Towards a project management framework for ICT projects in defence institutions

Lt Col. Sean D Filmalter[314]
South African National Defence Force

Prof. Rigard J Steenkamp[315]
University of South Africa

Abstract

A framework for information and communication technology (ICT) projects may address the discord between traditional project management and that which is required for ICT projects within defence institutions. The problem is underlined by the pace of technological development and the current application of compromised project management. Globally, no specific project management methodology is prominently suitable for solution delivery within defence institutions. The aim of this research was to address the problem by development of a framework for the management of ICT projects for defence institutions.

The research methods used to address the problem were twofold with respect to a descriptive study. Secondary sources were utilised to describe a thorough background to the problem, and secondly, a descriptive case study was used. The ICT function of the South African Department of Defence (DOD) was used for the case study. A synthesis of the data from these sources guided the development of a framework. The final outcome was the development and enlightenment of a conceptual framework for the management of ICT projects after considering the unique challenges of the military, while reviewing relevant project management methodologies. In conclusion, the conceptual framework proposes a hypothetically workable approach for the management of ICT projects in defence institutions.

Keywords: defence institutions, command and control, DOD, framework, ICT, methodology, project management, process.

Introduction

The Department of Defence (DOD is mandated in terms of section 200(2) of the Constitution, to defend and protect the Republic of South Africa (RSA), its territory and its people.[316] It is required to do this in a sustainable and affordable way by adopting project management to achieve business objectives. Projects in the South African Department of Defence (DOD) are done in very structured hierarchies and processes as detailed in the Defence Acquisition Process (DAP) 1000 and the most recent version of the Defence Acquisition Handbook (DAHB) 1000.[317] The current process used, as defined in the DAP 1000, was designed for the strategic acquisition of weapon systems, including material, components, product sub-systems and products that form part of an

integrated military capability.[318] Neither of the above-mentioned documents specifically addresses information and technology communication (ICT) projects. However, this has created a menacing gap and the need for a management process specifically suited to the DOD, which is apart from but corroborative with the DAP 1000 and DAHB 1000.[319,320]

Research has highlighted the development of project management as a science, which has been known in construction work from as early as the time of the Egyptians. Typically, project institutions are project-driven with clear characteristics such as defined command and control (C^2) structures and hierarchies, as well as objectives that are understood by all.[321] The Project Management Learning Group points out that there are fundamental differences between project-driven and non-project-driven institutions. Project-driven institutions (matrix structures) are deemed mature, while non-project-driven institutions (functional structures) are still viewed with scepticism. ICT institutions are seen to be hybrids of the two structures, where both project-driven and non-project-driven parts have to be considered.[322] Traditionally, defence institutions are non-project-driven, as they follow functional structures; however, with a strong move away from this since the 1960's.[323]

Generally, ICT is the accepted term given to all technologies for information and communication, and under this umbrella, we would find a broad range of constituent items, such as integrated computing, which consists of computer hardware, software and middleware, as well as data processing platforms.[324,325] Hashim supports the claim that the use of ICT has increased, regardless of size or mandate, and exploiting the potential of technology has become important.[326] ICT enables the execution of various activities of an institution by capturing, storing, retrieving, transmitting and processing data or information.[327] Internationally, militaries are vigorously utilising ICT as a strategic capability and, as established by Gartner, ICT has not only been identified as a future component of warfare, but also as a mechanism utilised in order for institutions to run smoothly.[328] This notion highlights the aspect and significance of ICT, as it is becoming progressively prominent internationally.[329,330]

As highlighted, defence institutions are traditionally not project-driven and tend to use conventional management methods that lack objectivity while not accounting for complexity, leading to failures.[331] The high failure rate of ICT projects in defence institutions, such as the DODDOD, is alarming and underlined by the current Fourth Industrial Revolution (4IR) sounding an alarm that, even with a surge in ICT investment, ICT projects continue to fail.[332]

As all projects are considered to be living and evolving as they progress, project management is required to be fluid, supportive and responsive in how the activities and milestones are completed. What sets project management apart from conventional management is the deliverables and finite timespan.[333] This is specifically true in the DOD with burdensome processes. The general changes experienced by global institutions and the unique nature of the military call for project management to be increasingly utilised as the solution for achieving objectives.[334,335] The effectiveness of project management is determined by numerous factors related to methodologies, social conditions within

which the project team operates, level of authority, effective communication, degree of top-management assistance, ownership and experience.[336,337]

Nicholas and Steyn (2001) define project management as the application of "project knowledge, skills, tools, and techniques to execute project activities to achieve project goals as per the project definition".[338] The definition by these authors is supported by Burke, who adds, "to meet stakeholders' needs and expectations".[339] The requirement for a relevant definition for DOD project management for ICT projects is fundamental. It is therefore crucial to define the term 'project management' for ICT projects for the DOD as:[340]

> Project management for ICT projects is the application of specialised skills and processes to manage projects for both information technology, computing platforms, resources and supporting infrastructure in support of the business objectives of the DOD.

The study on which this article reports explored the development of a conceptual project management framework utilising existing methodologies for ICT projects in defence institutions. The research problem, methods used and results of the study follow next.

The problem

Projects and project success are high on the agenda of defence forces although they are non-project-driven institutions. Project failure – especially in ICT projects – is common due to the compromise of traditional and professional project management.[341] The increased pressure for procuring and maintaining new ICT technologies and of trying to keep abreast of the evolving nature of warfare and changing objectives, have led to the identified need to manage and execute projects in a different way.[342] The lack of upscaling agility in current project management processes within defence institutions, particularly the DOD do not cater optimally for ICT projects with respect to the effective delivery of solutions.[343] This indicates a need for an adapted project management approach for ICT projects within defence institutions.[344] Integrating proven ICT project management methodologies may develop into such a framework to address the challenges.

Research methods

There are numerous advantages to having different, merged or integrated methodologies. Although some authors divert from traditional approaches to support the mindful distinction between qualitative and quantitative research, others, such as Plowright, are strongly inclined to support integrated methodology frameworks.[345]

To address the current research problem, the descriptive study used two methods, namely a descriptive literature study and a case study. Descriptive research is utilised to describe the characteristics of the phenomenon being investigated and looks at what the current status and characteristics being researched are.[346] A review of relevant literature on the subject of ICT project management and its associated methodologies and ICT

concepts was undertaken to address the uniqueness of managing ICT requirements through projects.

Furthermore, a descriptive case study was used within the ICT institution of the DOD to examine the current practice of managing ICT projects. Case study research was used as an encompassing method within the contextual situation of the DOD.[347] Case study research is elementary in that it highlights the significance and impact of the context under examination, which also investigates certain progress in real life within the context.[348] Case studies are often expounded upon as exploratory research, and are used where there are few theories or a deficient body of knowledge as was the case of the DOD with the application of project management for ICT projects.[349]

The synthesis of the data from the two sources guided the development of a conceptual project management framework for ICT projects. The conceptual framework is by definition not cast in stone and will need further testing, development and validation to become a model.

