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Industrial attachment and human capital of higher education students: Constraints of Ghanaian Technical Universities

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Industrial attachment and human capital of higher education students: Constraints of Ghanaian Technical Universities

Abstract

Purpose - The paucity of empirical evidence on the limitations of the industrial attachment programme of technical universities for enhancing students’ human capital in Africa tend to thwart concrete policy options.

Design/methodology/approach - We used the convergent mixed methods including 594 surveys, two focus groups and in-depth interviews to assess and accentuate the research gap in this study.

Findings - Evidence of constraints linked to the industrial attachment programme for developing students’ human capital needs include limited funding, logistics and incentive for supervision, incompatible placement, exploitation and sexual harassment of students. Insufficient duration and intrusion of the industrial attachment programme due to labour unrests, inadequate collaboration and fears of student interns breaching organisations’ confidentiality policies were also found to hinder the programme.

Originality - We have delineated empirical evidence on the constraints of the industrial attachment programme of Ghanaian technical universities to inform policy decisions on the planning, operations, funding and evaluation of the programme in collaboration with industry and government.

Research limitations/implications - The study’s dependence on participants’ perspectives has the possibility of being characterised by recollection prejudice. The comparatively limited scope and size of the study participants create concerns of representativeness and generalisability of the study outcome.
Practical implications - The outcome of this study could yield significant practical implications for the planning and operations of the industrial attachment programme of tertiary institutions. It also provides information which could serve as the basis for future research and comprehensive evaluation of the programme’s planning and implementation.

Keywords: Limitations, Human capital, Industrial training, Experiential learning, Technical universities,

1. Introduction

In the next decade, key aspects of the global development agenda as accentuated in the 2030 sustainable development goals (SDGs) are to guarantee quality education (SDG 4), ensure decent work and economic growth (SDG 8) and enhance industry, innovation and infrastructure (SDG 9) (Leal Filho et al., 2018; United Nations (UN), 2015). For this reason, both comprehensive and technical universities in Ghana have been established as institutions of higher learning with the mandate to conduct research, impart knowledge, provide community services and confer degrees on graduands. Comprehensive universities provide higher education in a wide range of disciplines without limitation while technical universities focus on providing technical and vocational oriented higher education.

Technical and vocational education and training (TVET) based on industrial attachment has become an effective strategy in universities and polytechnics in collaboration with industry to enhance quality education by improving students’ human capital potential for the world of work (Adjei et al., 2014a; Nunfam et al., 2015). Industrial attachment built on experiential learning is a valuable approach for equipping students, especially in TVET oriented institutions, with productive practical skills, knowledge and attitudes for entrepreneurship, self-employment and/or employment (Nunfam et al., 2015; Nunfam et al., 2021). Industrial attachment is conceptualised as a technical skill training initiative with the goal of bridging the gap between
the world of theoretical enterprise and the world of applied work (Lauber et al., 2004). It is also related to a process of anticipatory socialisation which presents students with a practical opportunity within an industrial setting to observe, learn, experiment and implement theoretical knowledge in practice (Ahmed, 2019; Kolb, 2013; Nunfam et al., 2015). Students with industrial attachment experiences tend to transit more smoothly from the academic world into the world of practical work by developing and/or improving on their work-related skills (e.g. critical thinking, problem solving, communication and human relations) and enhancing their job appointment opportunities (Ayarkwa et al., 2012; Adjei, 2013; Adjei et al., 2014b).

As one of the most cited theoretical frameworks, Kolb’s experiential learning theory was used as the basis to explain industrial attachment as a collaborative learning approach by which students improve on their human capital for the world of work (Heath et al., 2021; Heslin and Keating, 2017; Morris, 2020; Sato and Laughlin, 2018). According to Kolb (1984, p. 38) “learning is the process whereby knowledge is created through the transformation of experience”. Experiential learning theory centres on students learning based on experiences embodied in curriculum experience in a classroom setting and/or an incidental learning out of a classroom environment (Ahmed, 2019; Kolb, 2013; Kolb and Kolb, 2005). Experiential learning refers to a process in which students acquire knowledge, skills, attitudes and values from direct experience (Gross and Rutland, 2017). Hence, industrial attachment based on experiential learning provides the opportunity for students to (1) apply knowledge directly, (2) obtain real time training and response, (3) benefit from teamwork and communication skills, and (4) reflect on learning outcome personally or with others (Brookfield, 1983; Henderson et al., 2004; Jarvis, 1987; 1996; Kamis and Khan, 2019; Smith, 2005).
Following the work of Adam Smith (1776), the theoretical origins of human capital are often ascribed to scholarly works (e.g. Schultz, 1961; Becker, 1962) in the mid-20th Century. Conceptually, Becker (1964) refers to human capital as investment in, and returns to, training and education while Schultz (1961) considers knowledge and skills as forms of capital which substantially emanate from planned investment. Human capital is also interpreted as the stock of knowledge, skills, abilities and other characteristics (KSAOs) embodied in persons that enable the formation of individual and socioeconomic well-being (Ployhart and Moliterno, 2011). Similarly, human capital is considered as competencies demonstrated at the individual level (Winterton, 2017) and core competencies embodied in an organisation at the institutional level (Prahalad and Hamel, 1990; Winterton and Cafferkey, 2019). At the national level, qualification is basically used as a proxy to measure human capital in contrast with the proportion of workers with lower, intermediate and higher qualification (Healy and Côté, 2001; UNESCO, 2012). Thus, investment in human capital at the individual, organisational and national level tends to build, maintain and retain a reliable and viable stock of human resources. Like financial and physical assets, human capital embodied in labour significantly contributes to an organisation’s productivity, competitive edge, employability, performance and profitability, and in general, a country’s socioeconomic development (Garavan et al., 2001; Nafukho et al., 2004; Schultz, 1961; Schultz, 1993). It also symbolises the combined intelligence, skills and expertise which provides an organisation with its distinctive character that enhances its corporate image and human resource policy decisions (Roos and Jacobsen, 1999).

