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PRODUCT DEVELOPMENT PROCESSES AND PERFOMANCE OF CHARTERED PRIVATE UNIVERSITIES IN KENYA

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Abstract

Increased demand for tertiary education and subsequent challenges, led to strategic initiatives by Kenyan universities to raise their income. Some of the distinguishing features of the chartered universities are the programmes that they offer. For a university to keep up with change and demand, there is a need to develop products fast enough to meet market needs. A product can be developed through stage-gate or scrum method which are characterised by the period it takes to initiate, develop and launch into the market. A hybrid of the methods can also be used to incorporate the features of the two. The need to attract more students by a university through introduction of programmes that meet their needs motivated the study which sought to find out whether product development processes had a relationship with performance of private chartered universities and a subsequent null hypothesis was formulated:- Product development processes has no significant relationship with performance of chartered private universities in Kenya. The study adopted positivism research paradigm and used a combination of research designs namely, descriptive, cross sectional and survey. The population constituted all the 18 chartered private universities as at 2016, with Deans of Faculties/School forming the unit of observation. Identification of indicators of the method preferred in product development processes and the relationship between product development processes and performance were done by use of factor analysis and linear regression. The findings were that private universities used a hybrid of stage-gate and scrum processes. For every unit of product development processes there was a variance in performance of 1.325 units and therefore, the null hypothesis that stated that there was no significant relationship between product development processes and performance of chartered private universities in Kenya was rejected. Product development processes affected performance of private universities in Kenya. The findings can be used by policy makers to formulate policies that foster collaboration between the regulator and universities in order to ensure that relevant and quality programmes are introduced while

opportunities last. Managers of the universities can use the findings to facilitate faster introduction of degree programmes relevant to the market instead of being guided by traditions of their universities.

Key Words: *Product Development Processes, Stage-gate, Scrum, stage –gate/scrum hybrid methods.*

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Introduction

Mackay Commission on education reforms in Kenya of 1981 laid a foundation for establishment of private universities after serious challenges in higher education that required practical solutions (Oanda, Chege and Wesonga, 2008). A huge number of qualified students from secondary school level, few universities, frequent strikes by students and lecturers in public universities, rampant university closure that prolonged the period of completing degree programmes and wider gaps of transition between secondary and university education occurred (Wandiga, 1997:Nganga, 2010).

Subsequently, public universities started module II programmes that admitted self – sponsored students to broaden revenue stream and support government policy of providing higher education to all qualified citizens (Chacha, 2004). Middle level colleges were upgraded to expand university services to rural areas, satellite campuses were established and university education was liberalization (Oanda & Jowi, 2012). By 2016 Kenya had 48 chartered universities, constituent colleges and others operated on interim letter which solved the problem of limited capacity in higher education (CUE, 2016). These cleared the high number of previously qualified students and paved way for differentiation by universities as a competitive advantage. At the same time, Technical and Vocational Institutes (TVETs) gained a lot of support from the government because of outcry by the public and the industry on quality of degree graduates (Kitavi, 2017). This raised the question of relevance of some of the programmes offered by the universities and created an opportunity for a faster rate of development of programmes that addressed the market needs.

The module (II) programme in public universities, expansion of universities and colleges, decision by government to sponsor all qualifying students and place them in public and private universities, introduction of unit cost funding of degree programmes undermined revenue generation by universities (Wanzala, 2010). This background initiated the thought pattern that if private universities developed programmes fast enough to meet market demands; they would gain a competitive advantage and post a post a better performance. Therefore, the objective of the study was to establish the relationship between product development processes and performance of chartered private universities in Kenya and a null hypothesis was formulated as; there is no significant relationship between product development processes and performance of chartered private universities in Kenya.

Chartered Private Universities in Kenya.

Before the 90s, Private universities were not generally accepted in Kenya and the earliest accreditation was that of University of East Africa Baraton in 1991, Catholic University in 1994 and United states International university in 1999 while the rest were chartered after the year 2000 (CUE, 2016). However a majority of them were operating mainly as theological colleges. The establishment and expansion of private universities occurred in the 90s because of massffication of student intake by public universities and reduction of funding by government which contributed to lower quality of education (Wandiga,

1997). The setting up of the Commission for higher Education to regulate private universities also set the basis for growth of private universities. As a result, parents who could not bear the happenings in public universities and were able to finance education of their children, enrolled them to private universities (Oanda & Jowi, 2012).This accelerated the growth of private universities and by 2016 there were 18.

Product Development Processes

An organization is associated with a product or service which it creates, innovates or acquires with the intention of meeting the needs of its customers. When a rapid change occurs, business firms try to gain competitive advantage through unique products, services and processes. Consequently, a set of practices, metrics and pathways intended to introduce a new product or process are necessary for competitive advantage (Chang, Hu and Hong, 2013). Product development can be achieved through several methods which are distinguished by the period it takes to go through idea initiation, development and launch into the market. Some are characterized by bureaucratic processes which make it difficult for a firm to introduce a product to the market faster than the competitors. Other methods are agile in nature and they are used for the purpose of reacting to a rapid change that require a new or innovated product to solve an emerging problem.

Introduction of a product to the market can be a competitive advantage for a firm, if the methods or processes used to develop it are fast enough to take advantage of opportunity created by agility. Studies by Cooper (1990a) and Cooper, Edgett and Kleinschmidt (2002) showed that manufacturing firms in USA that relied on stage-gate method of product development processes delayed in product launch. Similarly, Rao, Naidu and Chakka, (2011) showed that stage-gate method is not fast enough in creating or innovating products in the wake of agility. Researches on agile product development processes methods by Leon, Farris, and Letens,(2013) and Copper (2016) gave indications that firms adopting the methods through systems approach and on a non- project basis, gained a competitive advantage in a constantly changing environment. The evidence gathered from the reviewed studies on product development processes led to the question: can a product development process adopted by private universities during the period of rapid change influence their performance?

