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Original Research Article

Computer Integrated Manufacturing sub-systems in Technical and Vocational Education and Training: A bewilderment for Stakeholders in Polytechnics in Zimbabwe

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Abstract

The embracing Computer Integrated Manufacturing (CIM) sub-systems are indispensable for sustainable development of entrepreneurship skills of students in Technical and Vocational Education and Training (TVET). There seems to be a dearth of requisite skills in Polytechnic students in Masvingo Province to measure up to the expectations of industry in this technological era. A case study of a polytechnic college was carried out to assess the barriers that militate against students' acquisition of full training in accredited TVET programmes. The study employed the qualitative approach which focuses on the interpretive paradigm. Five students, five lecturers, four college administrators and three captains of industry were purposively sampled to participate in semi-structured face to face interviews and participant observations. Results revealed that there are resource constraints and physical infrastructure inadequacy as well as mismatch between industry and training institutions in the provision of indispensable CIM software packages. The results also showed that not every lecturer is capable of using CIM sub-systems during teaching and learning besides having been staff-developed. The study recommended that TVET lectures be extensively condensed on the acceptance and use of CIM technology so that they become capable of using such technologies during teaching and learning taking cognisance of the 21st Century industry expectations. There is a need for the college through both government agencies and non-governmental organisations to initiate and mobilise resources to sufficiently equip TVET colleges with technological devices and indispensable CIM software packages. The training institution is recommended to network for collaboration and partnerships as well as starting innovation hubs to inform campuses, companies which would produce the same services that the industry is providing.

Keywords: Computer Integrated Manufacturing sub-systems (CIM sub-systems), TVET, sustainable development.

INTRODUCTION

The teaching of the technical and vocational subjects is widely perceived as a gateway to economic emancipation of common citizenry of many nation states. Thus it is indispensable to develop the requisite attitudes, knowledge and skills for sustainable development through Technical and Vocational Education and Training (TVET). TVET has the prospect of sustaining individuals with skills for economic empowerment, participation and functioning. The inclusion of technical and vocational subjects in education is a starting point of creating numerous opportunities for students when they leave higher and tertiary education. The global view of TVET has significantly changed to assume technological skillset in sustaining returns on outcomes and goals of such a system. Entrenched in applying educational technology are integrated computer programmes that drive TVET towards producing quality graduates with skills for employability.

The Global Education 2030 Agenda through Sustainable Development Goal (SDG) 4 on Education Quality aims to promote life-long learning opportunities for all in skills development for employability (UNESCO-COL, 2017).

Internationally, there are calls for transformation of TVET's role, in the conceptualisation, governance, funding and structural organisation to ensure that the sector is capable of responding effectively and efficiently to socio-economic sustainable transformational challenges of the 21st-century world (UNESCO –COL, 2017).

The Asian experience has shown that the recent TVET trend is a shift from traditional vocational skills development towards expanding training in information and smart learning by using computer driven technologies (Kim, 2018).

African Union in preparation of Second Decade of Education for Africa, 2006 – 2015, drafted a plan of action which acknowledged the significance of TVET programmes anchored on information and communication technology due to constantly changing labour market demands. The central effort to foster sustainable development in Africa has in its making TVET programmes for its relevance in employment creation, poverty reduction and improvement of livelihoods (African Union, 2012).This prompted the convening of capacity building initiatives to contribute towards refocusing TVET specifically on appropriate policy options that would create new dynamics for technical and technological training in Africa.

There has been a great concern from captains of industry on the competency levels of TVET graduates with regards to expectations of the industry (Mabhanda , 2017). Technology use in teaching and learning has not been transferred to contribute to industry because of a wide range of constraints .To avert some constrictions in computer literacy skills Zimbabwe's Office of the President and Cabinet(OPC) launched a campaign to provide institutions of learning with computers and auxiliary equipment (Musarurwa, 2011).This ensued in Polytechnics benefitting and accordingly enabling them to utilise computer integrated technologies in the teaching and learning process. Surprisingly there is little audit trail to ascertain how far the equipment has been put to good use.