Extant literature on studies including TVET which appraised the linkage between higher educational institutions and industries for training of faculty and students; innovation, research and development; knowledge and technology transfer; project funding and scholarship;
consultancy; and product commercialisation in developed and developing countries have yielded varied and evolving results (Addy and Adabor, 2021; Adjei et al., 2014b; Lin and Bozeman, 2006; Salleh and Omar, 2013; Woitrin, 1990; Winterton and Turner, 2019). Studies in the last decade suggest there is a rising research interest in the relationship between academic institutions, graduate employability and the world of work with the goal of enhancing their mutual interests (e.g. Nabulsi et al., 2021; Salleh and Omar, 2013; Winterton and Turner, 2019). However, studies which sought to assess the constraints of the industrial attachment programme of tertiary educational institutions to improve the human capital of students, particularly in sub-Saharan Africa, are inadequate (e.g. Addy and Adabor, 2021; Adjei et al., 2014b; Ayarkwa et al., 2012).

In view of this research gap in TVET-related studies, the research aims to answer the question: what are the constraints of the industrial attachment programme of technical universities in developing the human capital potentials of students? Hence, this study sought to highlight evidence of limitations associated with the industrial attachment programme of technical universities in Ghana in improving the human capital potentials of students for the world of work. The outcome of this study has the potential of yielding practical and policy options with significant implications for the planning and operations of the industrial attachment programme of tertiary institutions. It would also provide important information which would serve as the basis for future research as well as a comprehensive evaluation of the programme’s planning and implementation.

2. Materials and methods

2.1. Research design, population and sampling
Based on the pragmatist research approach, the convergent mixed method research design including a descriptive cross-sectional survey was employed to assess the research problem at a point in time (Creswell and Plano Clark, 2017; Nunfam, 2021). Both surveys and interpretive phenomenological research strategies were used to assess the constraints of the industrial attachment programme of technical universities in improving the human capital of students for the world of work (Creswell, 2013; Mertens, 2015). The study participants were stakeholders comprising senior members and students at technical universities and members of professional associations and industries who benefited from the industrial attachment programme.

Purposive and simple random sampling were used in selecting a sample of 616 respondents. We used purposive sampling by selecting information rich cases who were worthy of in-depth study and provided detailed insight into the constraints of the industrial attachment programme (Emmel, 2013). Hence, four technical universities were purposively selected due to their reputation in implementing the industrial attachment programme and were positioned in metropolitan areas with various industries and professional bodies. Purposive sampling was used to select 125 senior members of the technical universities because of their regular participation in the planning and implementation of the industrial attachment programme. Simple random sampling was used to select 361 out of 6,718 final year students based on a standardised sample size determination technique (Krejcie and Morgan, 1970). Purposive sampling was used to select 90 members of industry and 40 members of the professional associations who directly participated in the industrial attachment programme from records of the Industrial Liaison Officers (ILO) of the technical universities.

To be included in the survey participants were required to be adults (18 years) with the ability to listen, speak, write and read basic English language, had hitherto participated in the
industrial attachment programme as (1) students in the third year, (2) senior members (e.g. ILO, 
visiting/school-based supervisor), (3) members of identifiable professional associations and (4) 
members of industry (e.g. an industry-based supervisor) who showed willingness to give 
informed consent. Individuals who were less than 18 years, had never participated in the 
industrial attachment programme and students without any experience of the industrial 
attachment programme were excluded. As a result of retrieving 594 responses out of the 616 
available participants the study generated a response rate of 96.4%. The dataset comprised 594 
respondents including senior members, students, members of industry and professional 
associations. The participants were aged within 18 and 58 years ($M = 32.2, SD = 7.50$) with 
77.8% being males. The sampling distribution of the participants across various demographic 
characteristics are briefly presented in Table 1.

Insert Table 1 about here

2.2. Instruments and data collection process

Self-reported surveys and interviews were methods used to collect the quantitative and 
qualitative data respectively. Therefore, a Likert-scale questionnaire was used to elicit self-
reported primary data on the constraints of the industrial attachment programme and 
demographics of participants comprising senior members, students of the technical universities 
and members of industry and professional associations. The survey spanned from January to June 2016. A five-point Likert-scale ranging from Strongly Agree (5) to Strongly Disagree (1) 
was used to gauge all the items in the questionnaire. Self-reported data may be linked to 
measurement errors, common methods bias, and non-response; however it provides the 
opportunity to use multi-item scale to measure complex latent concepts (Maula and Stam, 2019).
In-depth interview guide was also employed to gather data from executive officers – mainly members of industry and professional associations. Two Focus Group Discussion (FGD) guides were used to also collect data from the senior members and students in executive positions. One FGD consisted of 12 discussants of senior members in executive positions which included Vice-Chancellors, Pro Vice-Chancellors, Registrars, Deans and ILOs (FGD 1). The other FGD included 12 discussants of students in executive positions comprising Students Representative Council (SRC) and committee members (FGD 2). The modified instruments drawn from the literature (Adjei, 2013) were peer reviewed to guarantee the appropriateness and clarity of wordings and minimise the likelihood of vagueness. Further efforts at reducing the possibility of common methods bias included practical research remedies (e.g. inform participants of their right to confidentiality, anonymity, informed consent and response privacy, and encourage them to answer honestly) (Podsakoff et al., 2003; Podsakoff et al., 2012). The instruments were further pretested resulting in very minor changes to some question items with low internal consistency.

