
PhD OR Is a Necessary Evil for Developing Economies Like EAC: A Personal Perspective

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Abstract: Irrefutably, PhD in operations research program is suggested to be the best approach to solve developing countries long term and persistent problems which require real time solutions and these are mostly applicable in OR. It should be recalled that PhD OR entails content to do with Operations research models, theories and related fields. This provides organisations or companies with best optimization solutions to achieve a competitive age among other benefits provided by the experts (operation researchers/management scientists/operation managers). This paper aimed at providing insights and awareness of the existence of PhD OR offered at UDDBS under ORSEA, its meaning, benefits, relevance and applications as a marketing strategy to the potential students from developing economies like East Africa. Using interpretive- inductive design, narrative approach to qualitative method was employed to gather data from personal experience as a stakeholder and pioneer of PhD OR program at UDDBS, content analysis was employed to analyse the collected data. The findings, ought to increase on the student intake which has been very low visa v the many resources which are needed during the facilitation of the program. This will also increase on the future OR experts to solve the community real problems. This paper has practical implications to all policy makers and all stakeholders of the program plus future academia. The recommendations will assist top managers to embark of meaningful and aggressive marketing strategies to attract the potential students to join the program.

Keywords: PhD OR, A Necessary Evil, Developing Economies, EAC

1. Introduction

In higher education, a Doctor of Philosophy (Ph.D) is conferred as a degree to the intended student interested in generating new knowledge through scientific research [11, 38]. Ph.D. Post graduate studies at a PhD level, offered at higher institutions of learning, are not a joking subject; and students universally in the quest to progeny new knowledge through scientific research have encountered numerous challenges which have rendered a big number specifically on the African continent to drop out of the program amongst which they entail: Financial, economic, social, cultural beliefs and ICT technophobia [11, 18, 41]. There is always a mixed feeling when it comes to issues of deciding what PhD program a potential student should undertake in developing countries like in the East African community and remains relevant to the society through acquiring relevant current skills to solve community business and organization world problems. This might be oozing from the fact that there is

lack of awareness among the students and the community at large due to inadequate advertising methods, most of which are poorly conducted in untimely and inconsistent manner.

In East Africa, PhD OR is a new four years taught program, which began on tenth April; 2017 at UDDBS under the department of general management to help full time business students from relevant fields to acquire superb skills and meet impatient customer needs using scientific, mathematical and statistical analytical tools. This program emanated from ORSEA (Operations Research for East Africa) which currently comprises of countries like Uganda, Tanzania and Kenya. The idea of having a PhD in operations research in East Africa was initiated by Professor Wasswa Balunywa Juma in 2012, during the ORSEA meeting in Dar es Salaam-Tanzania. The committee later was formed comprising of four members from ORSEA (Prof. Moya Musa Bukoma-Uganda, Dr. Kessy Severine-Tanzania, Prof. Uligenta. O. L. Mbamba-Tanzania, and Prof. Wainaina-Kenya) to take necessary procedures and come up with the

program structure in place, get facilitators, among others. It is suggested that the whole process took them three years from 2012 and in 2016; it was presented by the dean Prof. Uligenta. O. L. Mbamba to the University senate and was passed and recommended to commence in 2017. The first cohort had nine students of which two dropped out and the remaining seven are currently in third year. The second cohort has nine students who began in 2018 and are currently waiting for their comprehensive exams after having completed their course works.

Therefore this paper, seeks to make awareness of PhD OR with its numerous benefits to aspiring/potential PhD students in developing countries like EAC conducted at University of Dar-es Salaam Business School- Tanzania. This is all aimed at crafting the best marketing strategy to guide students to opt for programs which will increase on their analytical and research skills to solve world problems in a more efficient and effective way.

2. Literature Review

Definition of key terms

In this study, OR is defined as the ability of OR students and facilitators to apply scientific ways of computer based programming, mathematical modeling and statistical analytical tools to solve real life business related snags in the best efficient and effective mode.

PhD OR in this study refers to the doctor of philosophy degree in operations research conducted at University of Dar es Salaam Business School-Tanzania and is only the current taught PhD by coursework in the business school with duration of four years (one and a half in class and two and a half years for writing a dissertation). EAC is an acronym for East African Countries and in this study; they entail (Uganda, Tanzania & Kenya).

A Necessary Evil. In this study, this means that something you should not miss under normal circumstances because of its benefits and that is PhD in Operations Research (PhD OR).

Developing Economies. In this study, these refer to countries which are still at their infancy in terms of economic growth and development.

EAC. EAC is an acronym for East African Community. In this study, these are the three countries under ORSEA coordinating the PhD OR. They embrace Tanzania, Uganda and Kenya.

3. Theoretical Literature

Operations Research has been widely critiqued for lacking its own theories [12] and therefore borrows from other relevant disciplines and within the management discipline, other fields influence and are influenced by OM [30, 31]. Correspondingly, a mutual yell by most OR/OM researchers has been the proliferation of empirical research that are theoretical [34, 4, 28], too mathematical following quantitative perspectives and lack contextual factors [2].

