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The Role of the Technical Universities' Librarians in the Generation and Management of Technical Research Data (TRD) to Advance Inventions, Innovation and Commercialization in Ghana

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TOPIC: *The Role of the Technical Universities' Librarians in the Generation and Management of Technical Research Data (TRD) to Advance Inventions, Innovation and Commercialization in Ghana*.

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ABSTRACT

The act of the Technical Universities (TU) in Ghana mandates publications which promote invention and innovations. The study examined the role of librarians in the generation and management of technical research data to promote invention, innovation and commercialisation.

This is an exploration study which adopted quantitative approach to present its findings. All the librarians from the Ten (10) Technical Universities became the resultant population. Questionnaire was used to collect the data. Emails and mobile app on monkey survey were used to reach respondents.

Majority of the Librarians attested that management of technical research data play a key role in advancing invention and innovations. The study discovered some of the sources and varying formats of such data to include ''workshop report, laboratory recording and discoveries, prototypes from engineering practical centres, speeches, *patterns, amongst others. Data formats encompassed manuscript, photography, interviews, videos, audios and artefacts.*

The study revealed minimal integration of Technical Research Data (TRD) management in the research strategic objectives of the selected Technical Universities in Ghana. Majority of the respondents (70%) indicated inadequate infrastructure and resources needed to generate and store such data. Inadequate expertise recorded (60%). Lack of policies on research data recorded (40%), poor collaboration (30%), and inadequate funding for training and logistics (20%).

In addressing the identified challenges, provision of infrastructure and resources represented (38%). Funding (31%), capacity building on the part of the librarians represented (12%). Deepening collaboration on research data with stakeholders recorded (13%). Further consideration were the establishment of a centralised repository on technical research data among the Technical Universities instead of working in silos. Findings from the study also revealed the need to revamp the curriculum of the Library and Information science schools on emerging fields. Again the librarians are to allocate resources, services and infrastructure which distinctively support research, teaching, and training.

KEYWORDS: *Technical Research Data, Invention and Innovation, Research Data Management, Technical Universities, Librarians role in research.*

INTRODUCTION

The new paradigms of research and their support services have brought about the need for librarians to develop new roles and skills by repositioning themselves as academic and research librarians. Phenomenon such as collaborative research discoveries, knowledge management and transfers, distance and open education have impacted on the expectations and roles of librarians. Avuglah and Underwood (2019) and Searle et al (2015) corroborated on this, attributing it to emerging research policies, technological infrastructure, skills development and advisory services assumed by librarians in addition to their traditional roles. Electronic Information for Libraries' (EiFL) manual on Digital Research Literacy Training Programme for Librarians (2020) outlined the research lifecycle to encompass ''Discovery, Management of Intellectual Property, Research Publishing, Dissemination, Increased Visibility, and Measurement of Impact''. Managing the intellectual creativity of Higher Education Institutions (HEIs), according to Avuglah and Underwood (2019) facilitate reuse of data, compliance to funders' guidelines, continuity of research and the exploitation of gain culmination from inventions and innovation. It is against this backdrop that efforts have been made to improve the management of research data to facilitate intellectual creativity, technical knowledge and research outputs to address contemporary and domestic challenges.

Citing Fosci et al, (2019) Research Data Management (RDM) currently presents strategic opportunities to harness and develop in-house data repositories. This has also become a requirement from funders as to how the research output are disseminated and curated to impact lives. Studies have revealed varying research coverage and output that emanate from the Technical Universities of Ghana (Fosci et al 2019). To leverage these research data be become asset, there is the need for policies and strategies to curate them. Though there are Research Innovation and Technology Transfer Units in majority of the Technical Universities the onus of managing and curating the research data lies on the libraries.

The current trends in research coupled with exponential production of research data require robust management tools, expertise and enabling environment to manage these data to foster innovation and creativity. Librarians have over the years become stewards and managers of research data through the establishments of repositories (Abduldayan et al: 2021). The skills and job scope of librarians have widen to encompass application of information and communication technologies, research data managers , policy makers, community engagement and research consultants (Chiware:2020).Henceforth professional development and

continuous capacity building has become relevant for librarians particularly in developing countries in order to catch up with colleagues from the developed world (Joo and Schmidt: (2021).

