European Journal of Business and Innovation Research

Vol.6, No.1, pp.40-57, February 2018

Published by European Centre for Research Training and Development UK (www.eajournals.org)

AN EXAMINATION OF THE PROGRAM MIX AT TECHNICAL UNIVERSITIES OF GHANA: THE APPLICATION OF THE BOSTON CONSULTING GROUP MATRIX

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ABSTRACT: *The purpose of the study was to justify the significance of 'Non-technical programs at the Technical Universities in Ghana despite it not being mandated program, using Boston Consulting Group Matrix. The current study uses the various core programs as well as other necessary programs which must be offered by Technical Universities and classified them as strategic business units to determine the necessity of other necessary programs that the Technical University could develop and offer. The study used secondary data of 2012/2013 academic year enrollment of students into tertiary programs in Ghana to support empirical theory.Ten managers of public and private universities and selected polytechnics were conveniently sampled and interviewed to ascertain primary reasons for developing and offering programs in both mandated and non mandated areas. The study showed that the Technical University like any other tertiary institution in Ghana will need other non-technical programs in addition to their mandated technical programs to sustain technical education in an economy like Ghana where tertiary education funding is a shared responsibility. Business Programs for example are found to be cash cows, which are necessary to financially sustain Technical University education in Ghana.*

KEY WORDS: Business programs**,** Boston consulting group matrix, Market growth rate, and Relative market share

INTRODUCTION

The Boston Consulting Group (BCG) matrix offers one of the earliest and simplest (Wensley, 1991) as well as best known (Wilson & Gilligan, 1992) model for analyzing organizations with multiple business units. The model is concerned with the generation and use of cash within an organization and can be used to analyse the strategic business units of an organization (West, Ford & Ibrahim, 2010). The Boston Consulting Group model analysis is based on comparing the market growth rate and the relative market share of the respective business units of a strategic organization (Reeves, Moose & Venema, 2014). The use of Boston Consulting Group Matrix becomes necessary when the organization has different business portfolios that are all competing for the same resources of the organization (Spee & Jarzabkowski (2009).

ISSN: ISSN 2053-4019(Print), ISSN: ISSN 2053-4027(Online)

The usefulness of Boston Consulting Group Matrix as a tool for portfolio analysis in the extant literature is highly emphasised (Doyle & Stern, 2006; Kotler & Armstrong, 2010, Ovans, 2011; Whitehead, 2015). By the 1979, organizations that had successfully used the Boston Consulting Group Matrix acknowledged the positive effect of the model on competitive strategic business plan for organizations with multiple businesses (Haspeslagh, 1982; Hambrick, MacMillan & Day (1982), and found how the four components of Boston Consulting Group model either generate or consume cash. This suggests that if a strategic business unit should concentrate all its business effort around one or a few business portfolio just because it wants it has unique capabilities, there is the possibility of going out of business (Madsen & Johanson, 2016; Madsen & Stenheim, 2016) if such businesses fail to generate the needed cash for sustainability. Using a sample of over 1000 practicing managers in investment decisions making to access the effect of Boston Consulting Group matrix on business performance, Armstrong and Brodie (1994) aver that the model is very useful for business portfolio analysis that leads to corporate profitability. Also in a quantitative study to identify the causes of rise and fall of the B.C.G matrix, the authors concluded that the BCG matrix works in both managerial theory and practice, and that the tool if efficiently applied can substantiate the strategic decisions of an organization (Russell-Walling, 2008;Duică, Croitoru, Duică & Robescu, 2014). A study by Dag Øivind Madsen (2017) to examine the historical rise and fall and persistence of BCG matrix found that the BCG model is influential in portfolio management and has relatively stand the test of time compared to other portfolio models. It is worthy to note that the criticisms notwithstanding; the BCG model is still widely used as a corporate portfolio planning technique by practitioners (Pidun, Rubner, Krühler, Untiedt & Nippa, 2011).