A Belgian non-governmental organisation VVOB carried out a needs and situational analysis survey on the use of Information Communication Technologies (ICTs) in teacher training colleges and Polytechnics. VVOB identified a gap in the use of ICT in teaching and learning at Teacher Education Colleges and Polytechnics in Zimbabwe, which stimulated the rolling out of a College Information Technology Enhancement Programme (CITEP) aiming to capacitate lecturers towards acceptance and use technology in the foregoing institutions (Musarurwa, 2011).

This is evidenced by Mabhanda (2017) arguing that for effective teaching and learning in TVET there should be continuous training of lecturers so that they create relevant skills and have to update their technology application so as to teach and train students with the same equipment found in industries. This initiative is perceived to create harmony between the training curriculum and the needs of industry since the lecturers will be acquainted with latest technologies as obtained in industries.

Interestingly, the rate at which institutions of learning have embraced the use of ICTs is extraordinary, but it has not matched with an equal effort by tutors hence TVET students have been less exposed and trained in using such technologies (Mabhanda , 2017). Evidently, this has created a mismatch for lecturers who are knowledgeable with ICTs and e-learning in response to the demands of technology. This is worrisome since the supposedly equipped tutors have not appreciated the use of computer integrated technologies in the teaching and learning which exposes the competencies of those in positions of teaching.

The outcomes in TVET graduates in Polytechnics are that they complete accredited programmes yet cannot measure to the expectations of industry in technological prowess. This study is interested in Computer Integrated Manufacturing subsystems which are the combination of an entire manufacturing enterprise by using integrated systems and data communication attached with new administrative philosophies with the aim to improve structural and personnel efficiency (Wu et al., 2000). CIM is renowned in dedicated software packages such as Computer Aided Design (CAD), Computer Aided Manufacture (CAM) and Computer Aided Engineering (CAE) among other islands of automation. Applying CIM sub-systems contributes to the modern skillset commensurate with additive or smart manufacturing driven by artificial intelligence and machine learning. The underlying principle for most CIM sub-systems is in designing, manufacturing and engineering processes which precedes the outmoded manual practice. Design elements and attributes can easily be synchronised in CIM sub-systems for integral product realisation through simulations, modelling and design, job tracking, inventory control and material handling among other functions. With these ever evolving technologies, engineering and construction programmes in Polytechnics should be grounded in the use and acceptance of CIM sub-systems in teaching and learning so as to produce a desired graduate for employability .However there is suggestive evidence of the mismatch between industry world and what is taught in the institutions of learning with reference to acceptance and use of CIM technologies. The big question is; what are the obstacles in embracing Computer Integrated Manufacturing (CIM) sub-systems for sustainable development in TVET in Polytechnics?

The aim of the study is to explicate the obstacles in embracing Computer Integrated Manufacturing (CIM) sub-systems for sustainable development in Technical and Vocational Education and Training (TVET) in Polytechnics.

RESEARCH METHODOLOGY

The study used a qualitative approach which focuses on the interpretive paradigm. It seeks to understand people's interpretations in a natural setting in which they exist (Lune and Berg, 2017). The basis of it lies in the interpretive approach to social reality, and in the description of the lived experiences of human beings. The goal, if at all of the qualitative tradition, is to have a 'deep understanding of the particular'(Lune and Berg, 2017; Mohajan, 2018; Berg, 2009; Zireva, 2013). A case study was used as a research design because it is an empirical inquiry which gives emphasis on contemporary issues within the confines of the lived experiences (Berg, 2009; Zireva,2013). Five students, five lecturers, four college administrators and three captains of industry were purposively sampled to participate in semi-structured face to face interviews and participant observations. Data obtained were presented using themes and excerpts since this encompass documenting real events, recording and observing behaviour (Neuman, 2003). The study upheld the trustworthiness through member checking and prolonged engagement with the participants. The ethical considerations in this study were maintained through values of providing for privacy by giving protection and the dignity of respecting the views of the participants all the time (Clough and Nutbrown, 2012). For the purposes of anonymity the participants were coded as L1-5(Lecturers), S1-5(Students), A1- 4 (Administrators) and C1- 3(Captains of Industry).