Performance of a University

Performance can be viewed as the extent to which an entity accomplishes its objectives in order to achieve the overall goal (Kaur & Kumar, 2014). Performance of universities can be reflected better by both financial and non-financial measures of performance because they have multiple, contradictory and complex missions that include teaching, research, service to communities and revenue generation (Almatrooshi, Sanjay & Farouk, 2018). Twidale & Nichols (2013) explained that a variety of measures had been used successfully in assessing performance of universities in line with their broad goals. Bogt & Scapens (2009) identified some of them as education mission which had indicators such as number of programmes, student enrolment,

student- lecturer ratio, class size, number of graduates and academic pathways. Research excellence was measured by rankings, awards, honours, publications, funding and innovations (patents, spin-offs/products and license agreements). University faculty, staff, alumni and friends of the university measures were captured by expression of satisfaction and support they give to their respective universities. The final category included infrastructure and was indicated by number of faculties/schools, teaching space, laboratories, library and facilities such as accommodation, catering, recreation and information technology. These were supported by similar measures used by University of Toronto Canada in the past (University of Toronto, 2014). The study adopted non-financial measures of performance because educational institutions in Kenya were primarily driven by common good of the people and not purely by profit (Oanda et. al, 2008)

Literature Review

The existence of an organization is defined by the product or services that are offered to the customer. A product is therefore created, innovated or adopted from another firm in its original form or modified for differentiation. For agility purpose, business firms try to gain competitive advantage through unique products or the process of offering them to the customers. Relationship between product development which occurs internal to the organization and the consumer, who is external, can be explained by socio-technical systems theory. Zwaan Der Van (2001) associated the theory with Trist (1960) and others such as Brown; Emery (1967) whose works were based on dynamic systems. The theory anchors the idea that an organization has the capability to attain equilibrium of technical and social systems that optimize its productivity. Both systems must be configured to suit the operational processes that are specific to the functions of the organization

(Lakshman, 2018). The components of technical subsystems are assets, technology and information while social subsystem consists of human resource capabilities such as skills, competences and the interactions that are necessary for product development (Baxter &SommerVille, 2011)

Theory of constrains focuses on the systems improvement for optimal performance (Aryanezhad & Komijan, 2004), was also used to anchor the processes that a product is subjected to before a final product is delivered to the customers. It consists of five essentials which when followed lead to better performance. These include identification of the constraints, deciding on how to exploit the opportunities resulting from constraints, subordinating the other activities to the constraints, elevating the constraints and if a change occurs as a result of eliminating the constraint, the system is analysed further to identify new constrains(Trojanowska & Dostatni, 2017). These basics form step by step cyclic procedure of optimizing a production system for continuous improvement. Development of educational products can be triggered by scholars who generate knowledge for long term advancement of humanity (Lazega, 2005) or by a short term social economic need emanating from environment external to

the university. The process and efforts required to deliver an academic product are enormous and most of the initiatives to develop one that addresses the needs of market never materialize. The breakthrough in introducing a new educational product involves surmounting numerous constrains and challenges which calls for a method that ensures that this is achieved.

Traditionally, companies used one version or the other of stage –gate process to develop their products (Ettlie & Elsenbach, 2007). The method consists of stages and gates which represent actions and decision points that approve continuation or discontinuation of the processes. The method was popular with most manufacturing firms because it had ability to reduce technical and business uncertainties that the product poised before launch. The method provided precautionary measures that were necessary because of the massive resources that go into the whole process of product development and the implication of failure in the event that the product does not succeed (Craig, Wangbenmad, Mohamad, & Ahmed, 2013). Stage –gate process is associated with Cooper (1990a) who introduced and developed it progressively in subsequent publications. However, in a fast changing business environment, stage – gate method, was found to be inadequate in achieving shorter product development processes cycle that are required to introduce new products to the market either as a competitive advantage or as a way of meeting the changing demands of the consumers. Stage-gate approach aims at achieving a perfect product by eliminating iterations that improve the performance at each stage. However, Zhang (2012) explained that complete elimination of product imperfections by iterations was not achievable even in the last stage of product development processes and recommended that application of stage- gate method needed modification in order to yield the desired swift introduction to the market. Leon et.al, (2013) argued that the approach to product development processes by planned and frequent iterations was not necessary but needed to be introduced at the most productive point of product development process. Therefore, agile product development processes required an agile method of development that can get the product right the first time and launch it rapidly in order to take advantage of market opportunities.

Rao et. al, (2011) and Sommer, Hedegaard, Popovska, and Jensen (2015) identified nine methods of agile product development processes that were widely used to develop software products. These were scrum, crystal agile modelling, Dynamic System Development (DSD), pragmatic programming, internet speed development, extreme programming and Adaptive Software Development (ASD). Each of these had their own set of tools and advantages which implied that their applicability was to support a particular element of project management in development of software. While scrum and extreme programming methods were widely used in software development, it is only scrum that was applicable to product development processes beyond technological related industries. The method was also found to be appropriate in all other aspects of a product that needed to be developed (Abrahamsson, Warsta, & Ronkainen, 2003).

The term scrum is adopted from the game of rugby where players have to develop strategies of scoring while on the move. Scrum method therefore takes into account user's requests, time pressure, competition, quality, vision and resources that are available in the firm. These are necessary to deliver a product that responds to agility as was originally proposed by Takeuchi & Nonaka (1995) and the ideas have advanced since then to show the importance of scrum in rapid product development(Dhargakar, Shide & Arora, 2018). Unfortunately, scrum method was also found to have limitations because it is used for improving or modifying an existing product but not for creating a totally new one (Lonel, 2008). Stage-gate/scrum hybrid model is therefore a third method that was recommended because it puts into account iterations and speed that is required in developing and introducing a product to the market that guaranteed some level of competitive advantage (Cooper, 2016).

