Development of Business Process Model for Drone Regulation and Improvement in South Africa

Quintin Mokoena, Ilesanmi Daniyan, Khumbulani Mpofu

Department of Industrial Engineering
Tshwane University of Technology,
Pretoria, South Africa
qakoena@gmail.com, afolabiilesanmi@yahoo.com, MpofuK@tut.ac.za

Oluwayemisi Abisuga
Centre for Rapid Prototyping and Manufacturing,
Central University of Technology,
Bloemfontein, South Africa
oabisuga@cut.ac.za

Abstract

Processes are developed with activities that should be conducted to reach a set goal. There is no perfect process, and any process at a later stage will need to be improved to keep up with the time and the technology. Business Process Management (BPM) is essential for any process for the management, monitoring and improvement of the developed process. There are different types of business process management models that one could adopt for process enhancement. Drone approval process in South Africa has challenges regarding the implemented processes of the drone regulation. Challenges involve delays and there is a call by the drone industry to amend the regulation. This study explores six core elements and life cycle business process management models. The two BPM models were used to guide the development of the business process model to help improve the drone regulation in process in South Africa.

Keywords
Business Process Management, Drone, Life cycle, Model, South Africa.

1. Introduction
A definition by South African Bureau of Standards (2015), process is a set of interconnected activities that uses inputs to produce an intended result. Sujova and Marcinekova (2015) define process management as a systematic visualization, measurement, and improvement of business processes by applying principles and methods of process management to allow continual process evaluation. According to Dumas et al. (2013), example of processes in organizations may include procure-to-pay, order-to-cash, issue-to-resolution, quote-to-order and application-to-approval. The authors define application-to-approval process as when someone applies for an approval and ends when the approval in question is either granted or denied. Furthermore, this type of process is normally associated with government agencies where a person applies for a specific permit and be granted. Application to approval process type relates to South African Civil Aviation Authority (SACAA) process, because SACAA process involves in issuing of drone licenses and permits where a person could be approved or denied.

The approval process includes Certificate of Registration (CofR), RPAS Operating Certificate (ROC), RPA Letter of Approval (RLA), RPAS Maintenance Technician (RMT), Remote Pilot License (RPL). Commercial, corporate and non-profit drone operators are required to additionally apply for RPAS Operator certificate (ROC) including the operation specifications. The ROC process involves five phases of certification process, which are pre-application, formal application, documentation evaluation, demonstration and certification. South African Civil Aviation Authority (2015) describes ROC's five phases as follows:

a) Phase 1 - Pre-application: applicant makes contact and complete "Letter of Intent". The applicant will be guided on the entire five-phase Process.

b) Phase 2 - Formal application: submission of formal application for commercial operations and attach ASL issued by the Air Service License Council.
c) Phase 3 - Documentation evaluation: applicant submits all the required manuals to the SACAA for approval and thoroughly review of the manuals. Thereafter, decides if complies or not
d) Phase 4 – Demonstration: demonstrate ability to operate. The demonstration and inspection phase involves onsite evaluations of documentation as per the regulation and operations manual.

e) Phase 5 – Certification: application is issued with a ROC including operational specifications

Baldwin, Cave and Lodge (2011), define regulation as a way of controlling a process by specifying rules that need to be followed. The authors further state that it is important to put in mind when developing regulation that the rules adopted may impact the implementation or prevent to achieve the objectives (Baldwin, Cave and Lodge 2011). According to Radovic and Bodecker (2020), drone regulations are organized so that mandatory aviation law, non-mandatory aviation law and technical standards cooperate with each other to form a regulatory infrastructure for the drone industry. It is vital to implement a regulation that will benefit a country. According to Stocker et al. (2017), a law once prevented additional technological developments in the UK for 30 years while other countries to benefiting from the new technology.