RESULTS AND DISCUSSION

The collected data are presented and analysed in themes. The content covers critical and well selected thematic areas. Among other emerging themes, these include use of Computer Integrated Manufacturing (CIM) sub-systems, types and rationality of CIM sub-systems in teaching and learning, capabilities of lecturers in using CIM sub-systems and mismatch between the institution of training and industry.

Use of CIM sub-systems

The study looked at how CIM sub-systems were used during teaching and learning by the college. The interest was also focused on how these technologies were used by the industry during production. The aim was to find out how participants use these technologies in the discharge of their mandated obligations. The use of CIM sub-systems forms the core of this study since it could generate information which points to both existing and perceived obstacles in embracing such technology for responsive TVET.

The study using an interview sought to find out how participants use CIM sub-systems and it emerged from the collected data that some of the participants were using the technologies and others were not. Their responses were:

A 1*: We use Archi-CAD in all engineering courses though I am not certain about the level of content mastery by our lecturers since this is relatively new in our curriculum.*

A4: We use computers in all subjects which require computers. There are a lot of applications for specific areas. Computers are used as an instructional and teaching aid to beam notes and diagrams.

Administrators acknowledged the use of ICTs but were not certain about competences of lectures on specific CIM sub-systems .Theirs was a generalized view.

On the use of CIM sub-systems one of the captains of industry postulated that "We use them for stock inventory and assembly line. Due to our work we synchronize activities which are run through enterprise resource planning in terms of bill of quantities and raw materials management for replenishment purposes".

Lecturers reacted as follows: In the electrical department, we introduced a subject called Auto-CAD and each and every student should go through it .In drafting and designing, we have got dedicated software such as Multism, Proteas, Ego. We go into the laboratory while demonstrating using PowerPoint presentations.

We use computers for teaching, planning, scheming among other tasks .We have a newly introduced subject called Auto-CAD .We require typed assignments from students which will enable them to learn using these packages . I use a projector to present my work.

As for the students one of them lamented:

We got time for theory as we went to the computer laboratory for practice. We were taught the basics. Lecturers theorise more than practice when teaching us.

Some participants were not using CIM sub-systems since they were not articulate enough on the usage of such technologies .C3 argued: *We have zero usage of CIM sub-systems and have no fiscal capacity to such technology since we need license to keep with revised and latest versions.*

The data gathered reveal that administrators knew how CIM sub-systems were being used in teaching and learning though it was counterintuitive since they doubted the capability of lecturers in applying such technology in lectures .Students also concurred that CIM sub-systems were being used during teaching and learning though with some reservations on the quality of practice by the instructors .Lecturers were more specific about the usage of such technologies as they outlined the activities they used the sub-systems for. This implies that CIM sub-systems are acknowledged and accepted at this institution of higher learning.

Some captains of industries acknowledged the use of such technologies in production or services they offer but one of them spoke about having no budget capacity to use such technologies due to the cost of renewing and purchasing licenses for dedicated CIM software. In this case capacity can be linked to human capital's skill set, equipment and health financial positioning of an organisation in incorporating these technologies.

Observations were made to check whether there were available computer related technologies for use by students and lecturers at this polytechnic. The researcher looked at all computer integrated technologies which can be used for different teaching and learning programmes. Through observations the following devices for teaching and learning were seen; desk tops, laptops, interactive boards, digital projectors, printers, televisions, radios, cell phones, vehicle diagnostic machines, load testers and Programmable Logic Controllers.

The above data revealed that there are computer integrated devices that can be used in teaching and learning at the institution however the quantities were not verified. Quantifying the number of computer related technologies would have shed more light on the adequacy of the devices and technologies against the number of students who use such technologies.

Capability of lecturers in using CIM sub-systems during teaching and learning

The assessment of barriers in embracing CIM sub-systems for sustainable development in TVET is comparatively anchored on the calibre of lecturing staff with regards to level of competence in technology. The participants were requested to explain how capable the lecturers in using CIM sub-systems during teaching and learning were. The participants' views revealed a mixed feeling with S1 and S2 agreeing on the capability of lecturers through with misgivings:

I doubt their capability because at times they dismiss us claiming that we should learn from others especially when we seek clarity on how to go about it with other programmes such as CorelDraw and AutoCAD.

