering institutions. One study conducted by Harvey and Green (1993) immensely contributed to the quality dialogue in higher education in which they suggested five distinct but related ideas of quality. These include i. quality as exceptional(is seen as value higher than high principles, leaving prerequisite criteria); ii. quality as perfection (demonstrated over 'zero deficiency', 'regular and impeccable outcome'); iii. quality as fitness for purpose (displays product meeting the stated goal/ requirements/ fulfillment); iv. quality as value for money(exhibits competence, value and yield on investment); and v. quality as transformation(shows qualitative change, enhancement/empowerment, skill development or new knowledge capacity)(Harvey and Green, 1993: 11-28).However, the description of quality discourse in higher education can be equated to EE and these notions above on quality in higher education do not have a different perspective from the redefinition purpose in EE. Across the globe, redefinition of quality control in EE is guided bythe significant role played by the engineering professional bodies, which accords and agrees with reforms that pertain to in producing intellectual crop of young potential engineering graduates (ABET, 2015; OECD, 2016). These engineering professional bodies such as Accreditation Board for Engineering and Technology (ABET), European Network for Accreditation of Engineering Education (ENAEE), Sydney and Dublin Accords (SDA), the Engineers Competence Agreements (ECA), and so on, have set criteria for accrediting numerous types of engineering programmes (ABET, 2015). These accreditation criteria involves the redefinition of programme objectives, student outcomes, improvement measures, curriculum, faculty, facilities, research and institutional supports that ensure quality assurance of specified EE programmes. The continuous development of EE is required to focus on resolving an undesirable condition through the application of modern methodology, leading to complex, and integration of contemporary engineering practices towards a meaningful outcome(Jungblut et al., 2015). Significantly, the fitness for purpose and value for money in EE is a dominant conception of quality rooted on three aspects: similarity between knowledge, skills, and attitudes developed to meet with the workplace needs; the effectiveness of EE academic curriculum programmes as well as employed graduates in the labor market; and EE to national, regional, and global needs(Schindler et al., 2015). These three points arecaptured in the relevance of redefining EE in Africa in the 21st century.The irony of the situation of EE in Africa include the dearth of engineers, and engineering graduates remain unemployed or are under-employed, as this is attributed with the poor quality of EE(Filho et al., 2016). It then becomes imperative as standing engineering institutions need to urgently upgrade their public services and research laboratory. Poor public funding of African engineering educational institutions have for some epochs struggled from lack of funding and depreciated infrastructure (Jungblut et al., 2015; Schindler et al., 2015). Thus, engineering laboratory equipment is outdated and non-functional as well as engineering libraries do not have the appropriate books and recent journals, with little or no availability of information and communication technology (ICT) facilities and computers are still limited. Similarly, engineering courses curriculum need to be revised as most of them are obsolete and lack originality as most times they are relevant to the African context(Bennedsen et al., 2020). It is only few engineering universities in Africa that involves industrial and their professional bodies in curriculum revising. It would be worthwhile to suggest preparing problem based learning approach platforms that will improve engineering students' abilitiesand acquisition of skills leading to new inventiveness and flexibility(Elassy, 2015).

Moreover, engineering educators need to be trained to teach, carry out research and supervise their undergraduate students very well. For most of engineering educators feel comfortable with Master's degree in their appropriate field, acquiring little industrial experience and undergoing some pedagogical training that will keep them in their job positions(Schindler et al., 2015). Investments made in EE institutions will help to improve EE and 'brain drain' syndrome of engineers will be reduced. Important initiatives that foster redefinition and support regional mobility of professional engineers should be encouraged.African universities should reinstitute a strong regional body for accreditation purposes and EE initiatives(Elassy, 2015). Therefore, redefinition of EE qualityto fit the purpose and value for money should beaccommodatedwithhigh standards set up by EE regulatory bodies.

IV. THEORETICAL FRAMEWORK

This paper was guided byBecker's theory of Human Capital (HC), which was adapted and could be applied to interprete the ideals for redefinition of the principles in fitness for purpose and value for money in EE in the 21st century. The theory of HC was discovered from its origins linked to macroeconomic development theory where structural reorganization was based on values of land, labour, capital and management (Mincer, 1962b; Becker, 1964). The empirical work of Becker (1964), Schultz (1961) and Mincer (1974) revealed the predominant statement that development of capital is of utmost importance to economic achievement. The basic premise behind HC theory is that individual's educational abilitiesare of akin significance with resources involved in the invention ofgoods and services(Lucas 1990; Rottmann et al., 2015).