Against the backdrop of the literature reviewed, the purpose of the current article is to make a case for the development of academic programs for the Technical Universities in Ghana using the BGC matrix. Despite the fact that other studies have provided examination of the BCG Matrix as a model for managing different business portfolios of a strategic business unit, earlier contributions were centered on actual products and services. Also there is a debate as to whether the BCG model is out-of-date or still applicable after decades of its introduction (Pidun, Rubner, Krühler, Untiedt & Nippa, 2011; Whitehead, 2015). Moreover, program choice of universities in Ghana has usually been based on experience and capabilities of institutions to run particular programs. It is believed that this gap warrants a study that can contribute to knowledge regarding the usefulness of BCG matrix's in program development, rather than basing program mix on experience and capabilities. In view of the above, in this study, the BCG matrix is used as a business portfolio analysis tool to argue for the strategic implication for the choice and development of appropriate programs in the Technical Universities. An examination of BCG matrix should help technical universities plan the best way to develop educational program in a strategic business setting between technical and non-technical areas (Pidun, Rubner, Krühler, Untiedt & Nippa, 2011; Whitehead, 2015).

ISSN: ISSN 2053-4019(Print), ISSN: ISSN 2053-4027(Online)

Problem Statement

Technical University in Ghana is a recent development as far as university education in the country is concerned (established in 2016). As the name implies, its vision is to promote technical and vocational education at the tertiary level in Ghana and the sub-region. With the vision in mind there are some (including regulatory bodies) who have suggested that the institutions focus their efforts solely on technical and vocational programs where they may have unique capabilities to run (Lynch, 2003). This suggests that the technical universities are not allowed to develop and offer non-technical programs such as the business and other humanities. Thus running of non-technical programs is highly criticized and discouraged with the conversion of Polytechnics to Technical Universities in Ghana. While the advocates may have a point, this study believes that in situations like this emotions and experiences should not determine what should be done; rather tested models can be used to guide decision making. It is upon this basis that this article uses the BCG Matrix, which is one of the most tested and widely used strategic business management tool (Reeves, Moose & Venema, 2014, Dag Øivind Madsen, 2017) to help address the issue of whether Technical Universities in Ghana should focus their programs only on technical and vocational programs or be allowed to run other non-technical programs; and if so what form should the curriculum of non-tertiary programs take. The application of the Boston Consulting Group model should help all stakeholders, including regulators and managers of Technical Universities and even critics acknowledge that unique capabilities alone is not enough for program planning (Lynch, 2003) but also financial sustainability of organization through portfolio planning is key for total business success (Whitehead, 2015; Madsen & Stenheim, 2016).

The remainder of this paper considers the theoretical framework underpinning the BCG matrix, and a conceptual framework for the business portfolio of the Technical Universities. The article also discusses the theoretical analysis of the BCG model as well as the implications of the study for the ongoing relevance of the debate as to whether the Technical Universities should offer non-core programs (like business programs). The study also contains the data and methodology and results. It is climaxed with concluding comments.

LITERATURE REVIEW

Boston Consulting Group (BCG) Matrix

The Boston Consulting Group Matrix is a chat created by Bruce D. Henderson for the Boston Consulting Group in 1970s to help organizations analyze their business portfolios (BCG, 1973).

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This model helps organizations allocate resources and is used as an analytical tool in portfolio analysis (Hax & Majluf, 1990). It is an approach to strategic analysis that compares a firm's market share to the anticipated growth of its market. The model is usually used to analyze organizations with multiple divisions or business units ((Drummond & Ensor, 2001; Kotler & Armstrong, 2010). Analysis of BCG matrix is premised on four quadrants - Stars, Cash Cows, Question Marks and Dogs (see Figure 1).