At National Certificate level they theorise but at National Diploma they demonstrate but some lecturers confess that with Autocad they lag behind.

The situation is further clarified by S3 who opines that, *Some lecturers are knowledgeable yet some have little if any knowledge in using engineering software. Those who know are few.*

One other participant S5 informed the interviewing team:

Not all of them are capable, maybe 1 out of 10.The problem is we do basic computers .We have computerised wheel alignment machines but they are not using it which I feel is due to inability on the part of lecturers to teach us those computerised skills.

The lectures had this to say about their level of competence in using CIM sub-systems

L1:*I will give myself 10 on a scale of 1-10.I am very conversant since I am into computer programming, networking and software. Recently I have been to China so I am quite exposed in IT [Information Technology]but on CIM subsystems I am still familiarising myself with them. I am working on improving my Auto CAD skills and I cannot exude confidence in teaching this subject besides being a specialist in IT.*

L2:*I don't have proper knowledge in information communication systems. It is difficult to use that softwares. I need to be staff developed.*

L3:*I have a little bit of a challenge in AutoCAD but for Muiltism, Proteas… I am well versed .College involved Auto Desk to staff develop lecturers in Auto CAD but hesitancy in using it has been the order of the day.*

L4:*We were trained and have completed short courses in Auto CAD and CITEP but for the impact of such initiatives there is need to have positive interest and right attitude .Though we were trained some of us are still struggling in using computers.*

Probing further, on capabilities of lecturers in using computer integrated technologies administrators' views were:

A 1: *Lecturers have been trained in Partnership with Auto Desk. All lecturers are trained but we have not done a thorough evaluation to judge their competence levels as expected in their various departments.*

A 2: Lecturers *are capable because most of them have computer literacy skills. For CAM/CAD you have to consult with the Mechanical Head of Department. Auto Desk was here to train lectures.*

A 3: *I am confident that lecturers are up to date with computer literacy skills since College Information Technology Enhancement Programme (CITEP) helped the old generation through training so by now they have the knowledge of using computers in their areas of speciality.*

A 4: *Some lectures are capable but others are not though they were staff developed. Issues of computer literacy depend on attitude as some can resist technology so as to maintain the status quo.*

During observation there were some lecturers who were using computer related technologies during teaching. In one of the departments the lecturer was demonstrating using an application called Multism to the class and some students were given the room to attempt using the application.

In other instances lecturers were using the traditional instructional approach of delivering lectures using the lecture method even on content which required the use of basic computer visuals so that students could benefit both in audio and visual appeal. Some lecturers showed a negative attitude in embracing the use of computer related technologies as they felt it took a lot of time to collect all the needed hardware to present information hence preferring manual approach.

The data showed that students, lecturers and administrators were divided in asserting the aptitude level of lecturers in using CIM sub-systems during teaching and learning. Some lecturers were confident enough of their proficiency due to the fact that Information Communication Technology is their area of specialisation but were not much competent in CIM sub-systems relegating it to engineering and construction departments. Also those who benefitted through staff development programmes were confirmed capable of using such technologies but there was no evaluated and garnered evidence to endorse their acceptance and use of computers in particular CIM sub-systems.

Some lecturers admitted that they lacked some skills in certain applications besides the fact that they were supposed to teach with such important applications. Other lecturers accepted that they needed staff development to enhance their skill set in CIM sub-systems.

In agreement, were some students who pointed out that some lecturers were capable of using CIM subsystems but others were not. The word 'few' referred to the number of lecturers who were embracing the use of computer integrated technologies. Surprisingly ,administrators assumed that lectures were capable of using computer integrated technologies in teaching and learning but evidence from other participants including one of the administrators indicated that some lectures were not capable and had attitude issues towards the use and acceptance of technology.