RESULTS

The results from the descriptive literature study and the descriptive case study are presented to indicate the primary components prioritised to be included in the conceptual project management framework for ICT projects. This implies that the current weaknesses of the phenomenon are highlighted with a suggested solution. A summary of these solutions are represented in the conceptual project management framework.

The descriptive literature study

Defence institutions

Military projects begin with a required capability, which is normally identified by government or changes in the strategic focus of the defence force to address the rejuvenation or replacement of current or obsolescent equipment.[350] The ever-changing strategic environment creates the need to adapt and have an alert and balanced force that can execute its mandate in line with the national security requirement in the best way possible.[351]

Internationally, as well as that in South Africa, the military environment is unique in the way the attributes of the people and the military structures provide indicators towards how things are done. The military is a fully-fledged community with various professions – from drivers to soldiers, etc., just like any civilian community or workplace.[352] The obvious difference, however, is that the military is focused specifically on military operations that include all the relevant support elements. Bushell states that the key value that is important for militaries is C^2 with clearly defined functions and the sound management of the resources.[353] C^2 is essential and brings about responsibility, authority and accountability to support commanders.[354] Therefore, C^2 is deemed a critical part of application of military activities and project management.

Projects demand a special kind of management

Single or sporadic project activities require different management approaches, while projects need professional project management as underpinned by the Project Management Institute.[355] Nicholas differentiates between projects for operations and project management. Projects for operations are very different from job or assembly line type operations and thus it is crucial to understand the need for a special type of management. In reality, projects require evolved management techniques and institutional forms as they are unique, utilise multiple professions, and are usually temporary activities.[356]

Project management addresses the need for a single person running a project, who is independent from the normal chain of command. A project manager becomes the nodal point for a project to integrate the different professions, while focusing on delivering the intended solution within the scope of the project.

Project management methodologies

In venturing into the comparison of the identified project management methodologies, not all would be suitable, and therefore a combination of some could be proposed as an option in defining a unique project management approach for ICT projects in defence institutions. The methodologies considered were the 'scrum methodology', 'eXtreme programming', 'adaptive project framework', COBITv.5 and 'six sigma'. There are numerous ICT frameworks available, such as ITIL, CMMI and TCM et cetera, but for the purpose of this article, they were not considered, as the focus was on ways to address the situation sequentially. The four methodologies selected are those used particularly by the DOD (see Table 1) and were considered best suited, as they are structured and suitable for large institutions, create the required audit trail, allow for objectives to be achieved, and can be aligned to the DOD C^2 structures.

Table 1 highlights the analysis and comparison of the advantages and disadvantages of the identified methodologies. The DOD utilises specific methodologies for managing its projects; thus, PMBOK® (Project Management Body of Knowledge), process-based project management, PRINCE2® and benefits realisation are those best suited to be utilised by drawing on their advantages and therefore applied by the DOD.

Table 1: Comparison of the identified project management methodologies used by the DOD[357,358,359,360,361,362]

Methodology	Comparison
PMBOK	**Advantages**: • PMBOK, like PRINCE2, is an internationally recognised methodology and is widely used in the United States. • PMBOK applies an international standard to the waterfall method (sequential flow), and is a concise methodology that can be used to manage large projects. • This methodology supports work in a standardised way across departments and institutions. • PMBOK brings about standard terminology and practices to project management. **Disadvantages**: • PMBOK, like PRINCE2, is not suitable for smaller institutions who want to work at a faster pace and is complicated due to the methodologies conciseness.
Process-based project management	**Advantages**: • Improved project processes, which in turn increase value and benefits of the project, results are delivered at reduced costs. • Project alignment with the strategic vision of the institution. • Institutions gain flexibility, and processes are cross-cutting in that they reach different services within the institution. • Project roles and responsibilities are clearly defined to support the achievement of the goals of the institution. • There is optimised use of resources, which in turn reduces management and operational costs. • This process supports improvement, in that deficiencies are quickly identified, and the associated risks reduced. **Disadvantages**: • When implemented, this approach implies change for traditional hierarchical institutions and thus change management is crucial for success. • This methodology must be applied to the whole institution and not just single entities.

PRINCE2	**Advantages**: • PRINCE2 is the most-used methodology in the world and thus tried and tested. • There is common and understandable terminology for all projects. • It maps out phases of large projects from beginning to end, highlighting what will be delivered. • There is a focus on extensive documentation, which allows for lessons learnt and auditing of projects. **Disadvantages**: • Like all waterfall methods, PRINCE2 is very rigid in that nothing will take place unless the preceding step has been implemented. • It is not for small projects or institutions that do not have the time or resources to manage projects. • The extensive amount of documentation creates a disadvantage as changes are hard to accommodate, and documents must be redone, tying up resources that could hamper progress and delay deliverables.
Benefits realisation	**Advantages**: • Benefits realisation supports the success of projects that bring about change due to the focus on the added value the project brings. • It provides a practical 'framework' for ensuring real results. **Disadvantages**: • Institutions do not find this method easy, as managing benefits formally is a problem in institutions, as shown in the literature as reasons why projects fail. • Members within institutions do not always understand what benefits versus objectives are, as the achievement of objectives leads to the realisation of benefits. • The structuring of benefits realisation needs to be simplified and made clearer for a better understanding of the methodological process to be followed. • Accountability for benefits is not formally defined. • This method needs the active management of project plans.

Source: Authors' own compilation

The comparisons presented give an overview of the identified project management methodologies and indicate that some, such as PMBOK and PRINCE2, follow a waterfall method that was created to manage increasingly multiplex projects. The waterfall method is a chronological approach that is intensive and no headway can be made unless a previous stage has been completed. The disadvantage of a waterfall method is that it does not permit much room in project deviations as demanded by the fast pace of ICT.[363,364] In the examination of both PRINCE2 and PMBOK, it was found that both are arduous frameworks suitable for defence institutions.[365,366] The results of process-based management and benefits realisation emphasise vital features in that process-based project management is strategic and methodical for evolving and refining processes, thus focusing on the benefits to achieve performance.[367,368] Similarly, benefits realisation also emphasises the results, but by defining, planning and structuring. Benefits realisation provides the tools to corroborate projects delivering tangible outcomes in support of strategic objectives.[369,370] Both can be applied within a defence institution, as they allow for flexibility in managing the speed of ICT development, but retain the focus on the value that the ICT project must bring.