Additionally, White, Smith, and Currie [37] and indicate, despite the fact that operations research being a discipline that is gaining recognition in the developing countries, Africa inclusive, reviews specifically focusing on the respective continents and countries are missing. Such a trend has provoked the OR discipline to be considered atheoretical one, as theories are mainly derived from other disciplines coupled with the studies being deprived of practical contextual issues [12].

OM draws on theories from related fields, including finance, management science, organizational behavior, marketing, and strategy [21]. To some exponents of this "borrow-borrow" aspect, they proclaim that it seems to make sense, arguing that because real-world management problems often do not belong to a single discipline but are interdisciplinary in nature [12, 33].

We would argue in favor of a plurality of theoretical perspectives in operations management and that there is no need to tear down existing operations Management theories merely to be replaced by others [29]. Instead, the operations management community should strive to either develop or import new theoretical perspectives in case they offer a more fascinating explanation of operations management problems.

In spite of theories being pondered vital in illuminating reality, together with those in operations research and management, countless research in the discipline are considered barren or orphaned of theories [34, 4]. Some of the claimed reasons for empirical research in the field of operations research include the belief that OR is an applied discipline addressing practical issues that should not be "theoretical" [34]. Alternative promulgated reason for the discipline being theoretical is its newness in the field compared to others that have led it to bank on (borrow) greatly on theories from other disciplines [8]. The newness of the discipline coupled with rarity rather absence of theories was expected to motivate scholars onto theory generation which is still missing in the field of OR [12].

Theories mostly used in operations management may include these below:

Contingency theory has been commonly used by various researchers in the field of OM/OR [5, 16, 36] and [17]. The field of operations management (OM) has developed a significant body of research using contingency theory [34]. The work by Sousa and Voss [39] cited in [40], shows the extent of OM practice contingency research (OM PCR) and provides a critique of the current state of research and future directions. They state that, the main focus of studies in OM PCR is to understand the usefulness of certain 'best practices' when applied to different contextual factors

Romero-silva, Santos, Hurtado [26], in their study applied contingency theory to ascertain its relevance in the Operations Management/ Operations research field. Findings identified a systems-based single definition of organisation types that could designate the fit amidst organisational environment and organisational structure. They regarded the organisation as an integrated whole, instead of a sum of its parts and can aid to better categorize organisations in order to

detect fits between organisation types and incipient practices in Operations Management/OR. This is in agreement with [14]

Luthans & Stewart [17], in their study used contingency theory in operations management to develop a comprehensive and integrative theoretical framework for contingency management. In their findings, they came up with a General Contingency Theory (GCT) of Management, which acted as an overall framework that integrates the diverse process, quantitative and behavioral approaches to management; includes the environment; and initiates to bond the gap amidst management theory and practice. Finally, the study findings held that GCT provides the theorists, academicians and practitioners, the actual and prospective framework for incorporating prevailing contingency approaches and for coordinating imminent management research and development.

Another theory borrowed in OR/OM fields is the Control theory and has the biggest lag, with the theory having its origins in the nineteenth century [19], and then emerging in 1995 in Operation research articles. Other theories have a short gap between their emergence and application in Operations research/operations management, such as the resource-based view, which was first articulated in 1984 [35] and then was referred to two years later in the operations management journals [1]. The average lag between theory emergence and its subsequent application in operations management journals is about seventeen and a half years. It is worth noting that some theories, such as property rights theory, exhibit popularity for a time and then seem to be adopted less.

4. Empirical Literature

Operations Research (OR), which is synonymously used with operations management and management science, has military roots from 1940s [7, 12]. Back then, the term operational research is closely associated with radar technology and military tactics. It is to optimize allocation of resources to make the best effort possible to obtain the objective. It has evolved much since, but the name remained [3]. Semantically optimization is a more of a general term and OR refers to a discipline with optimization at its core [15]. Operations Research arose as an attempt to apply a number of mathematical “tools” (namely; optimization, queuing theory and other probabilistic models, and graph theory) to problems that arise in the military and, later, in industrial production [36, 20].

It is argued that, there is absence of a clear definition, among other definitions of OR are as follows: According to the Operational Research Society of Great Britain [24], Operational Research is the attack of modern science on complex problems arising in the direction and management of large systems of men, machines, materials and money in industry, business, government and defense. Its distinctive approach is to develop a scientific model of the system, incorporating measurements of factors such as change and

risk, with which to predict and compare the outcomes of alternative decisions, strategies or controls. The purpose is to help management determine its policy and actions scientifically.

Pocock [25] emphasizes that *Operations Research is an applied Science*. Pocock avers that, “*Operations Research is scientific methodology (analytical, mathematical, and quantitative) which by assessing the overall implication of various alternative courses of action in a management system provides an improved basis for management decisions*”. On the other side, Saaty [27] regards Operations Research to a tool of refining the quality of ripostes/answers. Saaty narrates, “*O.R. is the art of giving bad answers to problems which otherwise have worse answers*”. Miller and Starr [23] pins that, “*Operations Research is applied decision theory, which uses any scientific, mathematical or logical means to attempt to cope with the problems that confront the executive, when he tries to achieve a thorough-going rationality in dealing with his decision problem*”.

