

INFLUENCE OF THE PROJECT MANAGER'S TECHNICAL SKILLS ON RESEARCH AND DEVELOPMENT PROJECT OUTPUTS IN KENYA INDUSTRIAL RESEARCH AND DEVELOPMENT INSTITUTE

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ABSTRACT: *The main study objective was to assess the influence of the influence of the project manager's technical skills on research and development project outputs in Kenya industrial research and development institute. The research design adopted was both quantitative and qualitative with an explorative, descriptive and explanatory approach. The target population was 133 and stratified random sampling method applied to get to a 105 sample size. A response rate of 70% was realized. Data was collected from R&D staff of KIRDI through administration of structured questionnaires and personal interviews. Collected data was analyzed using content analysis. The analyzed data was presented as frequencies, mean, standard deviation in text, table, bar chart, graph and pie chart formats. The study used multiple linear regression analysis. With a p value of less than 0.05, the regression analysis showed that an increase in technical skills by one unit increased project output in R&D institutions by 1.122. The study recommends that institutions take cognizance of the importance of the three aspects of leadership when evaluating or building capacity of their staff. When recruiting R&D project managers, R&D institutions should not only focus on basic technical capabilities, but also consider other formal skills, human and contextual skills which include competence and/or training in leadership and project management.*

KEYWORDS: *Technical Skills, Research and Development, Project Output.*

INTRODUCTION

The R&D project manager needs to be conversant with the subject matter in order to provide accurate direction and counsel in matters concerning the project that he or she is in charge of. Technical skills are attained in the course of formal training in the subject matter that allows the manager to participate in the actual work and truly be considered as part of the project team. Lack of knowledge or skills in the area of focus places a project manager in an awkward situation especially in the R&D setting which can easily be beset by uncertainties. To be able to make the right decisions and provide valuable input to a team of experts in the field, the technical knowhow is critical for the R&D project manager. A project manager in a non-technical or non-scientific undertaking may however get away with possessing only project management knowledge and skills. Training in project management tools and techniques is an added advantage to the R&D project manager as it empowers him and facilitates his work to ensure that the work is done in time, within the defined scope and cost.

Erno-Kjohede (2000) contributes that managing a research project is more than managing knowledge workers; it is also about managing the generation of new knowledge and the sharing and dissemination of existing knowledge within a joint project. Thus, a R&D project manager requires deeper understanding of the R&D work he is overseeing. He has the task of overseeing both the complexities stemming from the research work and the uncertainties associated with generating research results. If R&D projects result in outputs that do not meet their set objectives, however efficient the projects may have been, they are not effective and it is therefore difficult to justify investment in them. R&D output needs to result in tangible or intangible outcomes. The simple fact is that a new agricultural or industrial technology has no actual economic value to an individual until it is adopted by that individual end-user or to an industry until it is adopted by a large number of industry end-users. The real benefits from R&D:- depend on the size of the outcomes flowing from the adoption of the outputs of R&D e.g. improvement in profit, efficiency or the environment; the rate of adoption; and the extent or scale of adoption (Clark, et al.). It had been argued that given issues such as accelerating population growth, environmental degradation, and increasing global competitiveness there is a great need to focus R&D on the achievement of outcomes rather than the production of outputs. In this study, the researcher dwells on the outputs of the research institution in relation to the R&D objective because the final outcome cannot be realized without the outputs. R&D outcomes are broader and require involvement of a much larger sample group, representing varying interests and/or needs. There can be no outcome without tangible or intangible outputs.