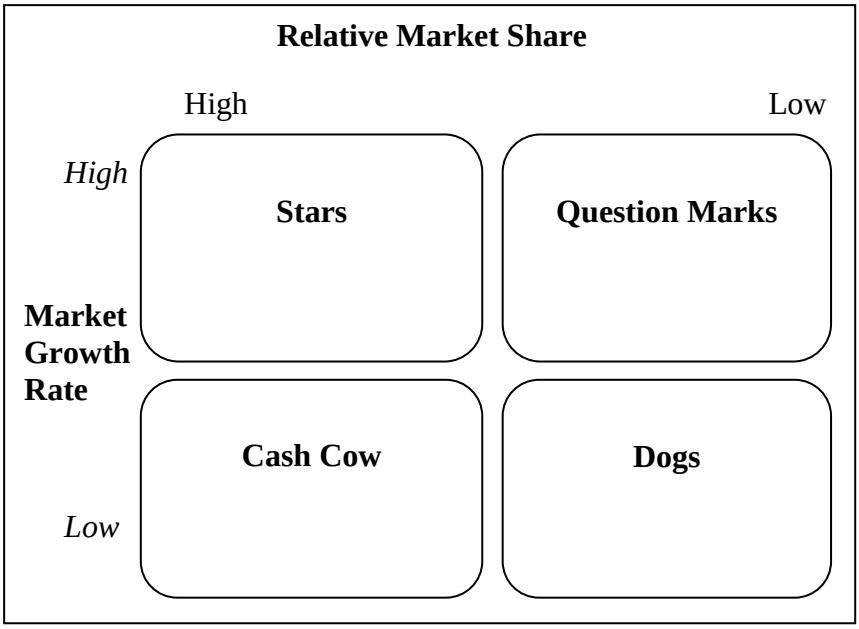

Figure 1: BCG Share-Growth Matrix for a Typical Strategic Business Unit (SBU)
Source: BCG (1973)

Stars are businesses having high market share in a high growth industry (Hooley, Saunders & Piercy, 1998). Businesses in this quadrant require high capital investments for growth as well as high revenue generation. Stars in the long run become cash cows as investment need reduces and the business is able to maintain its high income generation. Thus organization's investment in stars promotes growth in the short to medium term and creates opportunity for profitability in the long term (Botton, 2005). The high requirement for cash for investment requires that other businesses are needed to generate such cash to support investment in stars (Botton, 2005).

Cash cow refers to business portfolio that generates relatively high cash than it requires for investment (Hill & Jones, 1989). With the potential to generate enough cash than needed for investment, Cash Cow business portfolio constitutes the main sources of cash to support other business portfolios of an organization (Kotler & Armstrong, 2010). In most organizations, stars

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become cash cows as demand for investment reduces and generation of cash increases (Kotler, Armstrong, Saunders, & Wong, 1999. Thus, once a business portfolio attains Cash Cow status it must be well managed because such business is usually sustainably profitable. This suggests that concentrating solely on an organization core business portfolio may not be enough for competitiveness, especially if such is not a cash cow.

Question marks refer to organization's businesses that require high capital investment and relatively low income generation (Wilson & Gilligan, 1992). Such businesses have low market share and high growth rate. Question marks can grow to become stars if huge investment is made now to ensure growth in future to the point where income from its activities can grow to match its growth share. On the other hand, if investment does not result into corresponding growth in business this will lead to use of large sums of cash in the medium term, and eventually turn question marks to dogs (Aaker, 1995; Kotler & Armstrong, 2010). Thus, organizations require strategic marketing approach to ensure that investment into question marks enable such portfolios to eventually become starts, otherwise they may become dogs and a candidate for harvesting (Kotler, Armstrong, Saunders, & Wong, 1999).

Dogs are business units with low growth and low revenue generation (Aaker, 1995). This business portfolio usually does not produce sufficient cash to even sustain its relatively low growth. Despite the relatively little cash require to manage cash cow, if the growth is correspondingly low, revenue that might be required to grow other more competitive businesses may be deploy here, leading to waste of resources (Aaker, 1995; Kotler & Armstrong, 2010). On the other hand, dogs may be necessary business to maintain if they contribute to the growth of other business portfolios. This suggests that organizations do well to minimize the existence of Dogs in their business portfolio by adopting such marketing strategies as liquidation, divesture or retrenchment, but where they serve as contributors to other portfolios, they may be carefully managed as long as they achieve the ultimate goal of the organization.

Boston Consulting Group (BCG) Matrix and Technical University Programs Mix

It is just good for educational institutions to focus on core programs as a means of gaining competitive advantage (Agbonifoh, Ogwo, Nnolim & Nkemnebe, 2007). However, these core programs may in the short to medium term require investment that could not be sustained by the cash they generate. Therefore there will be the need to develop other program portfolios that can generate extra income to support such required investment. The BCG matrix, thus assumes that developing core programs that demands a high growth rate will consequently require extra investment that must be borne by other revenue generation portfolios (Kaplan & Atkinson, 1998). While it is most attractive to see growth in the long run by introducing core technical programs in the Technical Universities, introduction of other non-technical programs that may not demand relatively huge investment for growth, but yet may provide necessary cash for development might be appropriate for the total growth of a Technical Institution. This suggests

ISSN: ISSN 2053-4019(Print), ISSN: ISSN 2053-4027(Online)

that development of Technical Education in Ghana may require a portfolio of programs (including those outside their core mandated areas) such as business and other social science programs which have the potential of generating enough cash than will be needed to invest in such programs. This can help make the institutions as a whole economically sustainable. This is possible as the non-technical programs with its usually high students' enrollment generate extra cash to support development and maintenance of technical programs (Gohnson & Scholes, 2002).