OR is the use of advanced and highly analytical procedures to enhance the decision-making process. Operations research employs techniques such as mathematical modeling to help managers understand, examine and investigate difficult and complex situations. Operations Research can also be treated as science in the sense that it aids in it describing, understanding and predicting the systems behaviour, especially man-machine system. Thus O.R. specialists are involved in three classical aspect of science, they are as follows: Determining the systems behavior, Analyzing the systems behaviour by developing appropriate models and predicting the future behaviour using these models [34].

It should be recalled that OR is “*an interdisciplinary discipline which provided solutions to problems of military operations during World War II, and also successful in other operations*” [34]. Additionally, currently majority of the organizations, companies and businesses are emphasizing O.R analytical tools with the aim of attaining quick, effective and efficient working alternative timely solutions [12, 1]. This can be envisaged in areas such as; advertising policies, location as well as warehousing, and policies regarding inventory management. It is conceptually believed that in the developmental context in OR research; it is unmistakably signposted that OR in less developed economies, EAC being typical suggests different solutions which are contrary to those of most developed countries [14, 37]. In relation to the above, basing on Ravn and Vidal’s [42] squabble for the momentous role of OR in aiding development initiatives in developing economies like EACs, it can be assumed that OR in these countries is much needed for economic growth and development (a necessary evil) compared to its counterparts, the most developed countries (MDCs) that need OR to sustain (brook) their development, hence making this study worthwhile since according to the author’s knowledge, no study has been conducted in line with OR to provide insights and awareness of the existence of PhD OR offered at UDDBS under ORSEA, its meaning, benefits, relevance and

applications as a marketing strategy to the potential students from developing economies (like East Africa Community), that represent a fast economic and socially growing region in Africa and where relevant analytic practical skills are madly needed for not only industrialization but also achieving other world sustainable development goals (SDGs).

5. Methodology

The study was based at University of Dar es Salaam Business School- Tanzania. Narrative approach to Qualitative research was used in this study to identify the history, definitions, relevant fields, skills, benefits, related challenges as a marketing strategy of the PhD OR program. Personal perspective views supplemented with literature reviewed were analysed using content analysis.

6. Findings and Discussion

It has been found out that many people within in the EAC according to my personal perspective do not know the PhD OR program offered at UDDBS. The majority of the people do not know PhD OR/OR definitions, its location, its benefits, applications, the kind of jobs obtained, the relevant skills it offers, its difference from other PhD program offered at the University and its duration, content, tools and techniques and fees structure. This missing gap has affected the number of student intakes negatively despite the superb features and relevant skills needed currently for industrialization hence economic growth and development in the developing countries like EAC and other mushrooming economies with similar characteristics. This has partly been attributed to inadequate advertising, which is only reflected in the university website in untimely manner and inconsistent actual dates of commencement of the program.

When it comes to operation research (OR), the few people who may be aware of OR think that it is too mathematical, too statistical and too programmable using computer based tools, which is 90 percent true. However, the hidden beauty in the truth above lies in the fact that OR is almost applicable in all situations and in all institutions, be it private or government. This means that OR is everything done everywhere using scientific means to solve daily routine society and business oriented problems. In this papers OR simply means doing things in the best way in an effective and efficient way.

6.1. Tools/Techniques Applied in Operations Research

Tools applied in Operations Research according to [34] include among others: The common frequently used tools/techniques are mathematical procedures, cost analysis, electronic computation. However, operations researchers given special importance to the development and the use of techniques like linear programming, game theory, decision theory, queuing theory, inventory models and simulation. In addition to the above techniques, some other common tools are non-linear programming, integer programming, dynamic

programming, sequencing theory, Markov process, network scheduling (PERT/CPM), symbolic Model, information theory, and value theory [32]. Tools/techniques also exists many other Operations Research. The brief explanations of some of the above techniques/tools are as follows:

Linear Programming: This is a constrained optimization technique, which optimize some criterion within some constraints. In Linear programming the objective function (profit, loss or return on investment) and constraints are linear. There are different methods available to solve linear programming.

Game Theory: This is used for making decisions under conflicting situations where there are one or more players/opponents. In this the motive of the players are dichotomized. The success of one player tends to be at the cost of other players and hence they are in conflict. **Decision Theory:** Decision theory is concerned with making decisions under conditions of complete certainty about the future outcomes and under conditions such that we can make some probability about what will happen in future

Queuing Theory: Choose the solution to be used. 'Sell' the decision to operating managers; get their understanding and cooperation.

Manager and O.R. Specialist MBA-H2040 Quantitative Techniques for Managers. This is used in situations where the queue is formed (for example customers waiting for service, aircrafts waiting for landing, jobs waiting for processing in the computer system, etc). The objective here is minimizing the cost of waiting without increasing the cost of servicing. **Inventory Models:** Inventory model make a decisions that minimize total inventory cost. This model successfully reduces the total cost of purchasing, carrying, and out of stock inventory.

6.2. Some of the Benefits of Studying PhD OR at University of Dar es Salaam Business School

6.2.1. Environmental Benefits

The University location. UDDBS is situated in a hilly place with good scenery surrounded with tall green trees conducive for PhD OR studies. There is no noise at all which can disrupt studies despite the university being besides the road. Uninterruptable power supply with a standby generator unlike other colleges surrounding UDDBS. Good atmosphere with no noise. Located on a big land of University of Dar es Salaam where a student can judge around and swim for physical fitness. Dar es Salaam is a coastal area surrounded by beaches where students can relax whenever they feel like as longer as they do not miss lectures, given the fact that management and lecturers have zero tolerance to lecture dodgers/ choppers. These are not allowed to sit for exams if they are perpetual dodgers without proper reasons with evidence.