2.3. Data analysis

The quantitative data were organised and processed with Statistical Product and Service Solutions version 26 while the recorded and transcribed qualitative data were reviewed, authenticated and processed with NVivo version 11 to facilitate analysis. Descriptive statistical methods including frequencies and percentages were employed in analysing the quantitative data and presented in tables (Pallant, 2010). The qualitative data were thematically analysed and synthesised into themes which arose from the texts, quotation and extract of the interviews and discussions (Ritchie et al., 2013). The themes were used as the basis to describe and interpret the
relationships and differences arising from the respondents’ perceived constraints of the industrial attachment programme of technical universities in improving the human capital of students for the world of work. In the context of the convergent mixed methods approach, we merged and narratively described the quantitative (e.g. descriptive statistics) and qualitative (e.g. themes) outcomes concurrently to aid in interpretation and discussion as well as conclusions of the study (Fetters and Freshwater, 2015; Fetters and Molina-Azorin, 2019).

3. Results

The planning and execution of the industrial attachment programme of the technical universities is associated with constraints in improving students’ human capital for the world of work. Consistent with the convergent mixed methods approach, the results of the quantitative analysis were illustrated with descriptive statistics and complemented with analogous data from the qualitative results.

3.1 Senior members’ perception of the constraints of the industrial attachment programme

The constraints related to the industrial attachment programme from the perspectives of senior members emerged from both the quantitative and qualitative results. Senior members disagreed that industrial liaison officers had adequate means of transport to help in the discharge of their duties (44.1%) (Table 2). Senior members in executive positions complemented the results of the quantitative data based on their experiences with the implementation of the industrial attachment programme. For instance, the concern of inadequate means of transportation was confirmed during the FGDs as depicted in the following extracts by a participant:
‘Inadequate transportation was a major setback to the implementation of the industrial attachment programme...since adequate vehicles were required to carry out monitoring, supervision and assessment of students on industrial attachment’.

Similarly, another discussant indicated that:

*The inadequacy of the means of transportation for the work of the industrial liaison office for supervision and assessment of students is a serious challenge to the implementation of the industrial attachment programme. Under the circumstance, management negotiates with the supervisors to use their private vehicles to assist in the exercise while they are provided with fuel coupons and per diem.*

The study also showed that 40.5% of senior members disagreed that funds were easily released for the implementation of the industrial attachment programme in the universities (Table 2). Similar thoughts were articulated by participants involved in the FGDs to illustrate the challenge of funding the implementation of the industrial attachment programme as illustrated in the following statement: *‘It was a big challenge providing funds on time for the implementation of the industrial attachment programme. This was because of inadequate funds for the operation of the programme’. Another participant expressed similar sentiments as: ‘... dwindling budgetary allocation for industrial attachment over the years and inadequate incentives and motivation for supervisors hinder the implementation of the industrial attachment programme’.*

Furthermore, the senior members (46.6%) answered in the negative that it easy to visit and assess students on attachment in all parts of the country (Table 2). The stories of discussants from the FGDs showed that the feedback on the constraints of the industrial attachment programme were also related to increasing difficulty to access and adequately assess all the students across the country. This is evident in the following narrative of a participant:
I’ve been involved in organising and supervising the implementation of the industrial attachment programme for many years. Each time we conduct supervision, monitoring and assessment of the students, it often became difficult reaching all the students across the length and breadth of the country because of inadequate resources especially transportation.

It was further revealed that senior members (46.6%) disagreed that lecturers were adequately motivated to undertake industrial attachment supervision (Table 2). Similarly, evidence revealed from FGD showed that management should consider an upward review of the amount of financial incentives given to senior members as it was inadequate compared to the amount of risk and workload. The concerns of inadequate motivation expressed by a participant during the discussion is as follows:

To be adequately motivated for me is relative. Yeah, faculty members who get the opportunity to participate in the supervision of students receive incentives in the form of allowance and fuel coupons, but I think this is inadequate if you consider the amount of workload and risk involved in having to travel around on bumpy roads in some parts of the country.

Finally, as to whether consideration was given to internship experience during promotion of faculty members, the study showed that 50.5% of the senior members answered in the negative (Table 2). Like the quantitative data, the results of the FGDs with senior members in executive positions also indicated that internship experience of faculty members was not considered part of the promotion criteria for senior members. This is highlighted in a quotation of a participant as follows:
Internship experience of senior members doesn’t attract any consideration in terms of our promotions. The criteria for the promotion of faculty members are based on the quality and quantity of contribution to knowledge through research and publication, teaching and contribution to community service among others as stipulated in the conditions of service of the university.

3.2 Students’ perception of the constraints of the industrial attachment programme

The majority (60%) of students agreed that student interns were sometimes placed outside their major career areas of study (Table 3). The views of participants of the FGDs gave credence to the majority view revealed by the survey data. For instance, a discussant summed up their concerns of inappropriate placement as follows:

My colleagues often complaint of being placed in unrelated industries to their areas of study. Student population continues to grow and organisations can no more accommodate all the students who apply for practical training. The semester vacations coincide with the national service personnel intake.