DATA AND METHODOLOGY

The current study builds on theory to test how the Boston Consulting Group Matrix Model is applicable to the development and offer of programs at Technical Universities in Ghana. Using the BCG Model, the respective programs to be offered by the Technical Universities were put into the four quadrants of Stars, Cash Cows, Question Marks and Dogs, to examine the applicability of the model, which is unique to strategic business unit portfolio to development of programs for the Technical Universities in Ghana. Secondary data was collected on the average enrollment statistics of public and private universities in Ghana for the 2012/2013 academic year to confirm the applicability of the model, with regards to programs distribution.

To probe into the status of the program development and distribution, especially, at the non-technical versus technical programs, the author conducted in-depth interviews with ten senior managers of public and private tertiary institutions. All ten were interviewed in person during the 2016/2017 academic year using tape recording approach. The senior executives interviewed were all heads of academic affairs in each of the institutions. Six of them hold Deputy Registrar positions while four hold Senior Assistant Registrar positions. Four interviewees were in the public universities, four in private universities and the other two in the polytechnics (now Technical University). The interviews lasted anywhere from fifteen to thirty minutes, using a semi structured interview guide. Due to the nature of the exploratory study, the sampling was a convenience approach based on accessibility to informant.

RESULTS NAD DISCUSSION

BCG Model Application

Applying the BCG model to the development of programs in the Technical University, the institutions could be considered as strategic business and the respective programs run as business units. In this case programs that have the potential of large enrollment but which require minimum effort or investment (such as business programs) are referred to as ***cash cows***. These programs usually generate large amounts of cash compared to how much is invested by way of enrollment and program running costs. The excess cash generated over expenditure are used to support other programs that cannot generate as much cash. This suggests that Technical Universities will still need non-technical programs like Business Programs because as 'cash

ISSN: ISSN 2053-4019(Print), ISSN: ISSN 2053-4027(Online)

cows' they contribute significant revenue to sustain the institutions financially because they produce enough Internally Generated Fund (IGF) to support research and innovation in other technical programs (Botton, 2005).

In this analysis programs that attract fewer enrollments and generate little income, but which also require relatively less investment can be referred to as ***dogs***. Such programs by their nature may not contribute much to the overall cash requirement of the institutions, and in some cases might require that cash is taken from other program areas to fund them. Programs considered dogs (which in this case include non-tertiary programs) might just be available because they qualify students for other more attractive and preferred programs over time. In this connection, Technical Universities should decide whether to keep programs that have less potential for growth, and which rather consume huge cash or harvest them (West, Ford & Ibrahim, 2010).

Question marks in this portfolio analysis represents programs which require huge investment due to the course structure involving vocational and technical skills training but which are unable to generate correspondingly enough cash to finance the programs. These programs, such as 'Applied Arts' often attract a lot of cash spending with relatively little cash generation by the faculties due to low students' enrollment. Question Marks programs could be developed to become Stars if appropriate strategies are employed to increase students' enrollment while maintaining operational cost, and consequently become cash cows if operational costs subsequently slows relative to cash generation. On the contrary, any drop in cash generation relative to cash consumption could lead to 'Question Marks' becoming 'Dogs'. Thus Technical Universities in their program mix strategies might need to improve cash generation through increased enrollment and also find a way of reducing or maintaining operational expenditure to make Question Marks desired program portfolio for sustainability (Tudor & Valeriu, 2011).

Programs which require huge investment by way of laboratories, workshops and other technical training equipment, and also generate high revenue through relative increased students' enrolment, and available funding opportunities are referred to as ***stars*** (Hofer & Schendel, 1994). Programs in the Stars portfolio may generate a lot of cash, but at the same time due to the huge investment requirements they end up consuming almost every revenue generated, leaving virtually nothing to support other institutional activities. If managers of Technical Education adopt the right program planning strategies, Stars can become Cash Cows as program costs go down and cash generation improves relatively. As Stars programs are managed to become Cash Cows they generate extra cash to support other program portfolios in the long run. This requires that Technical Universities invest heavily in its core mandated programs (such as Engineering and Applied Sciences) in the short to medium term to develop Stars, while strategizing to move Stars to Cash Cows that generates extra cash in the long run to make the institutions competitive (Gurung, 2011). Until that is achieved, other non-technical programs such as Business programs

ISSN: ISSN 2053-4019(Print), ISSN: ISSN 2053-4027(Online)

which are already cash cows should continue to be given due attention to give necessary cash support to the Technical Universities education.