Dima (2017) describes drone regulation as a field where International, European, and national law is applicable. Regulation is enforced to protect the public or consumers in a situation where there are risks of safety, health, or performance. The government usually enforces regulation although sometimes there is self-regulation, which is not effective in most cases. Clarke (2016) is of the opinion that self-regulation and industry self-regulation tends to have difficulties to achieve an acceptable balance between innovations. Hodgkinson and Johnston (2018) also state that some regions aim to regulate drones to a standard of safety required for manned aircraft.
Manned and unmanned aircraft are two different technologies and designs; therefore, it is a challenge for drones to comply with some of the manned aircraft regulations. Rawlins (2018) expresses the view that Part 101: Regulation was established to respond to the evolving demands to regulate the drone industry to take advantage of the developing technology. Regulation can be a barrier to trade or can protect the public. In order to address the needs for managing the widespread use of drones, Tsiamis et al. (2019), believe that many countries have issued legislations in order to control the use of drones by setting guidelines for ensuring the safety and privacy of the public.

SACAA is struggling to enforce compliance of drones (Nagiah, 2020). Moreover, CUASAA (2019) further confirms SACAA has been having challenges to effectively implement the regulation. This indicate that the handling of process management is poor. South African drone regulation is in a difficult situation, which negatively affects the drone industry (Emma-Iwuoha 2018). This aligns with de Miguel Molina and Santamarina Campos (2018) that despite the fact that drones have positive impact to both economy and technology, regulation is biggest barrier that prevent the drone technology to grow because of the security, safety and privacy.

A survey conducted about the United States, United Kingdom and European Union laws indicate that the existing regulatory rules are not appropriate for drones (Hodgkinson and Johnston 2018). The authors' further state that many countries have decided not to include small drones below a certain weight level from compliance due to complex situations. Drone regulators tend to control, and monitor drones used for commercial purposes due to their growth and risks towards the public. The objective of this study is to develop a business process model for the improvement of drone regulation process. The novelty of this work lies in the development of a process model for enhancing the technological growth of the drone industry in South Africa. This has not been highlighted by the existing literature.

2. Literature Review

The perception by Hodgkinson and Johnston (2018) is that it is estimated that the number of unmanned aircraft operations which are drones will exceed manned aircraft operations in the next 20 years. Tsiamis et al. (2019) argue that the increasing use of drones has led to serious problems that authorities and regulators will need to address as the drone technology continues to develop. Drones are the most growing sector in the civil aviation industry and consist of two distinctive characteristics (Marope 201). These factors are holding back other countries to grow in drone technology including South Africa. This study discusses the identified factors affecting the drone application and the regulation process as follows:

a) *Rapid growth*
Rapid growth of drones is affecting most of the countries that needs to regulate drones due to its technology (Emma-Iwuoha, 2018; Rao et al. 2016). Rapid growth of civilians' applications to operate drones has led to challenges such as safety, regulatory, security and privacy (Rao et al. 2016). Countries are struggling to maintain the growing number of drones, hence challenges with drone process and the regulations. Cunliffe et al. (2017), point of view is that countries are developing regulatory frameworks to cope with the growth of drone technologies.

b) *Increase use of drones*
Increase use of drones is spreading around the world, especially in developed countries. Cunliffe et al. (2017), argue that the increase of drone use in the UK has allowed the authorities to highlight the need for a safe operational practice. Most countries use drones in different applications, and most are struggling to integrate drones into their regulations that have been enforced (Tsiamis et al*.,* 2019, Marope 2014).
Gregorski (2018) asserts that there is an increased safety risk due to the steadily increasing number of drones, which are not controlled, and some with lack of apparatus and pilot qualification's requirements. A study by Palm (2021) shows that drone industry in Europe is facing a massive growth as well as challenges.

c) *Regulatory framework*
An evaluation regarding the regulation of drones in Australia indicated the complexity in their regulation, which has raised doubt about the effectiveness of the regulatory framework (Clarke and Moses 2014). Most countries find it difficult to comply with the drone regulatory framework that have been implemented (Jones 2017). Challenges include problems such as industry failing to comply due to limiting or high requirements that have been enforced, or regulations that are difficult to implement. Clarke and Moses (2014) assertion is that the international drone framework is not yet complete and immature. In Japan, regulators, manufacturers, and users need to work together to effectively control and regulate the safety of this new technology (Nakamura and Kajikawab, 2018). In Clarke and Moses (2014) point of view, the discussions held so far shows that there is no transparency and the frameworks do not reflect the interest of all stakeholders

d) *Slow adoption of regulation*
Slow adoption of regulation negatively impacts most of the countries due to the fact that drones keep on evolving (Hodgkinson and Johnston, 2018). Delays in adopting the regulatory framework creates gap to fully regulate this drone technology. The opinion by Renduchintala et al. (2019) is that slow adoption of regulations and an increase in the illegal use of drone technology risks the safety, security of data, infrastructure, and the public.