OVERVIEW OF THE TECHNICAL UNIVERSITIES IN GHANA

Tertiary Education in Ghana included the Polytechnics with the mission to train human resources in the fields of ‘’manufacturing, commerce, science, technology, applied social, applied arts and other fields approved by the Ministry of Education . The Polytechnics have over the years strengthened and expanded their mandates by offering qualifications in a wide range of applied arts, science, technical programmes and research. These developments amongst other factors propelled the Government of Ghana to convert the Polytechnics to Technical Universities backed by legislature in August 3, 2016.

The Report of the Conversion Committee mandated the Technical Universities to drive the industries by way of producing research to promote inventions, industrial experience, entrepreneurial skills and technology transfer (Ministry of Education 2014). The Technical Universities have been mandated to provide career advancement to Technical and Vocational education and training in Ghana. This development according to Obeng (2019) shall unlock the potentials and skills of technical know-how to drive industrialisation, inventions and innovations. Further Government of Ghana’s social interventions programmes such as ‘‘One-District-One-Factory, One-Village-One-Dam, Mechanization, Agro business, Oil and Gas production shall be accelerated through research from the Technical Universities (Dwomoh, 2016), (Adei, 2018) and (Eshun, 2019).The production of technical research data and policies to inform and accelerate invention and innovation in Ghana is enshrined amongst in the Science, Technology and Innovation (STI) policy (2016) and Research and Technology Transfer offices the various Polytechnics campuses.

The importance and sustainability of technical research data which emanate of these Technical Universities cannot be downplayed and managed anyhow. This is because the use and re-use of the data leads to developments inventions and innovations. A number of success stories have emerged, amongst them are developed expertise and technical know –how in Oil and Gas by Takoradi Technical University. Further, the Ho Technical University in the field of Agricultural engineering has propounded innovative and mechanised ways to assist farmers. Expandable areas of focus for the Technical Universities include Materials Science,

Engineering, ’Ceramics, Metals, Polymers, Composites, Semiconductors, Biomaterials, Nanomaterials, Biomaterials (Ministry of Environment, Science, Technology and Innovation, 2017).

LITERATURE REVIEW

I. *Technical Research Data* (TRD)

According to Merriam-Webster (1828) research is an “investigation or experimentation aimed at the discovery and interpretation of facts, revision of accepted theories or laws in the light of new facts, or practical application of such new or revised theories or laws’’. Stolen et al (2007) has categorised research into ‘’ Basic or Applied and ’Classical research. Basic research refers to fundamental discoveries which yield new knowledge whilst ’Classical research result in discoveries which emanate from application of theories and cultures (Stolen et al,2007).

Technical skills has been defined as “the study, mastery and utilization of manufacturing methods and industrial arts’’ thus human manufactured objects to aid in production and artefact. Technical research focuses on the production of new and better way of doing things (Stølen et al, 2007) . The Technical Universities are characterised by applied research which seeks solutions to practical problems in the areas of Engineering, vocational training, Agro Enterprise Development, creative art amongst others (Obeng, 2019).

Technical research encompass artefacts, laboratory discoveries, functional prototype, reports and insights, specimen, traditional and tacit knowledge on procedures and processes which lead to inventions.(Botolf and Roger, 2020) and Zhang et al (2016). There is therefore the need to develop the skills and expertise of those that which will manage and sustain these intellectual creativity needed to boast industrialization and invention. Managing these data require facilities, skills and resources that will enable the use, curation, dissemination and re-use of data.

Opoku (2018) reported in Modern Ghana of a student of Takoradi Technical University who has invented Water Bicycle. Again the ‘’Mechanical Engineering Department of the Koforidua Polytechnic led by Mr. John Abban’’ in 2011 invented a fufu pounding machine. According to them the ‘’International Journal for Technology and Management Research’’ (IJTMR) facilitated in the provision of publications to achieve that invention (The Ghanaian Chronicle, 2011).