Mismatch between training institution and industry

The study further inquired on the mismatch between training institutions and industry. The lecturers and administrators were asked about this due to their experience in evaluating accredited programmes. The captains of industry were also asked about the mismatch because they are the beneficiaries of the trained students or graduates. Most of the participants agreed that there was a mismatch between training institution and industry and these were their views

A 1 lamented that, *There is a disparity between us and industry since some of the machines we are using are out-dated. If we cite engineering, we want CNCs (Computer Numerical Control), lathing and shaping machines. We require equipment, materials and consumables which we cannot afford at our institution yet they form the core of the courses we teach.*

In support of the disparity between industry and polytechnic what was said L1was corroborated by L2 who posited that:

There is a gap between the training institution and industry. We have the technology that we only talk about yet that equipment is found in industry. Industry is going at a faster pace than college so the government should support such technology projects so that we keep abreast with trending technologies.

There is higher expectation from both training institutions and industry. We train students in Systems Analysis but industry is there to make money so they do not have time to train students. Industry should come here [at the college] to train students for specific skills which they so desire in their work environments.

Concurring L3 was of the view that:

Industry is using Programmable Logic Controllers (PLCs) yet we are still using hard wiring .Syllabus requires us to teach VCR or Black and White TVs which are things that we cannot find in industry .In crafting syllabus we need to involve them [industry] because it seems the syllabus has been overtaken by events [technology].We need to invite industry to showcase their products as well as giving us tips. Also the idea of situating companies within training campuses helps in providing required skills.

The captains of industry had their views on mismatch between training institution and industry.

C 1: *Our education system just give people the academic knowledge, it does not give as much as you need. Within the starting weeks there is a lot of teaching and learning [induction] and at this phase output is very low then it picks with time. Graduates come here without requisite skills in using the technologies that we have here. Besides induction we train these graduates for work through mentoring for skills transfer.*

C 3: *Wrong curriculum.*

The above views are in agreement with the submission that there is a mismatch between training institutions and industry. Major issues which were raised had to do with pitiable funding, lack of equipment and reluctance by training institutions in adopting, using and accepting technology. The issue of overtaken content in syllabus and wrong curriculum were also cited as areas of mismatch. There was also a view of production versus training, where industry was cited as business oriented with limited if any time to train students in essential skills. The other view was on students gaining more of academic knowledge than competencies thereby creating a mismatch on expectations on competences and skills for employability.

However there was a contrasting view from one of the administrators, A 2 on the mismatch between training institution who argued:

I beg to differ; we have got part of training which specifies skills they have to do. We have got skills profession schedules which are written by the industry so I do not see any mismatch in that. We do programming here, there is a prototype and in industry they do the actual thing.

In view of the above assertion the skills profession schedules creates a synergy between the training institution and industry. Skills profession schedules endorse the collaboration of stakeholders in coming up with required skills for the industry.

The observation on the mismatch between training institutions and industry was made. Most of the disparities raised by participants were confirmed. The observations made on both the training institution and industry with regards to skills mismatch indicated the following:

Observation at the Training Institution: *The workshops are well built with working tables and spaces adequate. Most of the workshops were housed with old manually operated machines. These machines were said to be broken down since they were too old for 21st Century competitive training. A few of the workshops were observed to have computer driven or commanded instructions machines which were fully or partly automated.*

Considering the observed number of students who were working on one of the vehicle diagnostic machines the student ratio to machine or equipment was untenable. Students were scrambling to be closer to the machine for them to have access and opportunity to see how it is operated.

Other workshops had manual drawing tables which students were using. The same task was supposed to be done on a computer using Auto CAD but they insisted on a manual approach.

Observation in Industry:

The workshops were reasonably sized with equipment fully occupying the working spaces .Most of the equipment was relatively new with some having programmable instructions.

The machine operator was one per specified machine working with some few assistants .These assistants included students on attachment who were observed to be doing less of the operations but being mere followers and observers.

The machines were running with minimum downtime so as to meet production targets so students were expected to learn as the operations were in progress.

One of the companies had a draftsman who was drawing using at least versions of Autocad and MITEK softwares for truss design and drawing. The drawing machines which are manually operated were covered by a cloth and the cloth had visible dust accumulating on top showing that it was no longer in use.