Evolution of universities through product development can be traced back to medieval times where they trained manpower for church and state (Geuna, 1996). Growth of research universities in Germany and technical ones in the USA was attributed to product development that catered for emerging needs of the state, societies and industries (Goldin & Katz, 1999). Likewise, realization of Kenya's economic and social goals requires a responsive higher education that meets the emerging needs and challenges (Kavita, 2017). This can be achieved by developing products beyond traditional curricula. Examples of such include-; targeted research, training, specialized consultancy, translation of ideas, and innovations to actual products that capture agile drivers from industry, state and market.

Product Development Processes and Performance.

The period taken to develop and introduce a product to the market is critical for competition. Literature reviewed earlier, supported product development processes through scrum or stage-gate /scrum hybrid in developing a physical product in manufacturing industries. Scrum method was found to be successful in introducing a physical product to the market ahead of the scheduled time. It was empirically established that team dynamics, tooling, investment, co-allocation or diverse locations affected effectiveness of scrum method in developing products in the manufacturing firms (Sharifi &Pawar, 2001). Equally a study by Sommer, Hedegaard & Jensen, (2015) in manufacturing firms in Denmark indicated that development of a complex product by stage-gate method was a failure while a hybrid of stage gate and scrum had a positive relationship with agility.

There was evidence in literature that point to limitation of empirical studies on the appropriateness of the method followed in development of a service product. Where the studies had been conducted, the objective focused on other aspects besides the process that had been followed in ensuring that a product was launched while the opportunity existed. An example of such was a study by Suwannatat, Anuntroranich, and Chandracha (2012) in Thailand which concentrated on whether university – industry collaboration was necessary in animation industry. Durkin, Howcroft, & Fairless (2016) studied

product development processes in higher education marketing in UK universities to determine whether the fuzzy front end of product development processes was supported by innovation and market orientation.

Relationship between product development processes and performance formed the basis of researches that were reviewed. Events that triggered agility deliberations on challenges that affected manufacturing sector of USA in 1991 (IC, 1991) provided a clear indication that a company may have a product but fail to sell, if a demand does not exist. Therefore, the study proposed that product development processes affected performance of a university because a consumer will only have a relationship with an organization if there is a product on offer that meet their needs, wants or desires. The importance of a clear understanding of the relationship between a product and market drivers in higher education is necessary because of the incongruence of views of university mission by faculty and management staff. While the mission of faculty is to discover, organize and transmit knowledge for the sake of it, the goals of management are to meet the expectations of the stakeholders. These conflicting goals may inhibit development of products when a market exists. This is because either party may fail to perceive the opportunity created or reach a consensus on the procedures to be followed (OECD, 2003).

Research Methodology

Any credible research must have a basis on the accepted philosophical tenets that explicitly show ontology, epistemology and the paradigm, upon which the findings can be believed and replicated by future researchers to obtain similar results (Saunders, Lewis & Thornhill, 2009). Ontology rests on explaining the nature of the world as to whether it is fixed or dynamic while epistemology underlies how a researcher discovers knowledge either as part or independent of it (Guba & Lincoln, 1994). If knowledge discovered is independent of the researcher, the paradigm becomes positivism and if otherwise intepretivism. The study therefore adopted positivism approach because the aim was to investigate the relationship between product development processes and performance of private universities in Kenya and generalize the findings on the sector in similar background.

The study adopted descriptive, cross sectional designs and survey designs (Cooper & Emory, 1995) with intention of describing the state of the variable under study from a data that was collected in a short duration of about nine months from all the private universities in Kenya. The suitability of these research designs was explained by Zikmud (2003) who emphasized the importance of describing the nature and dynamics affecting a business within a given period of time.

Population of the study constituted of all the 18 chartered private universities in Kenya and the unit of observation was identified as 66 Deans of Schools or Faculties. Some universities had a Dean as the head of a school while in others the same was in charge of a faculty. The figure varied depending on the number of schools or faculties in a university. As at the time of ascertaining the number of Deans, three private universities had not indicated in

their websites as to whether there was a school or a faculty. During data collection, it was confirmed that the student population was small and they operated under one Dean in charge of academics. Deans were chosen as the unit of observation because they possessed the information sought and were responsible for academic operations and management at faculty or school level. Sampling was not done because of diversity in characteristics of the Schools or Faculties across and within universities.

The instrument for data collection consisted of a structured questionnaire with three sections that had items rated on a Likert scale. Administration of the instrument was executed by the researcher assisted by a trained assistant. Data was subjected to Component Factor Analysis (CFA) tests as a further measure for ascertaining reliability and also isolate statements associated with at a type of product development process that private universities used. Mean scores, frequency and one sample t-test were computed to determine the basic and general characteristics of the data. Correlation test was performed to identify whether product development processes had a linear relationship with performance. A linear regression model; $P = \beta_0 + \beta_1 PDP + \varepsilon$, was used to predict the relationship between product development processes and performance.

Validity and reliability

In social sciences, a measure of instrument validity is important in order to minimize systematic errors which cause actual measurement to be consistently higher or lower than what is considered to be a mean average in a given population parameter. Zikmud (2003) defined validity as the ability of a research instrument to measure what it is supposed to. Different data collection instruments may require different measures of validity depending on the variable construct in focus (Mooi, Sarstedt & Mooi-Reci, 2018). However, all instruments must meet face and content validity which in this case were established through literature and panel of experts reviews.

Reliability is the ability of research instrument to yield consistent results when data is collected from the same respondents more than once (Tavakol & Dennick, 2011). Cronbach's alpha scale developed in 1951 was used to determine internal consistency of items in the questionnaire with acceptable scale of 0.5 and above as suggested by various scholars (Douglas & Thomas, 2018). 0.5 was taken as the minimum value for purpose of assessing the reliability. CFA was also performed to establish whether the statements that measured product development processes were to be retained or excluded if they were below the accepted minimum for reliability of Cronbach's alpha value of 0.5. This line of thought was supported by Field (2006) and Tavakol and Dennick (2011) who argued that low Cronbach's alpha values do not necessarily imply that an instrument is unreliable. Additionally, CFA test was used to isolate clusters of statements that indicated whether the method of product development processes that were used in private universities was stage-gate, scrum or hybrid.