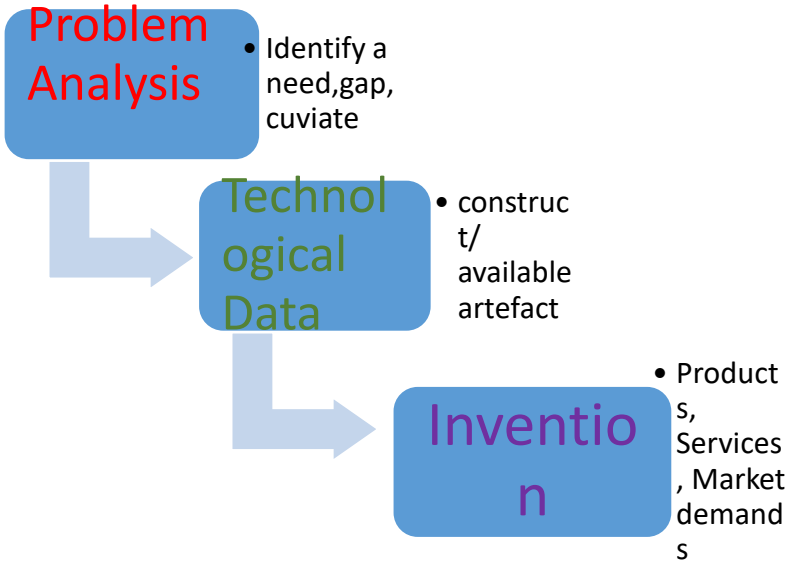
II. Role of Technical research data in advancing inventions and innovation

Research discoveries, inventions and innovations evolve from basic and applied research findings (Menna and Walsh, 2019). The Koforidua Polytechnic, now Koforidua Technical University relied on basic technical data such journals, laboratory findings, reports, video, audio podcasts'' in the development of its fufu pounding machine prototype. (Ghanaian Chronicles 2011). In Ghana, a number of inventions have been generated by the Technical Universities through research. For example, a creative art student, ''Lanto Kwame Azasime'' at the Takoradi Technical University documented the use of egg shells for art work (GhanaWeb, 2020).

Indian Technical Universities have offered job-oriented courses in technical and vocational education to address the technical know–how gaps in the areas of engineering and technology (Jayaram, 2013). Improvement in sustainable development in the areas of ''Creativity, Agriculture, Manufacturing, Hospitality and Tourism, Construction, Engineering and industrialisation have recorded gains in Southeast Asia through the provision of reliable technical research data (Jayaram,2013). The Technical Universities research output in South Korea, Singapore, Malaysia and Indonesia contributed 4.7% to the national GDP in 2006 (Jayaram,2013).

According to Pries and Guild (2011) availability of technical research findings lead to advancement in productivity. Technical research data management results in new and better transfer of knowledge which promote innovation and inventions. Figure 1 showcases the various stages in the production and utilisation of technical research data. The first stage indicate the existence of a problem, the second stage addresses how the identified problem shall be resolved through availability of appropriate data and information. The last stage is the output thus product developed based on application of data. Findings from Chawinga and Zinn (2020) showed how technical research data serve as raw material for current and future science discoveries, hence a call for investment on the part of research and academic institutions.

Figure 1: Technical Information flow Diagram



Source: SINTEF Report by Stolen et al (2007)

III. *Technical Research Data in Technology Transfer and Commercialization*

Some of the Technical Universities of Ghana have Research and Technology Transfer Offices (TTOs) which guides research policies and facilitate the ‘’commercialization, licensing, patenting or management of spin-off from intellectual creativity that emanate from research. . The issue of commercialization of research findings to firms and industries, culminated from their mandate has not been fully exploited, integrated and embraced by these Units. Min et al (2019) research findings revealed the gap between the quality of technologies provided by Universities and Public Research Institutes (U&PRIs) and the quality of technologies desired by the market. Among their recommendation was engagement with the industries and firms.

Min et al (2019) asserted to deepening collaboration in the areas of ‘’Joint Research and Development (R&D), repositories, investments, contract-based research, and licensing’’. These are needed to create a synergy between the industry and the Universities and Public Research Institutions (U&PRIs). Again engagement with Public-Private Partnership (PPP) shall harness the use of technical research output. The Ministry of Finance and Economic Planning of Ghana (2011) has a National Policy on Public-Private Partnership upon which the Technical Universities technical research serve as an impetus for industrial growth.