The project communication hub

Communication is identified as a primary success factor that may apply to all project methodologies with high stakes and high scope, and may be even more crucial in large bureaucratic institutions, such as the defence industry.[371] Leading authorities, such as Kerzner (2017), and Nicholas and Steyn (2008) define project management as the art of directing and integrating human and other resources throughout the unique project life cycle.[372,373] As previously stated, the project manager must integrate work efforts to achieve project objectives by bringing together people into a cohesive team working towards a common result. The project manager, team and project management system are the features that distinguish project management from other traditional forms of management.[374] The importance of project communication is therefore emphasised as critical to project success, and it is one of the primary roles of the project manager.[375]

Nicholas and Steyn provide a useful overview of the integration role of the project manager in terms of providing direction, decision-making and being the project communication hub.[376] The project manager is the central figure in the project office. Nicholas refers to the project office as the physical hub where projects are coordinated, and mentions that the effectiveness of project institutions depends on this.[377] The project manager will therefore need several communication mechanisms for integrating the efforts of all project stakeholders effectively throughout the entire project life cycle.

Challenges of ICT projects

Clements and Gido state that projects are set out to achieve an objective of delivering a unique solution through a particular set of associated tasks.[378] At institutional level, a project is defined as the effort that is related to the complexities within the institution. Hence, projects require the involvement of various activities, such as integration, co-ordination and accountability, under the auspices of the project manager. As stated

above, a project is always aimed at fulfilling the objectives or strategic needs of the institution, such as advancements and obsolescence of technology or equipment.[379] Thus, at the strategic level of institutions, project management is often the mechanism and competitive edge for strategic roll-out with respect to institutional goals and objectives.[380] Stoshikj, Kryvinska and Strauss, supported by Cohen and the University of California, identify project management roles within institutions as central, and thus project management has been repositioned in line with the fast-paced nature of the ICT space.[381,382,383] If projects are not managed properly and in an organised manner then, as Bushell argues, all initiatives will be prone to capability, schedule and cost risks.[384] Competent and experienced project managers are crucial in the defence industry due to the slowness caused by red tape and as Kerzner maintains, ICT projects are the most difficult to manage due to changes in specifications, demanding agility and responsiveness.[385]

The DOD case study

In this second part of the article, the DOD case study on ICT projects and project management is discussed. The primary measures used to study this case were secondary sources (reports and literature) and the first author's experiential knowledge and observation over several years as an employee of the DOD.

It is required of the DOD to provide, prepare and employ supported military capabilities to meet the needs of South Africa.[386] The structure of the DOD enables the execution of its mandate in all its entities.[387] However, with this in mind, like all defence institutions the DOD works within a formal C^2 approach. This approach brings with it a dilemma between the autonomy of project participants and their role within the routines and efforts of the institution. The challenge to work in the DOD is further enhanced by budgeting constraints, which have an effect on operations, resulting in the total defence mandate not being met. Currently, the DOD is battling underfunding and an operational 'overstretch' that further compromise its projects.[388] Highlighted in the Department of Defence Annual Performance Plan for 2019 is the fact that the worsening of facilities and the lack of rejuvenation of required technologies and information systems was due to a reduction in budgets.[389,390] This may threaten the viability of several projects due to the high risk of project failure. On the other hand, it may be possible to consider, accept and approve some important projects with high constraints if a highly skilled project team is appointed.

Although a defence institution is not project-driven, as previously discussed, ICT projects need special attention since neither the DAP 1000 or DAHB 1000 can handle or manage ICT-related projects due to the speed of the changes they bring. This emphasises the need for an adapted project management framework.[391,392] The ICT institution of the DOD is responsible for all ICT that is common or transversal, while unique ICT that is embedded in weapons systems is excluded and managed under the DAP 1000 process as part of Category 1 Matériel (DOD, 2017:16).[393] There is therefore a clear need for a formal process for the management of DOD ICT requirements in order to comply with applicable government and DOD policies, ICT industry standards and best practices. By

recognising the unique nature of ICT in general and what informs ICT requirements, makes it impractical for the DAP 1000 to be rigidly enforced.[394,395] The implication of changing the ICT processes for ICT projects will position DOD ICT to enable its business quicker, to align to ICT effectively, to manage its ICT requirements, and to save unnecessary costs while improving management accountabilities.

DOD projects

As previously discussed and brought to the fore, the DOD uses a project management methodology to achieve its business objectives by directing resources throughout the duration of a project.[396] This approach is supported by Blythe, who states that the principles and practices of project management are relevant in transforming the institution to undertake its actions with accountability and transparency while such principles and practices are suited to address the problems experienced.[397]

Within DOD project activities, there is a dilemma between self-determining requirements of participants and their role within the C^2 routines and efforts, as underpinned by Fernandes, Ward and Araujo who state that there would always be conflict between what the institution wants and the opportunities for adopting project practices for future projects.[398] What is noteworthy is that defence institutions, such as the DOD have started to maximise the use of project processes in the last few years to enable effective decision-making and delivery of strategic projects.[399] Recently, the significance of project management has become crucial in providing modernisation in defence industries, which face many issues, such as continuous monetary cuts. Due to the ever-shrinking defence budgets, project management becomes more important than before.[400] Many institutions adopt project management for productivity purposes, which indicates that project management as a methodology is best suited to address the support processes for capabilities and product systems, enhancing the potential of the institution to achieve its mandate.[401] Authors, such as Blythe and Conforto, Amaral, Da Silva, Di Felippo, Simon and Kamikawachi, state that questions have been raised about project success in defence institutions, such as the DOD, although they have been successful on numerous occasions.[402,403] With this in mind, the question posed is whether the DOD is really able to adopt pure project management to execute its objectives, as there is mounting concern that projects are not delivering the required capabilities.[404]

ICT capability for the DOD

The introduction and implementation of capabilities are not always managed as projects. The activity of managing products across the five primary stages known as development, introduction, growth, maturity, and decline is defined as life cycle management.[405] The use and definition of life cycle management in the DOD is similar to that of ICT requirement management.[406,407] The importance of ICT capability management is therefore being recognised in that it must be managed with a unique process, as stated in the DAHB 1000, to deliver solutions timeously.[408]

The DOD defines capability in terms of equipment, facilities and services to fulfil obligations, roles, functions and tasks.[409] The capabilities of the DOD can be described

in terms of the basic elements of the acronym POSTEDFIT (personnel, institution, support, training, equipment, doctrine, facilities and intelligence).[410] In considering an ICT capability being managed as an ICT project, consideration must be given to the make-up of the ideal project team to be responsible for the management of the solution delivery with respect to the capability for a stakeholder.[411] This crucial decision should be in the hands of the project manager with the support of the project sponsor.