6.2.2. Infrastructural Benefits

UDDBS has a well-furnished huge newly opened library, second best in Africa with the necessary books to facilitate your studies. The library is assumed to be with books

relevant to the PhD studies and also has reading places for the students who may want to alter the reading environment and also interact with other PhD students from other colleges hence building and widening on their social and academic / intellectual capital as they share new ideas and varying experiences. Similarly, as they network, they relief themselves from academic stress and it is also an avenue for connecting one another to new jobs, other social, religious, economic and political benefits.

The PhD OR students have the best lecture room with excellent furniture, Air condition, and wireless network, which enables them to carry out their PhD OR studies and submit course work assignments on time. This facilitating condition also motivates students to read harder with the aim of finishing their studies on time. More so, these students are not ashamed to associate themselves with UDDBS and are eager and walk with their heads up since they have a reliable and good place (UDDBS) with better facilitating conditions compared to other PhD colleagues and lecturers in other schools or colleges of the entire University of Dar es salaam, with poor facilities, a case of PhD students in Economics (wooden small reading rooms, students from Math department with tiny and not well furnished rooms/hard seats which reminds me of the primary and secondary school life, to name it). Given the fact that PhD students sit for long ours while studying and reviewing literature on daily basis for 3-4 years (serious and committed students) or 5 to 10 years (students with snags and un committed ones) and they pay a lot of money for tuition and administrative costs, it is very important for management to provide a highly reasonable reading environment with all the required facilitating conditions.

6.2.3. Social Benefits

It is widely known beyond measurable doubt that Tanzanians are welcoming people and social. So foreign students do not find any problems associated with insecurity, theft, fighting, strikes and hooliganism at campus and surrounding areas.

The top manager of the business school like Prof. Mbamba Ulingeta is a good listener and being with a science background from engineering, he solves students problems within his means as soon as he gets to know them (Just In Time) and the middle plus operational managers imitate the same style of leadership while implementing the given tasks. There is a visible improvement in student presentation schedules, which was missing and used to delay and demotivate hardworking students who completed their work and ready to present but all was in vain (3-7 months delays).

Similarly, the HOD (Dr. Rwehumbiza Deus) and coordinators (former- Dr. Canani Renger and Dr. Yusita Sumwinta) are too parental, very hard working and geared to solve students related problems and allocate facilitators they think are suitable to conduct the program. The facilitators are somewhat committed to their work, good time managers, good researchers, offer free guidance and counseling to the

students like Prof. Allen Mushi Rangia, Prof. Moya Musa Bukoma, Prof. Wainaina Gituru, Prof. Dev Jani, Prof. Neema Mori, Dr. Deus Rwehumbiza, Dr. Mbura Omari Khalifa, Dr. Senyonga Livingstone, Prof. Moya Musa, Dr. Deus Rwehumbiza, Dr. Mukandawile Mashaki, Dr. Ali Muniachi, Dr. Mwaipopo, Dr. Allan Shimba, Dr. Hellena Thomas, Kessy, S., among others.

6.2.4. Fees structure

The top management of PhD OR is too flexible when it comes to fees payments. They allow payment in installments as long as you can complete the fees before end of semester. This helps students to continue with their course works without any disturbance, thanks to the management for this gesture. Tanzanians pay about four million and two hundred thousand Tanzanian shillings (4.2 M) per year and the foreigners pay approximately Eight million and five hundred thousand Tanzanian shillings (8.5M), which is equivalent to (4065 dollars) plus other administrative costs in the bank using the control number obtained from the financial school system.

6.2.5. Cultural Benefits

PhD students from foreign countries can benefit from adopting a humble culture, learn Swahili language widely spoken as the official language to unit all Tanzanians (as one of the components of Ujama), among others.

6.2.6. Community Benefits

PhD OR students if equipped with skills can use operations research model and approach, to guide managers in various companies and businesses to know their decisions based on complete data, up-to-date decision techniques and tools, and accurate predictions of results, with an estimation of risks and the consideration of all available options.

Operations research is unique in that it uses the most advanced and highly developed models created by trained professionals. These technologies provide analytical capabilities that cannot be obtained by using popular software, and provide tailor-made solutions for each company. An operations research professional's analytical technologies help to achieve the following: Optimization which assists in narrowing the options to the best alternatives, especially when there are many feasible choices, simulation which provides the ability to try out different approaches and test various ideas for improvement, statistics and probabilities which aid in excavating information and weigh risks in order to uncover important insights and connections, make reliable forecasts and test conclusions.