In analysing the above observations it was seen that industry was moving with the time in providing competitive and modern technologically driven equipment. The training institutions were lagging behind in adopting technologically driven equipment and even servicing the already existing ones. As raised by one of the lectures that industry is for production it was observed to be true since all critical machines were being operated by a specialist who had no time to teach students on attachment as they were onlookers. Industry strives to make a return on investment so it avoids unnecessary production down time so as to maximize on the knowledge of their specialists.

Discussion

The study established that lecturers rarely use CIM sub-systems in teaching and learning. Most of the participants failed to articulate how they use dedicated applications for CIM sub-systems citing ICTs as a different subject from those they teach. Only a few were able to state the CIM dedicated software by their names. This indicates lack of ICT literacy on the part of lecturers. ICT literacy is an intellectual process, encompassing the aptitudes and dispositions needed to appreciate the link between technologies in their heterogeneous formats (Zainab et al., 2002; Mangwiro , 2016) .These findings tally with literature observation that the most commonly cited reason for lack of technology implementation in the institutions of learning has to do with inadequate professional development and training on the part of instructors ,lecturers and tutors (Ertmer et al., 1999). There was lecturer hesitancy in mentioning their competence level on using and accepting CIM sub-systems technology because it was referred to as a relatively new area with an industrial inclination than training. Lecturers were hesitant to share their expertise level in using CIM sub-systems probably due to their traditionalistic view which does not readily accept innovations. Tate and Copas (as cited in Zireva, 2017) argue that traditionalistic educators are afraid to be pushed in a zone of incompetence by their students.

In this regard TVET lecturers in Polytechnics have to be extensively staff developed on use and acceptance of technology so that they become capable of using such technologies during teaching and learning taking into cognisance the 21st Century industry expectations. There is need for the polytechnics to avail opportunities where TVET lecturers get to be trained and tested for competency on using CIM sub-systems so that they teach with the available technology tools so as to meet the required technological skills for employability.

The study established that polytechnic lecturers lag behind in ever evolving industrial experience and technical know-how with regards to technological changes and demands .Regarding industrial attachment, Wykes (2018) and Mabhanda (2017) argue that TVET lecturers need to be exposed to the workplace and undergoing frequent and related training on an on-going basis so as to ensure that they keep up-to-date of both structural and technological changes in the workplace and subsequently be able to adapt their training programmes accordingly.

In view of this, exchange programmes with the industry are very important for technology and skill transfer. Also professional development hours for practicing lecturers should be enforced so that they continually upgrade their skills in industry with the view of adapting to the modern training methodologies.

The findings of the study also indicated that most of the lecturers were not capable of using the CIM sub-systems particularly Autocad. This does not withstand the fact that staff development programmes were provided through Auto Desk and CITEP for Auto CAD and computer literacy respectively. This resonates with reviewed literature that if the teaching staff are not provided with continuous and effective professional development on new technologies, they will not be capable of using technology to its full potential(Johnson et al.,2014).This could be the reason why some lectures lag behind in using and accepting technology which requires continual up-skilling and re-skilling to broaden and keep up with latest knowledge and skills in science and technology through blended learning such as self-study ,trial and error and physical classes .

Evidence from the findings revealed that traditional didactics still take centre stage as compared to modern facilitative teaching trends such as online and blended learning. Literature concur that teachers do not actively integrate new computer technologies in teaching since it is often seen as a teaching and technological experimentation which is outside the scope of their job descriptions (Zainab et al., 2002).This exposes underlying cause for the neglect of CIM sub-systems since lecturers have the option of choosing between the traditional and current didactics. It is in this view that tutors never cease to be pushed to the zone of incompetency as they feel exposed to their academic misgivings which breeds negative attitudes. These lecturers are what Ganzel (as cited in Zireva, 2017) describes as resistant educators as they so dearly believe in miseducative experience. Miseducative experience is a set of conditions or procedures that impede continual professional development. In this regard negative attitude and resistance in accepting and using technology may be a result of miseducative experience by lecturers.