e) *Illegally drone use*
In other countries including South Africa, some drone operators have opted for illegally use of commercial drones due high requirements needed to meet legal operation (Renduchintala et al. 2019, Ayamga et al. 2020). This shows that high barriers could negatively affect the enforcement of the regulation.

f) *Ineffective drone regulatory framework*
Ineffective drone regulatory framework is one of factors that most countries are struggling with. Regulation frameworks are developed without sufficient consultations of the drone industry, which normally leads to poor adoption of the framework (Hodgkinson and Johnston, 2018, Clarke and Moses 2014).

g) *Restrictive regulation and ineffective enforcement*
Restrictive regulation and ineffective enforcement have led to most drone operators struggling to comply with the regulations. Regulations are preventing some of the drone operators to meet the requirements, which are too high to meet or comply with (Clarke and Moses, 2014). Poor drone regulation awareness has also led to some of the drone operators left unclear on how to follow and comply with the regulations.

h) *Manned aircraft requirements*
It is challenging for drones to meet some of the manned aircraft requirements which other countries have included in drone regulatory frameworks (Hodgkinson and Johnston 2018). Countries that have adopted manned aviation regulations are having difficulties with the enforcement including South Africa. Drones have different design compared to manned aviation, therefore, the two should not have the same regulations applied for safety control and monitoring.

i) *Lack of drone monitoring*
It is essential to monitor the operations of drones through regulations. Lack of drone monitoring may pose as a danger to the industry as well as the society (Gregorski 2018). Adequate monitoring of drones is vital for safety of the public.

j) *Lack of drone control*
Lack of drone control with its sophisticated technology is risky (Tobór et al. 2017). Therefore, it is important to have adequate regulation that can efficiently control the operation of drones.

k) *Lack of transparency and exclusion of stakeholder's interest*

It is crucial to have transparency and inclusion of stakeholders when developing regulations. Clarke and Moses (2014) states that lack of transparency and exclusion of stakeholder's interest are some of the factors making drone regulations inefficient. This normally leads to people ending up being skeptical to comply because there were not enough consultations and awareness about the new regulations. It is always a challenge to enforce a regulation due to resistance of the stakeholders.

l) *Strict regulations*

Countries with strict regulations are not winning with the regulation of drones. Only few complies, but most of the stakeholders do not comply because of the set requirements (Jackson, 2016).

3. Method

This paper addresses the drone regulation issues by developing a business process model that can be employed for drone regulation improvement. Literature review was conducted to determine the factors affecting the drone regulation process around the world. Two process models were identified namely; BPM life cycle and six BPM core elements. Elements related to this research were extracted from both models to develop suitable model for this study.

3.1 Business Process Model (BPM) for Drone Regulation and Improvement in South Africa

Figures 1 and 2 present the frameworks used as an analytical tool to understand the several variations and contexts that guide this study. The framework was developed by extracting the six BPM core elements and BPM lifecycle to illustrate the expected relationship between the variables that are applied in the management of the drone application process. Jabareen (2009) defines a conceptual framework as a network or "a plane" of interconnected concepts that together provide a complete understanding of a study. Tamene (2016) argues that a conceptual framework is a structure of concepts, assumptions, expectations, beliefs, and theories that validate the research.

The conceptual structure was developed by evaluating two BPM models, namely the Six Business Process Management core elements and Business Process Management lifecycle. Figure 1 describes process measures as one of the elements to help to analyse the process performance. Decision making as mentioned in Figure 1 is essential during process analysis. Figure 1 also lists 'roles and responsibilities' as one of the factors that can be used to ensure that all the activities of a process are completed. It is important to have a reporting structure and responsibilities for the success of the process (Stadtler et al. 2015). The elements of roles and responsibilities should be covered in a whole process management, meaning that each role needs to be clearly specified, and the reporting structure should be defined (Rosemann and Vom Brocke 2015). Roles and responsibilities should be assigned to all the relevant personnel in a process to avoid misunderstandings.