The PPP policy makes provision for the use of research to feed into the industry to increase production. The key institutions for the successful implementation of the PPP in Ghana included the Universities and Public Research Institutions (U&PRIs) on the provision of innovative designs and technology transfers and capacity building. (Ministry of Finance and

Economic Planning of Ghana: 2011). The Technical Universities are better placed in the supply of technical demand driven research and technology transfer to support both the Public and Private entities.

The benefit of the PPP according to Ministry of Finance and Economic Planning of Ghana (2011) and Shadik (2019) include ‘’promotion of infrastructure, technology transfer and capacity building, local development, technical and technological cooperation enhancement ,risk sharing, growth and integration, innovation and creativity, enhanced monitoring and cost sharing benefits’’. Concerning these, the Technical Universities through the provision of technical research data shall transfer technology to the PPP’s advancement. Further, development include the eTransform Project which has the Ghanaian Academic and Research Network (GARNET) advocating for the Universities and Research Institutions to package research data to leverage gains.

Technology transfer and Commercialization have become an emerging channels in which companies access new knowledge. A study by Pries and Guild (2010) identified the challenges of selecting appropriate business model and policies for transferring the invention from the academic world to the commercial arena. In pursuance to this, packaging the research output of the Technical Universities by librarians shall facilitate the transfer of knowledge and inventions. Again transitioning from invention to product and to commercialization shall resonate well with the Technical Universities industry driven and vocational programmes rolled out.

IV. *Librarians’ role in managing Technical Research Data (TRD)*

The call for advancement in research, inventions and innovations coupled with radical changes in technology has propelled production of volumes of technical research data. Librarians as partners in research play a role in the development of research policies, infrastructure, skills development and advisory services (Searle et al 2015). In championing these core areas, attention must be given to the services and infrastructure which distinctively support Research, teaching, recreation and training (Barfi et al,2018).

In strengthening research capacity of Ghana’s research system, Fosci et al (2019) proposed the establishment of a ‘’national infrastructure for scholarly communication, provision of research incentive mechanism and research management capacity using the ‘’hub-and-spoke model’’.

By this model the Librarians could manage the research output from diverse centres, satellite and remote services centres which is complement Virtual Research Environments (VRE) support. Additional competencies include: 'digitisation, electronic resources management, data auditing, content management systems applications, Data visualization, data standardisation skills and Literature gap analysis''(Barfi et al,2018).

Librarians' role in the management of research data to become asset requires infrastructure, policy framework, skills and expertise. Pointing to the findings of Avuglah and Underwood (2019) Policy, framework for RDM, particularly on Technical Research Data (TRD), stewardship and sustainability was paramount''. The RDM support services require the skills of Librarians and stakeholders towards a holistic approach in generating, processing, preservation and sharing of research data. Librarians need to upgrade themselves in the management, sharing and curating'' of scholarship as encapsulated in the research data lifecycle (University of Pretoria Library, 2020).

Managing Technical data involve a number of actors such as '' Researchers, ICT managers, policy makers and librarians as managers of knowledge. Glusker and Exner (2018) postulated the need for librarians to beef-up relationship building and user engagement skills to accomplish their research support mandate. Wang (2021) corroborated the above findings pointing to the fact that librarians are partners in research of which data has become the greatest intellectual property for the Universities and Public Research Institutions (U&PRIs).

The research landscape therefore requires librarians to adjust to this new trends which involve research consultation services, working in teams, outsourcing, community engagements and outreaches, social media application amongst others (ALA,2021) and (Smyth, 2016). Unfortunately, investigations in the capabilities of librarians in developing countries falls short compared to the developed world in the management of research data. Librarians lacked core research data-management competencies because of the lack of formal training opportunities (Chawinga and Zinn, 2020), (Glusker and Exner:2018) and (Calarcob:2016). Though there is the absence of data librarianship in our libraries some librarians have not given up but rather upgrading themselves through webinars and presentations from their counterparts from the advanced world. In addressing the skills gap on research data management particularly on technical data, Chiware (2020) recommended a revamp of the library and information Science curriculum to include component of data management courses.