In addition, TVET administrators and lecturers are inexperienced with the new technologies and methodologies, so they require special training in using these in their course areas and in the workplace and both physical and virtual classrooms (UNESCO-COL, 2017).Literature further reveal that current global thrust towards developing the requisite attitudes, knowledge and skills in educational practitioners is achieved through introspective dispositions. Introspection involves the questioning of own practices with the aim of improving own practice (Zireva, 2017).

The study revealed that the Polytechnic does not have that capacity to equip the laboratories and workshops with CIM sub-systems hardware and software components. This is a technological barrier which is a reflection of digital divide, lack of access and limiting infrastructure. According to Nyamadzawo (2011) the low levels of ICT diffusion in Zimbabwe contributes to restraining the prospective for digital solutions in enhancing sustainable development. The training institutions were lagging behind in adopting technologically driven equipment and even servicing the already existing ones. The mismatch is partly caused by misaligned priorities between industry and training institutions and this can be solved by bringing experts from the industry that come for skills transfer. Mabhanda (2017) asserts that by allowing experts from industry to teach at TVET colleges on a part-time or occasional basis, helps in touching real issues that the labour market so desire leading to meeting the expectations of industry. Staff and management of Technical and Vocational institutes should develop and implement strategies that strengthen access and linkages to industry (SACCI, 2011). There is a need to have a Public-Private Partnership (PPPs) strategy for skills development. Funding for retooling, hardware and software and architectural structures can possibly be availed through PPPs which enhances skills training.

Curriculum issues also contribute to alleviating the mismatch between industry and training institutions. Curriculum development is an inclusive process which requires input of various experts. Industry in this case should be actively involved in both curriculum development and evaluation so as to bridge the gap that arises due to long intervals of programme reviewing period. The argument is that programmes that blend college - and work-based learning illustrate the type of common engagement that public and private sides can achieve in skills development policy and practice which culminates to fulfilling and balanced curriculum (Jomo , 2020).This becomes a palatable approach in synchronising the training programmes with skillset required for employability. Polytechnics are recommended to start innovation hubs informed of campus companies which would produce the same services that the industry is providing. Campus companies would teach hands-on skills in technology use which would sufficiently close the gap of mismatch between industry world and what is taught in the institutions of learning. This would also aid in improving curriculum so that it becomes responsive to the societal, technological and economic needs of the country.

CONCLUSIONS

From the findings of this study, it can be concluded that the Polytechnic does not have adequate CIM sub-systems resources vis-à-vis student enrolment. The constraint of resources prohibits facilitative teaching which is an integral component of technology skills transfer. This suggests that graduates cannot be sufficiently equipped with requisite attitudes, knowledge and skills in using dedicated CIM sub-systems software and applications. Additionally, this study concluded that there is severe lacking for tech-savvy lecturers in applying CIM sub-systems and related technologies .Most of the lecturers trained before the dominance of robust technological interventions in designing ,annotating, analysing, computing, optimising and integrating manufacturing data leading to resistance to change by maintain status quo. While the Polytechnic management and leadership embarked on staff development in ICTs such efforts were general and not specific to a wide range of CIM sub-systems and can be seen as a misinformed priority as lectures testified to their inadequacies in that regard. The study also concluded that there is need for retooling of CIM sub-systems hardware and software equipment to meet the expectations of additive and smart manufacturing as obtained in industry .Retooling would make the Polytechnic competitive and responsive to the critical technology skills required for employability . The study also found out that most lecturers are not fully acquainted with the knowledge of using CIM sub-systems in teaching and learning situations. Applying educational technology is an adaptive instructional approach in modern teaching and learning for the promotion of self-study and self – paced learning. There was evidence of negative attitude by lecturers as they exhibited little if any interest on matters which concern the use and acceptance of CIM sub-systems technology preferring traditional didactics. The study further indicated that there was a mismatch between the industry world and what is taught in the institutions of learning with reference to acceptance and use of technology. Industry is far more equipped with least technologies as compared to the Polytechnic leading to a disparity in progressive and facilitative skills transfer to the graduates. The study further indicated that there was a mismatch between the industry world and what is taught in the institutions of learning with reference to acceptance and use of technology. Industry is far more equipped with least technologies as compared to the Polytechnic leading to a disparity in progressive and facilitative skills transfer to the graduates.

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