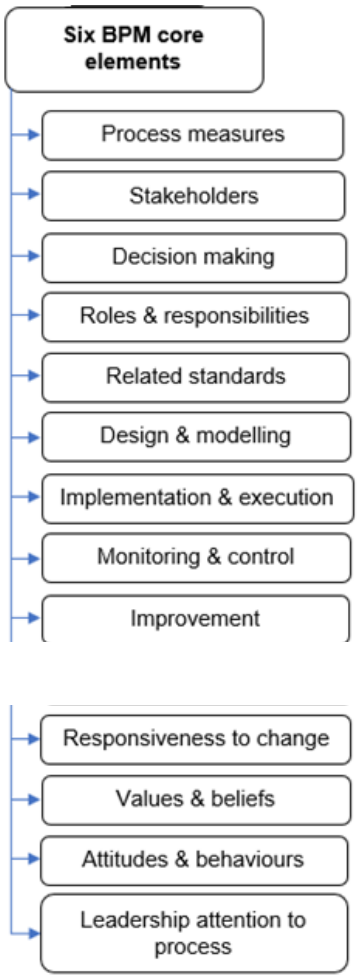

Figure 1: BPM core elements

Organisational culture is necessary for better process management. Organisational culture is about collective values and beliefs that structures process related behaviour and attitudes towards the improvement of business performance (Rosemann and Vom Brocke, 2015). Process improvement involves the removal of the steps that are not needed for improvement and cleaning (Rosemann and Vom Brocke, 2015). The responsiveness to change element indicated in Figure 1 is essential to ensure full implementation of the new changes in a process. The responsive to process change allows the organisation to change the ways of doing things and adapt to new changes, including the people affected by the changes (Rosemann and Vom Brocke, 2015).

Figure 1 also shows that training to handle the drone approval processes is necessary. Competency involves technical skills as well as good reasoning, emotions, values, and reflection in daily practice (Epstein and Hundert, 2002:226). As indicated in Figure 1, people should possess skills, expertise, and education to ensure the smooth operation of the business process. Bolger (2000) describes capacity as an understanding, attitude, values, skills, ability, and a condition that permit organisations to conduct functions to meet their goals.

Rosemann and Vom Brocke (2015) explain that companies should have personnel with expertise in process design, implementation, and process improvement. Alp and Tan (2008) state that capacity should include total productive capability to utilise resources such as a workforce and machinery. Capacity is usually measured by involving resources such as human**,** technological, and financial capital (Preston and Smith, 2009).

Processes should be continually improved to keep up with the new changes and technology. The process analysis approach could assist SACAA to identify weaknesses as well as their impact on the existing process. In addition, Information Technology should be integrated where relevant to improve business performance.

The drone approval process should be updated, transparent and allow the participation of all the interested stakeholders. It is important to ensure that all the employees in an organization accepts and adopts the new updated process. It is also crucial to have all the personnel with expertise to participate in the improvement of the process (Rosemann and Vom Brocke, 2015). Process management plays a crucial role in the performance and output results of a process. Good process management leads to growth.

According to Figure 2, process identification should be prioritised to ensure the implementation of an effective process. During process identification, business problems are explained in detail and addressed in order to come up with an updated process structure (Dumas et al.,2013). Figure 2 states that it is important to define process goals. These studies allow the processes to be documented and agreed upon by all the interested parties. Figure 2 also indicates accountability as an element to ensure better process management because everybody knows what it is expected of them. Accountability is about attitude and committed plans to achieve process goals (Vom Brocke and Mendling, 2017). The focus is to ensure that all the activities in a process are attended to in order to maintain the effective output of a process.

Figure 2. BPM life cycle elements

It is crucial to constantly change or update the process cycle to align with new technologies and social culture (Szelągowski 2018). The above models in Figures 1 and 2 were developed to be employed in enhancing the processes of the existing South African drone regulation structure.

Figure 3 is the combination of the models in Figures 1 and 2. The model in Figure 3 consists of the BPM elements that have been structured in sequence to create productive steps for drone regulation and improvement.