It was also observed by another participant that:

It is true. What is common in recent times is that students are placed in any department different from their fields of study. Like a dispensing technician student can be placed in the audit department as an office clerk just because such student cannot access any health facility to do the attachment.

Also, the majority (73.5%) of the students supported the statement that students were sometimes exploited or overused during attachment exercise (Table 3). Comments expressed by discussants during the FGDs were akin to exploiting or overusing students during industrial
attachment. A participant highlighted this frustration of the students in the following vignette: ‘I would say that students are sometimes overworked and burdened with work when doing their industrial attachment. This usually occurs when the organisation is under immense pressure to accomplish a task on time and/or clear a backlog of activities.’ Another participant indicated a similar assertion that: ‘They may just want to seize the opportunity to take advantage of the availability of students as an economical but short-lived human resource to accomplish some tasks and this can result in increasing the workload of students.’

Insert Table 3 about here

Similarly, the majority (51%) of students agreed that female student interns were sexually harassed or abused during industrial attachment (Table 3). Participants of the FGD corroborated the survey results which indicated that students fall victims to incidence of sexual harassment during industrial attachment. An executive member of the SRC who participated in the discussion narrated this awareness of sexual harassment by members of industry in the following extract: ‘A beautiful lady like you is irresistible. Look at those boobs and hips, so nice. When will you be my guest for a dinner’? Another participant contributed to the discussion and indicated as follows: ‘I suppose you don’t mind being my mistress and you don’t have to worry about getting to do your national service and even a job in this organisation after you finish school’.

Also, 49.6% of the students disagreed that there was a career centre in the university that collaborated with the liaison office in the placement of students for practical industrial attachment (Table 3). Similar views articulated by participants during the FGDs showed that the universities did not have career centres that work side by side with the liaison office to facilitate the placement of students for industrial attachment. The following extract exemplifies this assertion expressed by one of the discussants:
Even though the liaison office assists in getting placement, it was very difficult to secure a place for the attachment. I had to take four letters to different organisations but none granted my request. I agree that the setting up of a career centre to collaborate with the liaison office may help reduce the frustrations of students in searching for placement.

Finally, 46.4% of the students indicated that there was lack of modern training materials, tools and equipment at the industry to facilitate the acquisition of practical skills (Table 3). The concern of inadequate contemporary tools and equipment associated with the findings of the survey were also expressed by discussants in the FGD. For example, a participant indicated that:

Small scale industries in Ghana compared to developed countries seem to lack modern technology, tools and equipment which tend to provide students the opportunity to acquire modern skills. But if you are lucky to do your attachment with big companies in mining or manufacturing, you may be privileged to use them.

3.3 Members of professional associations’ perception of constraints of the industrial attachment programme

The majority (69.4%) of members of the professional associations agreed that organisations did not open up fully for the industrial attachment programme for fear of leakage of company secrets (Table 4). Organisations with the need to protect highly sensitive information of confidential nature in the context of rising incidence of cybercrimes hesitate in cooperating and fully opening up emerged during the in-depth interview as illustrated in the following quotation:

Several reasons may account for the unwillingness of organisations to cooperate and be transparent with the industrial training programme. It may be due to fear of data
theft, safeguard for privacy and confidentiality of information and the rising incidence of fraud and cybercrimes increase with the use of ICT infrastructure in work routines.

Also, 61.1% disagreed that the period for practical industrial training for students was adequate (Table 4). In an interview, the executive officer of the members of the professional association remarked as follows: ‘How can the industrial attachment period be adequate when the universities are often confronted with industrial actions? ...this tends to further reduce the limited period of three months for the industrial attachment programme during the long vacation’.

Furthermore, the majority (77.7%) of members of the professional associations agreed that the industrial actions in the universities did affect the industrial attachment programme. Similar sentiments of the executive officer of the professional association in an interview showed that industrial action seriously affects the industrial attachment programme as illustrated in the following extract: ‘The period for the industrial attachment is often disrupted by frequent industrial actions of the universities. If the lecturers are not on strike, the students are, and then the non-teaching staff will also follow with theirs’.

In addition, 69.5% of the members of the professional associations disagreed that the university authorities arranged for insurance cover for their students before the commencement of the attachment programme. The following quotation from an interview with the executive officer of the professional associations supports the majority view that the university authorities do not organise insurance cover for students before they start the industrial attachment programme:
Workers in any industrial setting may be exposed to workplace health and safety hazards. This is where work-related insurance is important; but as far as my working experience is concerned, I’m not sure and aware of any insurance cover for students who come for their industrial attachment training.

Insert Table 4 about here

3.4 Members of industry’s perception of the constraints of the industrial attachment programme

The study showed that 44.7% of members of industry disagreed that the universities came regularly to industry for interaction regarding the conduct of the internship programme. The irregular and limited level of linkage between the universities and industry was indicated during the interview session with the executive officer as highlighted in the following statement: ‘I would say there is a limited interaction ... and this inadequate level of interaction is inconsistent and will not create a strong linkage leading to exchange of resources, research and knowledge’.

Furthermore, the majority (58.8%) of members of industry agreed that industrial actions in the universities could affect the industrial attachment programme (Table 5). The results of the quantitative data were comparable to the views of the executive officer as illustrated in the following account:

*It is obvious that industrial actions adversely affect students’ training during industrial attachment. I recall there was a rescheduling of the academic calendar due to an industrial action by the teachers for better conditions of service and the period for the industrial attachment was reduced from 12 weeks to 6 weeks.*

Insert Table 5 about here
Lastly, 36.5% of members of industry disagreed that university authorities arranged insurance cover for their students before the practical attachment programme began (Table 5). The results of the quantitative data as shown by the members of industry were re-echoed in the views of the interviewee as exemplified in the following quotation: ‘I can’t confirm that students are covered with insurance before they start their attachment...I have not sighted any evidence of insurance cover. However, it is a good idea’.