Figure 2 below summarizes the conceptualization of the BCG model to the strategic planning of Technical University programs.

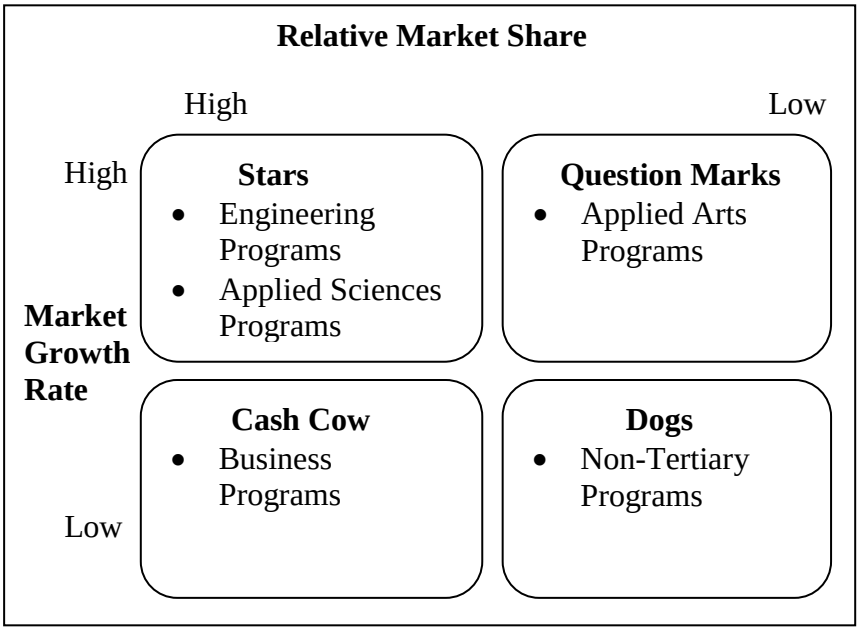

Figure 2: This figure shows BCG Matrix of Technical University Program mix. The four quadrants show four different business units (represented by programs) and their share of market or revenue generation versus their growth rate or investment required. The four quadrants are stars, cash cows, question marks and dogs.

From the figure 2 above, Stars (first quadrant) is represented by engineering and Applied Sciences programs. The figure shows that these have high relative market share and high market growth rate. This means engineering programs requires huge capital investment even though they also generate relatively enough cash to fund the necessary investment. Nonetheless, the level of investment required means that exist of Engineering and Applied Sciences alone cannot generate sufficient income for the programs and other institutional activities. From the figure 2, Business programs are represent cash cows (second quadrant), which shows high relative income generation, with relatively low investment. Thus extra funds can be 'milked' to support other programs including Engineering and Applied Sciences. Question Marks (third quadrant) is represented by Applied Arts programs, according to the figure 2. These generate relatively low income but require relatively high investment due to the need for studios, laboratories and other practical materials and resources. Dogs (the fourth quadrant) is represented by Non- Tertiary

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programs such as Certificates and diploma programs. These programs generate low income and also require relatively low investment due to the low enrollment of students into such programs in recent times, as well as the low interest and commitment of the Technical Universities to run these courses.

Analysis of secondary Data from Students Enrollment

The table 1 below justifies why the Business Programs are considered cash cow as indicated in figure 2 above. As found in the table, Humanities (comprising mostly business programmes) contribute the highest enrolment of 32% in Public Universities, 58% in Private Universities and 61% in the Polytechnics. Arts programme contribute 32% to Public Universities, 13% to Private Universities and about 13% to Polytechnics. While Arts and Science programmes need to spend a lot on 'practicals', Business programmes spend little on practical training. Thus, the institutions generate a lot of money from the large enrolments in Business, which means excess cash to support other programmes. This suggests that if Technical Universities can address their cash needs, especially in the short and medium term, they should have to offer business programs as part of technical education curriculum.