STATEMENT OF RESEARCH PROBLEM

Absence of Research Policy framework – The lack of well defined research data management policy according to Avuglah and Underwood (2019) and Chawinga and Zinn (2020) such as Intellectual property policies, research funding, technical data curating and dissemination hinders the adaptation data management practices in some Public Universities. Though there is Science, Technology, and Innovation (STI) policy of Ghana, there is the missing link between industry research focus and the Universities as a result of poor data management. (Chawinga and Zinn: 2020:468).

Quaye et al (2019) mentioned some of the actors on innovation under Ghana's Science, Technology and Innovation (STI) policy. These includes Universities, Research Institutions Trade and Industry Ministry and Agriculture sector. A well curated research data facilitate gaps analysis, reuse of data and eventually guide in advancing research. The absence of research data management policies have made it impossible to identify gaps in the production and curation of technical research data to advance innovation.

Infrastructural deficit- Managing technical research data to become asset require tools, applications and storage capacity. Massive concentration on data storage, protection and preservation is a major component in data management according to Abduldayan and Abifarin (2020).Lack of ICT infrastructure and support services have been identified as some of the issues which hinders the management of technical research data. Avuglah and Underwood (2019) mentioned the absence of technical infrastructure as some of the challenge posed in the curation and sharing of research data in Ghanaian Universities.

Inadequate Expertise/Human Resource, Library operations are in transition and requires new set of skills. Therefore Technical University Librarians require skills to manage technical research data generated by the Technical Universities. Inadequate awareness on research data

management and skills have threatened the management of intellectual creativity (Joo and Schmidt: (2021), Chawinga and Zinn (2020) and Wang (2013). A study by Chiware (2020:402) identified the skills gap required by librarians to go beyond the traditional (cataloguing and classification, indexing, and as custodians of books) library operations.

Calarcob, Kuchmac and Shearerd (2016:2) also pointed to the kind of training curriculum offered at some of the library schools. This according to him do not prepare candidates with diverse expertise and knowledge required to address contemporary and trending research needs on management of technical research data. Avuglah and Underwood (2019) asserted skills and knowledge gaps as lapses in the development of RMD in some public University in Ghana.

SIGNIFICANCE OF THE STUDY

The study aims to conscientize the Technical University librarians on the varied data generated and how to manage them to promote invention and innovation. Such include: technical reports videos, diaries, artfacts journals, engineering practical, prototype and discoveries from laboratory Centres.

OBJECTIVES OF THE STUDY

The study aimed to assess the level of awareness in the generation and management of Technical Research Data (TRD) by the Librarians of the Technical Universities in Ghana. It had an objective to assess the level of awareness and the role of Librarians in the generation and management of technical research data by the Technical Universities in Ghana. The study also sought to explore the extent to which the management of Technical Research Data (TRD) has been embedded in the research strategic objective of the Technical Universities. Finally, it ascertained the benefit and challenges in the management of Technical Research Data by the librarians.

METHODOLOGY

This is an exploratory study which adopted the qualitative approach to explain the generation and management of technical research data which emanate from the Technical Universities of Ghana. The respondents for the study were all the Head librarians manning the Ten (10) Technical Universities' libraries. There was no sampling because all the Technical Librarians participated in the survey. Questionnaire (both open-ended and closed questions) was the instrument used for the data collection. The questions were segmented to cover the following: the bio data, awareness and practices on technical research data, the role played by the librarians, the benefits and challenges encountered. The questions were emailed to respondents via the monkey survey affording them the opportunity to access them remotely and at convenient times. Some of the librarians were contacted via Whatsapp as well. The Statistical Package for Social Science (SPSS) and excel were used to analyse the data.

STUDY FINDINGS

All the Technical University Librarians responded to the questionnaire resulting in (100% response rate).These are the Technical Universities based in alphabetical order: Accra, Bolgatanga, Cape Coast, Ho, Koforidua Kumasi, Sunyani, Takoradi , Tamale and Wa Technical Universities. The findings have been discussed as follows:

1) Level of awareness of Technical Research Data

All the Librarians were aware that a lot of technical data emanate from the Technical Universities since the focus is on applied and technological research as against classical research. The librarians also attested that management of technical research data play a key role in advancing invention and innovations. Further investigations is yet to be made on the level of awareness among stakeholders other than the librarians.