4. Discussion

This study employed the convergent mixed method to assess and highlight the constraints of the industrial attachment programme of Ghanaian technical universities in improving the human capital of students. Based on the perspectives of senior members and students as well as members (industry and professional associations), the results of this study showed that the industrial attachment programme is fundamentally characterised by the following constraints: (1) inadequate funding, logistics and motivation for supervisors; (2) inappropriate placement, abuse and sexual harassment of students; (3) inadequate duration and disruption of the industrial attachment programme due to industrial action; (4) inadequate collaboration; and (5) Concerns of student interns breaching the organisations’ confidentiality policies.

The study revealed that inadequate financial support, logistics and motivation for supervisors was perceived by stakeholders as an impediment to the planning and implementation of the programme. Comparable studies accentuate the extent to which lack of funding, logistics, and incentives adversely impacts industrial attachment as a means to enhance students’ practical skills, productive knowledge, experiences and attitudes for the world of work (Adjei, 2013; Nkrumah et al., 2011; Nunfam et al., 2015; Wilson, 2016). Cuts in government funding,
dwindling subventions for universities, inadequate financial diversity, income generation and entrepreneurial innovation tend to negatively impact and/or worsen universities’ financial predicaments (Atuahene, 2015; Bondzi-Simpson et al., 2021). Thus, an institution’s condition of inadequate finances as exemplified in the studies (e.g. Adjei, 2013; Nkrumah et al., 2011; Nunfam et al., 2015) is inextricably linked to its inability to provide appropriate logistics (e.g. vehicles, office equipment and stationery), indemnity for students and satisfactory motivation for supervisors of the industrial attachment programme. This state of inadequate funding and logistics support tends to derail efforts at industrial attachment and human capital policy planning and implementation of the technical universities.

As evident in various studies (Adjei, 2013; Donkor et al., 2009; Wilson, 2016), this study found the constraints associated with the industrial attachment programme to include inapt placement, exploitation and harassment of students. The inappropriate and haphazard placement of students relates to placing students in industries unrelated to their field of study due to inadequate placement opportunities, increased demand and competition among students of the Ghana national service scheme and vacation industrial attachment programme for vacancies in industry (Wilson, 2016; Yawson, 2014). The abuse of students during industrial attachment as highlighted in previous studies (Adjei, 2013; Wilson, 2016; Zhang, 2020) is exemplified in this study as increased workload and overburdening of students as well as sexual harassment of female students. The prevalence of workplace sexual harassment towards female student interns has been attributed to power imbalance, uniforms of student interns (e.g. hospitality-related studies), sexual harassment-tolerant organisational culture and inadequate protection policies (Moorman, 2004; Zhang, 2020). Unsuitable placement, exploitation and harassment could
discourage students from participating in the industrial attachment programme thereby adversely affecting its policy objective of improving on the practical human capital of students.

As an important part of the Bachelor of Technology (B.Tech.) and Higher National Diploma (HND) studies, industrial attachment is a four-credit course in some technical universities (e.g. Takoradi Technical University), which is required to be completed by students pursuing HND for a duration of six months, that is, three months each for end-of-year one and year two respectively (Adjei, 2013). Our findings on the constraints of the industrial attachment programme related to inadequate duration and disruptions of the programme due to industrial actions of the technical universities re-echo results of analogous studies (e.g. Akomaning et al., 2011; Donkor et al., 2009; Yawson, 2014). The short duration of the industrial attachment programme coupled with instances of labour unrest and industrial action of the labour unions (e.g. Technical University Teachers Association of Ghana (TUTAG) and Technical Senior Administrators Association of Ghana (TUSAAG)) tend to thwart the opportunities for students to improve on their human capital (Adjei, 2013; Donkor et al., 2009; Yawson, 2014). It also has negative implication for the programmes’ policy guideline for students to satisfy at least six months duration of industrial training to qualify for graduation.

The study further showed evidence of inadequate collaboration between technical universities and industries as a constraint of the industrial attachment programme in developing students’ human capital. Results of this study on the limitation of the industrial attachment programme in terms of insufficient university-industry linkage resonate with various studies (e.g. Adjei et al., 2014a; Akomaning et al., 2011; Nkrumah et al., 2008; Nunfam et al., 2015) where a weak relationship between tertiary institutions (e.g. universities and polytechnics) and industry was identified as a factor which hinder the practical industrial training of students to improve on
their human capital. For example, Adjei et al. (2014a) found that the extent of relationship between polytechnics and industry was limited to improving the practical skills of lecturers and students as well as preparing and appraising the polytechnics’ curriculum. However, the areas of ineffective and poor collaboration included collective research, support for teaching and learning resources, financial support for research and the use of personnel from industry as visiting, guest and/or adjunct lecturers (Adjei et al., 2014a; Nunfam et al., 2015). The inadequacy of university-industry collaboration tends to affect the programmes’ policy guidelines on planning and implementation of students’ placement, supervision and evaluation as well as funding and logistics support from industry.