Table 1: Statistics of Students Enrolment by Programme in the Tertiary Education in Ghana – 2012/2013 Academic Year

Program	**Public Universities (% Enrollment)**	**Private Universities (% Enrollment)**	**Polytechnics (% Enrollment)**
Applied Science	22%	22%	26%
Natural Science	6%	7%	
Math	8%	-	
Humanities	32%	58%	61%
Arts	32%	13%	13%
Total	100%	100%	100%

Source: National Accreditation Board (NAB) Annual Statistical Report, 2012/2013 for student enrollment into tertiary education programs.
Note: Over 60% of the enrolment in Humanities is for Business Programmes

ISSN: ISSN 2053-4019(Print), ISSN: ISSN 2053-4027(Online)

Exploratory Study

Responses from ten senior officers of some selected public and private universities and polytechnics suggested that program development and offerings over the years have not based only on what constitute a university's core mandated courses or core capabilities. An important consideration is how to mix programs so that the universities could raise funds from some programs to support other programs. This assertion supports the theory and also supports the enrollment statistics. The interviews and proposition below confirms the point.

Seven of the ten executives interviewed indicated the critical role that business programs play in the program mix of tertiary education, such as generating sufficient cash to support financing of other programs such as technical, technology and other sciences. The executives who made such remarks think the business programs generate sufficient cash to support financing of technical programs such as engineering, applied sciences and other sciences. Here, an implication is that the universities lose their financial base in the absence of business programs. Hence, the proposition that: "If the business programs become subordinate to the technical programs it results in a weakened financial position at the universities".

One of the questions at this point is how the technical programs and other non core mandated programs can collaborate to find a common mix to the financial sustainability of the university as a whole. A less-than-cooperative relationship between technical programs and other programs may well diminish the financial contribution to tertiary education not only for the long-term performance but also for the short and medium term performance as noted from the interviews.

A deputy registrar of a public university said in an interview:

"I have worked at the directorate of academic affairs for about ten years, in charge of students' admission in our school. Now, I can say for a fact that the business programs really attract higher enrollment for the school, which also means more money. Business programs work really well. Every year we have more business applicant than we can admit, but we cannot say the same for sciences and engineering"

In his view, a senior assistant registrar from a teacher training university in an interview said:

"Though we are an institution mandated to train teachers, we like to admit people into various business programs. It's truly advantageous to have program mix. Our students who seek for admissions come from a variety of program backgrounds; same thing for business. I do think we do ourselves a lot of good by admitting as many of the business students as possible. We have been successful in trying to improve the finances of the university."

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One interviewee in the exploratory study also echoed this viewpoint:

"Our university is primarily a Science and Technology institution, yet we respect business programs a lot. For example, the curriculum development and admission sections resort to cross-program including not only Science and Technology (that is supposed to be the norm) but also business. The business programs add tremendous value to our program mix, since they contribute wonderfully to the financial muscles of the institution."

From the following responses, it is proposed that: The business programs such as marketing, accountancy, procurement and Management are fully integrated into the program mix of the technical universities. The exploratory study indicates that the technical programs remain relatively independent of the business and other non mandated programs.
Again, eight of the ten senior officers interviewed indicated that their program mix are independent of their core mandated programs, though three of the eight institutions are part of either an engineering, science and technology or teacher training universities. One executive who was interviewed pointed out:

"Our primary existence is for science and technology, and we've been setting ourselves apart from others with our cutting-edge technology. Our university provides technology-based support for the industry. Sufficient financing on these areas must come from business programs which need to generate enough to support it. That is why we still run business programs. They are necessary evil."

Such a statement is not surprising, given the importance of science and technology in economic growth of a country. Just as in the statement, in fact, the business program paradigm makes it imperative to provide the highest level of technology. This is only possible when the technology programs are closely aligned with business programs rather than technology program all alone. Hence, it is proposed that: Technical programs remain independent at a programs development of many universities. Nevertheless business programs have been receiving more than its share of attention recently as a strategic area within program mix, because it is one of the critical areas to realize the needed cash for strategic planning.

On the issue of what form should business programs in the Technical University take, seven of the informant believe that it should be more professional oriented rather than theoretical oriented.

One interviewee stated that:

"Current students from the traditional universities need time to learn the profession of the courses they claim they have done at school. I feel it is about time students have professional training right from school to make them employable, as a means of dealing with the current rate

ISSN: ISSN 2053-4019(Print), ISSN: ISSN 2053-4027(Online)

of competition for job. I hope the conversion of Polytechnics to Technical Universities will serve as panacea to that."