The study discovered the varying sources and formats of the data. Among them were ‘’workshop report, laboratory recording, discoveries, prototypes, speeches patterns, engineering practical centres amongst others. Data formats included ‘’, manuscript, photography, interviews, videos, audio, artefacts’’ amongst others (Northcentral University Library (2021). This the librarians had not given much attention.

2) Management of Technical Research Data (TRD) in Research objectives of the Technical Universities

The researchers sought to assess the extent by which the management of technical research data has been embedded in the research and development strategies of the Technical Universities. Fifty percent of the respondents (50%) indicated the use of the websites of the Universities to showcase the research output. Thirty percent (30%) indicated Institutional repositories to host the data. Twenty (20%) of the respondents indicated that the individual researchers store their own data. Although a number of them knew about repositories, majority of the journals were hosted on their websites.

Management of technical data goes beyond the repositories. It involves the processes involved in capturing primary data, discoveries, prototypes, patterns and findings from the laboratory centres, engineering practical centres amongst others. Data forms may include ‘’recording, manuscript, speeches, photography, interviews, videos, pictures, artefacts’’ amongst others (Northcentral University Library (2021). Technical data according to Stolen et al (2007) may be presented in any form or format which aids in development of innovation and invention.

3) Librarians’ role in managing Technical Research Data (TRD)

Figure Two (2) describes the roles performed by the librarians in the management of Technical Research Data. These were: engagement and awareness with key stakeholders (40%). Provision of infrastructure (30%), building human capacity (20%) and development of policies (10%). Creating the needed advocacy and engagement of key stakeholders such as faculty, students, finance directors, Registrars, the Council, IT departments amongst others about the importance of managing the intellectual creativity of the academic institutions is inevitable. This is because it requires a joint and concerted effort from all the University’s stakeholders (Johansson 2019). This corroborated the findings of Flores et al (2015), Glusker and Exner (2018) and Joo and Schmidt (2020) on the need for librarians to beef-up relationship building and user engagement to accomplish their mandate. Nevertheless infrastructure, capacity building and policies remain less low according to figure two (2).