An adapted process for the DOD must be proposed and the description of it formulated to support delivery of ICT capabilities through ICT projects.[412,413]

ICT requirements management in the DOD

The field of ICT is often conducive to inconsistent actions that have spread internationally, affecting the amount of money spent. While this picture has improved through project management and process improvement actions, stakeholders are still of the opinion that ICT projects remain dependent on antiquated methods. The authors Dekkers and Forselius believe that, as part of the ICT industry, all stakeholders need to address antiquated methods, taking actions to change the way things are done.[414]

As far back as 1998, managing ICT projects has become an important issue that was highlighted in the 1998 Report of the Presidential Review Commission. The Commission brought to the fore the need that ICT should be granted the same importance as the management of other resources and published findings and recommendations in this respect.[415] ICT is performing a role as a strategic enabler for the delivery of systems and solutions in the public service, so much so that the Department of Public Service and Administration (DPSA) developed the Corporate Governance of ICT (CGICT) Policy Framework. Through this policy framework, the DPSA requires the various organs of state to implement the policy framework as part of their governance procedures.[416] The accountabilities and responsibilities in the framework thus ensure that the DOD is able to align the importance of ICT services and support delivery with the institutional objectives while implementing sound ICT management practices. Within the DOD an ICT institution is responsible for enabling the department by means of ICT systems and support. The support encompasses numerous separate ICT products and services that are integrated into ICT capabilities over their life cycle and across all lines of DOD business.[417] Again, it is necessary to emphasise that some of these solutions need to be managed as projects due to their stakes and scope.

It has become apparent that there is a noticeable need for a process for ICT requirements to be able to comply with policies, ICT industry standards and best practices. With the focus on applying life cycle management on ICT requirements, the DOD could provide ICT capabilities cost-effectively with potentially reduced risks. As highlighted in the current initiative to update the DOD ICT Strategy, the structures for ICT do not display a life cycle management approach.[418] If the structures are changed, the impact will be felt in the current way ICT projects are managed. The ICT requirements process has a number of levels with each area of responsibility within the process allocated to another entity within the ICT institution, and a centralised decision point throughout that creates

the tendency towards long and arduous processes.[419] Clearly defined functions, roles and responsibilities, as well as processes have to be ensured, so that that life cycle management takes place effectively and efficiently to mitigate the risk of ICT project failure. The potential result of changing the ICT structure and processes will ensure enablement of the DOD ICT requirement is delivered fast and cheaply to stakeholders, while improving accountabilities.

DOD ICT project management

In the management of projects, the most important planning documents of any project are the statement of work (SOW), the work-breakdown structure (WBS) and specification requirements.[420] In many cases, the project stakeholders do not know what they need, making the management of projects more complicated. Needless to say, a project has no chance of success if the requirements are inadequate or incorrect. To address this problem, the DOD has attempted to provide a standardised approach through the DOD ICT Requirements Management Instruction, which aims to clarify the authority and responsibilities of the ICT stakeholders, gaining their commitment and supporting the delivery of ICT solutions to the DOD.[421] With the rapid changes in technology, the present arduous processes are having a negative effect on the management of the ICT projects of the DOD and thus warrant a rethink of how ICT projects are managed.

The DOD is aware of the problems and shortcomings it experiences in its ICT institutional structure and processes, which hampers the delivery of effective ICT projects. Even with an ICT requirements management process, the DOD is still troubled by issues in its ICT projects due to dwindling capacity, organisational structure and reduced resources. Therefore, the use of agile and responsive project management for ICT projects is crucial to meet the need for timeous reaction to technologies, opportunities and threats. This was part of meeting the stated requirement of the RSA Defence Review of 2015 with respect to the project management methodology for ICT projects of the DOD.

Factors that influence project management in the DOD

Any project institution will be affected by positive and negative forces that must managed by the project team. In the DOD there are many factors that influence projects across the levels of the institution that have the potential to affect the institution.[422] The factors can be grouped into two distinct categories, namely enablers and barriers. Schnittker, Marshall, Horberry and Young state that enablers and barriers are widely defined as anything that helps or impedes the successful achievement of project and other objectives within an institution.[423] According to Vaghefi, Lapointe and Shahbaznezhad, notable individual factors are those that are associated with willingness, motivation and ability to transfer knowledge.[424] These authors furthermore draw our attention to the reality that institutional factors are intrinsically linked to structure and culture. The impression is therefore that the levels of co-operation between the rigidness of the institutional form and individuals could obstruct or assist in the delivery of ICT projects.[425] The challenge to create a project team will depend on the project leadership focusing on project success regardless of the distractions and challenges. This is related to the project management

office and elements of organisational culture that emphasise project loyalty over military sentiment in the framework. This will demand an independent project culture that will be immune to negative military barriers.

There is increased support that leadership and processes, especially those which are encompassed by the current forms of C^2 within the DOD infrequently leads to optimal results. Institutional structure and C^2 approaches affect projects, project managers and project resources; therefore, there is a need to optimise how projects are managed.[426] By continually addressing barriers, rigidity could be reduced. The implementation of proposed activities could therefore support each other and have a universal effect in promoting ICT requirements and managing business change across the institution. However, the success of the DOD to manage ICT projects remains dependent on agreement and acceptance by top management to accommodate the appropriate project management methodology as proposed by the framework.

Altering processes in the DOD

It is well known that the military depends on rules and structure in order to function in battle, giving rise to the sense that militaries are rigid and inflexible. Defence institutions learn through the collaborative experience of their members, and transfer this knowledge to policies, doctrines and procedures. Based on these experiences, the DOD needs to adapt to the changing world within which it finds itself.[427]

As a bureaucratic institution, the DOD tends to create barriers which need to be removed.[428,429,430] Institutional agility in the DOD is needed to overcome these barriers and to drive change through process management to achieve collaboration between individuals and the rigour of form to support ICT projects in delivering the required outputs[431,432] The result of this is that the DOD tries to find a better understanding of processes and strategies to improve how they do things.[433,434] The DOD could therefore improve considerably and could take advantage from a redesigned or different project culture and approach to managing ICT projects. In doing so, the DOD needs to exploit the knowledge and skills of the collective to reinvent itself. The DOD, like many militaries, operates within a clear and structured C^2 paradigm. There is difficulty in breaking away from this, thus reducing any chances of success in most transformational change efforts. [435,436] This difficulty may remain in place, but with certain selected ICT projects, a matrix-type project institution can be very effective, provided that a competent project team is appointed.

It is noteworthy that there are many strong points in the DOD for managing projects. As previously mentioned, the DAP 1000 and DAHB 1000 are substantial guides for the project management of weapon systems.[437] The direction given is structured allowing for approved deliverables throughout the process, even given a dwindling budget. It is therefore crucial that the uniqueness of ICT is the main consideration when looking at appropriate project management methodologies used for different projects.

Results of the knowledge extracted from the literature review and case study

Table 2 reflects a consolidated summary of the knowledge extracted from the literature review linked to the case study leading to the conceptual project management framework defined in the next section.

Table 2: Comparison of the identified project management methodologies used in the DOD

Literature study	DOD case study
Projects demand a special kind of management. Clearly, any project must have a qualified and experienced project manager. ICT projects in the defence industry is no exception (regardless of being non-project-driven), although the military environment has unique challenges. This aspect is noted as the required knowledge that must be installed within the portfolio and project layers of the framework as well as the embedded knowledge of the project manager.	**ICT capability of the <u>DOD</u>**. ICT is identified as a capability. With this understanding then the ICT requirement to the product must be managed through the requirements life cycle. As defence institutions operate and maintain numerous ICT capabilities, some need to be managed as projects, and it becomes prudent that defence institutions utilise a unique project management methodology (as proposed in Figure 1) that will address ICT projects across their life cycle from both experience and theory. This component is defined as part of the benefits that have been achieved and the institutionalisation of portfolio and/or project management in the framework. The chosen methodologies reflected in Table 1 bring about their own unique advantages, specifically for large institutions to support the success of ICT projects and change of focus by providing a practical 'framework' for the realisation of benefits.