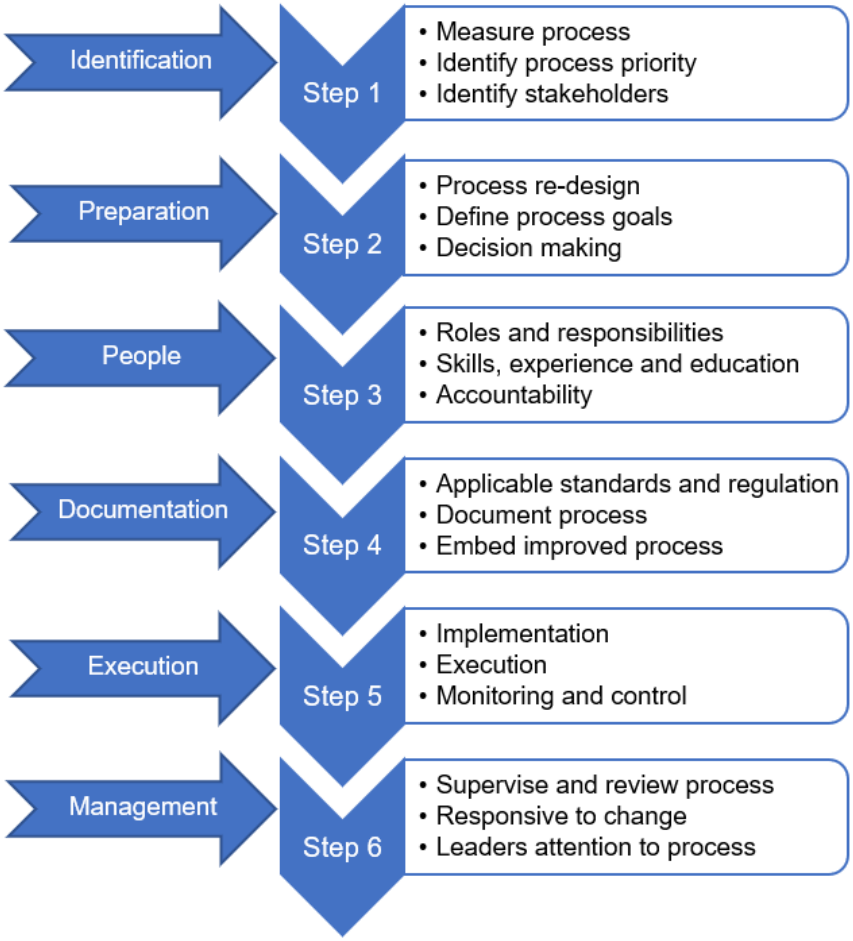

Figure 3. Proposed business process model for drone regulation and improvement

5. Results and Discussion

It is evident that most countries are struggling to regulate the fast-growing technology called drones. Hodgkinson and Johnston (2018) assert that most countries are failing to control the increase of drone industry. This shows that processes involved are not satisfactory to the drone industry. This confirms that the processes need to be revisited for improvement. The interpretation by Zelt et al. (2019) is that poor process management can lead to poor innovation, bad financial performance, and organizational conflicts. It is vital to have a business process model that could create positive outcome for the drone industry. A view by Foster (2013) is that responsiveness is the willingness of the company that provides service to assist in a promptly manner.

Figure 3 shows the business process model that can be adopted to improve the drone regulation process in South Africa. Six steps were documented which includes identification, preparation, people, documentation, execution, and management. The main aim is to develop the business process model that drone regulator in South African can refer to for improvement.

Regarding the first step (Identification), this paper recommends starting by measuring the process to get the overall view of the situation is important. Priorities of the process should be identified and presented for awareness. Stakeholders affected by the process should be identified and be part of the process at the initial stage. It is essential for the stakeholders to be involved in the operations of a process (Rosemann and Brocke, 2015).

Second step of the process is (Preparation). In this step, a plan to reduce and eliminate gaps in a process documented. This research indicates that a process should be re-designed and improved to ensure positive outcome.

Process goals are determined and measured and ensure that they are achievable. Decision-making plays an important role in a process during this step. Decision making is based on the analysis of information and data (SABS, 2015).