Another academic administrator interviewed pointed out:

"Engineering and science product must be sold, so it is not out of place that the Technical University while training people to produce can also at the same time train people with the necessary business ideas to design, manage and sell what is produced. The two programs must go together to complement each other."
Another informant who was interviewed said:

"*Ghana needs professionals in business, which the countries university graduates lack; I have a strong feeling that with the establishment of Technical Universities which is competency-based the gap may be filled."*
These comment show that business programs in Technical University is not expected to chat the same path of the theory-based training of the Traditional Universities, but one of professional-based. This suggests that appropriate professional curriculum should be developed for business programs in the Technical University education.

Furthermore five officers interviewed supported the business programs to be part of the program mix. The reason according to them is business programs provide both short and long term capital to support other programs and other activities. Three officers, on the other hand, expressed the need to link business programs with other technical programs in the mean time. Then in the future when the institutions are financially sound it can concentrate primarily on core mandated programs as its activities become highly technical.

It could be proposed that: Whether Technical University should limit its program mix to only technical programs should depend on a number of factors such as current financial position of the institution, the nature of state support and the nature of program mix strategy.

The various programs of the university education in general have different market attraction, require different investment and also generate varying revenue. Unless the programs are well mixed, these programs are unlikely to succeed on their own (Hooley, Saunders & Piercy, 1998). As indicated by the BCG model, concentrating on a few core mandated programs can create cash flow challenge for the institutions, which could affect the smooth running of the Technical Universities education in Ghana (Kotler, Armstrong, Saunders & Wong, 1999) with particular reference to the highly complex, dynamic and competitive, business environment facing the tertiary education institutions. The BCG model focuses on the critical need for Technical University managers to explore and exploit economic opportunities in their chosen market. With the current state of shared responsibility of cost of university education, it is critical that good

ISSN: ISSN 2053-4019(Print), ISSN: ISSN 2053-4027(Online)

strategy in program selection should not only base on policy and experience. Primarily, such strategic decision must among other things base also on logic (Gurung, 2011).

In this case the Technical Universities' key mandate will be to run programs in engineering and applied science. Nevertheless, the mounting needs on Universities to generate income internally to support the government's efforts in running these institutions, logically demands that programs such as 'business programs', which requires less investment but generate enough revenue are considered. While some may consider such a move as a deviation from policy, the scarce nature of funds to sponsor university education and the resulting reliance on internally generated funds to fund Technical education places a responsibility on managers of Technical Universities to adopt programs that make them strategically market orientated in order to be better positioned in tertiary education environment (Agbonifoh, Ogwo, Nnolim & Nkemnebe, 2007). This might explain why Kwame Nkrumah University of Science and Technology is investing a lot in 'business programs' instead of their original mandate of technical programs; and University of Cape Coast is currently running more business and other related non-core programs instead of their core mandated educational programs. University of Education, Winneba, though has not completely deviated from its mandate to run education programs; it is currently offering more education programs in business related courses.

The application of the BCG model for the Technical University programs mix is so as to analyze the significance of respective programs in the overall development and sustenance of the institutions. This can set the platform for effective and efficient allocation of resources among the various programs and charting a growth path for the Technical Universities (Perreault & McCarthy, 1996; Kotler & Keller, 2009). By adding 'business programs' to the core mandated technical programs such as Engineering and Applied Science, the universities are finding "a way to assess the needs, allocate resources, and spread risk across programs which, taken together, contribute to the achievement of corporate objectives" (Keegen, Moriarthy & Duncan, 1992:124).

The BCG model is a useful tool for university managers to recognize that a University is a collection of programs, where both core mandated and non-mandated programs may respectively contribute to the overall development of Technical education in Ghana (Haspeslagh, 1982). The importance of offering more programs beyond one's core mandated programs is that some programs are there to help generate sufficient incomes to support skills development of Technical Universities, which programs themselves may not be able to generate such required cash (Doyle & Stern (2006). In this connection the BCG model can be considered an important analytical tool to plan programs to be offered at the Technical Universities. Successful application of the BCG model can guide Technical Universities to develop core mandated programs (like Engineering and Applied Sciences). These programs will differ in terms of cash flow characteristic. Some will be net cash generators while others will require cash to grow in

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attractive market. Yet others would be using cash in declining market. Thus, the BCG model can help the Technical Universities to diversify by assessing the balance of programs in their portfolio and guide resource allocation among them. This the universities can do by allocating strong resources into more profitable programs, likely its core programs (Engineering and Applied Science), while developing the cash cow (Business programs) to generate and milk the cash needed to support the technical programs.