A lot of debates on the quality of engineering graduates produced from higher engineering educational institutions has attracted a lot of enormous investment from government, private and relevant stakeholders in developing their curriculum programmes in order to have a better teaching and learning frameworks for EE students (Juhl et al., 2018). Notedly, in enhancing the quality in EE in adopting the use of flexible developmental altitudes with increased development based on relevant needs achieved collaboratively by faculty and professional engineers. This will result to continuous and collaborative quality boost that is accompanied with excellence affirmation agreed at the national and international levels (Kolmos et al., 2018). This usually be accompanied with insights from experiences to improve engineering education and practices in contributing to significant improvements in EE at the programme level. This will assist potential engineers in future directions to address the gaps in redefining the important quality principles and value for money in EE in the 21st century (Singh, 2015). According to Becker (1964; 2002), the theory of HC is applied in the context of EE organizations and suggested that individuals who invested in education and training will increase their skill levels and be more productive than those less skilled. This is the justification of receiving higher earnings linked to high skill development and greater investment in human capital. As Becker (2002) indicated that redefinition of the principles of purpose that fits and its value for money in EE plays an important role in contemporary development of EE as engineering educators and students' knowledge as well as skill abilitiescan be developed through better investment in EE training and learning programmes (Singh, 2015; Heywood, 2016). Assessment and readjustment of EE can be aligned with higher standards use in establishing engineering institutions to fit the purpose of producing intellectual graduates for the value of money in choosing engineering as their career pathways(Heywood, 2016). One of the significant contributions of HC linked with the redefinition of principles in fitness for purpose and value for money in EE revealed that if relevant stakeholder put more efforts in investing in EE and training, will improve the productivity of the faculty member and students respectively (Kolmos et al., 2018). As engineering students are sole beneficiaries of the significant improvements that will earn them a successful career path.Redefinition of EE need to focus on how to seek and find information from a good revised curriculum, which satisfies a fundamental teaching principles that allows for true variations. Requirements to redefine the purpose and value for money in EE should be flexible to change as future engineers will need skill design, as well as analytical skills to thrive in fourth industrial era(Heywood, 2016; Filho et al., 2016).Thus, engineering curriculum programmes should be open to non-engineering educators that will add topics on social problems that will expose students to solve complex social problems in order to commoditize technical innovations to expunge poverty and unemployment (Singh, 2015).

V. DISCUSSION

The current state of engineering and EE has identified engineering capacity needs in Africa in the 21st century. Issues, challenges in EE has led to dearth of opportunities for development of EE as well as poor contributions from global experts to redefine the value of EE in the 21st century(ABET, 2016). Evaluation of the capacity of EE in African universities has called for a deep rethink on how to redefine and develop modules that will prepare engineering graduates for their role in industrial development and advancement of their career path(Korte, 2018). Thus far, the broad state of EE and training in Africa have been linked with shortage of engineers, yet engineering graduates remain unemployed. Similarly, poor funding to procure engineering equipments in laboratory and to support other facilities as well as outdated curriculum and methods of teaching were also reasons why EE in Africa were underrated(Kolmos et al., 2018). Relatedly, academic staff with little or no industrial experiences, difficulty in recruiting and retaining engineering educator workforce as a result of poor salaries and politicized stringent employment conditions gave serious rise to weak university-industry partnership and lack of opportunities for engineering students to gain access to industrial experience(Brunhaver et al., 2017).