Results and Discussions

The unit of analysis included all the 18 chartered private universities in Kenya and the unit of observation was 66 Deans of Faculties or Schools. This number was obtained from the websites of the chartered universities in 2016 and was verified during data collection. A total of 66 questionnaires were distributed, 44 returned and 22 were not as indicated in Table 4.1 below.

Table 4. 1: Response Rate by the Target Population

	Dispatched	Returned	Not Returned	Percent Returned
Deans	66	44	22	65.15
Universities	18	13	5	72.2

Source: Field data 2019

The response rate of 72.2 percent was considered as adequate for further analysis and drawing of conclusions, a view that was supported by Baruch (1999) and Morton, Robinson and Carr (2012) that, a response rate above 55 percent was acceptable given that it was becoming increasingly difficult to get managers to respond to research instruments. Demographics of the respondents involved identification of ownership of universities, fields of study (disciplines), levels of progression on a programme and the fastest growing programme. Regarding the ownership of the universities, out of the 13 that participated in the study, 11 had local ownership, two foreign while three had both has indicated on table 4.2 below.

Table 4. 2: Ownership of Universities

Chartered University	Locally	Foreign	Locally and Foreign	Specific Owner	
				Individual	Group
Private	11	2	3	3	10

Source: Field data 2019

Table 4.2 above indicates that there were nine universities associated with faith based organizations while four had no relationship with religious institutions and individuals owned the least number of universities probably because of heavy investment, strict regulation of establishment and competition. The finding concurred with an earlier study conducted by Abagi, Nzomo and Otieno (2005) which reported that, of the 14 chartered private universities that existed by then, only one was not owned by church or church related groups.The next statement in the questionnaire aimed at identifying the areas of study in private universities. The term disciplines was used to refer to a body of knowledge that is taught to impart knowledge that create a pool of professionals in a given area of specialization such as business, education, agriculture and many more. Table 4.3 below shows the type and distribution of academic disciplines that were found in chartered private universities. Business studies led with 18.8 percent, followed by social science, physical sciences and theological studies at 10.5 percent each, law studies 8.3 percent, information

technology 6.3 percent and the rest had frequencies of four and below.

Table 4. 3: Distribution of Disciplines in Private Universities in Kenya

Discipline of study	Frequency	Percent
Business	9	18.8
Physical Science	5	10.5
Economics	-	-
Education	5	10.5
Social Science	7	
Medicine	2	4.1
Agriculture	-	-
Public Health	1	2.1
Environment and Natural Resources	1	2.1
Nursing	1	2.1
Engineering	-	-
Electrical Engineering	-	-
Computer and Information Technology	3	6.3
Communication and Mass Media Studies	-	-
Discipline of Study	Frequency	Percent
Pharmacy	1	2.1
Dental Studies	-	-
population Studies	-	-
Diplomacy and International Studies	-	-
Veterinary Studies	-	-
Law Studies	4	8.3
Arts and Humanities	1	2.1
Architecture and Built Environment	-	-
Tourism and Hospitality Studies	1	2.1
Water Resource Management	-	-
Cooperative Management	-	-
Mining Engineering Studies	-	-
Theological Studies	5	10.5

All programmes are together	1	2.1
Total	48	100.0

Source: Field data 2019

As can be deduced from Table 4.4 above, a relatively high percentage of theological programmes in private universities was explained by findings of Abagi; et al. (2005) who observed that, churches established the earliest tertiary theological colleges in Kenya which later became chartered private universities. Physical science, engineering and medical schools were few possibly because of the resources required to introduce and maintain them. This finding concurred with a report by Chacha (2004) which observed that private universities had limited programmes in ICT and physical sciences which was attributed to low financing capability.

High number of Business Studies was explained by availability of diverse options of specialization, less initial investment, relatively lower entry grades and the high demand for professionals in business administration and management. It is also possible that students studied business administration and management with the aim of opting for business ventures as opposed to taking up formal employment, which was becoming rare to find in Kenya and did not pay as much compared to successful businesses.

Another statement in the questionnaire sought to find out the clusters and levels of programmes per discipline in the universities. The terms, levels of programmes meant that a university offered a certain area of study such as business with progressive programmes like diploma, degree, masters and/or doctor of philosophy as levels of advancement. Table 4.4 below shows how these levels were clustered per faculty or a school. Certificate, diploma, undergraduate degree, masters and PhD combination was the highest in private universities at 37.5 percent and undergraduate degree level was second at 16.7 percent.

Table 4.4: Level of Programmes Offered by a Faculty/School

Cluster of Programmes	Programmes clusters	
	Frequency	Percent
Certificate, diploma, undergraduate, master, PhD	18	37.5

Certificate, diploma, undergraduate, master, PhD	3	6.3
Certificate, diploma, undergraduate	4	8.3
Undergraduate, master	1	2.1
Diploma, undergraduate	1	2.1
Masters	-	-
Diploma, undergraduate, master, PhD	7	14.6
Undergraduate	8	16.7
Undergraduate, master, PhD	4	8.3
Diploma, undergraduate, master	2	4.2
Total	48	100.0

Source: Field data 2019

Certificate, diploma, undergraduate degree, masters and PhD was the most popular combination at 21.9 percent and diploma, undergraduate degree, masters and PhD followed with 16.7 percent. The observed trend of universities offering certificate and diploma programmes (which is a reserve of middle level colleges), might have resulted from the need to grow the numbers from one level to another as a result of competition that originated from rapid expansion of university education between 2007 and 2016 (Wanzala, 2018).

Regarding the fastest growing programme, the information obtained is indicated on Table 4.5 below. Programmes were divided according to levels of advancement starting with certificate as the lowest and PhD as the highest.

Table 4. 5: Fastest Growing Programmes

Programme	Private	
	Frequency	Percent
Certificate	-	-
Diploma	13	27.1
Undergraduate	24	50.0
Masters	6	12.5
PhD	5	10.4
Total	48	100.0

Source: Field data 2019

Data on table 4.6 above shows that the fastest growing programme was undergraduate degree at 50 percent followed by diploma level at 27.1, Masters Degree level at 12.5 percent and PhD at 5.0 percent. The growth of undergraduate degree programme could have been caused by the growing numbers of students transiting from secondary schools to university.