Literature study	DOD case study
The project communication hub. To integrate project activities, the project manager must be an excellent communicator in multiple terms. This is crucial in the military environment where functions become isolated entities. This component is integral to the skills and education of the project manager and separately highlighted as the communication hub in the project management office (PMO). This aspect is integral to both the C^2 and management layers of the framework.	**Altering processes in the DOD**. Communication and collaboration are required to move from a rigid C^2 doctrine to a process that can harness the collective to support the military while achieving success. This is noted in the framework by focusing on the institution that will use processes according to what the project management office and ICT enablement needs are and aligning all layers to the objectives set. As discussed in Table 1, a common and understandable project management methodology is required, which in turn will lead to the success of ICT projects, irrespective of the challenges faced.
Challenges of ICT projects. To manage ICT projects, institutions need to be adaptable change agents. This characteristic is especially important in a defence institution because specification and technology changes need to be accommodated with short lead times. Project management simply has to realign to changes to meet the value that the project and the institution require. Agility as well as communication is integral with the skills of the project manager as the integrator and change agent. It is also integral to the feedback loop in redefining needs, while being supported by the monitoring and control activities against the objectives set.	**Factors that influence project management in the DOD**. Clearly, defence institutions are affected by numerous factors that often work against proper project management. In suggesting a project culture, the proposed framework makes it clear that some ICT requirements must be managed as projects within an independent project management culture and methodology. The discussion in Table 1 highlights this fact by drawing on the fact that projects must focus on bringing about change with the focus on added value.

Literature study	DOD case study
	Management of ICT requirements in the DOD. The governance of ICT projects, whether delivering a once-off solution or a need for ongoing life cycle management, becomes crucial within the organisational culture in clarifying clearly defined functions, roles and responsibilities. This would allow defence institutions to support their ICT enablement objectives clearly and without confusion and/or resistance from all stakeholders. The experience of the people as well as the theory around roles and responsibilities will drive this. This is noted in the framework by applying governance that would address roles and responsibilities as well part of the alignment to higher authority. As projects reach closure, project management support is withdrawn, which creates a challenge of alignment. This must be addressed in the organisational culture of the framework in that it is catered for through continued portfolio management. The methodologies discussed in Table 1 are internationally recognised, and thus provide a common understanding for all by mapping out ICT projects and highlighting what must be delivered. There is a definitive focus on improved project processes to increase value while reducing risks for failure during the auditing of projects.
	DOD ICT project management. The ICT requirements must be reflected in the SOW and the remainder of the process must be part of managing the project. The most important features of a project are the SOW, WBS and requirements specification. As the military environment is not project-driven, the problems and shortcomings in its current ICT institution structure and processes, hamper the delivery of effective ICT. This component is therefore clearly noted in the framework defined as 'ICT project planning documents' (with reference to ICT requirements reflected in the SOW and others) setting clear activities that need to be followed to ensure that the required ICT enablement is delivered. In supporting this, Table 1 highlights the need for standard practices, optimised use of resources, and extensive documentation.

Literature study	DOD case study
Project management methodologies. As the military comprise large institutions that were well suited to waterfall type methodologies, technology has made it important to rethink project management methodologies by looking at agility and the realisation of business objectives. This aspect is integrated into all the layers of the framework as no single methodology reigns supreme. The combination of the dimensions (applicable to the DOD case) of the four selected methodologies included in the framework (Figure 1) will be highlighted in the next section.	**DOD projects**. It is clear that the principles of project management must be applied to projects and not be overshadowed by the C^2 of the defence institution. Projects must be allowed to maximise opportunities while meeting the needs of the institution. Defence institutions must become more project-driven than they currently are and this must be done at the core of C^2 justifying the need for this to be addressed in the framework. This aspect is noted in the framework by making the layers of project management part of C^2 as highlighted by the analysis of process-based project management, PMBOK and PRINCE2 in that they support alignment and common understanding of work across the institution, as well as being widely used (see Table 1).

The results of the descriptive study, as described in Table 2, are combined and reflected in the conceptual project management framework (Figure 1) for ICT projects described in section C.

Conceptual project management framework for ICT projects in defence institutions

The strong focus of the framework is on a separate project organisation culture (based on project leadership), ICT projects (derived from business objectives), the project management office (PMO), a project organisation (adapted to each project requirement), and the systems development process and project solutions. The framework incorporates the three levels of project management causes of project success based on Nicholas (2001) with respect to participants (A), communication, information sharing and feedback (B), and the project management systems development process (C).[438]
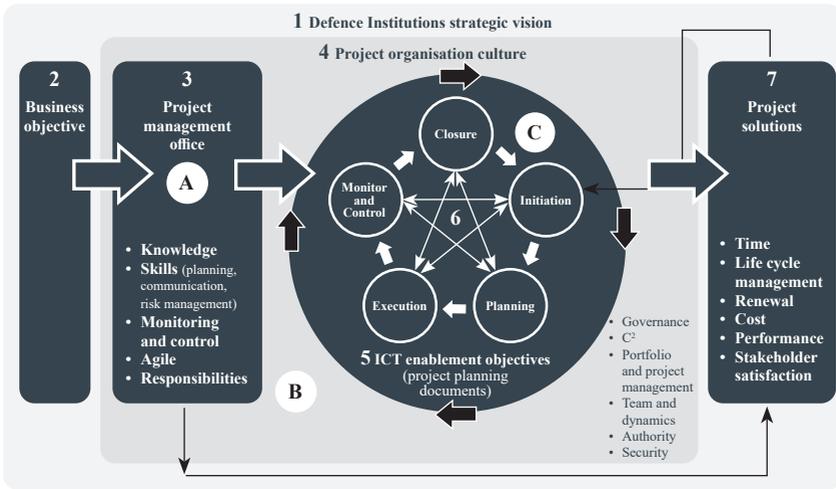
Figure 1: Conceptual project management framework for ICT projects in the DODDOD

Source: Authors' own compilation

The conceptual project management framework for ICT projects (Figure 1) is described in this section. This culminated from the results of the descriptive case study and advantages depicted in Table 1 for the identified ICT project management methodologies. The conceptual project management framework has the following layers, dimensions and documents:

- **Defence institution strategic vision**. The strategic vision of the defence institution is the capacity to establish purpose to determine long-term milestones as a firm foundation to direct the development of defence mandates supported by ICT projects.

- **Business objectives and projects**. This is the measurable results derived from the strategic positioning of the defence institution that must be achieved. The objectives will provide the identification and prioritisation of ICT projects, which include the level of resources that will be allocated. The conceptual project management framework for ICT projects in the DOD will support the achievement of business objectives in a sustainable and affordable way.