R&D institutions are central in the economic growth of any nation as supported by Odi & Omofonmwan (2013) who say that R&D impacts social, economic, political, educational, science and technology aspects of a society. The introduction of new products and services to the market or innovation depends on R & D (Onuoha, 2013). A research and development institution is considered successful when its work produces new knowledge or products that get to be utilized by the intended consumer or client for progress sake. It should strive to ensure that the R&D results are accessible to a wider range of users who can then further develop and exploit the technology into new products, processes, applications, materials or services. The intended user may be industry and/or scholars who then translate the R&D output to enhance livelihoods. This is commonly referred to as technology transfer. Spasic (2011) defines technology transfer as a series of processes enabling and facilitating flows of skills, knowledge, ideas, know-how and technology among the research institutions, international organizations, NGOs, private sector entities and individuals. Department for International Development [DFID] (2014) asserts that research has resulted in outputs that can be taken up and used by the population without any need for additional skills and have immensely transformed lives. This applies to new products that lead to genuine and immediate benefits for the people. M-PESA mobile banking technology that has spread at dramatic speed in Kenya without the need for any interventions to build people's capacity to use it is a good example.

The key sectors contributing to the economic growth in Kenya are agriculture, tourism and industry (Information Handling Services [IHS], 2016). These sectors are represented in the over 30 research institutions and R&D departments in various commercial goods and services organisations (Kenya Education Network [KENET], 2015). These contribute to the economy by adding new knowledge and innovative products commensurate with current needs and trends. Kenya's industrial sector which also faces challenges in funding and other areas, is dominated by food-processing industries - particularly of coffee and tea - most of which are located in the urban centers, accounts for around 15% of GDP. Kenya also manufactures chemicals, textiles, ceramics, shoes, beer and soft drinks, cigarettes, soap, machinery, metal products, batteries, plastics, cement, aluminum, steel, glass, rubber, wood, cork, furniture, and leather goods.

STATEMENT OF THE PROBLEM

R&D is only useful if its products can lead to economic development, industrialization, job creation and poverty reduction (Ogada, 2015). African research output has for over 10 years lagged behind those of the rest of the world and the links between industry and R&D institutions are weak and so research findings are often not adopted by the target industries (Nordling, 2015; Mutume, 2007). In Kenya, as presented by Moturi and Ogada (2006), the industrial sub-sector in Kenya, since 1996 has been faced with low capacity utilization, declining productivity, and limited technological advancement which are indicators of inadequate application of R&D products. A 2010 African Union survey further placed Kenya last amongst other African countries in terms of the increase in the number of published research papers, a basic R&D output (Irikefe, et al, 2011).

There are external and internal factors that contribute to the poor output in R&D. These factors include insufficient funding, poor support structures and the fact that R&D projects are full of uncertainty, risk and complexity on one hand, and that R&D project teams have substantial elements of creativity and innovation which makes it difficult to predict the output of research in full (Erno-Kjolhede, 2000; Jain, Triandis & Weick, 2010). The course set by Kenya's Vision 2030 for KIRDI, to bring about 'rapid growth in Kenya's manufacturing sector in order to attain a 10% annual growth' (Vision 2030), calls for action for improvement in the management of its resources which include people. To this effect, several studies have identified leadership as a major internal factor and contributor to project outputs (Thompson, 2010; Prabhakar, 2005). The management of people, regardless of their diversity and demands requires capable leadership. With leadership being an important component of any successful project – as provided in the various reviewed studies - this study therefore considers the leadership of the project or R&D project manager as a major factor in successful R&D project output.

In reference to related studies conducted in Africa, none considers the relationship between R&D project outputs and the leadership of the research teams. Somba (2015) attributes this to the fact that in less developed countries, the implementation of project management tools and techniques is still in its early phases of development. A few studies on challenges and progress in R&D have

been conducted in Nigeria (Odia & Omofonmwan, 2013; Onuoha, 2013) and South Africa (PATH, 2015). To address the problem(s) or challenges leading to the poor R&D outputs, this study set out to assess the influence of the project manager's leadership on the R&D project output in a government or public funded and non-academic R&D institution in Kenya.

LITERATURE REVIEW

The effective R&D project manager needs to be conversant and competent in the specific area or subject of research in order to realize positive R&D outputs while leading the R&D team. He should have technical skills which involve knowledge of and adeptness in specific methods, processes, procedures or techniques (Xiong, 2008; Katz as cited in Ballesteros & Chavarria, 2015). He should possess a high level of knowledge about the industry, competition and technical matters.