PRESENTATION OF FINDINGS

Figure 2 Librarians role in Management of TRD

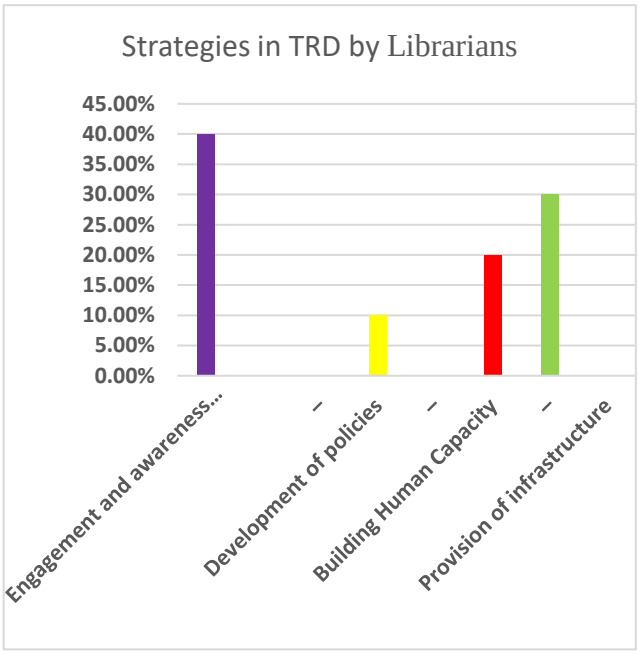


Figure 3: Benefits of Technical Research Data

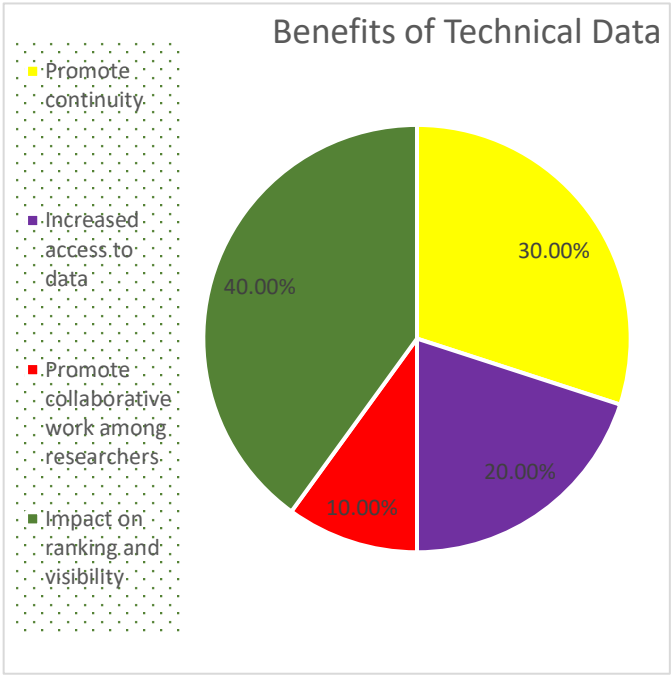


Figure 4 Challenges to the management of TRD

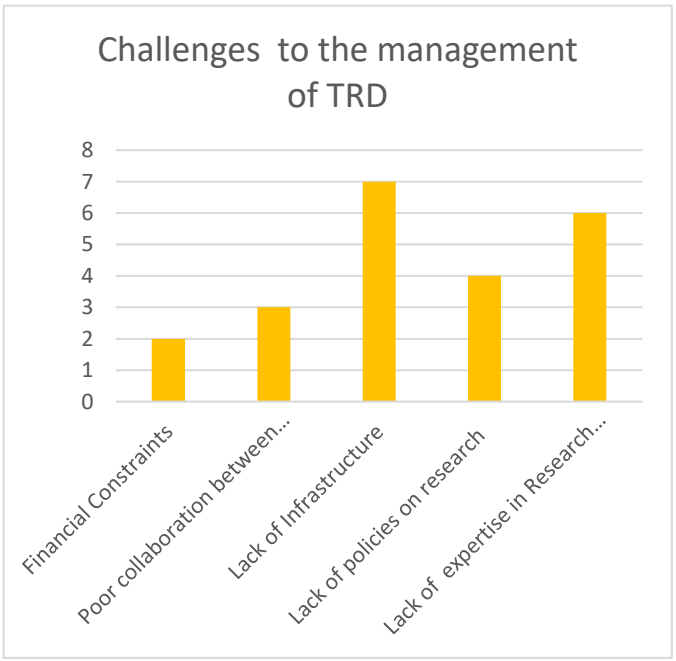
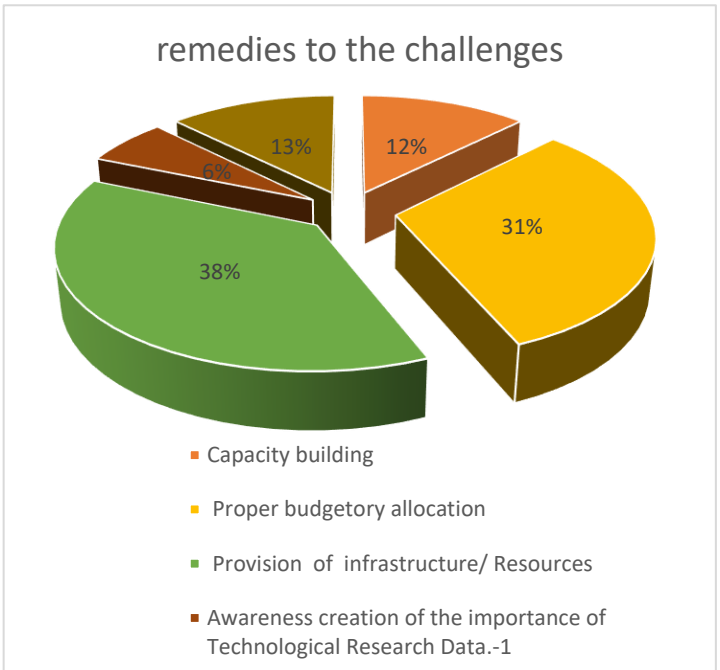


Figure 5 Remedies to address the challenges



4) Benefit of Managing Technical Research Data (TRD)

The figure three (3) represent the benefit derived in the management of Technical data. The following responses were provided. Impact on raking and visibility of the Universities recorded (40%), Continuity of research was endorsed by (30%) whiles increased access to data and collaborative work represented 20% and 10% respectively. A study by Chawinga and Zinn (2020),Walsh (2019), and Flores et al (2015) however revealed that the benefit included: continuity of research to foster invention and innovation.