- **Project management office (PMO) (A)**. Defence institutions should structure project management offices to ensure ICT enablement needs are aligned to the objectives set and the benefits they must deliver. The participants within this office are top management, the project team, stakeholders and, most importantly, the project manager, i.e. the person who will manage ICT projects in the DOD by using the conceptual project management framework. An agile

project manager should therefore be an excellent communicator, which is crucial in the military environment where functions become isolated entities. To ensure this, the correct training, skills and knowledge of the project manager and team members are crucial, as they are the communication hub in the PMO. This aspect is integral to both the C^2 and management layers of a defence institution.

- **Project organisational culture (B)**. Project organisational culture is an important influence on the success of a project. Defence institutions are affected by numerous factors that often work against proper project management. The proposed framework makes it clear that ICT projects must have an agile, independent project management culture and methodology that are installed as part of the total organisational culture and not only the current practiced form of just C^2. This is highlighted by the circle (C) that encapsulates project management activities (5). This project management culture must have clearly defined roles, functions and responsibilities that are not only assigned to the project manager, but to the team as well. Aligning governance to authority without breaking down independence, a project culture will be ensured. It must be stated that, as ICT projects reach closure, project management support is withdrawn, and this is addressed in the project organisational culture of the framework through continued portfolio management to ensure life cycle management throughout by means of monitoring the benefits achieved, communication, information sharing and feedback.

- **ICT enablement objectives**. The principles of project management are applied to ICT projects so that ICT enablement objectives are not overshadowed by C^2. Part of the principles is that ICT enablement requirements must make good business sense with a clear return on investment. ICT requirements must then be defined and documented correctly to determine the activities. Through this, ICT enablement requirements are reflected in the SOW and the documented process, such as the WBS, as part of managing the project. Defence institution structures and processes hamper the delivery of effective ICT and therefore the framework includes the ICT project planning documents as enabler in the systems development process to ensure timeous and accurate delivery. Similar to the agility focus in elements 3 and 6, the arrows outlining the circle allow for agility in action and lessons to be applied.

- **Project management systems development process (C)**. The principles of project management are applied here and, as mentioned above, are not overshadowed by C^2. This part highlights the move towards a project-driven institution in that the processes are encompassed as part of the organisational culture, ensuring that ICT projects can maximise opportunities while meeting the needs of the institution as key factors to project success. Typical linear waterfall methodologies are inappropriate for ICT; therefore, it is required that projects must be adaptable to change. Short lead times are required to be built into the processes and are denoted by the continual feedback circle as well as the lines interlinking the phases of project management.

- **Project solutions and outcomes**. This dimension refers to project success in terms of time, cost and performance. Benefits are achieved when ICT projects have delivered the desired changes. The quality ICT solution or service is delivered to meet the stakeholders' expectations. With the termination of a project or delivery of a solution, life cycle management takes over. It is required that the deliverables of ICT projects be managed through to redundancy for renewal to take place. This leads to the definition of a new ICT enablement requirement for project initiation. Return on investment will be measured to ensure that the efficiency of ICT deliverables does not lose value and if so, a timeous decision can be taken through the agility in the process.

Conclusion

It is widely argued that the development and progress of ICT pose challenges to traditional methods of practiced project management, especially within defence institutions. The challenges brought by ICT to current project management processes further the notion that ICT projects are known for their high failure rates. A dual approach was utilised with respect to a descriptive study. The data from the secondary sources, as well as the DOD as the context, were synthesised in the development of the conceptual framework. The top four methodologies, namely PMBOK, process-based project management, PRINCE2 and benefits realisation as applied by the DOD, were best suited for the purposes of the study. The methodologies were applied as best practices to add structure to the conceptual framework to allow for adaptation and improvement without changing how the DOD manages its ICT projects.

Therefore, in conclusion, this study spearheaded the effort to bridge the gap in generic project management methodologies as practiced, and ICT projects, taking into consideration the context of a defence institution within which ICT projects are managed. The result was the development of a blended approach in the form of a conceptual project management framework for ICT projects in the DOD. It is anticipated that result presented in this study will be helpful and insightful to the DOD and wider defence institutions.

––––––––––––––––––––

ENDNOTES

316 Republic of South Africa. *Constitution of the Republic of South Africa*. Pretoria: Government Printer, 1996, 1331.

317 TM Mkhaliphi. *Deliberating a contract-type based risk mitigation strategy for South African defence acquisitions.* MA thesis. Naval Postgraduate School, 2016, 6.

318 DOD. *Handbook for the acquisition of armaments in the Department of Defence and in Armscor – DAHB 1000.* Pretoria, 2016, 12.

319 DOD. *Policy and procedure for the acquisition of armaments.* Pretoria, 2003, 2.

320 DOD, *Handbook ... op. cit.*, p. 2.

321 S Azzopardi. "The evolution of project management, Part 2". ProjectSmart. 2013. <http://www.projectsmart.co.uk/evolution-of-project-management-part-2.html> Accessed on 29 October 2018.

322 Project Management Learning. "What is the difference between project-driven and non-project-driven organizations?" 2010. <https://projectmanagementlearning.com/what-is-the-difference-between-project-driven-and-non-project-driven-organizations.html> Accessed on 1 November 2021.

323 J Fidock. *Organisational structure and information technology (IT): Exploring the implications of IT for future military structures.* Edinburgh: Defence Science and Technology Organisation, 2006, 22.

324 OD Toyo. "Information and communication technology (ICT) adoption and the educational growth of colleges of education in Agbor and Warri, Delta State, Nigeria". *International Journal of Education and Evaluation* 3/7. 2017. 19.

325 A Mondal & J Mete. "ICT in higher education: Opportunities and challenges". *Bhatter College Journal of Multidisciplinary Studies* 2/1. 2012. 180.

326 J Hashim. "Information communication technology (ICT) adoption among SME owners in Malaysia". *International Journal of Business and Information* 2. 2015. 221.

327 TechTarget. "Definition: Information and communications technology". 2018. <https://searchcio.techtarget.com/definition/ICT-information-and-communications-technology-or-technologies> Accessed on 14 May 2018.

328 CSO. "Gartner's vision of infosec 2019: Four scenarios, all bad". 2018. <https://www.cso.com.au/article/524934/gartner_vision_infosec_2019_four_scenarios_all_bad/> Accessed on 8 May 2018.

329 Fowler, S., Sweetman, C., Ravindran, S., Joiner, K.F. & Sitnikova, E. Developing cyber-security policies that penetrate Australian defence acquisitions. *Australian Defence Force Journal*, (202). 2017 17-26.

330 EV Popa. "Cyber defence in the North-Atlantic Treaty Organisation: Structures and trends". In *Proceedings: International Scientific Conference: Strategies XXI*. 2016. 323–330. <http://www.cso.nato.int/pubs/rdp.asp?RDP=RTO-TR-SAS-050https://www.ceeol.com/search/chapter-detail?id=467088> Accessed on 8 May 2018.