Similarly, the tendency of external affiliates to breach organisations’ policies and procedures by leaking out core corporate information emerged as a constraint to the industrial attachment programme. As shown in earlier studies, increased collaboration and interactivity between organisations and their external partners (e.g. agents, suppliers and academic institutions) inevitably leads to a high probability of business knowledge leakage to prospective competitors (Contractor, 2019; Inkpen et al., 2019; Gilbert et al., 2008). Fundamental business knowledge at risk of being leaked out include (1) codified intellectual property (e.g. patents and copyrights) (2) codified or digitised corporate knowledge consciously kept private (e.g. trade secrets) and (3) uncodified or unregistered internalised knowledge and organisational procedures (Contractor, 2019). Thus, the need to safeguard confidential information from leaking out discourages organisations from completely participating and opening their doors to students and lectures. This constraint affects the policy decision of the industrial attachment programme to improve on the human capital of students.
Notwithstanding the significant contributions of this study as evident in the constraints of the industrial attachment programme in enriching students’ human capital, it is associated with limitations. The study’s dependence on participants’ perspectives of the constraints of the programme has the possibility of being characterised by recollection prejudice. Also, the participants were purposely sampled from only four out of eight technical universities and few industries and professional associations in Ghana. Furthermore, the survey did not involve students without any industrial attachment experience. The comparatively limited scope and size of the study participants especially to technical universities and few stakeholders in Ghana create concerns of representativeness and generalisability of the study outcome to the general population. Therefore, it is critical to proceed with prudence and devoid of cavalier attitude in the generalisation of the results unless there are similar cohort studies in other jurisdictions and cultures that confirms this outcome.

Conclusions and implications

University stakeholders including senior members, students and members (industry and professional associations) are key actors in planning and executing the industrial attachment policy and programme aimed at developing students’ human capital for the world of work. This study provides insights into the constraints of the industrial attachment programme of Ghanaian technical universities in enhancing students’ human capital from the perspectives of key stakeholders. Compared to similar studies (e.g. Adjei, 2013; Akomaning et al., 2011; Contractor, 2019; Nunfame et al., 2015; Zhang, 2020), we also found evidence of insufficient funding, logistics and incentive for supervision as well as unsuitable placement, exploitation and sexual harassment of students as constraints of the programme. Inadequate duration and interruption of the industrial attachment programme occasioned by labour unrests; weak collaboration; and
apprehensions of student interns breaching organisations’ privacy and confidentiality rules were also identified to impede the industrial attachment programme.

Our study has implications for the literature on industrial attachment and human capital, researchers and students, university managers and policy decision makers. First, our study gives adequate support for extant literature on constraints of industrial attachment in developing human capital from the perspective of experiential learning theory. Empirical results from this study have illustrated significance constraints of technical universities in using industrial attachment as the conduit for improving students’ human capital. Second, the implication of our study is that researchers can use it as a source of data and guidance for future research direction on industrial attachment and human capital. Third, an understanding of the limitations and challenges of the industrial attachment programme in developing students’ practical skills and productive knowledge among stakeholders is important in informing policy decisions and practices related to the programme’s planning and implementation. It would also serve as the basis for educating and training stakeholders (e.g. industry, policy decision makers, university managers and students) on the importance of the programme in enhancing the human capital of students for the world of work. Therefore, an enhanced synergy between the government, technical universities and industry in research, innovation, resource exchange, establishing mutual trust, and the creation of industrial attachment fund would provide the impetus to sustain the industrial attachment programme in improving students’ human capital for the world of work.

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**Conflict of interest**

The authors declare no conflict of interest

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[https://doi.org/10.1016/j.sbspro.2013.10.784](https://doi.org/10.1016/j.sbspro.2013.10.784)


### Table 1: Background information of respondents (n = 594); F = frequency; M = mean; SD = Standard deviation. Numbers in the columns refer to the number of respondents with % of respondents in parentheses.

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Senior members</th>
<th>Categories of respondents</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>F(%)</td>
<td>F(%)</td>
<td>F(%)</td>
</tr>
<tr>
<td><strong>Sex</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>104(5588.31)</td>
<td>258(72.7)</td>
<td>73(85.9)</td>
</tr>
<tr>
<td>Female</td>
<td>14(1414.79)</td>
<td>97(27.3)</td>
<td>12(14.1)</td>
</tr>
<tr>
<td><strong>Age (M = 32.2; SD = 7.50)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;20</td>
<td>0(0)</td>
<td>11(3.1)</td>
<td>0(0)</td>
</tr>
<tr>
<td>20-29</td>
<td>2(1.7)</td>
<td>315(88.7)</td>
<td>19(22.4)</td>
</tr>
<tr>
<td>30-39</td>
<td>34(28.8)</td>
<td>27(7.6)</td>
<td>24(28.2)</td>
</tr>
<tr>
<td>40-49</td>
<td>45(38.1)</td>
<td>2(0.6)</td>
<td>25(29.4)</td>
</tr>
<tr>
<td>50+</td>
<td>37(31.4)</td>
<td>0(0)</td>
<td>17(20.0)</td>
</tr>
<tr>
<td><strong>Educational qualification</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Doctorate degree</td>
<td>18(15.3)</td>
<td>0(0)</td>
<td>0(0)</td>
</tr>
<tr>
<td>Master’s degree</td>
<td>71(60.2)</td>
<td>0(0)</td>
<td>16(18.8)</td>
</tr>
<tr>
<td>Bachelor’s degree</td>
<td>29(24.5)</td>
<td>0(0)</td>
<td>33(38.8)</td>
</tr>
<tr>
<td>HND/Diploma certificate</td>
<td>0(0)</td>
<td>0(0)</td>
<td>36(42.4)</td>
</tr>
<tr>
<td>High school certificate</td>
<td>0(0)</td>
<td>355(100)</td>
<td>0(0)</td>
</tr>
<tr>
<td>Total</td>
<td>118</td>
<td>355</td>
<td>85</td>
</tr>
</tbody>
</table>