The Technical Universities through dialogue and policies could commercialise inventions like the Bayh-Dole Act granted to Universities in the US. Such Act serve as motivational tool for Universities to be more accountable and good steward of their intellectual creativity. Universities in the US invest in research and its data which promote inventions and transfer technology from the lab to commercialisation ventures (Drexel University,2021). The same could be replicated to compel the Technical Universities to package research finding which will lead to invention through the generation and management of Technical research data.

5) Challenges Experienced by the Librarians in the Management of Technical Research Data

Figure Four (4) shows the challenges faced by the Librarians in the management of technical research data at the Technical Universities in Ghana. The challenges included, inadequate infrastructure (70%), Lack of expertise (60%) inadequate of policies on research (40%), poor collaboration between librarians and Stakeholders (30%) and financial constraints (20%). There were others such as inadequate capacity building and poor policies which leads to duplication or loss of data. A study by Abduldayan et al (2021), Chawinga and Zinn (2020) and Avuglah and Underwood (2019) corroborated on similar findings in their study at Federal

universities of Technology in Nigeria, University of Malawi and University of Ghana respectively.

Addressing the challenges of Managing Technical Research Data

Figure Five (5) showcases Respondents proposed remedies in cubing the challenges, Majority of the librarians indicated provision of infrastructure and resources (38%). This was followed by proper budgetary allocation (31%). Development and integration of Research policies (13%) and Capacity building for librarians (12%) respectively. Awareness creation to stakeholders (6%).Others were of the view of strong collaboration among the Technical Universities on development of centralised repository on technical research data. This shall propel the industry and private partners to utilise research discoveries and to identify gaps to address them. There was also the need for research policy for the Technical Universities pertaining to inventions (Flores et al 2015). Citing Kenney and Patton (2009) on the Bayh-Doly Act, Universities in the US were given the mandate to commercialise inventions. The Technical Universities in Ghana may consider such.

Bayh-Doly Act has been modified and adapted by other countries such as ‘’South Africa, India, Malaysia’’ concerning innovation policies. Additionally is the development of Intellectual property policies championed by The World Intellectual Property Organisation (WIPO) to mandate universities to place premium on intellectual data and research out as the main impetus to advance innovation and invention. The Technical Universities through the Technical research data can also develop policies to sustain research.

CONCLUSION

Majority of the Technical University Librarians were aware of the production of technical research data in the Technical Universities. Some libraries have made effort to establish repositories but less emphasis was placed on technical research data which comprises of artfacts, laboratory discoveries, engineering prototype amongst others. Findings revealed minimal engagement with stakeholders, inadequate infrastructure, skills gap, lack of policies on research and poor funding. Upscaling the skills of librarians in the Technical Universities on technical research data management has become necessary.

RECOMMENDATION

The study has provided the following recommendations in the management of Technical Research Data (TRD) to advance invention and innovation in Ghana

i. Upgrade the skills and competencies of the librarians in areas of digitisation, electronic resources management, data auditing, content management systems applications, Virtual Research Environments (VRE) support, Data visualization, data standardisation skills and Literature gap analysis. Others soft skills include communication skills, leadership and management competencies and monitoring and evaluation and fundraising and financial management skills.

ii. Collaboration among the Technical Universities in developing and sustaining a centralised database on technical research data. This will enable them to avoid duplication of research efforts and reinventing the wheel. Limited resources can be well directed towards demand-driven and critical research. There is the need to deepen collaboration between researchers and librarians to facilitate the generation of innovation and inventions which can be commercialized for the benefit of the society.

iii. Provision of research policies to strengthen University-Industry collaboration and protect and promote intellectual property rights as well as build innovative culture to stimulate commercializable research outputs. Technical Universities should be encouraged to specialise and focus on specific research areas in the national development plan.

iv. There is the need to provide infrastructure and tools for it implementation. These include scanners, cameras, storage devices, content management tools, software, research commons, etc.

v. The Technical Universities may consider the Bayh-Doly Act as a yardstick to motivate researchers on areas of innovations inventions.

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