Reliability and Validity Tests

On test of reliability, the Cronbach's alpha test values for product development by stage-gate method was 0.379, product development by scrum method 0.665 and the overall for product development processes was 0.341. The value for stage-gate method and that for overall processes were not reliable because they were below

0.5. CFA was performed to determine whether the statements that measured product development by stage gate method were to be retained or excluded. This line of thought was supported by Field (2006) argument that, low Cronbach's alpha values do not necessarily imply that an instrument is unreliable. Such values can be assessed further before items describing a certain construct are declared unreliable. Low Cronbach's alpha values can be attributed to a small number of items in an instrument or presence of reversal questions and statements. Stage–gate method is characterized by iterations while scrum is action oriented (Cooper, 2016). Iterations and actions in a process describe activities and tasks that are opposite of each other. The 14 statements in stage-gate method violated the assumptions of the tan equivalent model on which Cronbach's alpha test is based (Tavakol & Dennick 2011).

The next step was to ascertain whether the items that measured product development processes were reliable enough for further analysis. The CFA was performed and Table 4.6 below shows the output of Kaiser-Meyer-Olkin (KMO) and Barlett's test.

Table 4. 6: Kaiser-Meyer-Olkin and Barlett's Test for Product Development Development Processes

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.569
Bartlett's Test of Sphericity	Approx. Chi-Square	208.686
	df	91
	Sig.	0.000

Source: Field data 2019

The KMO measure of sampling adequacy had a value of 0.569 and p-value of 0.001 at significance level of 0.05 which indicated that further tests by factor analysis could be carried out. Correlation test was then conducted to identify the extent to which items described product development processes and results presented as shown on Table 4.7 below.

Table 4. 7: Correlation of Product Development for Private Universities

Statements	Extraction
Programme development is initiated by top management	.664
Programme development goes through various stages of approval before implementation	.786
There is a lot of lobbying by faculty before a new programme is approved	.792

Other faculties were given priority in programme development	.817
There is restriction by management when faculty wants to initiate a new programme	.721
Some programmes are stopped before going through all stages of approval	.477
A programme takes 1-3 years before launch	.734
There is a department purely for programme development	.538
A programme takes 1-3 years before launch	.755
Programmes are initiated by the faculty members after independent market research	.676
Programme development takes a short time to be approved	.713
Programme development is done by self-organized teams with frequent consultation with management	.750
Self-organized teams are in constant consultation with industry when developing programmes	.681
Programme takes a short time (6 months) to launch	.665

Source: Field data 2019

All of 14 items had correlation values above 0.600 except one which had a value of 0.535. The highest value was 0.817 and therefore, these statements that measured product development processes had a close relationship that validated the description of product development processes in private universities. A Component Principle Analysis (CPA) extraction was obtained as a further analysis to identify the number of items that best described the variable and the results presented as shown in Table 4.8 below. All of the14 factors that loaded accounted for total variance in product development processes. The four factors with eigen value greater than 1.000 had contributions of 14.352 percent, 11.772 percent, 11.093 percent and 8.783 respectively. The total variance explained by these factors was 69.80 percent while about 30 percent was explained by the rest. Therefore the percentage variance that was explained by the statements was a sufficient contribution to explain product development processes in private universities.

Table 4.8: Total Variance Explained for Product Development in Private Universities

Total Variance Explained									
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	Percent of Variance	Cumulative Percent	Total	Percent of Variance	Cumulative Percent	Total	Percent of Variance	Cumulative Percent

1	3.330	23.784	23.784	3.330	23.784	23.784	2.517	17.981	17.981
2	2.009	14.352	38.135	2.009	14.352	38.135	2.102	15.017	32.998
3	1.648	11.772	49.907	1.648	11.772	49.907	1.907	13.622	46.621
4	1.553	11.093	61.001	1.553	11.093	61.001	1.679	11.993	58.613
5	1.230	8.783	69.784	1.230	8.783	69.784	1.564	11.171	69.784
6	.818	5.844	75.628						
7	.719	5.137	80.766						
8	.676	4.831	85.597						
9	.549	3.922	89.519						
10	.532	3.800	93.318						
11	.313	2.235	95.553						
12	.248	1.774	97.327						
13	.211	1.509	98.836						
14	.163	1.164	100.000						
Extraction Method: Principal Component Analysis.									

Source: Field data 2019

Rotation of the results was then carried out to isolate the groups of statements that best explained product development processes and the results presented on Table 4.9 below. The following statements that loaded onto factor one were programme development is initiated by top management and self-organized teams are in constant consultation with industry when developing programmes. The statements, programme takes 1 to 3 years before launch and some programmes are stopped before going through all stages of approval had negative values which indicated that they had an inverse relationship with the other statements that made the cluster. This factor indicated that product development processes in private universities was through collaboration between management and self-organized teams. As a result, there was no need of stopping a programme from being developed and it took a shorter time to introduce it to the market.

Table 4.10: Rotated Component Matrix for Product Development in Private Universities

Rotated Component Matrix[a]	Component			
	1	2	3	4
A programme takes 1-3 years before launch	-.876			
Some programmes are stopped before going through all stages of approval	-.837			

Programme development is initiated by top management	.698	.485		
Self-organized teams are in constant consultation with industry when developing programmes	.691	.466		
Programme development is done by self-organized teams with frequent consultation with management		.771		
Programme development takes a short time to be approved		.749		
Programmes are initiated by the faculty members after independent market research		.578		
There is a department purely for programme development			.795	
There is restriction by management when faculty wants to initiate a new programme			.692	
Programme takes a short time (6 months) to launch			.568	
Programme development goes through various stages of approval before implementation			.472	
There is a lot of lobbying by faculty before a new programme is approved				.783
Other faculties were given priority in programme development				.744
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.				
a. Rotation converged in 6 iterations.				