Source: Field survey, 2016
<table>
<thead>
<tr>
<th>Statement</th>
<th>SA %</th>
<th>A %</th>
<th>U %</th>
<th>D %</th>
<th>SD %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industrial attachment programme in the university is well structured</td>
<td>25.4</td>
<td>47.5</td>
<td>12.7</td>
<td>11.9</td>
<td>2.5</td>
</tr>
<tr>
<td>There is a full-time industrial Liaison Officer in the university</td>
<td>67.8</td>
<td>27.1</td>
<td>2.5</td>
<td>2.5</td>
<td>0.0</td>
</tr>
<tr>
<td>Each department has a departmental coordinator for attachment</td>
<td>36.4</td>
<td>22.0</td>
<td>14.4</td>
<td>22.0</td>
<td>5.1</td>
</tr>
<tr>
<td>The industrial Liaison Officer in the university has a well-resourced office accommodation</td>
<td>17.8</td>
<td>46.6</td>
<td>11.0</td>
<td>20.3</td>
<td>4.2</td>
</tr>
<tr>
<td>There is a committee responsible for industrial attachment issues in the university</td>
<td>18.6</td>
<td>40.7</td>
<td>15.3</td>
<td>21.2</td>
<td>4.2</td>
</tr>
<tr>
<td>The Liaison officer has a means of transport to help in the discharge of his duties</td>
<td>10.2</td>
<td>30.5</td>
<td>15.3</td>
<td>37.3</td>
<td>6.8</td>
</tr>
<tr>
<td>Funds are easily released for the implementation of the industrial attachment programme in the university</td>
<td>9.3</td>
<td>28.8</td>
<td>21.4</td>
<td>36.3</td>
<td>4.2</td>
</tr>
<tr>
<td>Lecturers find it easy to visit and assess students on attachment in all parts of the country</td>
<td>10.2</td>
<td>26.3</td>
<td>16.9</td>
<td>34.7</td>
<td>11.9</td>
</tr>
<tr>
<td>Lecturers are adequately motivated to undertake industrial attachment supervision</td>
<td>8.5</td>
<td>22.9</td>
<td>22.0</td>
<td>34.7</td>
<td>11.9</td>
</tr>
<tr>
<td>Consideration is given to internship experience during promotion of faculty members</td>
<td>0.8</td>
<td>13.6</td>
<td>34.7</td>
<td>39.8</td>
<td>11.0</td>
</tr>
</tbody>
</table>

Source: Field survey, 2016
Table 3: Students’ perception of the constraints of the industrial attachment programme (n=355)

<table>
<thead>
<tr>
<th>Statement</th>
<th>SA</th>
<th>A</th>
<th>U</th>
<th>D</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industrial Liaison officers assist students to get places for attachment</td>
<td>18.3</td>
<td>36.3</td>
<td>8.2</td>
<td>20.6</td>
<td>16.6</td>
</tr>
<tr>
<td>Students are paid some stipends to get places for attachment</td>
<td>7.0</td>
<td>31.3</td>
<td>15.8</td>
<td>28.2</td>
<td>17.7</td>
</tr>
<tr>
<td>Student interns are sometimes placed outside their major career areas of study</td>
<td>17.2</td>
<td>42.8</td>
<td>13.0</td>
<td>19.2</td>
<td>7.9</td>
</tr>
<tr>
<td>Students are sometimes exploited or overused during attachment</td>
<td>27.9</td>
<td>45.6</td>
<td>10.4</td>
<td>12.7</td>
<td>4.4</td>
</tr>
<tr>
<td>Female interns are sexually harassed or abused during attachment</td>
<td>19.7</td>
<td>31.3</td>
<td>26.2</td>
<td>16.3</td>
<td>6.5</td>
</tr>
<tr>
<td>Students have to look for their own places for attachment for convenience sake</td>
<td>38.6</td>
<td>42.8</td>
<td>5.4</td>
<td>8.2</td>
<td>5.1</td>
</tr>
<tr>
<td>Practical lessons in the polytechnic are effectively handled by the lecturers concerned</td>
<td>17.2</td>
<td>38.0</td>
<td>16.1</td>
<td>18.3</td>
<td>10.4</td>
</tr>
<tr>
<td>The equipment in the laboratories and workshops are modern ones</td>
<td>6.8</td>
<td>23.4</td>
<td>16.9</td>
<td>34.4</td>
<td>18.6</td>
</tr>
<tr>
<td>There is a career centre in the polytechnic that collaborates with the liaison office in the placement of students</td>
<td>8.7</td>
<td>16.6</td>
<td>25.1</td>
<td>29.9</td>
<td>19.7</td>
</tr>
<tr>
<td>The liaison officer/coordinator organises a kick-off meeting with students to brief them well about the attachment exercise</td>
<td>17.7</td>
<td>33.0</td>
<td>9.9</td>
<td>11.3</td>
<td>5.9</td>
</tr>
<tr>
<td>There is an orientation exercise at the industry before the start of the attachment</td>
<td>22.8</td>
<td>50.7</td>
<td>9.3</td>
<td>11.3</td>
<td>5.9</td>
</tr>
<tr>
<td>There is lack of modern training materials, tools and equipment at the industry to facilitate the acquisition of practical skills</td>
<td>16.3</td>
<td>30.1</td>
<td>17.5</td>
<td>28.7</td>
<td>7.3</td>
</tr>
</tbody>
</table>