Third step focuses on (People) in an organization. This paper advises that personnel should be assigned with roles and responsibilities to ensure an effective process. Roles and responsibilities assignment in a process ensures smooth communication flow between roles to provide decision-making platform, which helps to avoid unstructured escalation during disputes (vom Brocke and Mendling 2017). Equipping personnel with sufficient resources such as training and education is vital to ensure effective business process.

Fourth step is organizational (Documentation). Processes should be documented to avoid discrepancy and ensure consistency. Documented process helps organizational personnel in their daily work as well as training to new employees on how to execute their job to delivery same results with consistent quality (vom Brocke and Mendling 2017). All applicable standards should be followed and conform to. This study advises that all stakeholders should be involved during this step to be aware of the documented process. After the process documentation, the next step is to embed the improved process. Improved process helps to clarify and provide information about the process (vom Brocke and Mendling 2017).

Fifth step involve in the business process model is (Execution). Once a process has been re-designed and documented, the next stage is implementation and execution of the process. Rosemann and vom Brocke (2015) define the implementation and execution step as a method to transform process models into workable business process using related methods for process execution. It is essential to have monitoring and controlling tools to ensure that the implemented process is meeting the intended objectives.

Management is the last step of the process model. This step is about ensuring that the re-design and implemented process is well managed. Continually supervision and review of the process is vital to ensure that the documented process is followed. Responsive to change should also be measured and ensure that all impacted understand the changes. Review of process involves determination of the appropriateness and effectiveness of the process to meet the established objectives (SABS 2015). Top management should be involved in an improved process and continually received feedback regarding the performance. Senior management and executives should demonstrate the level of commitment and attention to process management and processes (Rosemann and vom Brocke 2015).
Many business process models have been developed in the academic environments to fit a certain problems being investigated. Like drone industry, process models can be used to monitor and improve while the industry is evolving. Process model recommended in this paper can be adopted or modified to fit another any problem.

6. Conclusion

The purpose of this study was to develop a process model to help improve the drone regulation process. The factors, which affect the growth of drones including the regulations in South Africa and other countries, were identified in this study through literature review. Two process models were also identified namely; BPM life cycle and six BPM core elements for the development of the BPM. Several elements of the Business Process Management were highlighted to improve the drone regulation in South Africa. Elements related to this study were selected from the BPM core elements and BPM life cycle elements, and thereafter combined and illustrated as a business process model to be used for drone regulation improvement in South Africa. Business process management models need to be continually improved to keep up with the new ways to do things. The business process model recommended in this study can be employed to any process that has challenges. This research will contribute to South African research and literature in drones since there are few research in this environment. More concepts development in this field are essential to build knowledge that will be used for reference in the future.

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Biographies

Quintin Mokoena is a Master's student in Engineering Management in the Department of Industrial Engineering at Tshwane University of Technology in South Africa. He has B-Tech in Quality and B-Tech in Electrical Engineering. Currently he is an Engineer at an ICT company responsible for product compliance. He also has an experience in testing of electrical products, Standards development, and Quality Management Systems. His research focuses on the improvement of drone regulations in South Africa.

Ilesanmi Afolabi Daniyan is a Postdoctoral Research Fellow at the Department of Industrial Engineering, Tshwane University of Technology, Pretoria, South Africa. His research interest include production engineering and advanced manufacturing.

Khumbulani Mpofu is the Research Chair in Manufacturing and Skills Development, Department of Industrial Engineering, Tshwane University of Technology, Pretoria, South Africa. His research interest is in the field of include advanced manufacturing.

Dr. Oluwayemisi Abisuga-Oyekunle received degrees, diplomas and certificates in many areas of studies of marketing, human resources management, business administration, fashion design, textile production and bead-making. She completed her doctoral degree at the Tshwane University of Technology, Business School. For the past twenty-five years, she has worked as a lecturer and researcher in reputable international institutions/organisations. She has published in several journals and books. Her research interest has been on Arts, Cultural and Creative industries, cultural policy, indigenous knowledge, SMEs. Among other activities, she is involved in many community development projects in some African countries, on training and empowerment of rural youths and women on the production of handicraft and cultural products. Presently, she is working on a project in collaboration with the Faculty of Engineering, Central University of Technology, Bloemfontein, South Africa to create appropriate machines and tools for the craft producers to enhance job creations and development of the African crafts and cultural products.