Source: Field data 2019

The second factor had the following cluster of items programme development is done by self-organized teams with frequent consultation with management; programme development takes a short time to be approved and programmes are initiated by the faculty members after independent market research. The cluster indicated that private universities used scrum approach to product development processes where teams, faculty and management collaborated to produce and launch a product within the shortest time possible.

The third factor had a loading of the following items there is a department purely for programme development; there is restriction by management when faculty wants to initiate a new programme; programme takes a short time (6 months) to launch and programme development goes through various stages of approval before implementation. This factor implied that compliance processes and quick launch of the product were put into account by the management.

The fourth factor consisted of the following items there is a lot of lobbying by faculty before a new programme is approved and other faculties were given priority in programme development. This factor showed that competitiveness was a factor of consideration when choosing products and the faculty to develop it.

The general pattern of loading of factors indicated that curricula, programmes and development of other products used scrum method. Factors that determined product

development processes were control by management, time taken to introduce the product to the market and collaboration between management and teams. Compliance and competitive processes were followed which implied that private universities were agile in developing and introducing products that market desired. This approach was supported by Takeuchi & Nonaka (1995) who observed that scrum method took into account user's requests, time pressure, competition, quality, vision and resources available in the firm in order to respond to a trigger.

Descriptive Statistics for Product Development

The statements in the questionnaire regarding product development process were based on a likert scale which had measurement that ranged between 1.0=strongly disagree to 5.0= strongly agree. The following were the rankings of the opinions. 1.00-1.99 strongly disagrees, 2.00-2.99 disagrees, 3.0-3.99 agrees to some extent and 4.00< agree to strongly agree. Means and one sample t-test were carried out to identify the extent to which the respondents agreed or disagreed with the statement that measured a type of method that was used to develop their programmes. 3.00 was set as an average where all the results below 3 were interpreted to mean a disagreement while those above 3.00 meant agreement. The mean differences were indicators of the variation in responses within the sector of the university.

Means and one sample t-test for product development by stage -gate method was carried out and the results recorded on Table 4. 9below. The statements measured the indicators of stage-gate method such as control of the process by management, stages that the process went through, restrictions and any priority that was given to some faculties. Any special consideration of product development by a team or department was also measured.

Table 4.11: Descriptive Statistics for Product Development by Stage gate Method.

Statement	Mean		T-test	Sig. (2-tailed)
Programme development is initiated by top management	11	3.25	1.107	.274
Programme development goes through various stages of approval before implementation	11	3.79	4.703	.000
There is a lot of lobbying by faculty before a new programme is approved	11	2.25	-4.418	.000
Other faculties were given priority in programme	11	1.94	-6.471	.000

development				
There is restriction by management when faculty wants to initiate a new programme	11	2.31	-3.436	.001
Some programmes are stopped before going through all stages of approval	11	2.96	-.200	.842
There is a department purely for programme development	11	2.92	-.389	.699
There is a department purely for programme development	11	2.92	-.389	.699

Source: Field data 2019

The extent to which programme development was initiated by top management was rated 3.2 t- test statistics 1.107 with a p-value of 0.274 which indicated a none statistical significance. Since the mean was close to 3.00, programme development was initiated by top management in some universities while in others it was not.

The statement-; programme development goes through various stages of approval before implementation scored 3.79 and one sample t-test statistics was 3.90. The p-values was 0.001 which implied that programme development went through various stages of approval before implementation.

On the statement that; there is a lot of lobbying by faculty before a new programme is approved, mean was 2.25 and the t-test score of -4.418. P-values had a statistical significance because it was less than significance level of 0.05 and the conclusion was that faculties did not lobby for approval when they wanted to develop new programmes.

The statement, some programmes were stopped before going through all stages of approval, had a mean of 2.96, t-test statistics was –0.200 and a p-value of 0.842. P value was greater than 0.05 hence there was no statistical significance between the means and the set mean which implied that some programmes were stopped before going through all the stages of product development.

Regarding the statement; there is a department purely for programme development, the mean was 2.9, t-test statistics -.389 and the p-value of 0.699 which was not statistically significant. Given the mean response of 2.92 it is possible that private universities had set a way of developing programmes.

The statement -; a programme takes 1-3years before launch had a mean result of 3.58 and p-value of 0.931 for private. The value was not statistically significant hence a programme took 1-3 years before launch. While the governing bodies of the universities had a mandate to choose degree programmes to be developed, CUE had the ultimate say in allowing it to be launched which explained the long duration it took before the launch (CUE, 2014).

Analysis of scrum method of product development was measured by use of indicators such as identification of source of initiation of the process, the period it took to develop the programme and development of the programme by independent teams who are able to monitor the demand by the market. Table 4.12

shows mean responses and one sample t-test statistics for each of the items.

Table 4.12: Desccriptive Statistics for Product Development by Scrum Method

Statement	N	Mean	t-test	Sig. (2-tailed)
Programmes are initiated by the faculty members after independent market research	11	3.69	3.788	.000
Programme development takes a short time to be approved	11	3.21	1.010	.317
Programme development is done by self-organized teams with frequent consultation with management	11	3.48	2.299	.026
Self-organized teams are in constant consultation with industry when developing programmes	11	3.02	.096	.924
Programme takes a short time (6months) to launch	11	2.85	-.784	.437

Source: Field data 2019

The mean scores of the following statements as appearing on Table 4.12 above were as follows-: programmes are initiated by the faculty members after independent market research, had mean scores of 3.69, t-test score of 3.788 and P-values of 0.001. The p-value was statistically significant hence programmes were initiated by the faculty members after independent market research.

On the statement; programme development takes a short time to be approved, the mean was 3.21, t-test 1.010 and 0.317. The p- value was greater than 0.05 hence the mean was not statistically significant. The implication was that programme development took a short time to be approved by the management.