CONCLUSIONS, REOMMENDATIONS AND LIMITATIONS

The current study aimed at making a case for the development of academic programs for the Technical Universities in Ghana by applying the BGC matrix. Theory-based analysis was done using existing literature and empirical studies on BCG matrix. Also secondary data were collected on the 2012/2013 students enrollment to Universities and Polytechnics in Ghana, to make a case for underlying practice of programs mix in the tertiary institutions. Again, using convenient sampling approach, ten administrators of tertiary institutions in Ghana were interviewed to help have a better appreciation of factors influencing programs development and choice at the tertiary institutions. The study revealed that the BCG model is relatively applicable for strategic program planning at the technical universities (Armstrong & Brodie, 1994; Dag Øivind Madsen, 2017), as there are portfolio of programs. Also, the use of BCG matrix in this current study has provided the understanding that the development of programs in a university should be informed among other things by several relevant considerations, such as financial sustainability for the institutions and, not only on capabilities or institutional experience.

This study has made some contributions to knowledge in the following areas:

1. The study has confirmed that contrary to the criticism that BCG matrix is out-dated, it is still useful and application for business portfolio planning (Dag Øivind Madsen, 2017)
2. With the application of the BCG matrix to examine program mix in the technical university, potential technical and non-technical programs alike have been categorized into the four main quadrant of Stars, Cash cow, Question marks and Dogs, in the marketing literature for use by marketing authours
3. Another contribution of this study is that it has enhanced knowledge on the concept of programs mix in the marketing literature.
4. The current study has also helped theorise the principle for examination of program development and choice in the technical universities that gives sustainable competitive advantage

Based on the findings and conclusions, it is recommended that;

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1. While regulators of tertiary education should keep an eye on the program development of the Technical Universities, there should not be strict rules regarding which program mix a particular Technical University pursues. Empirical models and theories, rather than strict adherence to specific policy on programs based on emotions and personal experience, should determine the program mix. Such critical approach could help the Technical Universities generate enough cash from other programs to support investment into the core mandated programs and thereby supporting the cost sharing principle of the tertiary education in Ghana.
2. Again, BCG matrix is not out-of-date; therefore managers of technical universities can apply the model in developing and offering programs in the universities.
3. Moreover, regulators of technical universities should ensure that while emphasizing on technical and vocational programs, technical universities are allowed to develop their own programs mix based on their examination and application of the BGC matrix. In this connection, the technical universities also have a responsibility of developing non-technical curriculum that are tailored toward professional and competency-based rather than traditional and theory based.
4. Finally, managers of technical universities should be able to argue for offer of non-technical programs on the basis of how other business portfolio support stars or core business as indicated by the BGC matrix.
5. Also the institutions can use the BCG model to identify programs that generate extra cash and those that consume so much cash so as to be able to determine profitability or otherwise of the programs (Drummond & Ensor, 2011).

This study is not without limitations. One limitation is that the current study used enrollment statistics of 2012/2013 academic year which seems old, though it was the only available statistics. This in some way may not reflect current situation. Secondly, the study failed to consider the policy implications of the running of the non-core programs and concentrated on financial sustainability, which constitutes a limitation; though in business, economic motives overrides other considerations. Thirdly, running humanity programs does not necessary mean the Technical Universities shall present the same courses, training and career option as the Traditional Universities. Yet the scope of this study does not cover how business programs in the Technical Universities will differ from that of the Traditional Universities in terms of content and career direction. While there shall be definitely some differences, inability to emphasis any such differences constitutes a limitation. Finally, a quantitative study of the application of the BCG in the Ghanaian University market would have been given practical answer to why business programs in Technical University education cannot be over emphasised. While qualitative study coupled with theoretical analysis based on credible model is a step toward understanding the issues, a quantitative research would have provided more superior results. Future studies may consider investigating any of the limitations identified. Future studies do well to address some of the limitations outlined

ISSN: ISSN 2053-4019(Print), ISSN: ISSN 2053-4027(Online)

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ACKNOWLEDGEMENT:

I acknowledge that this paper is an original work of the author, who has professional as well as academic marketing background. The author of the current study owns his gratitude to all previous writers whose works have contributed to this article.