6.3. Benefits from Course units (CUs) Covered

There are strictly nine course units and each semester of five (5) weeks, three (3) CUs are offered. In the five weeks, it is indicated that 3 are for lecturing and 2 for independent reading and assignments. These embrace: IM700 (statistical methods), IM701 (Deterministic), IM702 (Philosophy of science & critical thinking), IM703 (stochastic methods), IM706 (OR research seminars), IM709 (OR special topics),

MK 700 (Marketing modeling), and other elective (IM 707 Special OR Topics in Transportations, IM 708 in Management Information Systems, FN 700 Special OR Topics in Finance). It is vehemently believed beyond measurable doubt that a student, who has attended 90 – 100 percent of lectures from the above units, stands higher chances of finishing her/his studies in the prescribed time frame or even before. This is supported by the relevant research skills attained during the course work session for writing and analyzing quantitative, qualitative or mixed data so as to successfully finish his/ her PhD OR dissertation just in time (leaving other factors constant). This is contrary to other PhD by thesis students who struggle to grasp the philosophical orientations and other jargons (waffles) related to PhD academic writing on their own and through this struggle of stretching their brains to understand hard stuff, they age very fast, get frustrated, get demotivated, some become very rude with swinging moods, drop out, blame their supervisors who are also too busy for an serious and stagnant students, change supervisors drastically, quarrel/conflict/ at those at the extreme (elsewhere not at UDDBS) wish to or kill their supervisors whom they claim are frustrating them, blames others serious students for being favoured by the system or supervisors, etc. More to the above, it is evident that some students of other PhD program by thesis who have sneaked in the PhD OR classes for some to attain relevant writing and analyzing skills are progressing very fast, such as the likes of Cosmas Masanja, Terezia Busagala, to mention but a few, and they utter out publically that indeed they gained a lot to skills which have enabled them to be where they are now in academic writing. Hence making PhD OR, a necessary evil for all PhD students in developing economies like EAC.

6.4. The Application of PhD Operations Research

Students who are entitled to called operational researchers obtain relevant skills at the end of the course works and can apply them in writing their research very fast, writing articles related to OR fields and others fields to, leaving other factors constant.

It is worth noting that the applications of operations research today is in almost all fields of business and government utilizing the benefits of OR. There are voluminous of applications of Operations Research. Although it is not feasible to cover all applications of O.R, in brief, the following are the abbreviated set of typical operations research applications to show how widely these techniques are used today.

Accounting: Assigning audit teams effectively credit policy analysis cash flow planning Developing standard costs establishing costs for byproducts planning of delinquent account strategy. Finance sector: OR skills obtained aid in portfolio selection to maximize profits and minimize losses.

Construction: Project scheduling, monitoring and control determination of proper work force deployment of work force, allocation of resources to projects, facilities planning:

Factory location and size decision Estimation of number of facilities required. Epidemic

Healthcare/Hospitals: Assists in determining the distribution of vaccines to prevent any shortage during flu outbreak. In predicting the growth of a rampant disease, so as to minimize victims. More so, it is applied in dispatching ambulances to respond in the fastest way possible. Finally, it is vital in assigning beds in a hospital to serve more patients.

Production planning and scheduling of machines to minimize machine idle time or to maximize rate of production coupled with planning of resources to minimize any delay in production delivery or to use resources to full extent. CPU allocation: how to allocate CPUs of a computer to do tasks in the least possible time.

Facility location: how to locate facilities to minimize traveled distance to maximize coverage facilities can attain. Supply chain: how to plan delivery of items from factory to end-users (customers) to satisfy demand with the least possible cost. Energy: how to optimize energy usage, where by it enables to minimize energy wastage.

Conversely, in the Transportation industry, OR tools attained enables operation researchers to determine the best routes most suitable for minimizing travel time. Similarly, it helps in determining the right moment to dispatch our supply trucks to have fewer delays and maximum coverage to name it.

6.5. OR in Military

It involves finding the best search patterns to locate enemy ships and submarines, evaluating the trade-offs in the following situations: Using planes as merchant marine escorts and having these same planes bomb U-boat docks; Attacking enemy ships versus attacking the factories that produce ships; Determining the required forces of different types to undertake various military operations; Evaluating rapid maneuvering versus antiaircraft fire to defend warships against Kamikaze suicide plane attacks; Developing countermeasures to enemy radar; and Evaluating weapons effectiveness and determining the best methods for using them [22]. Also, the development of nuclear weapons provides an intriguing case study for applying operations research to intelligence questions. In asking whether a “proliferator” is pursuing a nuclear weapons program, it is important to understand the possible forms a project designed to produce such [22].

6.6. Connecting the Dots

Perhaps the most fundamental problem in intelligence analysis is that of “connecting the dots,” meaning “... selecting and assembling disparate pieces of information to produce a general understanding of a threat ...” [10]. Direct application of statistical tools such as data mining to large databases documenting travel or financial transactions invariably suffer from the false positive problem that follows from searching databases in which the base rate of individuals involved in terrorism is

extremely low [9].

6.7. In Artificial Intelligence

Analytic Standards, intelligence analysts are expected to "... perform their analytic and informational functions from an unbiased perspective" and "independent of political considerations" [6] cited in [13, 19]. The intelligence analyst does not make decisions, but provides information in support of government (or military) executive decision makers. Operations researchers similarly play the advisory role of unbiased analysts in relation to executive decision makers.