The item-; programme development is done by self-organized teams with frequent

Consultation with management had a mean of 3.49 in public and 3.48 in private. The t-test scores were 4.155 in public and 2.299 in private. The p-values were 0.000 and 0.026 for public and private respectively. The means were statistically significant and therefore programme development was done by self-organized teams with frequent consultation with management in both public and private universities. This implied that a hybrid of stage gate and scrum methods was used in programme development.

The statement -: programme takes a short time (6 months) to launch, had a mean of 2.78, t-test value of -0.784 and the p-value of 0.037 which was less than the significance level of 0.05 hence they were statistically significant. Therefore, programmes did not take a short time (6months) to be launched in the market.

Indicators of Performance in Private universities

Similar procedures to those used to isolate product development processes were applied to extract indicators of non-financial measures of performance. The KMO results of sampling adequacy and Bartlett's test of sphericity were 0.685 and 521.033 respectively with a p-value of 0.001. The test was significant (P-values

<0.05) and further analysis was conducted where the output led to the following conclusions. The indicators of performance in private universities were execution of requests and feedback to complaints, access of services by both staff and students, modes of learning offered to students, improvement of facilities, updating of information technology, processing of exams, tracking of results, receiving of inquiries and disseminating of information. Others included collaborations with the industry and introduction of new academic programmes. The pattern of loadings indicated that customer service was the highest determinant of performance, followed by internal processes, modes of offering of academic programmes and introduction of new programmes. These measures were closely related to those used by University of Toronto in Canada (University of Toronto, 2014).

Product Development processes on Performance

Linearity was tested through determination of Pearson's correlation of product development processes and performance of chartered private universities. The results were presented as shown in table 4.13 below.

Table 4.13: Correlation of Product Development and Performance of Private Universities in Kenya.

		performance	Product development
Performance	Pearson Correlation	1	.720**
	Sig. (2-tailed)		.000
	N	11	11
Product development	Pearson Correlation	.720**	1
	Sig. (2-tailed)	.000	
	N	11	11

Source: Field data 2019

Correlation value of 0.580 shown above implied that programme development processes and performance had a positive linear relationship; therefore data was subjected to regression analysis test. This was conducted and results indicated in Table 4.14 below

Table 4.14: Regression of Product Development and Performance of Chartered Private Universities.

Model Summary [a]

Model 1	R	R Square	Adjusted R Square	Std. Error of the Estimate
	.720[a]	.519	.475	1.93408

ANOVAa					
Model 1	Mean of squares	df	Mean Squares	F	Sig
Regression	746.220	1	746.220	11.854	.005[c]
Residual	692.445	11	62.950		
Total	1438.665	12			
Coefficients a					
Model 1	Unstandardized Coefficients		Standardized Coefficients	T-Value	Sig.
Constant	9.566			.571	.580
Product Development	1.325		.720	3.443	.005

Source: Field data 2019

Model Summary on Table 4.14 above show that product development processes explained 51.9 percent (R^2= 51.9) of the performance of chartered private universities in Kenya. The model was statistically significant because p-value (.005) was less than significance level of 0.05. The unstandardized coefficient of 1.325 implied that for every unit change of product development processes, on average performance would change by 1.325 units. The p-value for the constant was .580 (>0.005), consequently it had no statistical significance because a university cannot post any performance without an offering. The model indicating the relationship between product development processes and performance was P=1.325 PDP. The standardized coefficient of 0.720 indicated that product development processes had a substantial influence on performance of chartered private universities.

Summary of the findings and conclusion

The objective of the study was to investigate the relationship between product development processes and performance of private universities in Kenya, with a subsequent corresponding null hypothesis. The study adopted positivism research paradigm and used three research designs namely descriptive, cross sectional and survey. The 18 chartered private universities by 2016 formed the unit of analysis while 66 deans of faculties/schools formed the unit of observation. A structured questionnaire that had three sections with statements that described demographics, independent and dependent variable was used to collect data. Data was assessed for validity, reliability, suitability and analysed step wise by use of descriptive statistics, CFA and linear regression analysis. Summary and conclusions were as follows.

Thirteen of the universities participated in the study where 44 Deans provided the responses. The response rate was 72.2% and hence it was a sufficient condition for making conclusions on what the objective set out to achieve. Concerning the ownership of the private universities, 11 had local ownership, two were owned by foreigners, three had both local and foreign ownership and overall, religious institutions owned a majority of them.

Regarding the distribution of disciplines, Business Studies were largest followed by Social Sciences, Physical Sciences, Law Studies, Information Technology and the rest had low occurrence. It was also noted that most of the physical science related courses such as Engineering, Dental Surgery; Veterinary Medicine and Architecture were predominantly low. On the levels of progression offered by a university in a given field; degree, masters and PhD cluster was the highest followed by diploma, degree, masters and PhD. Degree programme had the highest growth followed by diploma programmes and masters degree. These clusters may have resulted from specialization in certain courses such as communication or theological studies or the need to grow number of students from one level to another.

Concerning product development processes, CFA test isolated factors that indicated that private universities used scrum method of product development more and a hybrid of stage–gate to a lesser extent possibly for purpose of compliance and quality checks. Therefore, private

universities developed programmes fast enough to capture opportunities that increased demand in the market.

One the analysis of extent to which product development processes predicted performance of universities, the model indicated that 51.9 percent(R^2 = 0.519) of performance was explained by product development processes and for every unit of product development processes, performance would on average go up by 1.325 units (P=1.325PDP) with an insignificant constant. The standardized coefficient was 0.720 which implied that product development processes had a substantial influence on performance of private universities.

At the theory level, the propositions of social-technical systems theory and theory of constrains were confirmed in that the processes of product development involved internal processes, external collaborations and compliance to requirements. The theories however did not explain the cognitive aspects of product development.

The contribution of findings to policy makers is that policies that assist private universities to rapidly develop products that capture the demands of the market while upholding compliance and quality are necessary. The higher education regulators should serve the role of a collaborator and provide guidance rather than supervisory role. Policies targeting investors in university should also be formulated because religious institutions own most of the private universities in Kenya. There is a possibility that programmes offered by these institutions are structured to suit the vision and mission of the owners. More liberal private universities may serve certain niches not already known and the fact that there is a wider market within the African continent.