331 CW Fowler. *Systemic management: Sustainable human interactions with ecosystems and the biosphere*. Oxford: Oxford University Press, 2009.

332 DL Hughes, YK Dwivedi, NP Rana & AC Simintiras. "Information systems project failure: Analysis of causal links using interpretive structural modelling". *Production Planning & Control* 27/16. 2016. 1315.

333 Association for Project Management. "What is project management?" 2021. <https://www.apm.org.uk/resources/what-is-project-management/> Accessed on 27 September 2021.

334 H Kerzner. *Project management: A systems approach to planning, scheduling and controlling.* 12th ed. Ney York: Wiley, 2017, 36.

335 Getsmarter. "The increasing need for project managers in South Africa". 2018. <https://www.getsmarter.com/career-advice/industry-advice/the-increasing-need-for-project-managers-in-south-africa> Accessed on 25 May 2018.

336 MD Dilts & KR Pence. "Impact of role in the decision to fail: An exploratory study of terminal projects". *Journal of Operations Management* 24. 2006. 380.

337 L Crawford. "Senior management perceptions of project management competence". *International Journal of Project Management* 23. 2005. 11–12.

338 JM Nicholas & H Steyn. *Project management for engineering, business and technology*. Oxfordshire: Routledge, 2008, 598.

339 R Burke. *Project management: Planning and control techniques*. Ney York: Wiley, 2013, 3.

340 SD Filmalter. "Transforming the traditional Department of Defence project management processes for information and communication technology solutions". PhD thesis. Unisa, 2021.

341 P Svejvig & P Andersen. "Rethinking project management: A structured literature review with a critical look at the brave new world". *International Journal of Project Management* 33. 2015. 279. doi: 10.1016/j.ijproman.2014.06.004

342 *Ibid*., p. 279.

343 DOD *Handbook ... op. cit*., p. 2.

344 R. Oosthuizen. "Assessing command and control system vulnerabilities in underdeveloped, degraded and denied operational environments". Paper presented at the 18th International Command and Control Research and Technology Symposium, Pretoria, 2013.

345 P Plowright. *Using mixed methods: Frameworks for an integrated methodology.* London: Sage, 2011, 2–3.

346 P Shields & N Rangarajan. *A playbook for research methods: Integrating conceptual frameworks and project management*. Stillwater, OK: New Forums Press, 2013.

347 JA Watkins. *Theses / Dissertations / Research reports: A practical guide for students to the preparation of written presentations of academic research*. Cape Town: Lavender Moon, 2012, 45.

348 K Gerrish & A Lacey. *Research process in nursing.* 6th ed. West Sussex: Wiley-Blackwell, 2010, 247.

349 J Collis & R Hussey. *Business research: A practical guide for undergraduate and postgraduate students.* 4th ed. New York, NY: Palgrave-McMillan, 2013, 82.

350 T Bushell. "Australia's failing defence structure and management methodology". *Air Power Australia Analysis* 28 December 2011. 11.

351 DOD. *Defence Review 2015.* Pretoria, 2015, Chapter 11-5.

352 SA Redmond, SL Wilcox, S Campbell, A Kim, K Finney, K Barr & AM Hassan. "A brief introduction to the military workplace culture". *Work* 50/1. 2015. 9–20.

353 Bushell *op. cit*., p. 11.

354 SADF (South African Defence Force). *Military Dictionary*. Pretoria, n.d., 206.

355 PMI (Project Management Institute). "What is project management?" 2018. <http://www.pmi.org/About-Us/About-Us-What-is-Project-Management.aspx> Accessed on 26 May 2018.

356 JM Nicholas. "Project management for business and technology: Principles and practice". PhD dissertation. Univerza v Mariboru, Ekonomsko-poslovna fakulteta, 2001, 22–23.

357 L Binder. "The top project management methodologies: Which is right for you?" Monday.com. 2019. <https://monday.com/blog/top-project-management-methodologies/> Accessed on 19 March 2019.

358 PRINCE2. "What is Prince2?" 2019. <https://www.prince2.com/zar/what-is-prince2> Accessed on 13 May 2019.

359 M Patrick. "Project-based project management". Chron. 2019. <https://smallbusiness.chron.com/projectbased-project-management-31090.html> Accessed on 8 May 2019.

360 C Enoch. "Benefits realisation management". Paper presented at the PMSA KwaZulu-Natal Regional Conference, Project Managing Your Success, 18–19 April 2016. <https://cdn.ymaws.com/www.projectmanagement.org.za/resource/resmgr/KZN_Reg_Conference_2016/4.Clive_Enoch.pdf> Accessed on 19 March 2019.

361 S Green. "Choose your project management methodology: Pros and cons of Agile, Waterfall, PRiSM and more". WorkflowMax. 2016. <https://www.workflowmax.com/blog/choose-your-project-management-methodology-pros-and-cons-of-agile-waterfall-prism-and-more> Accessed on 19 March 2019.

362 E Cohen. "Project management methodologies: Everything you need to know". workamajig. 2017. <https://www.workamajig.com/blog/project-management-methodologies> Accessed on 31 October 2018.

363 *Ibid.*

364 Green *op. cit*.

365 PRINCE2 *op. cit*.

366 PMI *op. cit*.

367 U Farooq. "Process-based project management | Principles & process of PBPM". Business Study Notes. 2017. <http://www.businessstudynotes.com/finance/project-management/process-based-project-management-principles-process-pbpm/> Accessed on 19 March 2019.

368 Patrick *op. cit*.

369 Enoch *op. cit*.

370 Project Management Informed Solutions. "Benefits realisation – a hugely valuable process". 2019. <https://www.pmis-consulting.com/articles/benefits-realisation/> Accessed on 19 March 2019.

371 A Watkins, D Com & JA Meyer. "Process and communication serving as catalysts for successful capability management in the Department of Defence". *PM World Journal* VII/IX. 2018. 4.

372 Kerzner *op. cit*., p. 4.

373 Nicholas & Steyn *op. cit*., p. 478.

374 *Ibid*., p. 478

375 PMI (Project Management Institute). "Project communication – foundation for project success". 2021. <https://www.pmi.org/learning/library/project-communication-foundation-project-success-7796> Accessed on 1 November 2021.

376 Nicholas & Steyn *op. cit*., p. 478.

377 Nicholas *op. cit*., pp. 450–452.

378 JP Clements & J Gido. *Successful project management.* 6th ed. Boston, MA: Cengage Learning, 2014, 6–14.

379 VS Anantatmula. "Project management concepts". *Operations management: Emerging trend in the digital era.* London: IntechOpen, 2020, Chapter 1.

380 PMI, "What is project management?" *op. cit*.

381 M Stoshikj, N Kryvinska & C Strauss. "Efficient managing of complex programs with project management services". *Global Journal of Flexible Systems Management* 15. 2014. 3.