To help investigate this variable, focus was on the R&D project manager's ability to manage resources and achieve R&D goals as stipulated in the leadership competency theory. Technical competence elements drawn from the ICB framework and Leadership competence theory dimensions which include managing resources and achieving was incorporated and scrutinized as part of the R&D project manager's technical skills. R&D should result in outputs that can be taken up and used by the population without any need for additional skills and should transform lives (DFID, 2014). The final output of the R&D project is a dependent variable that consists of both tangible and intangible outputs. The study adopted study measurement elements established by Vuolle, Lonnqvist and van der Meer (2009) during their study that examined the measurement of intangible aspects of research and development (R&D) projects. This assisted in defining and determining KIRDI's R&D outputs, in relation to the study independent variables.

The human capital related outputs of an R&D project include, e.g. enhanced R&D process skills, tacit knowledge that is gained by experience or learning by doing and new personal relationships. Structural capital related outputs are: Documented information, papers/publications, technical reports; lessons learned; new technology, licenses, technological knowledge; patents, patent citations, new product announcements; and new or improved processes or services, organizational innovations. Relational capital related outputs are: New or improved relationships with customers and other external stakeholders; brands, trademarks and service marks; organization's image; and knowledge spillovers. Several studies have suggested the application of tailor-made tools and techniques in the management of research and development activities or projects. Others have studied leadership styles and skills for project success and a few specific to Research and development projects. For instance, vom Brocke and Lippe (as cited in Kuchta & Skowron, 2015) proposed implementation of traditional Project Management techniques by the Project Management Institute for R&D teams. Others include - adaptation methods such as Scrum proposed by Marchesi et al. (as cited in Kuchta & Skowron, 2015), or scientific approaches

proposed by Coffin and Taylor, Belhe and Kusiak, and Kolisch and Meyer (as cited in Kuchta & Skowron, 2015).

In their study Hampson and Brandon (2004) identify 'leadership in R&D' as the 'overarching vision' which facilitates the achievement of the other visions of the construction industry. The proper management of interdisciplinary teamwork, leadership styles and work environment are also cited as contributing to the success of R&D efforts (Sawhney and Prandelli; Shim and Lee (as cited in Kulatunga, Amaratunga, & Haigh, 2009)). Slevin and Pinto (as cited in Prabhakar, 2005) contend that project managers who employ transformational leadership and, more specifically, idealized influence, in conjunction with a relationship-oriented approach enjoy more project success.

RESEARCH METHODOLOGY

The research design adopted was explorative, descriptive and explanatory which fall within a quantitative design and a qualitative design. The study used interview schedules and self-administered questionnaires. In this case, purposive sampling was used to determine and select the sample. The sample size from the target population size of 119. To collect the necessary primary data, questionnaires and interview guides were formulated and used. Quantitative data was analysed using both descriptive and inferential statistics.

FINDINGS

The study sought to establish the link and importance of technical skills in the R&D project outputs at KIRDI. The R&D managers were hence asked about their academic background, to establish if they had been formally trained in their respective fields of research. It was necessary to further establish if they had any training in project management and/or leadership, in case of respondents without pertinent technical skills. A project management or leadership qualification could also be assessed further to see if it formed a positive correlation with R&D project output. See Table 1.