At the university level, managers can possibly create a department/ function /teams that are purely responsible for scanning the environment continuously in order to create timely and appropriate degree programmes while innovating those that exist to capture any immerging issues contingent to the discipline. Private universities can also develop various products such as training modules for specific industries, research, curricula for other educational levels or for universities beyond Kenya and consultancy service products. A pool of faculty intellectuals operating in an enabling environment has abilities that can be immeasurably exploited to create products that solve emerging and unpredictable social-economic challenges in a society.

References

Almatrooshi, B., Sanjay, S.,Faruok (2016). Determinants of organizational performance: A proposed framework. *International Journal of Productivity and Performance*

Baxter, G., & SommerVille, I. (2011). SocioTechnical: From design methods to systems engineering. Retrieved from www.elsevier.com/locate/intcom

Craig, J., Wangbenmad, C., Mohamad, O., & Ahmed Z.U. (2013).The empirical link between market orientation: New product development processes and performance in export venture. *Academy of Global Business Advancement, 1*, 279-289.

Chacha, N. (2004). *Reforming higher education in Kenya, challenges, lessons and opportunities.* Paper presented at state of New York workshop with parliamentary committee on education science and technology. Naivasha, Kenya.

Chang, A., Hu, K., & Hong, Y. (2013). An ISM – ANP: Approach to identifying key agile factors in launching a new product. *International Journal of Production Research, 51*(20), 582-597.

Cooper, R.G., Edgett S.S., & Kleinschmidt, E. J. (2002). Optimizing the stage gate –process: What best-practice companies do. *Research-Technology, 45*(5), 21-27.

Cooper, R. G. (2016). Agile stage-gate hybrid. *Research Technology Management, 59,* 21-29.

Commission for University Education, (2016). Accredited universities in Kenya.

Commission for University Education. Nairobi, Kenya.

Dhargalkar, K., Shide , K.,& Arora, Y.(2016). Universal new product development and up-gradation framework. *Journal of Innovation and Entrepreneurship*

Durkin, M., Howcroft, B., & Fairless, C. (2016). Product development in higher education marketing, *International Journal of Education Management, 30* (3), 354-369.

Ettlie, J.E & Elsenbach J. M. (2007). Modified stage-gate regimes in new product development processes. *Journal of Product Innovation Management, 24,* 20-33.

Geuna, A. (1996). *European Universities: An interpretive history*. Economic Research Institute on Innovation and Technology (MERIT). Limburg: Maastricht University,

Goldin, G., & Katz , L.F. (1999).The Shaping of Higher Education: The formative years in the United States, 1890 to 1940. *Journal of Economic Perspectives, 13* (1), 37–62

Iacocca Institute, (1991). *21st Century manufacturing enterprise strategy: An industry-led view.* Bethlehem, PA: Iacocca Institute at Lehigh University.

Kaur, P., & Sharma, S. K. (2014). Evaluating the relationship and influence of the critical success factors of TQM on business performance, evidence from SMS of manufacturing sector, IUP. *Journal of Management, 12*(4), 2014.

Kitavi, G. (2017). *The role of Kenya's formal higher education in sustainable developing within the context of globalization.* Springer International publishing house A.G

Lackshman, B.,Kondur , H., (2018) Socio- Technical systems of a company. The dimensionality socio Technical system . *PURSHRTA*, VL-XL

Leon, H.C.M., Farris, J.A., & Letens, G. (2013). Improving product development processes performance through iteration front-loading. *IEEE Transactions on Engineering Management, 60*(3), 552-565.

Lonel, N. (2008). Critical analysis of the scrum project management methodology. *Academy of Economic Studies Bucharest Management,* 435-440.

Nganga, G. (2010). *Private universities to expand access.* Retrieved on Nov. 28 2017 from http://www.universitiesworldwide news.com.

Oanda, I., O. & Jowi, J. (2012). University expansion and challenges to social, development in Kenya: Dilemmas and Pitfalls. *JHEA/REA, 10* (1), 49-71.

Rao, K. N., Naidu, G. K., & Chakka, P. (2011). A study of the agile software development methods, applicability and implications in industry. *International Journal of Software Engineering and Its Applications, 5*(2), 35-44.

Sharifi, S., & Pawar, K.S. (2001). Product development strategies for agility. Case study of three manufacturing companies in UK. *International Journal of Production, 62*(3), 176-192.

Sommer, F. A., Hedegaard, C., & Jensen, K. S. (2015). Improved product development processes performance through agile/stage gate hybrids: The next stage –gate process. *Research – Technology Management,* 34-44.

Suwannatat, P. Anuntroranich, P. & Chandracha, S. (2012). University and animation industry collaboration: New product development processes process. *International Journal of Humanities and Social Science, 2*(11), 106-113.

Saunders, M., Lewis, P. and Thornhill, A. (2009) Research Methods for Business Students. Pearson, New York.

Takeuchi, H. & Nonaka, I. (1995). *The knowledge creating company*. New York, NY: Oxford University Press.

Tavakol, M., & Dennick, R. (2011). Making Sense of Cronbach's Alpha. *International Journal of medical education, 2*(53), 2042-6372.

Twidale, M.B., & Nichols, D.M. (2013). Agile methods for agile universities: Re-imagining the creative university of the 21st century.Retrieved from https://doi.org/10.1007/978-94-6209-458-1_2

University of Toronto. (2014). *University of Toronto Performance Indicators*. Retrieved from https**:**//data.utoronto.ca/performance-indicators

Wandiga ,S .O .(1997). Capacity building and institutional development in higher Education in Kenya. A case of Public investment project (1994) Retrieved from http://www.iiep.unesco.org.

Zhang, L. (2012). Managing project changes: Case studies on stage iterations and functional interaction. *International Journal of Project Management, 31*(7), 958-970.

Zikmud, W.G. (2003). *Business research methods*. Ohio, OH: Thomson South-West.