7. Conclusion and Limitations

In the nutshell, this paper aimed at creating awareness of PhD OR with its numerous benefits to aspiring/potential PhD students in developing countries like EAC conducted at University of Dar-es Salaam Business School- Tanzania. As resonated above, operations research includes a wide range of techniques for solving problems and different methods used in the search for a better decision-making process. Tools used by operational researchers include probability theory, game theory, statistics, decision analysis, simulation optimization, queuing theory, graph theory and mathematical modeling. Given the fact that OR is highly based on computations and calculations, it has a strong link to the computer science and analytics studies, top managers should ensure that the right experts with OR background are obtained and motivated to offer the relevant skills to the suitable students for the program. There is no doubt that the experts in operations research when confronted with a new world real problem, they always first determine which technique to employ to yield the best solution. OR has numerous benefits, is applicable to many fields and for lack of its own theories, it borrows from others fields it cuts across. Perhaps the justification for this is that, the world actual management snags (problems) habitually do not belong to a single discipline but are inter- punitive in nature. This study was limited to PhD OR at UDDBS from a student perspective, so findings can be generalized to other PhD studies studied elsewhere apart from those related to OR like PhD in management science, PhD in operations management.

8. Implication and Recommendations

This study will help policy makers, top managers of PhD OR to consider taking massive awareness of the existence of the program using alternative marketing strategies to market program hence increasing on the intake coupled with its associated benefits, the potential students and other community members will be able to enroll for the program after getting a clear view of the definitions, expectations, benefits, contents of OR (tools/ techniques/ fields/ theories/ reference books) the partner Universities and above all the location of the program in East Africa by the time of conducting this study (UDDBS-Tanzania) which they lacked before. The future academia will utilize this study as a

foundation for empirical literature.

Recommendations include the following:

All stakeholders should embark on massive advertisement through various channels using different national languages. All television channel in Tanzania (also Uganda and Kenya as member countries of ORSEA), Radios, different websites of the centers in UDDBS, whatsapp groups, word of mouth, brochures, fliers, T-Shirts/ caps/cups/ pens/key holders/books/ etc, with PhD OR logo.

Top management should introduce seminars and workshops for operations research within the three schools, these will bring people from various places to participate and be aware about the program offered at OR.

Top managers should outsource different OR experts (within the EAC and outside Africa) in computing science/information technology/ engineering/ mathematics/statistics background and other related fields to increase on the available inadequate human resource from the above fields.

Also at the right time of advertising, all official communication emails at UDDBS should bear at the end the communication an advert of PhD OR with enticing awareness words. For example, "*Dear our lovely dedicated, hardworking and smart employees, let us join hands together by informing our close and distant friends about the opening of online applications of PhD OR which can be obtained the university website*". This will motivate staff to send more awareness to friends in their group emails, old boys/girls, former workmates and relatives as they advertise more. They will feel a sense of togetherness and ownership of the program especially if it's a message from the top leader of the school whose signature must be appended at the end of the message.

Top managers should encourage current PhD OR to become ambassadors of advertising their Program since they interact with many friends who ask them about the benefits and quality the PhD OR program they are taking. In fact, if I am not mistaken, they are the get keepers to most potential students and new students. I am happy to report that I have persuaded many and sweet talked to some students who eventually joined the second cohort and some have confirmed joining the third cohort which is commencing in November this year according to the information I received from a primary source.

Masters students should be encouraged to enroll and specialize in their fields since OR cuts across most fields as like modeling business related fields. For instance banking, supermarkets, transport (airline modeling/ vehicle routing modeling to find the shortest route possible), hospitals (bed assignment/ staff scheduling/ modeling in-patient or out-patient rooms, theater/operation rooms modeling, etc), education sector (timetabling issues to avoid collisions while considering the hard constraints /non avoidable and soft constraints/ flexible and can be ignored a bit, classroom modeling/ staff scheduling/teaching facilities like projectors which are shared if not fixed in rooms), hotel modeling, politics modeling, among others.

The top management of a PhD OR program leads by example and affects the motivation felt by the facilitators and students. A top and middle management team that takes a sincere interest and connects with the facilitators and students is more likely to inspire them to achieve. Transparency from the management team about the PhD OR program's future aids in motivating the immediate stakeholders (students and lecturers) because it gives them a better idea of the reasons for their work/duties hence calling for top management immerse fully in the awareness campaign and encourage middle and operations/immediate managers to speak the same language on as their top leaders.

Top management should ensure that the line of communication and transparency continues throughout the PhD OR program as well. Make it a PhD OR program policy that top managers meet regularly with their facilitators monthly, for example-to discuss their progress. Monthly facilitators and students meetings are good for keeping everyone informed of coming activities, but they're not a substitute for meeting one-on-one, where each facilitator/student has the opportunity to express problems, issues and concerns.

Top managers should set a corporate culture. It should be recalled that the corporate policies and acceptable behaviors generally start at the top level of management in every organization and are seen as role models. The leaders/managers of the PhD OR Program should establish procedures and expectations through those policies which should be communicated to the stakeholders just in time. The way the program is run day to day, based on those policies, helps establish the corporate culture.