Table 1 R&D project manager area of specialisation – Technical skills at KIRDI

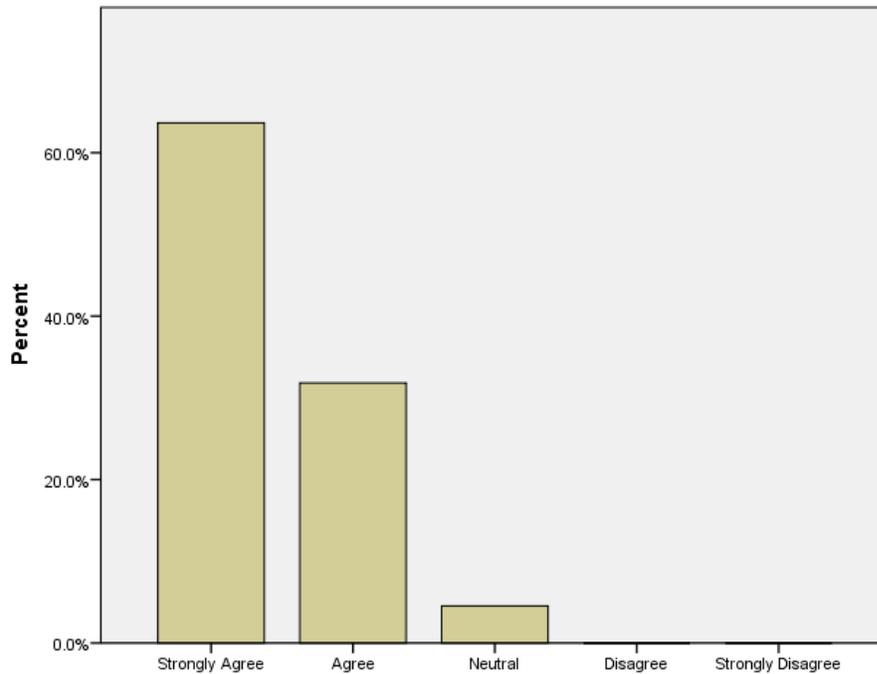
	N	Mean	Std. Deviation
How much does your academic background add value to your current work?	7	1.00	.000
Is the training specific to your R&D area of specialization?	7	1.00	.000
Formal training in project management and/or leadership?	7	2.57	1.134

Questions 1 & 2 were answered by respondents based on a Likert scale with the highest positive response valued at '1' which were "To a very great extent" and "Yes". For Question 3, the respondents were provided 4 values that were nominal i.e. 1- Project Management, 2- Leadership, 3- Both, 4 - None of the two. With a mean rate of 1, 1, and 2.57 on academic background, relevance of training to R&D work and training in project management or leadership, all the R&D staff indicated that their academic background added value to their work to a very great extent. They also confirmed that their training had been pertinent to the specific area of specialization at KIRDI. The respondents specified that they had been trained in project management/leadership, based on the mean rate. However, the standard deviation might have been caused by one extreme choice of '4' by a minority of the respondents. This showed that the respondents were significantly familiar with project management and leadership principles.

R&D team's view on R&D project manager's technical skills at KIRDI

The R&D staff were asked if they agreed that the R&D project manager needed to have technical skills that were relevant or pertaining to the research work undertaken. This was important because the team members look up to the manager for leadership and guidance and their perception or confidence in the manager's competence to lead the team is tied to the manager's capabilities which include all aspects of their leadership skills.

Figure 1. KIRDI R&D staff response on whether the R&D project manager should possess technical skills



All the respondents, except 4.5% who remained neutral on the matter indicated that they believed that technical skills were important for the project manager. None of the respondents disagreed with the affirmation. 63.6% stated that they ‘strongly agree’ that R&D project managers should have technical skills. 31.8% ‘agreed’. They were further asked to explain how the R&D project manager’s technical skills contributed to the final output. Majority shared that these skills were necessary for the R&D project manager to work more efficiently. They said that the skills enabled the manager “to monitor and evaluate work of the team”, and “better management of resources, proper planning and monitoring and evaluation”, among others. Technical skills are therefore considered necessary for the effective leader in KIRDI’s R&D project.

Apart from stating their academic qualification and experience in their respective field of specialization, the R&D project managers were asked to state if they applied technical skills in their role as project managers. They were also required to state if they felt that their team members appreciated application of the same technical skills in the R&D project. 5 point Likert scale was used to provide measurable options with weightings as follows: 5 - To a very great extent, 4 - To a great extent, 3 - Not at all, 2 - To a small extent and 1 - To a very small extent. Table 2 provides statistical point view of the collected feedback.