Source: Field survey, 2016
Table 4: Members of professional associations’ perception of the constraints of the industrial attachment programme (n=36)

<table>
<thead>
<tr>
<th>Statement</th>
<th>SA</th>
<th>A</th>
<th>U</th>
<th>D</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>It is convenient to the company/organisation for students to approach them individually for placement</td>
<td>8.3</td>
<td>36.1</td>
<td>8.3</td>
<td>39.0</td>
<td>8.3</td>
</tr>
<tr>
<td>The organisation is reluctant to open up fully for the industrial attachment programme for fear of leakage of company secrets</td>
<td>30.5</td>
<td>38.9</td>
<td>13.9</td>
<td>5.6</td>
<td>11.1</td>
</tr>
<tr>
<td>Student interns disorganise the planned programme or activities of the organisation during the period of attachment</td>
<td>8.3</td>
<td>25.1</td>
<td>19.4</td>
<td>44.4</td>
<td>2.8</td>
</tr>
<tr>
<td>Universities come regularly to industry for interaction regarding the conduct of the internship programme</td>
<td>16.7</td>
<td>47.3</td>
<td>8.3</td>
<td>19.4</td>
<td>8.3</td>
</tr>
<tr>
<td>Universities' curriculum is consistent with what pertains in the world of work</td>
<td>25.0</td>
<td>22.2</td>
<td>13.9</td>
<td>27.8</td>
<td>11.1</td>
</tr>
<tr>
<td>Student interns mishandle equipment and facilities during industrial attachment</td>
<td>0.0</td>
<td>27.8</td>
<td>22.2</td>
<td>44.4</td>
<td>5.6</td>
</tr>
<tr>
<td>Managers and supervisors have little knowledge about the required assessment procedure for student interns</td>
<td>0.0</td>
<td>22.2</td>
<td>19.4</td>
<td>58.4</td>
<td>0.0</td>
</tr>
<tr>
<td>The period for practical industrial attachment training for students is adequate</td>
<td>0.0</td>
<td>25.0</td>
<td>13.9</td>
<td>58.3</td>
<td>2.8</td>
</tr>
<tr>
<td>Industrial actions in the universities do affect the industrial attachment programme</td>
<td>19.4</td>
<td>58.3</td>
<td>2.8</td>
<td>5.6</td>
<td>13.9</td>
</tr>
<tr>
<td>University authorities arrange insurance covers for their students before the programme begins</td>
<td>2.8</td>
<td>11.1</td>
<td>16.7</td>
<td>27.8</td>
<td>41.7</td>
</tr>
</tbody>
</table>

Source: Field survey, 2016
Table 5: Members of industry’s perception of constraints of the industrial attachment programme (n=85)

<table>
<thead>
<tr>
<th>Statement</th>
<th>SA %</th>
<th>A %</th>
<th>U %</th>
<th>D %</th>
<th>SD %</th>
</tr>
</thead>
<tbody>
<tr>
<td>It is convenient to the organisation for students to approach them individually for placement</td>
<td>11.8</td>
<td>34.1</td>
<td>14.1</td>
<td>34.1</td>
<td>5.9</td>
</tr>
<tr>
<td>The organisation is reluctant to open up fully for the industrial attachment programme for fear of leakage of company secrets</td>
<td>15.3</td>
<td>24.7</td>
<td>11.8</td>
<td>37.6</td>
<td>10.6</td>
</tr>
<tr>
<td>Student interns disorganise the planned programme or activities of the organisation during the period of attachment</td>
<td>2.4</td>
<td>10.6</td>
<td>12.9</td>
<td>55.3</td>
<td>18.8</td>
</tr>
<tr>
<td>Universities come regularly to industry for interaction regarding the conduct of the internship programme</td>
<td>11.8</td>
<td>28.2</td>
<td>15.3</td>
<td>34.1</td>
<td>10.6</td>
</tr>
<tr>
<td>Universities' curriculum is consistent with what pertains in the world of work</td>
<td>3.5</td>
<td>34.1</td>
<td>43.5</td>
<td>16.5</td>
<td>2.4</td>
</tr>
<tr>
<td>Student interns find it difficult to adjust to the code of conduct of the company</td>
<td>7.1</td>
<td>14.1</td>
<td>20.0</td>
<td>51.7</td>
<td>7.1</td>
</tr>
<tr>
<td>Student interns mishandle equipment and facilities during industrial attachment</td>
<td>2.3</td>
<td>16.5</td>
<td>16.5</td>
<td>55.3</td>
<td>9.4</td>
</tr>
<tr>
<td>Managers and supervisors of the host company have little knowledge about the required assessment procedure for student interns</td>
<td>4.7</td>
<td>32.4</td>
<td>12.9</td>
<td>42.9</td>
<td>7.1</td>
</tr>
<tr>
<td>The period for practical industrial attachment training for students is adequate</td>
<td>5.9</td>
<td>41.2</td>
<td>11.8</td>
<td>34.0</td>
<td>7.1</td>
</tr>
<tr>
<td>Industrial actions in the polytechnics do affect the industrial attachment programme</td>
<td>23.5</td>
<td>35.3</td>
<td>22.4</td>
<td>15.3</td>
<td>3.5</td>
</tr>
<tr>
<td>University authorities arrange insurance covers for their students before the programme begins</td>
<td>8.2</td>
<td>23.5</td>
<td>31.8</td>
<td>22.4</td>
<td>14.1</td>
</tr>
</tbody>
</table>

Source: Field survey, 2016