A culture that encourages creativity, innovation and out-of-the-box thinking is likely to result in the awareness of PhD OR program that will be successful and continually comes up with new ideas, as commended by [5]. A muggy corporate culture limits the efforts of the facilitators and PhD students, making it difficult for the program to advance smoothly. When lecturers/facilitators know they have the top management team's support, they contribute without holding back.

Lastly, the goals and vision of the PhD OR program (POP), guide the work that is completed by the students and facilitators in making awareness of the POP and therefore should be clearly communicated by top management. To reach higher achievements for the PhD OR program, top management should first sure everyone in the PhD OR program knows what the PhD OR program's overall goals and strategy are. It is not enough to know their goals. They need to understand the direction, the PhD OR program is heading and what management wants to achieve so that they can see where their efforts fit into the overall marketing strategy.

Top management should encourage PhD OR current students to participate in Corporate Social Responsibilities (CSR) in the Tanzanian community surrounding the university, for example; by cleaning and picking rubbish on Saturdays in the market areas, hospitals, secondary schools

(once in a semester), donate sanitary pads and books to the girls and boys respectively in primary and secondary, put running and football/netball extra-curricular activities where students interact with the locals and win prizes to increase awareness, narrate to the community members about the skills of OR which can help them to achieve economic growth and development.

Top management should think of introducing a scholarship scheme to potential PhD OR students (50% or full scholarship). They can get them from other funders or organizations and companies like tigo/MTN for Uganda, Airtel/Warid for Uganda, WHO, DANIDA, from government, to name it. This will increase on the number of the students' intakes and increase relevant skills hence economic growth and development in EAC.

Introduction of foundation programs to enable even others students to have some OR skills before they join PhD or those who may not wish or intend to reach PhD level. For example: certificate courses, postgraduate diploma courses, master's level and this should be in other schools also under ORSEA to produce students who will join PhD at UDBS.

Appendix

Some recommended books for PhD Operations Research Potential Students for some core course units

Paul, H. Williams. Model Building in Mathematical Programming, Fifth Edition. WILEY

Micheal, R. Summer. (1998). Analyzing Operations in Business: Issues, Tools, and Techniques

Yehouda, Shenhav. (1999). Manufacturing Rationality: The Engineering Foundations of the Managerial Revolution, Oxford University

Robert J. Thierauf/John Wiley & Sons. (1978). An Introductory Approach to Operations Research.

Stephen, P. Waring. (1991). *Taylorism Transformed: Scientific Management Theory since 1945*, University of North Carolina Press.

Librarian's tip: Chap. 2 "Management by the Numbers: Operations Research and Management Science"

Peter Hore; Tam Dalyell/F. Cass. (2003). Patrick Blackett: Sailor, Scientist, and Socialist

Edward C. Bursk; John F. Chapman. (1963). New Decision-Making Tools for Managers: Mathematical Programming as an Aid in the Solving of Business Problems. By Harvard University Press.

References

- [1] Goodridge, M. (1986), "Operations management of human resources in the 1990s", *International Journal of Operations & Production Management*, 6 (4), 42-60.
- [2] Barratt, M., Choi, T. Y. & Li, M. (2011). Qualitative case studies in operations management: trends, research outcomes, and future research implications. *Journal of Operations Management*, 29 (4), 329-342.