Table 2 Role of R&D project managers' technical skills and importance to the research teams at KIRDI

	Do you apply technical skills in your current role?	Do you feel that the team members appreciate your technical skills in the R&D project?
Mean	4.43	4.57
Std. Deviation	0.535	0.535
N	7	7

A mean rate of 4.43 and 4.57 respectively and a standard deviation of less than 1 i.e. 0.535 in this case, imply that there was very little variance in the respondents view point concerning the importance of technical skills in the R&D project. Respondents agree to a very great extent or great extent that technical skills are a requisite for positive R&D outputs.

R&D Project Managers' application of project and project management concepts

Application of project and project management concepts were also attributed to the R&D project manager's competence in regard to technical skills. The study worked on the premise that since project management would not be the key area of specialization for the R&D project manager, and then the application of project management strategies would be regarded as an extra ability. Therefore, as part of assessment of the managers' contextual skills, the R&D managers were asked to state which PM concepts they applied during the management of R&D work. Questions related to this were posed on a 5 point Likert scaling of 1 – Strongly Agree, 2 - Agree, 3 - Neutral, 4 - Disagree and 5 – Strongly disagree. An additional scale of 6 for 'no comment' was later added to take care of the missing fields and to help balance the final calculation of the mean and standard deviation, based on a sample size of 7.

Table 3 Application of PM concepts by KIRDI R&D Project Managers

Project management tools and techniques	Mean	Std. Deviation
Activity Duration Estimating	0.57	0.535
Communications Management Plan	0.14	0.378
Cost Budgeting	1.00	0.000
Formal Acceptance and Closure	0.00	0.000
Network Diagram	0.00	0.000
Performance Reports	1.00	0.000
Procurement Management Plan	0.43	0.535
Product Description	0.86	0.378
Project Charter	0.00	0.000
Quality Management Plan	0.29	0.488
Resource Planning	0.57	0.535
Risk Management Plan	0.00	0.000
Schedule Management Plan	0.43	0.535

Scope Management Plan	0.14	0.378
Staffing Management Plan	0.00	0.000
Work Breakdown Structure	0.71	.488

Out of the 16 listed PM concepts, it was established that all the respondents indicated that they applied Cost Budgeting and Performance Reporting in their work. These were followed by Product Description, at a mean rate of 0.86 and standard deviation of 0.378. Work Breakdown Structure came 4th with a mean of 0.71 and standard deviation of 0.488. The remaining two with a mean rate nearer to 1 than 0 were Activity Duration Estimating and Resource Planning, both having a mean rate of 0.57 and standard deviation of 0.535. The implementation of PM concepts by the KIRDI managers is therefore in line with Bushaway's (2007) position that research management requires the skills of project management to be combined with the ability to formulate a longer-term strategy and implement its objectives in terms of operational development.

Five of the concepts were not selected by the respondents, to imply that they were either not applicable to the R&D project work, not conforming to the institutional framework for projects or not known to the project managers. The respondents were however not required to explain their feedback. The concepts were - formal acceptance and closure, network diagram, project charter, risk management plan and staffing management plan. Bolles and Hubbard (2007) acknowledges that incorporating project management process into the existing operational work process requires an analysis of how the institution currently develops its business strategies and accomplishes its related business objectives. This explains why the R&D project manager may not be able to apply all the PM strategies, especially if the existing institutional work processes are not accommodative.

CONCLUSION AND RECOMMENDATION

The study therefore concluded that effective leadership in R&D projects require skills and knowledge in the technical or core subject area, in human relations and ability to present the project within set contexts of operation from the institutional to the global perspective. The R&D project manager requires all the three skills in order to effectively manage all the dynamics of R&D work in a non-academic, public research institution. Technical skills of the R&D project manager includes all the formal knowledge required to understand and undertake the research work from inception to conclusion. The project manager in the R&D institution should therefore ensure that he updates his technical knowhow and skills on a regular basis. Just like is happening in KIRDI, there should be training opportunities availed to the managers to build their capacity due to the constant change in trends.

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