382 E Cohen. "The definitive guide to project management methodologies". workamajig. 2017. <https://www.workamajig.com/blog/project-management-methodologies> Accessed on 19 March 2019.

383 University of California. "Project management methodology". 2018. <https://its.ucsc.edu/project-management/pm-methodology.html> Accessed on 31 October 2018.

[384] Bushell *op. cit*., p. 30.

[385] Kerzner *op. cit*., p. 10.

[386] DOD. *Annual performance plan for 2019.* Pretoria, 2019, 23, 43.

[387] *Ibid.,* pp. 57–58.

[388] *Ibid.,* p. 41.

[389] *Ibid.*

[390] HR Heitman. "Armscor delays undermine SANDF capabilities". *IHS Jane's Defence Weekly.* 2013. <http://www.janes.com/article/28094/armscor-delays-undermine-sandf-capabilities> Accessed on 8 May 2018.

[391] DOD, *Policy and procedure ... op. cit.*, p. 8.

[392] DOD, *Handbook ... op. cit.*, p. 6.

[393] *Ibid*., p. 6.

[394] DOD, *Policy and procedure ... op. cit.*, p. 2.

[395] DOD, *Handbook ... op. cit.*, p. 2.

[396] *Ibid*., p. 64.

[397] D Blythe. "An alignment strategy for SANDF engineering programmes"*.* MBA thesis. University of Pretoria, 2001, 240–244.

[398] G Fernandes, S Ward & M Araújo. "Improving and embedding project management practice in organisations: A qualitative study". *International Journal of Project Management* 33. 2015. 1053.

[399] US Government Accountability Office. *Defence contracting: Factors DOD considers when choosing best value processes are consistent with guidance for selected acquisitions.* Washington, DC, 2014.

[400] 20/20 Business Insight. "Project management within the aerospace and defence industry". 2017. < https://2020projectmanagement.com>. Accessed on 15 November 2021.

[401] AP Eigbe, BJ Sauser & W Felder. "Systemic analysis of the critical dimensions of project management that impact test and evaluation program outcomes". *International Journal of Project Management* 33/4. 2014. 747.

[402] Blythe *op. cit*., p. 244.

[403] EC Conforto, DC Amaral, SL da Silva, A di Felippo, D Simon & L Kamikawachi. "The agility construct on project management theory". *International Journal of Project Management* 34/4. 2016. 660–674.

[404] Institute for Security Studies. *The South African Army vision 2020. Volume 2: The South African Army relevant and ready for future security challenges in Africa.* L le Roux, ed. Pretoria, 2008, 10–12.

[405] J Stark. *Product life-cycle management*, Volume 1. New York, NY: Springer, 2015.

[406] DOD. *DOD ICT Strategy.* Pretoria, 2017, 4.

[407] DOD. *DOD ICT Capability Plan.* Pretoria, 2018, 2.

[408] DOD, *Handbook ... op. cit.*, p. 2.

[409] DOD, *Policy and procedure ... op. cit.*, p. 10.

[410] *Ibid*. pp. 29–31.

[411] *Ibid*. p. 32.

[412] DOD, *Policy and procedure ... op. cit.*, p. 2.

[413] DOD, *Handbook ... op. cit.*, p. 2.

[414] C Dekkers & P Forselius. "Scope management for adults: A 12-step program for ICT program recovery". Paper presented at the PMI Global Congress 2008, Sydney, 2008.

[415] South African Government. "Information management, systems and technology". In *Report of the Presidential Review Commission on the Reform and Transformation of the Public Service in South Africa.* 1998. <https://www.gov.za/documents/report-presidential-review-commission-reform-and-transformation-public-service-south> Accessed on 8 May 2018, Chapter 6.

416 Department of Public Service and Administration. *Public Service Corporate Governance of Information and Communication Technology Policy Framework.* Pretoria, 2012, iii–iv.

417 DOD. *CMIS Division Annual Performance Plan for 2019.* Pretoria, 2019, 15, 27.

418 DOD. *Draft DOD ICT Strategy.* Pretoria, 2020, 7.

419 DOD, *Handbook ... op. cit.*, pp. 11–37.

420 R Burke. *Project management: Planning and control techniques*. Second Edition. Ney York: Wiley, 2018, 206-219.

421 *Ibid*.

422 I Vaghefi, L Lapointe & H Shahbaznezhad. "Multilevel process view of organizational knowledge transfer: Enablers versus barriers". *Journal of Management Analytics* 5/1. 2018. 9.

423 R Schnittker, S Marshall, T Horberry & KL Young. "Human factors enablers and barriers for successful airway management: An in-depth interview study". *Anaesthesia* 73/8. 2018. 982.

424 I Vaghefi, L Lapointe & H Shahbaznezhad. "A multilevel process view of organizational knowledge transfer: Enablers versus barriers". *Journal of Management Analytics* 5/1. 2018. 9–10.

425 M Chakkol, K Selviaridis & M Finne. "The governance of collaboration in complex projects". *International Journal of Operations & Production Management*. 2018. 5.

426 MA de Oliveira, LVOD Valentina & O Possamai. "Forecasting project performance considering the influence of leadership style on organizational agility". *International Journal of Productivity and Performance Management* 61/6. 2012. 657.

427 CP Gehler. "Agile leaders, agile institutions: Educating adaptive and innovative leaders for today and tomorrow". US Army War College. 2005. <http://oai.dtic.mil/oai/oai?verb=getRecord&metadataPrefix=html&identifier=ADA434868> Accessed on 22 March 2019.

428 S Jawad, A Ledwith & F Panahifar. "Enablers and barriers to the successful implementation of project control systems in the petroleum and chemical industry". *International Journal of Engineering Business Management* 10. 2018. 11.

429 F Fischer, K Lange, K Klose, W Greiner & A Kraemer. "Barriers and strategies in guideline implementation: A scoping review". *Healthcare* 4/3. 2016. 3.

430 H Al-Nasseri & R Aulin. "Enablers and barriers to project planning and scheduling based on construction projects in Oman". *Journal of Construction in Developing Countries* December 2016. 13–14.

431 Heitman *op. cit*.

432 Gehler *op. cit.*, p. 7.

433 Fischer *et al. op. cit.*, p. 3.

434 L Warne, I Ali, C Pascoe & K Agostino. "Holistic approach to knowledge management and social learning: Lessons learnt from military headquarters". *AJIS Special Edition Knowledge Management* December 2001. 140.

435 D Sinclair. "Self-regulation versus command and control? Beyond false dichotomies". *Law & Policy* 19/4. 1997. 540.

436 D Anderson & LA Anderson. "How command and control as a change leadership style causes transformational change efforts to fail". Being First. 2013. <https://legacy.beingfirst.com/resource/how-command-and-control-as-a-change-leadership-style-causes-transformational-change-efforts-to-fail/> Accessed on 30 November 2021.

437 DOD, *Policy and procedure … op. cit.*, p. 2.

438 Nicholas *op. cit*., p. 544.