- [3] Berk Orbay. (2017). History and definition of OR. *the Royal Society of London*, 16 (2), 270-283.
- [4] Boer, H., Holweg, M., Kilduff, M., Pagell, M., Shmenner, R., & Voss, C. (2015). Making a meaningful contribution to theory. *International Journal of Operations and Production Management*, 35 (9), 1231-1252.
- [5] Burns, T., & Stalker, G. (1961). *The Management of Innovation*, Tavistock, London.
- [6] Director of National Intelligence. (2007). *Intelligence Community Directive (ICD) 203: Analytic Standards*. June 21. Available: http://www.dni.gov/electronic_reading_room/ICD_203.pdf
- [7] Fortun, M., Schweber, S. S. (1993). Scientists and the Legacy of World War II: The Case of Operations Research (OR). Accessed at <https://doi.org/10.1177/030631293023004001>.
- [8] Flynn, B. B., Sakakibara, S., Schroeder, R. G., Bates, K., & Flynn, E. J. (1990). Empirical Research Methods in Operations Management. *Journal of Operations Management* 9 (2), 250-284.
- [9] Hollywood, J., K. Strom, & Pope. M. (2009). Can data mining turn up terrorists? *Operations Research/Management Science Today* 36 (1): 20–27.
- [10] Hollywood, J., Snyder, D., McKay, K., & Boon. J. (2004). Out of the ordinary: Finding hidden threats by analyzing unusual behavior. *Santa Monica, CA: RAND Corporation*.
- [11] Kagoya & Mkwizu. (2019). ICT Usage in Panelist Sessions to Enhance Completion of PhD Studies in Public Universities: Study of Uganda and Tanzania. Atlas conference – Uganda.
- [12] Kagoya, M. S., Jani, D., & Tinali, G. P. (2018). Appraisal of the Theoretical, Contextual, and Methodological Elements of ORSEA Journal Articles (2011-2017). 13th *Orsea conference proceedings* March 2018 - Kenya.
- [13] Kaplan, E. H. (2011). *Intelligence Analysis: Behavioral and Social Scientific Foundations. Book Chapter (2) Operations Research and Intelligence Analysis*.
- [14] Kembball-Cook, D. & Wright, D. J. (1981). The search for appropriate OR: a review of operational research in developing countries. *Journal of the Operational Research Society*, 32, 1024-1037.
- [15] Kirby. (2003). *Operational research in war and peace*. Imperial College Press, London (2003) and *The Operational Research Society*, Birmingham, UK.
- [16] Lawrence, P., & Lorsch, J. (1967). *Organisation and Environment: Managing Differentiation and Integration*, Harvard University Press, Boston, MA.
- [17] Luthans, F., & Stewart, T. (1977). A General Contingency Theory of Management. *The Academy of Management Review*, 2 (2), 181-195. Retrieved from <http://www.jstor.org/stable/257902>
- [18] Masele, J. J., & Kagoya, S. M. (2018). “Academic Safety and Health requirements for ICT usage by PhD students in developing countries: A case of University of Dar es Salaam (Tanzania) and Makerere University (Uganda).” *International Journal of Education and Development using ICT* 14 (3): 72-92.
- [19] Maxwell, J. C. (1867-1868). “On governors”, *Proceedings of the Royal Society of London*, 16 (2), 270-283.
- [20] McCloskey, J. F. (1987). “British Operational Research in World War II,” *Operations Research*, 35 (4): 453-470.
- [21] Melnyk, S. A. and Handfield, R. B. (1998), “May you live in interesting times, the emergence of theory-driven empirical research”, *Journal of Operations Management*, 16 (4), 311-319.
- [22] Morse, P. M., & Kimball. G. E. (1951). *Methods of operations research*. Cambridge, MA: MIT Press.
- [23] Miller & Starr. (1990). Definition of Operations Research.
- [24] Operational Research Society of Great Britain. (1962). *Operational Research Quarterly*, 13 (3): 282.
- [25] Pocock, J. W. (1953). Operations Research and the Management Consultant. *Journal of Operation Research of America*, 1 (3), 15-25. Accessed at: <https://doi.org/10.1287/opre.1.3.137>.
- [26] Romero-Silva, R., Santos, J., & Hurtado, M. (2018). A note on defining organisational systems for contingency theory in OM. *Production Planning & Control*, 29 (16), 1343-1348.
- [27] Saaty, E. (2015). Definition and History of Operations research. Accessed at: <https://www.coursehero.com/file/20901646/1Operations-Research2015day-1/>
- [28] Shmenner, R. W., & Swink, M. L. (1998). On theory in operations management. *Journal of Operations Management*, 17, 97-113.
- [29] Schmenner, R. W., Wassenhove, L. V., Ketokivi, M., Heyl, J. & Lusch, R. F. (2009). “Too much theory, not enough understanding”, *Journal of Operations Management*, 27 (5), 339-343.
- [30] Schroeder, R. G. (2007). *Operations Management: Contemporary Concepts and Cases*, McGraw-Hill Irwin, New York, NY.
- [31] Schroeder, R. G. (2008). “Introduction to the special issue on theory development in operations management”, *Production & Operations Management*, 17 (3), 354-356.
- [32] Mettral, T. (2018). Deterministic versus stochastic contracts in a dynamic principal-agent model. *Economic Theory Bulletin*, 6 (2), 209-218. Van de Ven, A. H. (2007), *Engaged Scholarship: A Guide for Organisational and Social Research*, Oxford University Press, Oxford.
- [33] Walker, H., Chicksand, D., Radnor, Z., & Watson, G. (2015). "Theoretical perspectives in operations management: an analysis of the literature", *International Journal of Operations & Production Management*, 35 (8), 1182-1206. Accessed on <https://doi.org/10.1108/IJOPM-02-2014-0089>.
- [34] Wernerfelt, B. (1984). “A resource-based view of the firm”, *Strategic Management Journal*, 5 (2), 171-180.
- [35] Woodward, J. (1965). *Industrial Organization: Theory and Practice*, Oxford Press, Oxford.
- [36] White, L., Smith, H., & Currie, C. (2011). OR in developing countries: a review. *European Journal of Operational Research*, 208 (1), 1-11.

- [37] Owen, J., Henderson Metzger, L., Gorgens, K., & Nadkarni, L. (2019). Psychologists' role in master's-level training in counseling: A wolf in the chicken coop or unlikely friends? *Training and Education in Professional Psychology, 13* (2), 100.
- [38] Sousa, R., & Voss, C. A. (2008). "Contingency Research in Operations Management Practices." *Journal of Operations Management 26* (6): 697–713. 10.1016/j.jom.2008.06.001.
- [39] Salimian, H., Rashidirad, M., & Soltani, E. (2017). A contingency view on the impact of supplier development on design and conformance quality performance. *Production Planning & Control, 28* (4), 310-320.
- [40] Woldegiyorgis, A. A. (2020). Challenges of Development of Doctoral Education in Africa. *Trends and Issues in Doctoral Education: A Global Perspective, 213*.
- [41] Ravn, H. F., & Vidal, R. V. V. (1986). Operational research for developing countries—A case of transfer of technology. *Journal of the Operational Research Society, 37* (2), 205-210.