Equally, engineering graduates were seen to have weak management, entrepreneurial, and lack skill development when employed in fourth industrial organizations as well as female engineers are under-represented in engineering institutions(Bennett, 2016).There has been an increasing awareness that EE and training plays an important role in national development and advancement of economic activities. Weak availability of statistical data on indicators in EE has been identified in several studies (Heywood, 2016; UNDP, 2017; Kolmos et al., 2018) and harmonization of engineering programmes and qualifications with engineering professionals to facilitate mobility within Africa has been proven abortive. Hence, it is not so unanticipated, maybe, that engineers do not feel that public domain values their professional status (Brunhaver et al., 2017). A major underlying factors of redefining EE is the recognition of the systems of engineering practice and EE, depends on whether engineering professionals across structural systems of EE has a profound character. This goes a long way, in such that professional engineers who are practicing, strive to seek and maintain a professional identity that they can carry with them irrespective of who is their present employer (Singh, 2015; Rottmann, 2015). Redefinition of engineering educations requires also an encouraging and enlisting of support for engineering education by building on existing and new innovations that are essential and thereby, providing incentives for their support that can be approved by engineering faculty (Villanueva et al., 2018). This can been based on decisions for permanent tenure that is primarily centred on excellence in research. In Africa, engineering institutions has benefited enormously from wider efforts of research universities, through their research faculty and Ph.D. programs, although it has not been translated into excellence in undergraduate engineering education due to unknown reasons (Rottmann, 2015). The engineering profession will be compared with and supported to capture the minds of undergraduate students, thus moving engineering to the forefront as engineering educational institutions should be redefined to have a rethink and redesign undergraduate educational curriculum programme(ABET, 2014; 2016). Engineering graduates should be included to be among the most creative, energetic, and dynamic young professionals in the world. Presently, engineering schools are still facing challenges they have never faced before(Schindler et al., 2015). They must prepare engineers for solving unknown problems and not for addressing assumed scenarios. Therefore, more emphasis should be placed and focused on teaching in order to learn rather than providing more knowledge. However, in Africa engineering institutions, mobility and internalization have been the main agenda matters since their foundation in order to produce potential engineering scholars that can compete with their international counterparts. Nevertheless, modernization as well as globalization has brought different innovations that has forced EE beyond traditional mobility and internationalization notions in Africa in the 21st century (UNDP, 2017). African engineering educational institutions needs to adopt, develop and create defined principles to cope with current challenges that have emerged in EE as a result of global influence. Engineering educators need to provide learning instructional models that will redefine EE with its purpose and value for money in selecting career opportunities (References). As the focus of the society shifts impacts every aspect of humanity, so do the focus and values of the system of EE.

VI. CONCLUSION AND RECOMMENDATIONS

This paper attempts to show that global perspective on critical skill is key for engineering profession of the 21st century. Engineering institutions must ensure that our educational environment offers a variety of challenging and rewarding international experiences. To make a significant contribution towards sustainable EE in the 21st century is to create a conducive environment for conducting ground-breaking engineering scientific research that will allow engineering knowledge to be translated into technological innovations and activity with both economic and social value with societal relevance. This will create a commitment to society and translate knowledge into solutions of value that will produce self-motivated and responsible engineers of the highest quality who are able to help solve the societal and engineering challenges of the 21st century through creative workable solutions. Several advocators has discussed a way forward that will address and solicit for redefinition of principles of purpose that fits the value for money in EE, in order to rebuild reform agenda priorities to resuscitate EE programmes. The importance of redefinition and value for money in EE is key as this will reinforced better strategies and opportunities to reform engineering curriculum programmes to promote a shared greater investments in engineering as a profession. However, an emergent and coordinated set of reform strategies of revised EE curriculum and instructional materials are targeted and put in place as an intervention framework to address EE challenges and its value for money. Engineering educational bodies and professional regulatory agents are expected to have a open-minded dialogue on how they can come together to rebuildEE. This will assist to look at range of approaches to bring redefinition of the purpose of EE and its value for money.Therefore, we identified the following practical recommendations in addressing challenges related to the redefinition of principles in fitness for purpose and value for money in EE:

1. redefining purpose to fit in EE and its value for money requires engineering stakeholders to develop strategic priorities for 21st century skills and engineering competencies by equipping learners with current skills which require a significant change of EE curriculum programmes.
2. Government and relevant stakeholders should invest more of the country's GDP on education system that will foster innovative teaching and building learning capability across disciplines such as EE.

3. Build regional capability through collaboration byinvesting in regional networks of educators to create, foster and spread innovative practices. Thus, establishing an educational innovation hub to nurture new and emerging approaches to teaching and learning in EE is very key as it will stimulate redefinition of purpose in creating its value for money in EE.
4. Designingand implementing an effective funding to align with initiatives in EE is key. This can be done through reprioritizing of existing resources, establishing a public-private partnerships and creating flexibility in funding policies.
5. Implementing a coordinated, system-wide effort that will align with the present 21st century curriculum, infrastructure, funding and legislation. This can be done by integrating international curriculum that will enhance effective teaching practices that will be beneficial to students.
6. Establishing an solid programme of research and evaluation to promote innovation and improvement in EE. This includesharing knowledge and collaborating with researchers across local and global networks in EE.

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